

Guidebook on Engaging Frontline Employees in Adopting New Transit Technologies

Publication Details:

Date: March 2022

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Executive Summary

Guidebook on Engaging Frontline Employees in Adopting New Transit Technologies

Chapter 1 of the Guidebook opens with an explanation of its purpose, which is to help management staff in the United States (US) transit industry with a particular aspect of the transit technology adoption process—how to best engage frontline employees as they transition into a new era of transit technologies. This chapter also explains that the Amalgamated Transit Union (ATU) was a partner in developing the content and direction of the Guidebook, taking part in interviews and connecting its author with transit agencies that have unique and broadly applicable experience in the field. Due to the ATU's involvement, it became clear to the National Center for Applied Transit Technology (N-CATT) that zero-emission bus (ZEB) technologies, which include both battery electric buses (BEB) and fuel cell electric buses (FCEB) powered by hydrogen, could serve as the relevant technologies of focus for the Guidebook. Not only is ZEB technology incredibly complex in terms of the infrastructure and planning required, but it is also becoming increasingly prevalent at transit agencies across the US. Due to its level of complexity, transit agencies that are early adopters of the technology have struggled to handle all of the operational aspects required; consequently, agencies often find it challenging to address the full scope of workforce development activities needed for ZEB technologies.

In Chapter 2, the question of how to best engage frontline employees in adopting new transit technologies is put into a broader framework for context. The transit industry has for many years, even prior to the COVID-19 pandemic, struggled to attract and retain enough workers to operate transit services. Documented reasons for this state of affairs, including the current and continuing wave of staff retirements, are provided and coupled with something to keep front-of-mind—when addressing the challenges of the transit industry, consider that it has a variety of strengths to consider and optimize. It offers its professionals job stability, career potential, job options, and impactful work. The Guidebook leans on these strengths from beginning to end to stress how important it is for the transit industry to maximize what it already has in place—meaningful and stable work of which employees can be proud. The chapter closes with an overview of the top three ways to engage employees; these are leveraged throughout the Guidebook to help focus related efforts.

Since having employees who understand and are prepared to work confidently with new technologies is a prerequisite for engagement with the technology adoption process, Chapter 3 is focused on the topic of training frontline employees on new transit technologies. This chapter leverages a detailed interview conducted with a representative of IndyGo, a transit agency in Indianapolis, Indiana and one of the largest transit agencies in the Midwest incorporating BEBs into its fleet, to serve as a contextual example of specific training activities that are fundamental for preparing the transit workforce to deploy new transit technologies. These activities include training through the original equipment manufacturer (OEM), periodic training for existing staff, on-the-job training, and mentorship programs; they are often used in combination for multi-prong training efforts. Toward the end of the chapter, special attention is given to apprenticeships, a particular method within the larger topic of training, which are critical for the inclusion of new recruits with high-tech skills.

Due to the transit industry's current and continuing wave of staff retirements, in part, the industry and its agencies cannot afford to avoid the need to successfully attract and retain workers who are just beginning their careers. They are the ones who should be invested in now so the transit industry has a high-tech talent pipeline for years to come. If the transit industry does not succeed in beating the competition for high-tech workers—they are in high demand from a range of employers—it could have dire consequences for the long-term operational outlook of the transit industry. There are no shortcuts to address this problem; high-tech apprenticeships should be a major investment for the industry moving forward. Not only would it increase the likelihood of having a stable transit workforce, it would serve as a base for employee engagement—employees who are invested in are more likely be committed to their work.

Chapter 4 provides background on how apprenticeships work, relying on the example set by Santa Clara Valley Transit Authority (VTA), a transit agency in Santa Clara County, California, that implemented the Transportation Apprenticeships for Professional Career Advancement (TAPCA) Program in 2016 in close partnership with Mission College and ATU Local 265. Through interviews with an ATU representative early in the research process for the Guidebook, VTA's TAPCA program was identified as an exemplary effort. This chapter covers why VTA initially developed the TAPCA program, how the program facilitates career pathways, how its partnerships work, and which funding options were leveraged. It goes into detail on how these apprenticeships are structured, the specific benefits of apprenticeships, and the current known status of ZEB apprenticeships across the US. The information on VTA's TAPCA program provides the reader with a template that can be used as an illustrative educational example—or even held up as a model to follow.

Chapter 5, “Next Steps for Engaging Frontline Employees in Adopting New Transit Technologies,” is an instructional chapter that builds on the content from the previous four chapters and provides five “next steps” categories. The first three proposed next step categories relate to the top three ways to engage employees shared in Chapter 2—establishing a shared vision and purpose, investing in individual employees, and tailoring engagement strategies to both current employees and potential new recruits.

The last two proposed next step categories pertain to Chapters 3 and 4—train frontline employees on new transit technologies and establish apprenticeships for new transit technologies. The next steps contained in Chapter 5, as a set, can be used by transit professionals to help guide their process of applying the information from Chapters 1-4 to their own situation.

Chapter 1: Introduction and Overview

1.1 Guidebook purpose

From operations that are increasingly software and data-driven to zero emission buses and public-facing apps, transit agencies are constantly learning about, planning for, and deploying new transit technologies. While such advances contribute to progress for the transit industry as a whole, individual agencies often struggle to find the time, expertise, and funding necessary to support the ongoing adoption process for new transit technologies. The purpose of this Guidebook is to help management staff in the United States (US) transit industry with a particular aspect of the adoption process—how to best engage frontline employees as they transition into a new era of transit technologies.

The management staff of a transit agency typically leads the strategic planning and decision-making aspects of the adoption process, while frontline employees often lead the on-the-ground implementation activities required to deploy the new technology. Therefore, the involvement of frontline employees is foundational to the overall effort. This Guidebook goes a step beyond the *involvement* of frontline employees—it is aimed at *engagement*. For reference, the Merriam-Webster dictionary [defines engagement](https://www.merriam-webster.com/dictionary/engagement) as “emotional involvement or commitment.”¹

The reasons why engagement is targeted, rather than involvement, are twofold. First, an engaged employee (i.e., one who is emotionally involved and committed) is more likely to stay with their employer over time. Due to concerns of staff turnover at many transit agencies, staff retention is often front of mind for transit agency management staff. Second, an employee who is engaged in their work is typically more likely to perform their work to a higher standard due to their commitment and emotional involvement. An engaged employee tends to be someone who takes pride in their work, and that pride shows in the final product or service.

Since frontline employees often work with a significant amount of transit technologies, with this trend set to continue, it is not practical to separate their engagement with the transit technology adoption process from their job overall—technology is embedded within their daily work. Accordingly, while this Guidebook focuses on how frontline employees interact with new transit technologies, it does not isolate this interaction from their job as a whole. By considering the transit technology adoption process within the larger framework of frontline employee engagement, contextual elements can be brought together for a more complete picture.

¹ <https://www.merriam-webster.com/dictionary/engagement>

1.2 Potential audiences

The primary target audience for this Guidebook is management staff in the US transit industry. When available, specific guidance for small-urban, rural, and tribal transit agencies is provided; management staff at a transit agency of any size may find the Guidebook helpful.

In addition to the primary audience, frontline employees and the organizations that support them are also a target audience; they can use this Guidebook as a tool to help advocate for changes they'd like to see in the workplace.

Further, professionals from any background in the US transit industry, as well as internationally outside of the US, are a potential audience for this Guidebook; they can use the Guidebook as a general primer on how to prepare the transit workforce for the current and future eras of transit technologies.

1.3 Collaboration with the Amalgamated Transit Union (ATU)

Since the Guidebook is focused on frontline employees, a representative from the Amalgamated Transit Union (ATU) provided input on the employee perspective through interviews conducted during November and December 2021.

Discussions with the ATU representative revealed the following questions in relation to engaging frontline employees in adopting new transit technologies:

- How will gaining these new skills benefit frontline employees in the long-term?
- How will these new skills position them for new opportunities, possibly with a salary increase, greater career stability, even a move into management?
- How will these new skills enable them to have more career flexibility, in case they'd like to work at other transit agencies and develop their career across the US?
- How will these new skills instill a sense of pride in their work and more confidence in what they can accomplish as individuals?

The ATU collaboration has helped clarify the primary workforce development question at play when new technologies are adopted at transit agencies; how can the employee and employer perspectives be brought together to facilitate an effective, mutually-beneficial approach to incorporating new technologies—one that helps foster employee engagement?

1.4 Information collection process

As mentioned in section 1.3, the first step in the information collection process involved speaking with an ATU representative to better understand the employee perspective. These discussions revealed key questions to help with the Guidebook's content development. Through the ATU, potential contacts were suggested to gain the perspectives of individual transit agencies. In addition to interviews with the ATU, interviews were also conducted with transit agency representatives. The primary interview with transit agency staff took place in December 2021 and was with the

Deputy Director of Preventive Maintenance and Repairs at IndyGo in Indianapolis, Indiana. Beginning his transit career as a bus operator, Mr. Thierno Balde has been with IndyGo for 18 years working in different departments until 2016 when he became head of the Electric Vehicle Maintenance Department. He has since been promoted to his current position. Additional online research was conducted on topics that came up during the interviews to help round out the Guidebook's content.

1.5 Primary referenced transit technologies

Initial interviews with the ATU revealed that one of the most significant, increasingly wide-spread, and impactful technologies currently facing the transit industry involve zero-emission bus (ZEB) technologies including technologies associated with battery electric buses (BEB) and fuel cell electric buses (FCEB) powered by hydrogen. ZEBs do not have polluting tailpipe emissions and do not rely on fossil fuels for their operation, contributing to improvements in local air quality. Interviews and discussions with both the ATU and transit agencies centered on ZEB technologies. In addition, discussions with the ATU revealed that the positions of bus operator and mechanic are two of the positions most impacted by ZEB technologies and, therefore, are often mentioned throughout the Guidebook when occupational examples are given.

While much of the Guidebook information applies generally to many types of transit technology, ZEB technologies are the focus of the Guidebook to enable a deeper look into how to engage employees on some of the most complex technologies currently facing the transit industry. *Research Report 219: Guidebook for Deploying Zero-Emission Transit Buses*, published by the Transit Cooperative Research Program (TCRP) in 2021, is a valuable resource.² A technical overview of ZEB technologies is provided on page 6 through page 20; this report is recommended reading as a primer for those who are unfamiliar with ZEB technologies.

Chapter 2: Challenges and Ways Forward

2.1 Difficulty Attracting and Retaining Employees

In the current climate, it is difficult to attract and retain staff at US transit agencies. In November 2021, the American Public Transit Association (APTA) published *On the Horizon: Planning for Post-Pandemic Travel* to help its membership consider challenges the future may bring in light of the aftermath of the COVID-19 pandemic.³ The topic of staff shortages is featured prominently in the document, and occupations such as vehicle operator and mechanic are mentioned often. Available data on the US transit workforce, such as trends in staff shortages and projections of future staff needs, are limited, as mentioned in a 2019 US Government Accountability Office (GAO) report, *Transit Workforce Development: Improved Strategic Planning Practices Could Enhance FTA Efforts*, "The extent of future transit workforce needs is unclear due to the absence of transit-specific workforce projections, unclear communication on the data that are

² <https://www.nap.edu/catalog/25842/guidebook-for-deploying-zero-emission-transit-buses>

³ <https://www.apta.com/research-technical-resources/research-reports/on-the-horizon-planning-for-post-pandemic-travel/>

available, and because the data that are available do not extend past 2022.”⁴ Through APTA’s *On the Horizon* report, the GAO *Transit Workforce Development* report, and others, more information is available to better understand why transit staff shortages exist and persist. In *On the Horizon*, long-standing reasons for staff shortages that were present before the pandemic are referenced, such as retirements, but more attention is given to the challenges that transit agencies currently face on the topic of attracting and keeping employees. These challenges include the:

- **Rise in private sector wages during 2020-21**, making it more difficult for transit agencies to compete with other job opportunities. At the same time, the cost of living in some parts of the US has risen during the same period, and is slated to continue on that trajectory, resulting in additional wage pressure.
- **Lack of remote work and flexible schedules**, with transit agency work most often done in-person and shift-based—especially for positions such as vehicle operator and mechanic. It is noted in *On the Horizon* that the desire for these conditions goes far beyond convenience, since at times employees have needed to stay home and care for children in remote schooling or have had health concerns for themselves or their loved ones. “Persistent concerns about disease exposure” is mentioned in the same document in relation to reasons why *ridership* may decline, but the *same* concerns are likely in the minds of frontline employees as well.
- **Layoffs that took place during 2020-21 in the transit industry**, in part due to financial decline related to reduced ridership during the pandemic, some of which were done with the intent to rehire once the agency’s financial situation improved.
- **Continuing trends in retirement**, with some staff retiring earlier than anticipated during the COVID-19 pandemic.

In *Building an Apprenticeship and Training System for Maintenance Occupations in the American Transit Industry*, published by the Transportation Learning Center in 2009, it is stated that transit systems in the US are “facing unprecedented challenges in obtaining the workforce skills needed to address pervasive technological changes, increasing retirements of skilled workers, and rapid industry growth... an inadequate flow of new recruits is entering the industry. Transit maintenance jobs are not considered attractive by many of today’s high school graduates. The general public has an inaccurate perception of transit as an old fashioned, low-tech industry... Problems in attracting recruits in some areas are exacerbated by lack of pay incentives, poorly developed career ladders, and unfavorable working conditions for new hires. The industry is facing these unprecedented challenges with insufficient training capacity.”⁵ A table called “Examples of Challenges That Selected Transit Stakeholders Cited in Recruiting and Retaining Transit Workers (2018)” in the 2019 GAO report, *Transit Workforce Development*, provides further information on the topic as shown in figure 1.

⁴ <https://www.gao.gov/products/gao-19-290>

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https://www.transittraining.net/images/uploads/document_previews/Building_an_Apprenticeship_and_Training_System_for_Maintenance_Occupations_in_the_American_Transit_Industry_-_Bob_Glover_PREVIEW.pdf

Table 1: Examples of Challenges That Selected Transit Stakeholders Cited in Recruiting and Retaining Transit Workers (2018)

Challenge	Examples cited by stakeholders
Job requirements	In many locations, the pool of applicants eligible to meet the job requirements for transit jobs or who already have transit related skills is small. For example, many agencies require that operators have a commercial driver’s license (CDL) with a passenger endorsement. (Drivers with CDLs who plan to operate special types of commercial motor vehicles must pass additional knowledge and/or skills tests to obtain any endorsements placed on their CDL, such as an endorsement for operating vehicles that carry passengers.) One stakeholder specifically noted that the difficulty of passing the CDL test, obtaining passenger endorsements on their CDL, drug-testing requirements, the high cost of required physicals, and skills gaps were the primary reasons for their challenges in finding bus operators. Another stakeholder said that attendance issues affect retention because transit is a very structured environment and requires punctuality to keep transit running on time.
Pay and benefits	Transit agencies cannot always provide competitive wages and benefits, particularly in rural areas or areas with low unemployment; this situation can make hiring and retaining employees difficult. For example, one stakeholder noted problems with competing with wages paid by local fast food establishments.
Transit automation and technology	Obtaining in-house expertise for technology-related challenges is difficult. For example, knowledge of more sophisticated vehicles, electronics, and operations software is required, and workers with those skills are difficult to find. One stakeholder stated that buses and trains are, in effect, really big computers so a different skill set is needed for operators. Several stakeholders said that preparing for automation is difficult because there are not many workers available who know how to operate or maintain automated transit vehicles or to train future workers, and one stakeholder indicated that the rapid advancement of technology makes it difficult to remain current on training and best practices.
Work schedule	Many transit positions are assigned according to seniority, meaning that newer workers are often required to work unappealing shifts—such as split shifts and late night shifts—or routes. One stakeholder specifically noted that trucking companies and car dealerships are attractive to transit operators and mechanics because they offer a more traditional work schedule. Also, according to another stakeholder, most transit agencies are so short staffed that they require their employees to work overtime.
Workplace health and safety	Transit workers face health and safety concerns that can make transit jobs unappealing. One stakeholder specifically noted risks including assault from passengers, poor ventilation (on buses) that has led to asthma problems among drivers, and inadequate scheduling of breaks by automated-scheduling systems. Another stakeholder noted that abusive behavior by passengers toward other passengers or transit agency drivers is also a deterrent to hiring.

Source: GAO analysis of stakeholder information. | GAO-19-290

Figure 1

Many of these cited factors speak to issues that are broader than the topic of engaging frontline employees who currently work at a transit agency. If a transit agency is unable to attract new talent to replace retired workers, for example, there is a fundamental problem (i.e., a lack of replacement staff). The fundamental problem must be addressed so that issues like a lack of engagement from current frontline employees can improve. Further, it is possible that the fundamental problem of a lack of replacement staff already is, or becomes in the future, *persistent* for various reasons. Take, for example, the difficulty of providing competitive wages—such challenges can aid this fundamental problem in becoming persistent, even more resistant to turning the tide. If new talent is difficult to attract, and they are sorely needed in part due to an outflow of retiring staff, having real or perceived barriers such as low wages can make addressing the fundamental problem nearly insurmountable. Some agencies may find that wages must be made competitive to have any chance of maintaining a strong workforce. Even if wages are kept competitive, the issue still might not be resolved entirely. For instance, if a worker is comparing a job in the transit industry to one in another industry with similar pay, the fact that transit jobs tend to lack flexible and remote work could easily be a reason why they choose another industry.

At the same time, working toward improvements in the engagement of frontline employees (i.e., having employees who are more emotionally involved and committed to their work) can be considered from two general points of view. The first is the point of view of a staff member who already works for the agency, while the second point of view is from a potential new recruit to the agency. Due to greater pressure on replacement staff needs related to high rates of retirement, in part, the second point of view is just as important to consider as the first. In the 2019 GAO *Transit Workforce Development* report, both impending retirements and advances in transit technology were cited as some of the primary challenges facing the US transit workforce, “The operation of transit systems depends on a skilled, qualified workforce, but impending transit worker retirements and advances in transit technology may create challenges for the transit workforce such as finding eligible applicants for transit jobs and obtaining the technology expertise needed.”⁶ In *Building an Apprenticeship and Training System for Maintenance Occupations in the American Transit Industry*, it is explained that “While updating the skills of incumbent workers — especially in electronics — is important, apprenticeship is central to replacing the skilled maintenance workforce on the verge of retirement.”⁷

This Guidebook, therefore, focuses not only on *retaining* current staff at transit agencies, but also on *attracting* new staff—strategically developing a talent pipeline of newcomers to the transit industry in general and to transit agencies in particular. Further, it calls for the transit industry to view the influx of new technologies into the industry as an opportunity from a workforce development perspective. Helping newcomers enter the transit industry as technology specialists of various types may be a motivating factor and an impetus for them to select the transit industry over other industries.

2.2 Strengths of the Transit Industry

While there are challenges, the transit industry also has its strengths. A number of reasons why someone might be attracted to beginning work, and remain working, in the transit industry include:

- **Job stability**
 - The field tends to have attractive benefits such as options for retirement and periodic wage increases. Depending on the agency, there may also be defined paths for internal promotions, ongoing education, and other opportunities for advancement. In addition, transit industry jobs often have union representation, which can help protect workers in some cases from adverse events such as layoffs.
 - An APTA report from 2015, *Workforce Planning: Maximizing the New Reality of a Revolving Workforce*, presented a summary of a survey that

⁶ <https://www.gao.gov/products/gao-19-290>

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https://www.transittraining.net/images/uploads/document_previews/Building_an_Apprenticeship_and_Training_System_for_Maintenance_Occupations_in_the_American_Transit_Industry_-_Bob_Glover_PREVIEW.pdf

had 38 responses from transit agencies and companies across the US.⁸ “Respondents were asked a number of questions about salary and benefits and their perceived impact on attracting and retaining employees. Two-thirds of survey respondents believed that their benefits are their most effective way to attract and retain employees and two-thirds of respondents also reported that they believe their salary system in place for represented employees was effective in retaining employees.” However, is worth noting that, despite these reports, more than 70 percent said they “were experiencing higher than average turnover concentrated in the front-line positions such as operators and mechanics. With higher turnover occurring at most companies as reported through the survey and salary and benefits packages trending to become less lucrative over time, finding new strategies to attract and retain employees beyond traditional salary and benefits programs is going to become increasingly important.”

- **Career potential**

- The transit industry provides a viable path for workers who choose to embark on a career without a bachelor’s degree. In some industries, the transit industry included, workers without a bachelor’s degree may end up at risk of doing low-wage, low-skill work with little opportunity for growth or advancement in the future. In a 2018 publication of COWS⁹ (a nonprofit “think-and-do tank” based at the University of Wisconsin-Madison), *Equity from the Frontline: Worker Voice Leads to a Network of Accessible Apprenticeship Pathways*, opportunities for advancement at the Santa Clara Valley Transportation Authority (VTA) in Santa Clara County, California are explained.¹⁰ “People with limited skills but mechanical interest can enter VTA as an operator; transfer to service, station or facilities worker; and work their way into a mechanic or track worker apprenticeship. ‘These jobs now lead to a career, benefits, and better schedule,’ states Carl Hart, Program Graduate.”
- The transit industry has a history of providing apprenticeship programs that combine classroom education, often through a community college or trade school, with on-the-job training to help prepare apprentices for their first job with a transit agency. In addition, these programs have often offered payment to apprentices in exchange for their time investment, with the guarantee of a paid position at the transit agency if they successfully complete the program. In *Building an Apprenticeship and Training System for Maintenance Occupations in the American Transit Industry*, it is mentioned that TriMet, the transit agency serving the Portland, Oregon metro area, and ATU Local 757 have been partnering to provide apprenticeships since the early 1980’s. The same report references an apprenticeship program that began in 1989 to support workers at

⁸ <https://apta.com/wp-content/uploads/Resources/members/memberprogramsandservices/leadershipapta/previous/PublishingImages/Team%205%20Report.pdf>

⁹ <https://cows.org>

¹⁰ https://equityinapprenticeship.org/assets/documents/Equity%20in%20Apprenticeship_VTA.pdf

Alameda-Contra Costa County Transit District (AC Transit) in partnership with ATU Local 192 in Oakland, California.

- While there is a history of having apprenticeship programs in the transit industry, it has not become a common practice across the entire country. As stated in *Building an Apprenticeship and Training System for Maintenance Occupations in the American Transit Industry*, “A survey of agencies in selected major urban areas identified fifteen agencies with self-described apprenticeship programs in various stages of development exhibiting a wide range of quality and approaches (Community Transportation Center, 2007).” Having an apprenticeship program demonstrates that a transit agency will invest in the apprentice on the expectation that the apprentice will invest in the transit agency in turn. Apprenticeship programs help those without a bachelor’s degree to learn a trade in a growing industry that needs workers, providing them with career potential without a student loan. At the same time, it helps the transit agency gain new staff members who thoroughly understand their role at the agency and possess the skills they need to succeed.
- The investment that transit agencies make in apprentices, and the investment that apprentices make in themselves and their future through such programs, sets apprentices up for a true career—not a one-off job that may lead to a series of other low-wage, low-skill jobs.
- **Job options**
 - Depending on their position in the transit industry, employees have options to work for other employers—including other transit agencies but also other industries. For example, someone in a bus operator position can later go work for companies that employ bus/coach/large vehicle operators in fields such as shipping and freight transportation or even school systems. A mechanic can work in vehicle repair in many other fields. As they gain ZEB-related skill sets, workers are better able to handle zero emission vehicles, making them even more attractive to industries that are going through a similar ZEB transition process.
 - The transit industry, as a whole, should work together to keep employees within the industry; it is far better for transit agencies to compete among each other for talent rather than with other industries. Workers are often aware of the fact that they are gaining valuable skills that can be leveraged in dynamic ways throughout their careers—this may play a part in why a worker picks a certain industry in the first place. Through opportunities for employees to gain valuable, high-tech skills, the transit industry offers its workers greater career flexibility and growth potential over time.
 - The potential to gain valuable, high-tech skills likely is, or could be, a selling point in attracting newcomers to the transit industry. Though it may seem counterintuitive (since it sets workers up for more options elsewhere), transit agencies could even consider including this as a selling point in its job marketing to potential new employees. Once an employee has joined a transit agency, the key is to make sure they want to stay

there, or in the transit industry at large, with other strategies and tactics that help retain workers. In short, a strategy to attract must be followed by a strategy to retain. This is further explained in section 2.3.

- **Impactful work**

- At many jobs, including jobs in the transit industry, the day-to-day activities of an employee can seem rote, and it may be easy for an employee to forget about their contribution and how meaningful it is. The US transit industry is the backbone one of the most vital functions in any society—the movement of people to their daily activities—feeding into critical outcomes in social mobility, health, education, and many other realms of people’s lives.
- Furthermore, the more trips taken by transit in the US—as opposed to other more polluting modes—the less negative environmental consequences there are for the movement of people to their daily activities. The positive impact of the US transit industry is local, within the US, but also global—helping the US to lower its carbon footprint overall to world-wide benefit.
- Not all industries can boast this level of societal benefit, and it may be a reason why professionals in the transit industry start working in it in the first place, and why some remain in it for their lifetimes. As Lisa Vickery, VTA Superintendent, explained in *Equity from the Frontline*, “This is not a slick marketing roll-out. These are people’s lives, hopes, and dreams. They want something that is going to be a career for them. It’s very easy to forget how important work is to people, their sense of selves. This should be held at the forefront.”

In addition, the transit industry has the potential for state-wide and national solutions. This Guidebook refers to the “transit industry” frequently, as opposed to separate, individual agencies, because many of the challenges that agencies have are typically faced by all transit agencies to a lesser or greater degree. The US has national funding, labor, organizational, and research structures in place for the transit industry such as the Federal Transit Administration (FTA), multiple unions including the ATU, the American Public Transit Association (APTA), the Community Transportation Association of America (CTAA), and the Transit Cooperative Research Program (TCRP). States often have their own state-level organizations to support their transit industry and its professionals as well such as the [Georgia Transit Association \(GTA\)](https://www.gatransit.org),¹¹ [New York Public Transit Association \(NYPTA\)](https://nytransit.org/),¹² and [Washington State Transit Association \(WSTA\)](https://watransit.com/about-about-wsta)¹³. The transit industry, therefore, has the communication pathways and forums needed to gain input on major challenges to the industry and report back on solutions and paths forward as they develop.

2.3 Ways to Engage Employees

¹¹ <https://www.gatransit.org>

¹² <https://nytransit.org/>

¹³ <https://watransit.com/about-about-wsta>

The Guidebook centers on three primary ways to engage employees: establishing a shared vision and purpose, investing in individual employees, and tailoring engagement strategies to both current employees and potential new recruits.

2.3.1 Establishing a Shared Vision and Purpose

As management staff and frontline employees work together, a shared vision of the transit agency's new transit technology direction is key. When frontline employees fully understand where the transit agency is headed, why they are headed that way, and their role within that direction, they are better able to see themselves within the big picture—contributing to higher levels of engagement. The purpose of deploying new technologies at a transit agency typically relates to specific anticipated outcomes. While this is not an exhaustive list of core outcomes for all situations, these three outcomes are often related to technology improvements.

- **Higher level of operational efficiency** – Technology, depending on the type, has the potential to reduce overall operational costs and enables the agency to allocate financial savings to improve operations and customer service elsewhere.
- **Improvements in customer service** – Often technology can make transit service information more transparent and accessible or make the service itself faster and more convenient, both of which contribute to the customer service bottom line.
- **Reduction in environmental impact** – While transit service is typically more environmentally-friendly than, for example, a person driving their personal vehicle, the fossil fuels that historically have been used to run transit service—and the accompanying vehicles—are undergoing an upgrading process to reduce transit's environmental impact overall.

A newly-adopted technology may contribute to one, two, or all three core outcomes as well as other outcomes not listed. Not only should transit agency management understand precisely how a proposed technology will contribute to this bottom line before committing to it, but they should also be vocal and direct with frontline employees about how the new technology will contribute to these outcomes. Otherwise, new technology can fall into a trap of frontline employees thinking it is being deployed for other reasons such as to make the agency appear more modern or to “keep up with the times.” While these reasons may also be true, which is not necessarily a bad thing, these reasons are likely not very compelling to frontline employees who may see themselves as part of a broader social mission to ensure people have access to affordable, accessible, and environmentally-friendly transportation options.

Communication about technology within transit agencies may fall victim to mixed messaging, such as different managers talking about the technology's benefits in different and uncoordinated ways, or may even fall into a messaging gap in which the benefits are not communicated at all. With some technology, managers may assume everyone understands why the technology matters, when in actuality, staff may understand only a part or misunderstand entirely. For these reasons, it is important that transit agency management be clear, unified, and precise in their communication about new technology, specifically with frontline employees, in order to keep the entire agency

on the same page. Frontline employees of transit agencies need to know where the agency is headed and how their role contributes to that vision; this understanding can help pave the way for an employee to become more engaged (i.e., emotionally involved and committed) with their work.

2.3.2 Investing in Individual Employees

If handled with a targeted approach, new transit technologies can be positioned as a way to help frontline staff further their careers—it can pave the way to internal promotions, position them for opportunities in the US transit industry at large, and enable them to have a solid base in a career as compared to a stand-alone job.

Investing in individual employees can take many different forms. For existing staff, for example, having a mentor to speak with periodically can be a valuable tool in navigating the personal and professional challenges that come up on the job. Section 3.5 of the Guidebook goes into mentorship in further detail. It is also important that existing staff have the opportunity to build a customized career path for themselves, with management's input, at the agency. This can involve lateral moves to explore different departments and vertical moves within their current position's trajectory, potentially also involving periods of agency-sponsored training to help them gain the skills they'll need for the next move. As mentioned in section 2.2 under "career potential," the US transit industry has a history of providing apprenticeships. While nearly all forms of training are valuable, apprenticeships illustrate perhaps the deepest level of investment a transit agency can devote to an individual. Apprenticeships can be accessed by current staff as well as new staff, and are a primary pathway for the latter to enter not only the transit agency—but the transit industry at large—for the first time.

By taking an active role in positioning individual employees for a positive career outlook, bolstered by employee knowledge of and experience with transit technologies, transit agency management can foster frontline employee engagement by investing directly in their future. When people are invested in, they are much more likely to be emotionally involved and committed to their work (i.e., be engaged employees). Jess Martinez, a Service Mechanic Apprentice and former station maintainer at VTA, explained in *Equity from the Frontline* why his apprenticeship has been motivating, "Where else can you make money while you learn? Provide for your family as you learn? That brings loyalty."

2.3.3 Tailoring Engagement Strategies to Both Current Employees and Potential New Recruits

While section 2.3.2 "investing in individual employees" supports the individual experiences of specific staff members, transit agencies also need to consider broad, large-scale strategies that improve the experience of working at the transit agency, and entering the agency for the first time, for all workers in general.

As mentioned in section 2.1, there are two general employee points of view—the point of view of a current staff member and the point of view of a potential new recruit to the agency. In addition, under "job options" in section 2.2, it was stated that a strategy to attract must be followed by a strategy to retain. For current staff members, strategies

that support the goal of retaining them at the agency should be the focus. However, for potential new recruits, strategies that support the goal of attracting them to the agency should instead be the initial focus. As the strategy to attract new staff has some success, and potential new recruits become new staff members, an agency should shift gears and focus on retaining them as current staff. In this way, the goals of retaining current staff and attracting new staff become circular and connect with each other over time.

Current employees have a wide range of specific viewpoints depending on their position, the years they've been with the agency, their past work experiences, and other factors. A tailored strategy for current employees to foster engagement, and ideally retain them, should be rooted in making improvements in their immediate and long-term experiences at the agency. Potential improvements should be identified through direct employee input, and they should be prioritized based on which ones matter the most to employees—achieving the greatest impact based on their perspectives. Suggested activities and topics for discussion to help guide this process are proposed below, broken down according to the strengths of the transit industry explained in section 2.2. When current employees know they have job stability, career potential, job options, and an important role to play in impactful work, there is a far greater chance of retaining them as employees at a transit agency.

<p style="text-align: center;">Job Stability</p>	<ul style="list-style-type: none"> • Ask staff which benefits are most in need of improvement; develop plans to improve them whenever feasible. This can build goodwill between management and frontline employees. • Ensure that wages keep pace with inflation, at a minimum, and whenever possible, raise wages to keep pace with competitors from the public and private sectors. • Ask staff for their input on preferences for advancement at the agency. Define paths for internal promotions, both vertically within a certain position and laterally across positions (including from frontline staff to management level). Communicate with employees about how these options can help them progress through the agency over the years. • Work collaboratively with unions and employees to set mutually-agreeable terms, especially for job protections.
<p style="text-align: center;">Career Potential</p>	<ul style="list-style-type: none"> • Advertise apprenticeship programs with current staff so they are aware of other opportunities within the agency into which they can transition. • Gain feedback from staff on apprenticeship programs they would like to have access to in the future for a better understanding how they want their role at the agency to evolve.

	<ul style="list-style-type: none"> • Identify and plan for training opportunities of other types (i.e., not apprenticeships) to help them learn new skills.
Job Options	<ul style="list-style-type: none"> • Find out what staff members would like to accomplish over the years; commit to doing what is possible to help them on that path. • Set up career advice and coaching sessions with workforce development professionals. Ensure that each employee has a documented, customized career path (i.e., personal development plan) for themselves that guides their growth at the transit agency. • Leverage the skills staff already have, possibly applicable to other departments or, with additional training, as a vertical promotion to help them achieve their desired advancements.
Impactful Work	<ul style="list-style-type: none"> • Learn why frontline staff find their work meaningful and compelling, by asking them directly through surveys, team meetings, and group discussions. This can help management identify trends and better shape their workforce development practices in those directions. • Reference the known reasons why frontline work is compelling to staff in communications of all types on a daily basis in order to remind them why their work matters.

Potential new recruits to a transit agency generally fall into four groups. Each group would share similar viewpoints based on their shared interests as shown in figure 2.

- Group 1: New to the transit industry and just leaving high school (or potentially with some trade school/community college/university experience)
- Group 2: New to the transit industry with some/significant work experience in another industry, but without skills highly valuable to the transit industry
- Group 3: New to the transit industry with some/significant work experience in another industry with skills highly valuable to the transit industry
- Group 4: Previously working in the transit industry for another agency



Figure 2

A tailored strategy for the engagement of potential new recruits aimed at attracting them to work at a transit agency—perhaps even the transit industry at large—would involve first identifying clear and logical ways that they could enter the transit agency. A multi-level, targeted pathway into the agency must be designed, implemented, and communicated to the recruits. Communication-related activities such as messaging and targeting would be tailored to the diverse interests and access points of group 1, group 2, group 3, and group 4; the groups would enter the pathway at different levels as shown in figure 3.

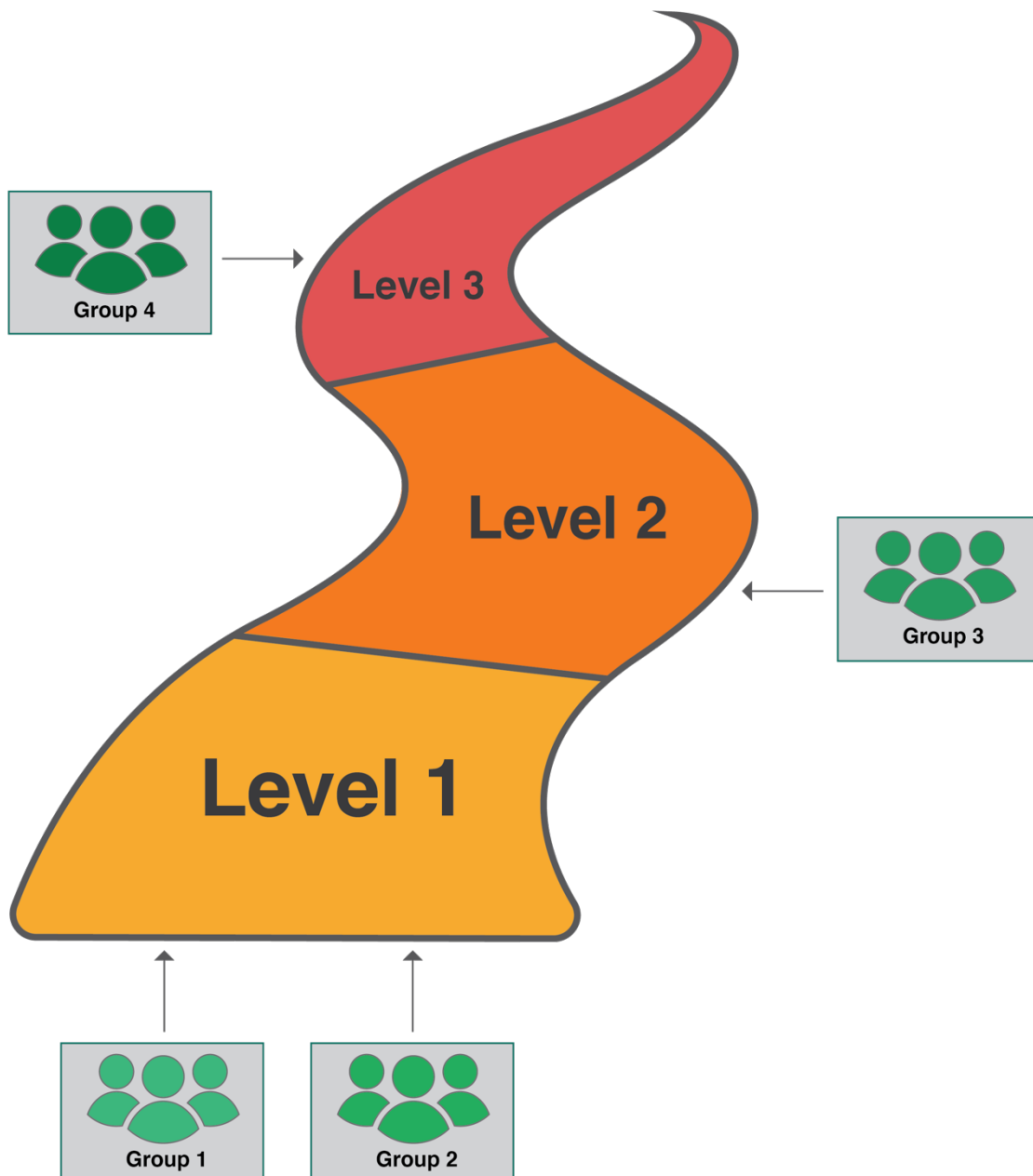


Figure 3

When potential new recruits can hear about and understand pathways for them to enter a transit agency for the first time, there is a far greater chance of attracting them to become new employees of a transit agency. While including the topics of job stability, career potential, job options, and impactful work in initial messaging to them, so they have a clear and compelling reason “why” for being interested in a transit agency, understanding that there is a clear path for them into the agency answers their next question, “how” can I successfully enter the agency? Both “why and how” questions

should be easily answerable by diverse potential new recruits—this is the foundation needed for them to think that a transit agency may be a potential match for them and their career aspirations.

<p>Level 1: Basic Education</p>	<p>Level 1, the entry level of the pathway, would involve educating workers who are not familiar with the transit industry, have little professional experience, and lack basic skills to complete transit-related work tasks. Typically, members of groups 1 and 2 would enter at level 1, which would involve beginning with an apprenticeship program, the classroom education component in particular, to teach them the basics they need to know in order to do the work.</p>
<p>Level 2: Skill Gap Training</p>	<p>Level 2 would involve training recruits in order to address gaps in their skills, either to complete the final stages of classroom education within the apprenticeship program (the next step for groups 1 and 2 after completing level 1), or as a stand-alone training effort. The stand-alone training effort would be developed for specific audiences such as those in group 3 who should not begin at the ground level in level 1, since the valuable skills they have are already highly applicable to the transit industry.</p>
<p>Level 3: On-the-job Training & Mentorship</p>	<p>Level 3 would involve on-the-job training and mentorship, either as the finishing stage of the apprenticeship/training program (the final step for groups 1, 2, and 3), or as stand-alone efforts targeted, for example, at members of group 4—someone who previously worked in the transit industry for another agency. As a new member of the transit agency, even if they had a similar role at another agency, they would still need to have a transitional learning period that enables them to understand how the new agency works through on-the-job training. In addition, mentorship programs have been shown to be very valuable to transit agencies, as explained further in section 3.5. During level 3, mentorship programs would begin; they often continue into the first few years of employment or further—long after level 3 of the pathway to the agency has been completed.</p>

Chapter 3: Training Frontline Employees on New Transit Technologies

3.1 Opening

In *Building an Apprenticeship and Training System for Maintenance Occupations in the American Transit Industry*, the following is explained, “Changing technologies are driving the need for advanced training, especially applications of information technology and intelligent transportation systems to transit – including advanced electronic communications for bus and train operations and automated processes for fare collection, passenger counts, vehicle location, and next-stop announcements. Digital electronics, computers and microprocessor-based systems are increasingly found in all aspects of transit... At the same time, dramatic demographic challenges are hitting the industry. Transit is facing a huge wave of retirements, which will bring significant losses of experienced mechanics.”

A primary employee engagement method transit agency management can use in order to retain current employees and attract new employees—and ultimately have more emotionally involved and committed staff—is through training activities of various types. For new transit technologies such as ZEBs, training is foundational to staff having even a basic understanding of the technology including how to incorporate it into their daily work and how to stay safe around it. In section 2.2, the strengths of the transit industry were explained as falling into four categories: job stability, career potential, job options, and impactful work. Training, as an engagement method, is directly or indirectly related to all four of these strengths.

- Job stability – Training can feed into the total employment package offered to new employees and can expand over time for existing employees. Agency-funded training bolsters the plans that staff may have for internal promotions and other advancement opportunities; training is necessary, in particular, when new transit technologies are involved.
- Career potential – Providing significant training opportunities such as apprenticeship programs on the topic of new transit technologies to staff can help them move from thinking of their role as a “job” to thinking of it as a career, at the same time providing them with a skill base from which they can better navigate their careers.
- Job options – Agency-funded training for new transit technologies can help employees gain high-value skills enabling them to have a more flexible career, a reason why a worker may be attracted to working in the transit industry.
- Impactful work – Providing agency-funded training that not only covers technical topics but also builds in concepts related to how impactful an employee’s work is can help ensure this important messaging—critical to employee engagement—is instilled in employees, reminding them how meaningful their work is and how much their contribution matters.

In section 2.3 “ways to engage employees,” three primary ways to engage employees were mentioned: establishing a shared vision and purpose, investing in individual employees, and tailoring engagement strategies to both current employees and potential new recruits. Training has a significant role to play in each.

- In order to support “establishing a shared vision and purpose” (section 2.3.1), agency-funded training can provide an opportunity to make sure employees are familiar with core outcomes of new transit technologies such as a higher level of

operational efficiency, improvements in customer service, and a reduction in environmental impact.

- Training, as an employee engagement method, often plays an important role in “investing in individual employees” (section 2.3.2). As mentioned in that section, although there are many ways to invest in employees, training in particular is one of the most impactful ways.
- As mentioned under “tailoring engagement strategies to both current employees and potential new recruits” (section 2.3.3), training can be used as a strategy for two points of view—the point of view of a current staff member as well as the point of view of a potential new recruit to the agency.
- For the former, training can help expand their current role and future career path at the transit agency to incorporate new transit technologies, while for the latter, training is often their entry point to the transit agency—perhaps even the transit industry at large. As aforementioned, transit agencies should establish clear pathways into the agency for potential new recruits from Level 1 with its apprenticeship programs to Level 2 involving training for skill gaps and culminating in Level 3 with on-the-job training and mentorship—each level built around the four potential new recruit groups, matching their needs with the pathway.

While agency-funded training is commonly leveraged in order to ensure frontline employees gain the skills and knowledge they need fulfill the requirements of their current roles, training can be leveraged to accomplish much more than that for management and frontline employee relationships. Transit agencies, by positioning new transit technologies as a highly desired area of expertise at *their* agency through training, enable staff to achieve two ends with one move as training participants—a competitive advantage that is useful at the transit agency in the present *as well as* benefits to their career path in the future. Employees are aware that this advantage (i.e., advanced knowledge of new transit technologies) can help them compete in the marketplace as professionals seeking greater job satisfaction, financial stability, and career progression. They would likely be more engaged with employers that help bolster their long-term career prospects, as opposed to employers that appear to be looking out only for the transit agency’s interests.

Employee engagement is about *more* than making sure employees are emotionally invested in and committed to the transit agency they work for; it is *also* about making sure employees are engaged with their work in the transit industry and their careers more broadly. In this way, engagement works on a level that is internal—personal to the employee—but also external, supporting their relationship with their employer *as well as* their experiences with and perceptions of the transit industry more broadly. Knowing that they have a significant competitive advantage in their career due to their knowledge of and experience with new transit technologies helps their internal engagement; they know they are building a solid career in a growing area of knowledge. Transit technologies will change over the years as new technologies replace old ones, but the need to know about them and understand them deeply will only intensify over the years. Many frontline employees are well aware that their competency in this area will give

them a significant advantage in their careers in the future, and the employers that support them on this path through agency-funded training are more likely to gain greater levels of commitment from them.

Based on the interviews mentioned in sections 1.3 and 1.4, four primary methods for training frontline staff were identified: (1) training through the original equipment manufacturer (OEM), (2) periodic training for existing staff, (3) on-the-job training and mentorship programs, and (4) apprenticeships. These methods are not mutually exclusive and may be combined for a particular training effort. The experience of IndyGo in Indianapolis, Indiana is referenced in detail in this chapter to give the reader context while providing an example to help illustrate the points being made.

3.2 Getting started with BEBs at IndyGo

IndyGo is one of the largest transit agencies in the Midwest using battery electric buses (BEB). In 2015, IndyGo began the process of incorporating BEBs into its fleet, receiving two Transit Investments for Greenhouse Gas and Energy Reduction (TIGGER) grants from the FTA that year to assist the effort. IndyGo purchased 21 40-foot buses, all of which were originally diesel-powered buses that were refurbished to become BEBs. Based on a 310-kwh battery, these vehicles have approximately 80 miles of range, meaning they can travel 80 miles without needing a full charge—although the agency had expected the vehicles to have closer to 130 miles of range. Due to this realization that the actual range was far lower than the anticipated range, it became clear to IndyGo that these vehicles would only be suited to specific purposes. Currently they are used for rush hour and peak times, purposes that allow for the vehicles to be returned quickly and recharged after shorter periods of use, in order to boost the number of available vehicles in the fleet. It took the agency approximately one year to know enough about the vehicles to begin actively using them in its fleet.

In 2018, IndyGo purchased 31 60-foot BEBs from BYD Co. Ltd., an original equipment manufacturer (OEM) of electric buses. These vehicles have 140-200 miles of range, depending on the weather, from a 640-kwh battery. In September 2019, IndyGo began using these BEBs on the 13-mile long “red” bus rapid transit (BRT) line, one of the first uses of BEBs on BRT routes in the US.

Currently, IndyGo is preparing to order 28 more BEBs from BYD, based on the original contract between IndyGo and BYD that allows for purchasing up to 75 buses in total over time at an agreed-upon price. IndyGo plans to allocate these buses to its “purple” BRT line.

Regarding getting its frontline workers ready for this transition, an IndyGo representative explained that ensuring the mechanics were prepared to repair the vehicles was the one of the greatest employee-related challenges. By 2016, the agency had approximately three mechanics on staff to support BEBs. These mechanics, who were already on staff at IndyGo prior to beginning their work with BEBs, had previously worked on fully diesel-powered buses as well as hybrid buses at IndyGo—their experience with hybrid buses provided them with a knowledge base for BEBs. During 2015-16, they were trained by

the OEM to handle the maintenance needed on the BEB vehicles that the OEM had delivered to IndyGo. From there, IndyGo opened up approximately ten new mechanic positions; the staff who ended up filling those positions did not have prior BEB experience but were trained through a combination of efforts on the parts of both the OEM and mechanics at IndyGo with BEB skills.

IndyGo has faced additional notable challenges with BEBs due to how cold the local climate is in Indianapolis, Indiana. A representative from IndyGo explained that weather extremes in winter can lead to a 30 percent reduction in mileage range (i.e., the number of miles a vehicle can travel without being charged again). One of the specific reasons for this challenge is connected to the heating systems on the vehicles that keep the passengers and operators warm; they are reported to be the primary reason for draining the battery more quickly. IndyGo's next round of BEBs, already ordered, will include diesel-powered heaters in the BEBs in order to reduce pressure on the electric battery and keep the maximum mileage range intact. In addition, they are putting in place other measures to boost the mileage range such as installing the infrastructure necessary for bus drivers to charge the buses while on break.

It is not only cold climates that face challenges with BEBs. In *Transforming Transit, Realizing Opportunity: How battery-electric buses can benefit the environment, the economy, and public transit*,¹⁴ a report published by Jobs to Move America in 2019,¹⁵ the following is mentioned, "With its combination of flat and hilly terrain, and demanding climatic conditions (coastal air that can corrode bus components and roadway temperatures that can reach 120 degrees), Los Angeles presents an array of challenges for bus performance. By driving the pilot project buses on some of their toughest routes, Metro staff learned a range of lessons about the capabilities of the pilot BEBs."

3.3 Training through the original equipment manufacturer

Due to the fact that ZEB technologies are newer, rapidly-evolving technologies, the original equipment manufacturer (OEM) often knows the technology the best and, therefore, is often well positioned to communicate how it works to others. This means that OEMs may offer training as a part of the total package, in combination with the equipment, or that training may be purchased by a transit agency along with an equipment order.

Considerations to take into account related to this training approach are explained in FTA Report No. 0182, *Transit Vehicle Innovation Deployment Centers (TVIDC) Advisory Panel Overview and Conclusions*, published in 2021, "The continued deployment of ZEBs requires a workforce of transit operators, technicians, engineers, and planners who are trained in the sourcing, deployment, and management of vehicles and supporting infrastructure with considerably different operational characteristics from diesel and CNG (compressed natural gas) buses. Transit agencies currently rely on OEMs to provide high-level training for the operation and maintenance of the vehicles they sell. Whereas this training and technical support are critical to successful

¹⁴ <https://jobstomoveamerica.org/resource/transforming-transit-realizing-opportunity/>

¹⁵ <https://jobstomoveamerica.org>

deployments, they are not designed to provide ongoing training after the initial introductory period, especially as new employees onboard. Moreover, this training lacks standardization across the industry, with varying approaches from OEM to OEM and no certification mechanism.”¹⁶

As mentioned in section 3.2, IndyGo included training in its initial contract with an OEM in 2015. This enabled the agency to train the first three mechanics in BEB-related skills during 2015-16; these three mechanics, along with the OEM, assisted in training an additional ten mechanics on staff at IndyGo in BEB-related skills in subsequent years.

As noted by an IndyGo representative, all staff members who interact with the BEBs will need safety training. Vehicle mechanics who work with BEB technologies in the transit industry, often called “high voltage” technicians, have a great deal to learn such as about the specifics of BEB suspension systems and BEB computer-based diagnostics. Bus operators of BEBs require a lesser amount of BEB-focused training when compared with mechanics; an IndyGo representative noted that it is possible to incorporate BEB-related training topics into general bus operator training programs, for example. One of the main skills BEB operators need to learn involves braking. The technology behind BEBs involves the batteries recharging while the vehicle is in motion and during the braking process (called “regenerative braking”). It is important that operators brake early and slowly in order to allow the batteries to recharge. A BEB is at risk of a reduction in mileage range when an operator brakes suddenly, something that is not necessarily a problem for diesel-powered buses.

Initially in 2015-16, the OEM trained a set of bus operators at IndyGo on BEB-related skills. Once the agency had that knowledge base on staff, they then moved into planning and implementing “train the trainer” programs, enabling drivers more experienced in operating BEBs to train those with less experience. A representative of IndyGo mentioned that “train the trainer” programs can be very beneficial for training drivers on BEB technologies.

In the *Transforming Transit, Realizing Opportunity* report from 2019, the reader is cautioned against an overreliance on the OEM for BEB training purposes, “Maintenance workers at agencies that have started to use BEBs described challenges associated with BEB technology that maintenance staff are still in the early stages of learning. As of the writing of this report, most BEBs currently in use are still under warranty, therefore many agencies likely rely on OEMs for the lion’s share of maintenance service and technical assistance. Robust information does not yet exist on the degree to which adequate trainings are available to teach agency maintenance staff about servicing BEBs, however conversations with maintenance staff have made clear that transit maintenance workers have strong concerns that they will not receive the training that they need to take care of BEB fleets. Maintenance workers also worry that as BEB technology matures, the lower maintenance needs of BEBs will eventually put them out of their jobs.” A quote from Michael Terry, President and CEO of IndyGo, is provided in the report, explaining that transit agencies “shouldn’t be under the illusion that a

¹⁶ <https://www.transit.dot.gov/sites/fta.dot.gov/files/2021-01/FTA-Report-No-0182.pdf>

manufacturer's warranty is going to provide full, deep, rigorous protection." Terry stressed the importance of having highly-skilled staff at the transit agency who know how to diagnose BEB problems and can track the fleet's performance.

3.4 Periodic training for existing staff

Transit agency employees are often trained periodically on a variety of topics to ensure that their skills and knowledge are kept up-to-date. In some cases, agencies have incorporated training on new technologies within their own structure of periodic training. Although these training events may not be led by the OEM, the curriculum may be based on content provided by the OEM at other BEB training events. The curriculum may be also be based on the internal learning process of a transit agency, with lessons learned extracted from the "research and development" process that agencies themselves often undertake when they commit to becoming early adopters of new technology.

IndyGo's training process, deployed during the early stages of getting set up with BEBs, is typical. The training provided by the OEM was relied upon in the earliest stage to achieve two objectives: training the first set of staff members who would work with the new technology and leveraging the OEM training content and guidance for future training events for additional staff. Once IndyGo had a base of content and guidance, they could combine that with the agency's experience and develop their own customized training materials in the later stages. Such training materials (i.e., curricula) can then be used for various efforts such as train-the-trainer programs, mentorship programs, and as a part of periodic training for staff (which may be broader in scope than ZEB technology topics). Gradually, an agency can establish their own curricula in order to support all their staff members internally—through targeted and diverse educational activities—as they learn more about ZEB technologies.

3.5 On-the-job training and mentorship programs

On-the-job training and mentorship programs and are often used to connect skills-based learning with experiential learning, both key processes in gaining and applying new knowledge. While on-the-job training may involve a staff member riding along with a bus operator during their first few rides in a ZEB, for example, mentorship would typically be an ongoing process with periodic check-ins between mentor and mentee. Mentorship programs help add in a social aspect to transit roles, which is especially important for roles that can be isolating such as bus operation. Mentorship programs help avoid a feeling among employees that they are on their own and can also help with the overall effort of transitioning from skills-based learning to experiential learning; mentorship programs often last far beyond when a formal on-the-job training period would end.

In addition to classroom training, the mechanics at IndyGo benefitted from significant on-the-job training in order to gain hands-on experience with BEB technologies. A representative from the ATU explained how important the transit industry has found mentorship to be. A training process for a bus operator, for instance, that lacks significant on-the-job training can run the risk of putting them out on the road with passengers too soon—contributing to employee disengagement or even quitting.

Operators deal with a wide variety of street sizes, intersection types, and traffic conditions, and learning how to navigate an entire transit district with all its conditions involves a steep learning curve. In addition, having bus passengers on board introduces several challenges from dealing with disgruntled or unruly passengers to accepting different forms of payment, to name a few. An operator's day-to-day work comes with unique challenges such as sitting for prolonged periods of time and needing to stay off of devices/being out of communication with family and friends for long periods of time for safety reasons.

The stresses of being a bus operator are best shared with other, more experienced operators in the form of mentorship. Mentorship provides new bus operators with an outlet to discuss and sort through the physical and psychological challenges of the role with more experienced operators who can provide perspective. In the 2018 report, *Equity from the Frontline*, Armando Barbosa, a coach operator apprenticeship graduate and employee of VTA, explained why having a mentor was critical for his development as a staff member, "My mentor drove the bus on my first day. It helped with the stress because I had the opportunity to ask questions and see how it should be done. Each situation is different from the next. I was very worried about crashing the bus for the first six months. The mentors were always there if you are ready to accept help."

3.6 Apprenticeships

Training through apprenticeships is covered in detail in Chapter 4, but is briefly mentioned in this section to bring some of the topics of the previous sections together and explain the importance of having apprenticeship programs, especially those that enable frontline staff to specialize in new transit technologies. If 1) training through the original equipment manufacturer, 2) periodic training for existing staff, and 3) on-the-job training and mentorship programs are the only training methods applied, a transit agency will have very limited ability to attract new employees. As mentioned in section 2.3.3, there are four general types of potential new recruits to a transit agency:

- Group 1: New to the transit industry and just leaving high school (or potentially with some trade school/community college/university experience)
- Group 2: New to the transit industry with some/significant work experience in another industry, but without skills highly valuable to the transit industry
- Group 3: New to the transit industry with some/significant work experience in another industry with skills highly valuable to the transit industry
- Group 4: Previously working in the transit industry for another agency

The pathways into the transit agency, also described in section 2.3.3, build on each other from level 1 with its apprenticeship programs to level 2 involving training to address skill gaps and level 3 with on-the-job training and mentorship. While all three levels would likely need to be completed by groups 1 and 2, group 3 would typically begin at a more advanced place in level 2, and group 4 (the most advanced group) would commonly begin with level 3.

If apprenticeship programs are not available in support of new transit technologies, then a transit agency would have difficulty attracting members of groups 1 and 2 who want to

specialize in new transit technologies—those new to the transit industry and just leaving high school/trade school/community college (beginning their careers) or those new to the transit industry with some/significant work experience in another industry, but without skills that are highly valuable to the transit industry. Cutting these groups off, group 1 in particular, would result in a major gap in the talent pipeline—not only for individual transit agencies but for the transit industry as a whole. The transit industry and its agencies would be missing a vital piece of the workforce development puzzle— younger workers beginning their careers—just as the anticipated rates of retirement threaten the workforce stability of the transit industry *and* new transit technologies become a commonplace knowledge requirement for the transit workforce.

A representative from IndyGo explained that apprenticeships are the best way to train new mechanics on BEB technologies; in addition, incorporating apprenticeships for new transit technologies into an agency may also contribute to needing new job classifications. In order to address the fact that IndyGo’s BEB mechanics will be spending a portion of their time in the classroom (staff new to BEB), a portion in on-the-job training (staff needing hands-on experience with BEB), and a portion working day-to-day in the repair shop (experienced BEB staff), IndyGo has opened up a new job classification for its BEB mechanics that better reflects this breakdown as compared with mechanics focused primarily on diesel-powered buses. BEB mechanics are also more likely to be required to work on emergency needs with little notice, often to address new issues with the technology that come up suddenly, and the BEB mechanic positions are built around the kind of flexibility often required of these mechanics. Having a specific job classification in place makes IndyGo better able to balance the demands of BEB technologies such as requiring a certain percentage of the mechanics, at least at the present time, to be in the classroom and not in the repair shop.

IndyGo is currently working on an apprenticeship program, consisting of both classroom and on-the-job components to ensure apprentices gain both academic and hands-on experience, in order to train new BEB mechanics. IndyGo plans to employ a manager for this program and partner with Ivy Tech Community College in Indianapolis, Indiana.

3.7 Lessons Learned by IndyGo

Some of the lessons learned by IndyGo as they rolled-out BEB technologies include:

- **Involve frontline staff** – Frontline staff should be involved early on when decisions impacting their work, such as the agency transitioning into ZEBs, are made. This enables them to be prepared for upcoming changes, such as needing to learn about new technologies that alter their daily work flows.
- **Prepare to train mechanics** – The mechanics (also called technicians or engineers) of a transit agency, in particular, need to be involved early in the decision-making and roll-out processes for ZEB technologies. The ability of the agency to repair the vehicles, address unforeseen issues, and test the vehicles (for mileage range and other factors) largely depends on the skills of the mechanics; significant delays in vehicle usage can occur if they are not involved. Ideally, mechanics and other staff members would be trained on the vehicle technologies prior to them being delivered, so that the timelines align (i.e., by the

time the agency has the buses, it also has mechanics who know how to work with them).

- **Leverage staff experience with hybrid vehicles when possible** – As was noted by representatives of the ATU and IndyGo, mechanics who have worked at a transit agency that uses hybrid buses, buses that have both an internal combustion engine powered by diesel *and* an electric motor powered by battery-stored energy, *prior* to using ZEBs are much better prepared for an agency's transition into using ZEB vehicles. Through their experience with hybrid buses, they have developed a knowledge base of ZEB-related technologies. IndyGo, for example, already had 12 hybrid buses in use in 2015, along with mechanics who knew how to work with them, when they made their first purchase of BEBs.
- **Plan for appropriate organizational structures** – Transit agency management should consider the organizational structures that may need to be put into place to support rolling out new technologies such as ZEBs. IndyGo realized, for example, that they would need not only frontline staff but also a supervisor with BEB expertise to help lead the roll-out of the new technology.
- **Test a single vehicle first** – It is better to test a single vehicle to make sure it fits the agency's needs, as opposed to placing a large order without agency testing, since the agency may find out later that they've committed to vehicles that don't meet the requirements.
- **Execute contracts that enable future purchases** – It may be ideal for transit agencies to have contracts with OEMs that allow for an agency to purchase additional buses in the future with clear terms. This allows for a more seamless pipeline of vehicles, since the price is known and the board of the transit agency and other stakeholders would not need to approve the terms of additional contracts.
- **Obtain the longest warranty possible** – The longer the ZEB warranty period, the better. This is always helpful in general, but even more so with newer technologies that may not function in the ways a transit agency anticipated.
- **Include training packages in contracts** – Many transit agencies rely on the OEM, at least in the early stages, to train their staff on the new technology. Transit agencies will benefit from understanding in depth what types of training are needed so that these details are included in the purchase package; there may be some financial savings when the training is bundled with the vehicle purchase. A 2021 International Transportation Learning Center (ITLC) resource, [*Providing Training for Zero Emission Buses: Recommended Expanded RFP Language*](#), provides related guidance on this topic.¹⁷
- **Understand operational implications in depth** – The TCRP *Research Report 219: Guidebook for Deploying Zero-Emission Transit Buses* is a helpful primer on the operations that take place in support of ZEB technologies, such as the way that charging/refueling infrastructure works, the importance of working with local utilities in order to plan for energy use, and ensuring that first responders are briefed on the types of emergency events that could occur with the new technologies.

¹⁷ https://www.transportcenter.org/images/uploads/publications/ITLC_ZEB_Report_Final_2-11-2022.pdf

- **Make sure that operational needs and employee needs are aligned** – It became clear through the interviews with IndyGo and the ATU that the sheer complexity of ZEB technologies leads to many issues that come up which are not necessarily directly related to employees, but impact them nonetheless and change the flow of their daily work. For example, having bus operators charge BEBs while on break, in order to maximize the mileage range, changes where they can take breaks. The break locations, break timing, and charging infrastructure must be thought out in detail to enable all the pieces to work together. Where the BEBs are parked at night requires even more consideration, so that the vehicles can reach full charge. A representative of IndyGo noted that all of these nuanced issues require more ongoing communication among staff than was previously required. The scheduling of shifts and breaks must be very precise, and all staff members must understand how the parts of the system work together.

Chapter 4: Apprenticeships for New Transit Technologies

4.1 Opening

Apprenticeship programs are a method that transit agencies can apply to achieve goals such as recruiting new staff effectively, ensuring that staff have critical knowledge and skills, and supporting a solid career base for employees. Apprenticeships are one way the transit industry can ensure it has a sustainable talent pipeline; however, the practice has not been universally adopted at transit agencies. In the US, they have predominantly been most common within the construction industry; apprenticeships have traditionally not been as common in the US in general when compared with countries such as Germany, for example. Apprenticeship programs are an attractive option for transit agencies striving for jobs that have the potential to become careers with greater long-term opportunities—providing a base for employee engagement and helping to retain staff.

Although a comprehensive resource that elucidates the current status of apprenticeship programs in the US transit industry is not currently publicly available, a report called *Building an Apprenticeship and Training System for Maintenance Occupations in the American Transit Industry* was published by the Transportation Learning Center (TLC) in 2009 that helps shed light on the topic.¹⁸ The researchers of the report were able to confirm through surveys that there were fifteen known “self-described” apprenticeship programs (of any type, not only for maintenance occupations) at transit agencies in the US. It is explained in the TLC report that the term “self-described” is applied because the programs are “in various stages of development” and are “exhibiting a wide range of quality and approaches,” going further to say, “Most transit apprenticeship programs were jointly administered through employer-union partnerships. Many programs were registered with state apprenticeship agencies or the US Department of Labor... The

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https://www.transittraining.net/images/uploads/full_documents/Building_an_Apprenticeship_and_Training_System_for_Maintenance_Occupations_in_the_American_Transit_Industry_-_Bob_Glover.pdf

isolation and independence of individual transit agencies has led to a great deal of local variation among transit apprenticeships. Transit agencies train workers based on the specific needs, equipment, organizational structure, and idiosyncratic culture of their agency. The result is that the term *transit apprenticeship* can refer to a variety of programs with often widely dissimilar aims and practices.”

There are two general ways that a transit agency could go about addressing the educational requirements for new transit technologies with an apprenticeship program—adding transit technology-specific content to an existing program or working toward having a new apprenticeship program. A new apprenticeship program could either incorporate transit technology-specific content within a broader topic (e.g., a “coach operator” apprenticeship that includes ZEB-specific details) or enable the apprentice to specialize in a new transit technology through the apprenticeship program (such as a “ZEB mechanic” apprenticeship). There are resources available that may help a transit agency with any of these paths.

- In August 2021, the FTA announced the creation of the Transit Workforce Center (TWC), funded through a \$5 million cooperative agreement with the [International Transportation Learning Center \(ITLC\)](#).¹⁹ Explained [about the TWC](#), it “is the first FTA-funded technical assistance center to directly support public transit workforce development. Its mission is to help transit agencies recruit, hire, train, and retain a diverse workforce needed now and in the future.”²⁰ This, and other efforts, comprise FTA’s [Workforce Development Initiative](#).²¹ It should be noted that the TLC and the ITLC are the same organization, going by different names at different points in time.
- On the TWC webpage of the ITLC’s website, it is mentioned that the activities of the TWC [fall into two programs](#), one with “technical assistance activities within and for transit agencies that promote more effective and efficient training of frontline workers involved in public transportation maintenance and operations” and another that involves implementing “technical assistance activities through collaborative partnerships between transit agency management and labor, including apprenticeships.”²²
- Also explained on the ITLC’s website, a part of the TWC’s activities will involve overseeing the [American Transit Training and Apprenticeship Innovators Network \(ATTAIN\)](#).²³ ITLC provides further detail, “Membership in ATTAIN provides agencies interested in implementing an apprenticeship with continuous support from the TWC and the opportunity to learn from each other through peer dialogue. This exchange of ideas and experiences complements the individual technical assistance that ATTAIN members will receive from the TWC to help agencies learn and apply best practices for registered apprenticeship.”
- There have been grants in the past in support of apprenticeships in the US transit industry, such as those provided through the FTA’s Innovative Transit Workforce

¹⁹ <https://www.transportcenter.org>

²⁰ <https://www.transit.dot.gov/research-innovation/workforce-development-initiative>

²¹ <https://www.transit.dot.gov/research-innovation/workforce-development-initiative>

²² https://www.transportcenter.org/solutions_services/detail_view/TWC

²³ https://www.transportcenter.org/solutions_services/detail_view/attain

Development Program (ITWDP) which consisted of a series of projects in 2011, 2012, and 2015²⁴ totaling \$20 million for approximately 40 grants.²⁵

The Santa Clara Valley Transit Authority's (VTA) partnership with Mission College and Amalgamated Transit Union (ATU) Local 265 was brought to the National Center for Applied Transit Technology's (N-CATT) attention by a representative from the ATU who had direct experience with the partnership. This partnership is referenced throughout this chapter in order to contextualize points being made with a well-documented and successful apprenticeship program already in place.

An apprenticeship program that is focused on new transit technologies, which the VTA example is not, would have been ideal to include in this Guidebook. That was not possible, since interviews with a representative of the ATU revealed that such apprenticeship programs are currently in development, but not yet in place. More details on this are provided in section 4.8. In summary, the VTA example is provided to thoroughly explain and illustrate how an agency could go about establishing an apprenticeship program in general, and this information can be applied to any type of apprenticeship program—regardless of if it is focused on new transit technologies or not. The VTA example is not intended to provide an exhaustive list of activities, but instead a general framework to consider when setting up a new partnership-based apprenticeship program. *Behind the Wheel: A Case Study of Mission College and Santa Clara Valley Transportation Authority's Coach Operator Apprenticeship Program*, published in 2019 and prepared for the Foundation for California Community Colleges, has provided the majority of detailed information in this chapter; citations are in place for other information sources when applicable.²⁶

4.2 Leveraging apprenticeships to address challenges at Santa Clara Valley Transit Authority (VTA)

Mission College, VTA, and ATU Local 265 partnered in 2016 to create the Transportation Apprenticeships for Professional Career Advancement (TAPCA) Program. This program originally consisted of four apprenticeships including:

- Coach Operator (i.e., bus operator)
- Track Worker
- Service Mechanic
- Overhead Line Worker

The program has since grown to include another apprenticeship, Public Transit Leadership; an overview of all five apprenticeship programs can be found on [Mission College's website](#).²⁷ The same three TAPCA partners are working with [California Transit](#)

²⁴ <https://www.transit.dot.gov/funding/grants/innovative-public-transportation-workforce-development-program-project-selections>

²⁵ <https://www.transit.dot.gov/sites/fta.dot.gov/files/docs/research-innovation/133661/innovative-transit-workforce-development-program-key-lessons-learned-ftareportno0139.pdf>

²⁶ <https://caihub.foundationccc.org/Portals/0/Documents/CAICaseStudies/cai-pre-apprenticeship-transportation.pdf>

²⁷ https://missioncollege.edu/student_services/job-placement-internship-center/apprenticeships.html

Works to develop an additional apprenticeship for light rail operators.²⁸ As explained in the *Behind the Wheel* report, these apprenticeships are “registered” apprenticeships in California; California registered apprenticeships involve five components:

- “Programs provide both on-the-job-training and job-related classroom instruction; the classroom curriculum is critiqued and approved by a local education agency.
- Participants are paid by the employer during the apprenticeship, and compensation follows wage progression scales.
- On-the-job training is conducted in a work setting with the guidance of a more senior employee.
- Programs meet California’s minimum hours for registration: 144 hours of classroom instruction and 2,000 hours of on-the-job training.
- Participants who complete the program receive an industry-recognized credential.”

In recent years, VTA has faced a number of staff-related challenges. In 2013, the agency hired 30 new coach operators per year on average; by 2018 that figure had risen to 100. The rise in this figure is due primarily to an increase in retirements. Low local unemployment rates in recent years, such as 2.4 percent in November 2018, have made hiring at such a pace difficult due to applicants having many options from which to choose.

Apprenticeship programs are uniquely suited to address such challenges by creating new and clear pathways into key occupations. The TAPCA program supports two critical outcomes that help generate demand for prospective employees to become interested in the program and help retain current staff throughout their career at VTA.

1. It pays staff members as they are learning and honing their skill set. This means that prospective employees do not have to risk falling behind financially as they invest in their education.
2. The program also puts apprentices in a position to take advantage of advancement opportunities within VTA for many years. Prior to the advent of the TAPCA program, there were some entry-level occupations at VTA with limited opportunity for advancement; in some cases, there was no clear path for career progression. The program has built-in two key concepts to address this— “career lattice” and “career ladder” apprenticeships. The former supports an employee with lateral moves to other career paths, while the latter supports an employee with vertical moves within the same career path; these concepts even help employees see how they can become part of management at some point in their career. This is illustrated in the *Equity from the Frontline* report as shown in figure 4.

²⁸ <http://www.catransitworks.org>

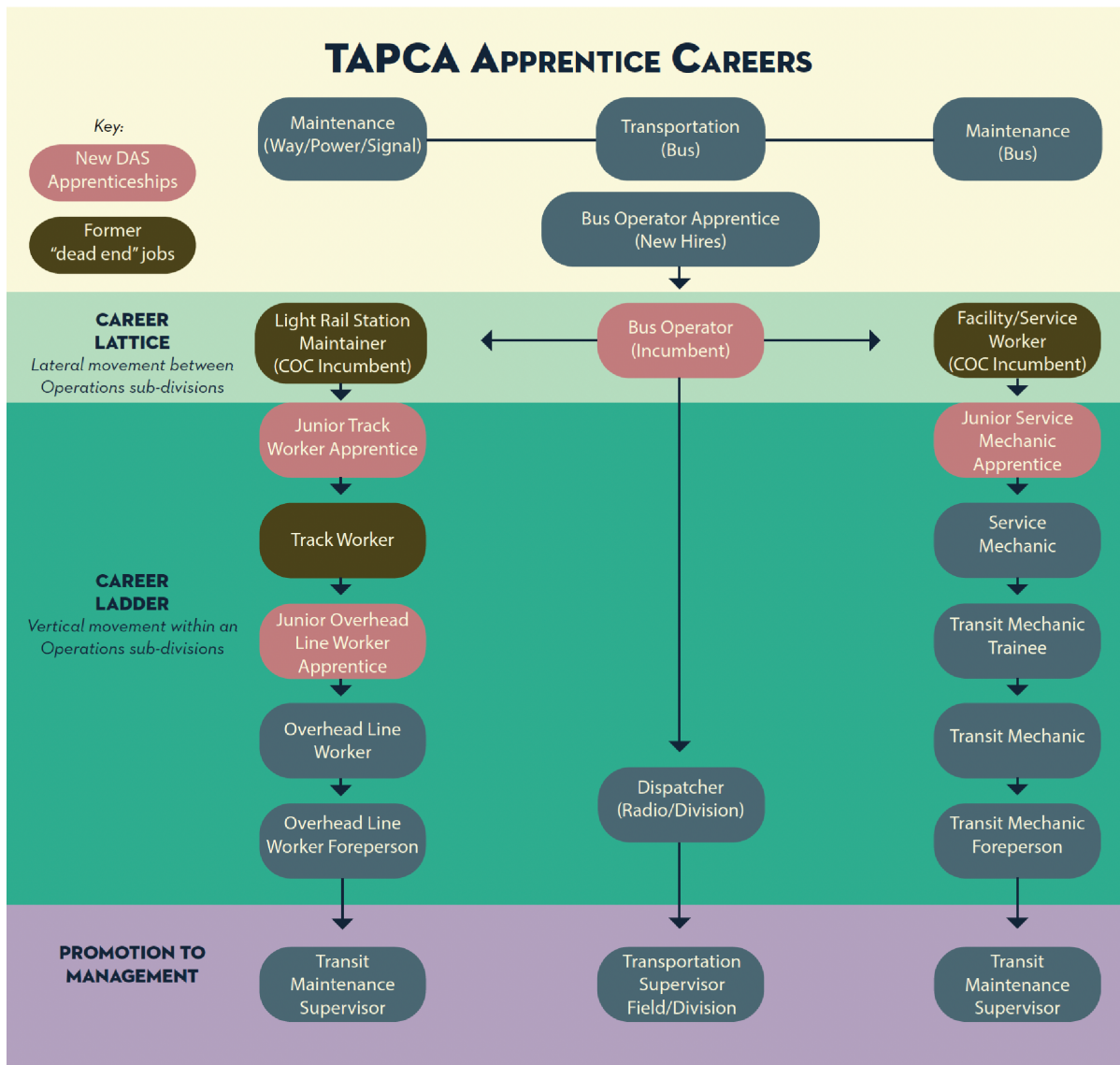


Figure 4

The way that VTA frames the apprenticeships is key to understanding how they work. VTA sees the apprenticeships, first and foremost, as occupations. The first part, of course, involves learning, while the second part involves gaining hands-on experience, but this entire trajectory is part of what is considered an occupation. In other words, these programs are not something that exists outside of VTA; they are fully integrated into its operations. Much of the training and onboarding is actually provided by experienced colleagues and mentors at the agency. These colleagues and mentors also have systems for reporting back to management on what is working well and not so well, so that issues can be addressed in future iterations of the program.

As aforementioned, apprenticeships in the US are common in the building and construction trades, and the TAPCA program was modelled on the apprenticeship culture fostered in those trades—bringing the apprentice into a social and professional

community that takes pride in the craft and importance of their work. It is worth noting that the only way to become a new coach operator at VTA is through the apprenticeship program. Tom Fink, a retired bus operator and former official of ATU Local 265, says in the *Equity from the Frontline* report about his experience in creating new apprenticeship programs, “The experience of the solidarity of work percolated down through the operators in a profound way. Aside from the workforce issues addressed, we were dealing with the very meaning of work. We talked about making work about more than just a paycheck. We recognized and defined the work as a craft. There was a certain pride that went into being a bus operator.”

It is also pointed out in the *Equity from the Frontline* report that the VTA apprenticeship program has instilled personal and professional pride in its graduates. Eliseo Acosta, a service mechanic apprenticeship graduate, said “The apprenticeship gave me the ability to be proud around my family. My daughter asked me to present at her school career day. Because of the program and where it’s taken me, I felt good about presenting. I was up there with doctors, but the kids liked that I worked on engines, really big engines.”

Between January 2016 and June 2018, the program served 419 registered coach operator apprentices. The apprentices, upon finishing the program, commented that the it helped them learn important communication skills which are required to address what can sometimes be stressful situations with the public. This was reported to be one of the most significant struggles they have in their occupation; it was also mentioned that both the on-the-job (OJT) and mentorship components of the program have helped them build their confidence in this key skill area. Apprentices have also said that the TAPCA program makes potential paths for career advancement much clearer than they were previously, enabling current staff in particular aware of career paths in the agency through the apprenticeships. On a personal note, apprentices have reported that the program has made them more aware of and confident in their own educational and professional potential, more open to plotting additional career moves after completing the program. The program is beneficial to the apprentices in myriad ways, while also benefitting the transit agency. In the *Behind the Wheel* report, the experience of one apprenticeship program participant is noted, “earning college credit through the Coach Operator Apprenticeship program had inspired him to complete his degree, helping him to advance on the job. He also reported that earning college credit has won over otherwise skeptical spouses and parents of aspiring apprentices because it adds legitimacy to the training—especially for younger workers— because it allows them to learn skills and a trade while also earning a living, rather than forcing a choice between the two. It also aids in retention because it signals a clear commitment to training and development that benefits the employee and not the company alone.”

Specific ways the apprenticeship program has benefited VTA were also noted by its assistant superintendent in 2018 in the *Behind the Wheel* report, who said it “effectively, predictably, and efficiently trains the coach operators that the company needs, and connects them to a career path (which aids in retention)” while, at the same time, it “strengthens and adds value to the labor–management partnership... by integrating the

pre-existing mentorship approach that VTA and ATU are well known for into formal credit-bearing training and professional development programs.” In addition, the program “structures and makes transparent what had been disparate processes for recruiting, training, and internal promotion and advancement, so that job seekers and employees can more easily understand how to build satisfying careers at VTA.”

4.3 How apprenticeships can help facilitate career pathways

In section 4.2, the concepts of “career lattices” and “career ladders” were mentioned along with figure 4, which helps to illustrate these concepts. The *Equity from the Frontline* report sheds light on how these concepts, and their accompanying apprenticeships, were developed and the impact they’ve had on individual staff members, “The apprenticeships have turned what was once a dead-end position into a professional gateway.”

When VTA realized it was in need of more staff, experienced bus mechanics and facility/service workers (i.e., staff members who help with fueling vehicles, cleaning them, etc.) suggested developing a career path from facility/service work positions to bus mechanic positions. As a part of developing this path, the “Mechanic Helper” pilot program was put in place. Mike Hursh, former VTA Chief Operating Officer, explains in the *Equity from the Frontline* report that “we took vacant, mechanic positions and built an apprenticeship program for fuel island workers around them. We then used vacant fuel island positions to fill from the community. To provide access to union jobs with benefits, career jobs.”

Ten “Mechanic Helpers” were recruited from the facility and service worker pool in 2008. Eligibility and selection are explained further in *Equity from the Frontline*, “a worker must have completed Evergreen College’s Automotive Systems 102 (employer reimbursement for C or higher), passed a mechanical aptitude test, and demonstrated good job attendance and performance. Selection was then based upon seniority.” The apprenticeship program transitioned from “Mechanic Helpers” to the “Service Mechanic” title (the current TAPCA iteration) between 2008 and 2016.

Carl Hart, a program graduate, said in *Equity from the Frontline* “Workers once stuck in entry-level cleaning positions express the deepest appreciation for... the mentorship program, and the apprenticeship career ladder. People can now see that it’s possible to move from the Fuel Island into a more professional position.” When VTA began this program, the only ways to become a bus mechanic were mainly through technical schools (outside of VTA), the military, or auto dealerships/repair shops. VTA was able to chart a path through the agency from less-skilled positions to skilled maintenance positions and change the status quo dramatically.

The personal story of Eliseo Acosta, a service mechanic apprenticeship graduate, is shared in *Equity from the Frontline*. “Eliseo became a service worker because it was an opportunity to work for the VTA, an agency known for family-sustaining, long-term careers. He soon experienced the low morale and stagnation of working on the fuel island... cleaning and fueling coaches on the 6:00 pm to 2:30 am shift did not provide

the skills or opportunity to progress.” Describing his early experience, Acosta explained “It’s hard to see a future on the fuel island. It’s not the kind of job you can see yourself doing long-term.” Once he met the eligibility requirements, he joined the first cohort of the Service Mechanic apprenticeship, which was then considered a pilot project. All ten apprentices in his cohort made it through the program. Acosta explains in *Equity from the Frontline*, “If there was no Mechanic Helper Apprenticeship, I probably would have left the company. We got paid to go to school for a year at our previous union wage. We also kept our seniority. That was really important.”

4.4 Partnerships with educational and organized labor partners

Educational partners, such as community colleges and trade schools, often use apprenticeships as a way for their students to access the talent pipeline into certain industries and with specific employers such as VTA. Unions also sometimes play a support role in apprenticeships.

In *Building an Apprenticeship and Training System for Maintenance Occupations in the American Transit Industry*, it is stated that “American apprenticeship programs are sponsored either unilaterally by employers alone or jointly by unions and employers. In joint programs, apprenticeship is often organized under terms of the collective bargaining agreement that specify the training wages, apprentice-worker ratios, and financing of apprenticeship. Training is commonly financed from a dedicated training trust fund into which employers contribute a few cents per every hour of labor hired. The local Joint Apprenticeship and Training Committee (JATC), composed of representatives of unions and employers in equal numbers, administers the training program and use of the dedicated training fund, and makes decisions concerning program requirements, curriculum, and admissions, and monitors the performance and advancement of apprentices.”

The TAPCA Program, which began in 2016, was built atop previous efforts among the three partners: VTA, ATU Local 265, and Mission College. An earlier effort between VTA and ATU Local 265, the Joint Workforce Investment (JWI), was launched in 2006. VTA had identified multiple workforce challenges that led the agency to realize a new approach was needed. As mentioned in the *Behind the Wheel* report, these challenges included “pending large-scale retirements, recruiting and retention challenges in key positions, ongoing integration of new technologies, worker health and safety concerns, and the need to help VTA employees better prepare for the public service aspects of their jobs.” The JWI had three main goals including professionalizing key occupations, improving the talent pipeline for critical positions, and increasing the “engagement, well-being, satisfaction, and retention” of workers.

A JWI mentoring and professional development program was launched in 2007. Foundational concepts of the TAPCA program, such as “career lattices” and “career ladders,” have their roots in the JWI. Building on the details shared in section 4.3, employees with jobs cleaning and fueling vehicles were able to move into entry-level service mechanic positions in 2008 through JWI’s “Career Ladders Training Project.” The educational program consisted of credit-based training, on-the-job training, and

peer mentoring—all of which were paid work. An additional career path was supported; workers who were already entry-level service mechanics were able to advance into full transit mechanic positions, moving into a higher salary with a greater skill level. The JWI also helped to produce a coach operator training program, a precursor to the Coach Operator Apprenticeship of the TAPCA program.

The partnership between VTA and Mission College developed over time as well. Initially, Mission College was brought into the JWI partnership in order to help create what was called the “JWI Academy,” a program with a set of courses with the aim of fostering leadership skills in field-level workers—culminating in a certificate of achievement. In 2012, Mission College reached out to VTA expressing interest in potentially setting up apprenticeships. As the relationship evolved, Mission College realized that VTA’s size (2,100 employees) and its level of demand for newly-trained employees presented an opportunity to have a single program with multiple apprenticeship options (i.e., something similar what the TAPCA program became), all supporting the transit industry which had earlier been identified as a key priority for the state and region. As mentioned in the *Behind the Wheel* report, by 2015 Mission College had “...secured one of 46 American Apprenticeship Initiative grants awarded by the US DOL to build apprenticeship programs in key sectors. This federal grant helped Mission College apprenticeship champions get their arms around registered apprenticeship as a concept and a process. It also laid a foundation for the development of TAPCA... In particular, it familiarized college program staff and VTA with the process of establishing an apprenticeship program—including documenting needs, identifying occupations, building and registering programs, implementing training, and tracking processes.”

4.5 Funding opportunities and registering apprenticeships

Section 4.1 mentioned past grants funded through FTA’s Innovative Transit Workforce Development Program (ITWDP); the [Workforce Innovation and Opportunity Act \(WIOA\)](#) has been another significant source of federal funding.²⁹ Some funding requires the participation of partners with a transit agency—both from unions and from an educational institution, for instance.

The four apprenticeships within the TAPCA program were initially funded through the California Apprenticeship Initiative (CAI) grant program in 2016. This grant was awarded to Mission College in partnership with VTA and ATU Local 265 and supported registering the apprenticeships with California’s Division of Apprenticeship Standards (DAS) in 2016. The apprenticeships were registered under the American Apprenticeship Initiative with the US Department of Labor’s (US DOL) Office of Apprenticeship (OA) in 2015.

An [Eno Center for Transportation article](#) from 2019, “Training and Apprenticeships to Address Transit Workforce Gaps,” provides guidance on how to go about registering an apprenticeship.³⁰ “There are several steps needed to achieve registered apprenticeship

²⁹ <https://www.dol.gov/agencies/eta/wioa>

³⁰ <https://www.enotrans.org/article/training-and-apprenticeships-to-address-transit-workforce-gaps/>

status. Like all Department of Labor (DOL) sponsored apprenticeships, the program is designed with flexibility, allowing agencies to benefit from the national guidelines but tailoring them to address individual agency needs and resources. First, top labor and management representatives from the agency must commit to the program. A joint apprenticeship committee (JAC) is formed with equal representation of labor and management to develop local standards that determine how the apprentice program is structured (i.e., apprentice and mentor selection process, work hours, wage progression, etc.) and the training program's content (i.e., work process schedule, OJT, and classroom coordination, etc.). The final step is to formally register with DOL and launch the program."

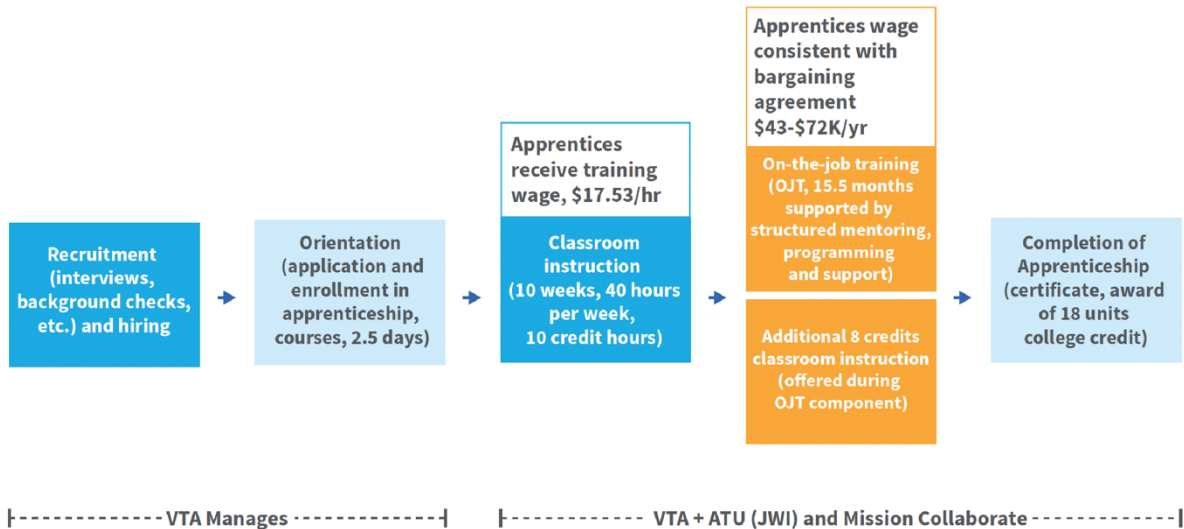
4.6 How apprenticeships work

Apprenticeships typically have a classroom-based period to gain skills and an on-the-job period to practice those skills, often supplemented by a mentorship program. Apprentices in the transit industry typically become both agency employee and college student simultaneously and tend to be paid during the apprenticeship period.

The Building an Apprenticeship and Training System for Maintenance Occupations in the American Transit Industry report provides an overview of how apprenticeship programs often work. "Most registered apprenticeship programs are time-based, although competency-based programs, or hybrids of competency-based and time-based programs have been approved. Apprentices are paid according to a progressively increasing schedule of wages as their skills improve. The term of time-based apprenticeships ranges from one to six years, but three or four years is the most common. Apprentices are expected to complete 2000 hours of supervised on-the-job training and at least 144 hours of related in-class instruction per year... Classes are normally taught by advanced journey-level skilled workers or supervisors who also work with the trade."

VTA's Coach Operator Apprenticeship, part of the TAPCA program and used as the example in sections 4.6.1-4.6.5, includes 10 weeks of full-time classroom training followed by 15.5 months of on-the-job training for approximately 18 months in total. These details are illustrated in the *Behind the Wheel* report as shown in figure 5. Mentoring is integrated throughout the on-the-job training component. The apprenticeship program is the only way to become a new coach operator at VTA.

**EXHIBIT 7.
Coach Operator Apprenticeship Program**



Coach Operator Apprenticeship: Approximately 2000 hours (18 months)

Figure 5

4.6.1 Recruitment

Recruitment is handled by VTA a few times a year through highly-advertised open application periods. Interviews, background checks, and other internal processes are completed by VTA. After being selected for the program, the new staff members join a two-and-a-half-day orientation program, also managed by VTA. Apprentices complete their Mission College admission applications during orientation, since they need to be enrolled as students in order to begin. Among other topics, the orientation introduces them to the JWI and the mentorship part of the program, which begins during the on-the-job training period. As further detailed in the *Equity from the Frontline* report, “VTA’s human resources department handles recruitment of new operators. Selection is highly competitive with the agency receiving over six thousand applications in the one week per year that the position is open. One in seven applicants receives an interview and practical exam on a coach (i.e., bus).”

4.6.2 Classroom training

Following orientation, they go right into the 10 weeks of classroom training, which is when they officially become both VTA employees and Mission College students *and* begin receiving an hourly wage (\$17.53 per hour as of December 2018). The courses are taught at VTA facilities by VTA instructors; all instructors are approved by Mission College. At the end of the 10 weeks, apprentices have 10 hours of academic credit. In general, these new recruits are also new VTA employees, but in some cases, they are current VTA employees who have decided to transfer to a new occupation.

4.6.3 On-the-job training

Soon after the completion of classroom training, the on-the-job training component begins. One of the first activities apprentices take part in is a series of “ride-alongs” with their mentors, so they can become accustomed to what happens on the bus without being the driver. Their pay goes up during this 15.5-month period (to \$43,000–\$72,000 annually as of December 2018). They are paid a standard annual wage in line with the collective bargaining agreement.

4.6.4 Mentoring

Throughout the on-the-job training component, apprentices benefit from mentoring. This takes the form of coaching while the apprentice is operating the bus, guidance on how to best manage interactions with the public, and advising them on other matters such as handling night shifts and “split shifts” (i.e., having a shift with a non-paid break in the middle of the shift). Experienced VTA coach operators serve as mentors after applying and completing training in order to do so.

4.6.5 Certifications

In order to gain approvals and register the coach operator apprenticeship, along with the other TAPCA apprenticeships, the curriculum was submitted for approval at Mission College and registered with the US DOL in 2015 as well as with the California DAS in 2016. At completion, each apprentice receives a certificate of achievement from Mission College, outlining college credentials, and “journeyman certificates” from DAS and US DOL. The ATU, in particular, has emphasized the importance of these certificates to recognize these occupations as professions while encouraging apprentices to pursue additional higher education and training.

4.6.6 Administrative aspects

The partnership group is interested in making a number of administrative improvements to the TAPCA program including:

- Mission College application and course registration – It has been noted that the complexity of the application process can be cumbersome for first-time college attendees, which the apprentices tend to be. In addition, the current registration processes do not easily make an exception for apprentices to avoid the payment of registration fees, which they are exempt from per state regulation. To address both of these concerns in the short-term, Mission College and VTA have a paper registration process they facilitate with hands-on help during the orientation process. This gives them more control, enabling them to explain to apprentices how to complete certain sections and how to avoid the payment of unnecessary fees.
- Hiring VTA employees as faculty – The instructors of the classroom component are VTA employees, but they must be officially hired by Mission College as well—a requirement for the apprentices to earn college credit. Typically, being a college instructor would require a certain level of education and certain types of college credit, which even the most experienced employees at VTA may not have. In its first year, 2016, it was difficult to gain college approval for the

instructors. Mission College has since changed the criteria required to become an instructor and anticipates these changes will make it easier for the program to secure instructors.

- Data and reporting processes – Reporting is required for California’s Division of Apprenticeship Standards (DAS), the California Apprenticeship Initiative (CAI) grant program, the American Apprenticeship Initiative grant program, and Mission College. The data that are required differ among the various entities, although there is some overlap, and there is a wide variety of required data formatting. The type of information being sought after often relates to apprenticeship program inputs such as how much time the apprentices spend in training/on the job and outcomes such as skills gained and other achievements. The lack of coordination or standards among these processes, involving multiple data entry and reporting requirements, results in a significant administrative burden, both for Mission College and VTA.

4.7 Specific benefits of apprenticeships

The *Equity from the Frontline* report outlines specific benefits of apprenticeships to transit agencies that should be taken into account, based on the experience of VTA.

- Assists in gaining reliable, highly-skilled, and motivated staff – Maurice Beard, a VTA Bus Training Supervisor, explains, “...eleven years into program, the biggest piece is trust. JWI has helped immensely with the competition for labor. We used to wait forever to get some positions filled such as overhead line worker. When you look at the numbers—morale, retention rate, stress, sick time— that is the benefit to the employer. Now management can rely on something. We rely on the benefits that the apprenticeship provides on the job.”
- Helps with reduced absenteeism and retention – Tai Lam, a Mechanic Helper Apprentice, says “Not just the worker has the benefit, VTA has the benefit too. It creates a sense of belonging. People are not going to go anywhere.” The authors of the report explain further, “VTA’s willingness to work differently has yielded significant benefits. Apprenticeship’s professionalized training and mentoring is evident on the road and in the maintenance bay. Absenteeism is less of a problem when people feel good at their job. VTA learned this lesson when a lack of resources placed the mentorship program on hold for a year. The agency experienced a return to high levels of absenteeism and complaints.”
- Achieves multiple needs simultaneously – The authors of the report describe the range of benefits, “The Coach Operator and Service Mechanic apprenticeships have become models for simultaneously addressing increased transit demand, deployment of high technology ‘green’ transit vehicles, impending massive workforce retirements, and the transit incumbent workforce with limited career access, training gaps, and low morale.”

4.8 Status of apprenticeships for ZEBs

A representative of the ATU reported there are approximately five known transit agencies in the US that are in the process of creating apprenticeships for mechanics specialized in ZEB technologies, and as mentioned in section 3.6, IndyGo is one of them.

Also notable regarding educational paths, Rio Hondo College in Whittier, California stands out as an example of a college that offers an [Alternative Fuels Technology program](#)³¹ consisting of two different degree options, “Electric Vehicle and Fuel Cell Technology Technician” and “Alternative Fuels and Advanced Transportation Technology.” Although this program is not targeted specifically at coach vehicles or public transit buses, the description on the program’s webpage notes that employers in the transit industry are among the employers of past graduates, “Local employers seek out our students when they need automotive service technicians with Electric/Fuel cell vehicle skills. Students who complete the automotive program should have no trouble finding a job as an Alternative Fuels technician, service writer or even a service manager at dealerships, independent repair shops, parts stores or even start their own business! Our graduates are currently working at Proterra Electric Bus, LA Metro Transit, Los Angeles Department of Water and Power Fleet Technicians, and even Space-EX Technicians.”

Chapter 5: Next Steps for Engaging Frontline Employees in Adopting New Transit Technologies

The suggested next steps are broken down into five categories according to earlier sections of the Guidebook. In section 2.3 of Chapter 2 “ways to engage employees,” three primary ways to engage employees were mentioned: (1) establishing a shared vision and purpose, (2) investing in individual employees, and (3) tailoring engagement strategies to both current employees and potential new recruits. Chapters 3 and 4 went into depth on the topics of (4) training and (5) apprenticeships, both key methods for ensuring frontline employees have the skills needed to interact with new transit technologies—foundational to their engagement. Below, next steps are proposed within these five categories.

In order to apply the information from Chapters 1-4 to the specific situation of an individual transit agency, professionals can use the proposed next steps as a guide to help identify areas where more work is needed or even as a checklist. The next steps, as a set, could also be used for collaborative purposes, helping to guide internal discussions at an agency. They are meant to be used in combination and can be applied to support strategic planning efforts for engaging frontline employees in adopting new transit technologies.

5.1 Establish a shared vision and purpose

5.1.1 Ensure that transit agency management understands the implications and benefits of new technologies under consideration.

Too often a new technology is pursued without decision-makers having a detailed understanding of what a specific technology will, or should, accomplish. While core technology outcomes mentioned in section 2.3 include a higher level of operational efficiency, improvements in customer service, and a reduction in environmental impact, other outcomes may be important to an agency depending on their specific goals.

³¹ <https://www.riohondo.edu/altfuels/>

In addition, a transit agency may lack a strategic approach to technology overall (i.e., a process for considering all the current and future technology types and how they should connect). Considering each piece of technology as if it is an island is a dangerous prospect and can cause headaches down the road. The technology used by transit agencies is often networked by nature, connecting between different activities, users, and purposes to serve joint requirements. N-CATT resources including *A Framework for Making Successful Technology Decisions*,³² as well as the *Guidebook on New Software Adoption for Small Transit Agencies*,³³ could help transit professionals navigate related technology decision-making processes.

Management may also lack key information about the commitment level required to successfully deploy a new technology. For example, in speaking with a representative of IndyGo it is clear how challenging it is to set up new BEB operations (e.g., charging stations, fleet strategy based on mileage range, training mechanics, etc.). If management is not solidly grounded on all of these topics, then the following next steps lack a base to be built upon. If required, management should pause planning efforts in order to conduct research or work with a technology consultant/specialist in order to gain this information.

5.1.2 Involve frontline employees in technology-related decisions that will impact their day-to-day work.

With employees, discuss the potential outcomes of technologies under consideration as well as how the technologies could impact their day-to-day work. Sometimes it may seem like going down a certain technology path has a life of its own, and management may be ready to move forward. But pausing to consider how to best involve employees can pay off later. Enabling them to provide input into the decision-making process will help them mentally prepare for the coming changes, and this will help the agency's transition process to go more smoothly.

N-CATT staff shared an anecdote of a transit agency in the US that was moving forward with ZEB technologies. The bus operators had not been involved in either the strategic direction of ZEB or the selection of the particular buses. As it turns out, the selected buses required bus operators to be a certain minimum height in order to reach the pedals; those who did not meet the minimum height found this out the hard way. Could situations such as this be avoided? They can if, for example, there is a core group of frontline employees involved in selecting the buses. They could attend a trade show or go to a show room and try the vehicles out for themselves; after all, they are the ones who will be operating them all day. It makes sense to include them, not only so they are more engaged in the process, but also so the agency can avoid lackluster decisions that result in committing the agency to a technology solution that does not work for the primary users of the technology. As buses have more and more technology-related components, it becomes increasingly important that bus operators test all of the components prior to procurement becoming final.

³² <https://n-catt.org/resources/a-framework-for-making-successful-technology-decisions/>

³³ <https://n-catt.org/resources/new-software-adoption-for-small-transit-agencies/>

5.1.3 Leverage discussions with frontline staff to establish a shared purpose for new technologies, based on anticipated outcomes.

One of the purposes of the technology could be, for example, to make the job tasks of the technology user easier. As mentioned with the ZEB example for workers who did not meet the minimum height requirement in next step 5.1.2, not only is the work not necessarily easier for a specific group of people, but there is clearly a fundamental barrier to use for this group. Aside from basic functionality, the more high-value outcomes (such as a higher level of operational efficiency, improvements in customer service, and a reduction in environmental impact) identified with employees, the clearer the technology's purpose will be to the entire agency. As an additional step, a shared vision can be created with staff that builds upon the anticipated outcomes of several different types of technology—considering how they'll work together to support the agency's operations. The vision can tie together the high-value outcomes, how the technology supports and improves the day-to-day work of the employees, and how the technology fits into the agency's broader mission.

5.1.4 Be clear, unified, and precise when communicating about new technologies moving forward.

When members of management all have different ideas about a technology's benefits, they may have counterproductive communication practices in place without even realizing it. Through the steps above, management would have had the time and focus to identify the main points to communicate. As a final step, it is productive for management to agree—together—on how the technology will be presented and communicated, even segmented by specific groups such as various frontline staff groups, the board, and passengers.

5.2 Invest in individual employees

5.2.1 Consider all the potential ways that the transit agency could invest in individual employees.

Section 2.3 mentioned a number of example ways to invest in employees such as establishing a mentorship program, putting activities in place to help employees customize their career paths through lateral and vertical moves, and providing agency-sponsored training. These, and more, could be under consideration.

5.2.2 Discuss options with employees and gain their input.

As early as possible, it is best to hear from employees. If management is open to it, employees can even be involved in the earliest step to generate a list of potential ways to invest in employees, possibly through a group brainstorming session.

5.2.3 Evaluate and compare the different ways to invest in employees.

Comparing the different ways to invest in employees can be based on factors such as anticipated level of impact, degree of employee interest, financial implications, and cost/benefit, to name a few. From there, a short list of high priority items could be drafted.

5.2.4 Pinpoint what it would take to make some of the top items a reality.

The high priority items could be detailed in terms of the activities that would need to be undertaken to make them a reality. The amounts and types of required resources, including financial resources, should also be detailed. Putting these items together could lead to the creation of a road map.

5.3 Tailor engagement strategies to both current employees and potential new recruits

5.3.1 Use the table in section 2.3.3 to find out from current employees what interests them most on the topics of job stability, career potential, job options, and impactful work.

It is a good idea to have a neutral third party, such as someone who works in the community engagement field or even someone who conducts focus groups, to elicit this information from employees. For example, during these discussions, it may come up that offering an impressive benefits package, competitive pay, and a schedule for raises, among other financial and economic incentives, helps support financial stability for transit agency employees. When employees can support themselves and their families, they are in a better position to stay engaged in their work. Another common topic might be related to employees wanting paths forward within an organization (both vertically and laterally)—this enables the staff to see themselves working at the agency in the future. There should be clear ways to gain promotions, even possibilities to move into management someday.

5.3.2 Consider the results of these discussions and outline ways to implement the measures that are most important to the current employees.

Ensuring that employees have ways to be heard and understood by management allows for dialogue that is valuable for both sides. Whenever possible, management should demonstrate that feedback and information gained from employees has been acted upon in a concrete way. For instance, following a survey or an open discussion, management should respond with a list of items that it will include in its future activities as a clear response.

5.3.3 Create a targeted pathway into the agency for potential new recruits that meets the needs of groups 1, 2, 3, and 4.

For the groups including those who are new to the transit industry and just leaving high school/trade school/community college (group 1), new to the transit industry with some/significant work experience in another industry, but without skills that are highly valuable to the transit industry (group 2), new to the transit industry with some/significant work experience in another industry with skills that are highly valuable to the transit industry (group 3), and previously working in the transit industry for another agency (group 4), a targeted pathway should be developed that helps each of these groups successfully become new employees. The general pathway proposed in section 2.3.3 with three levels is an example of a pathway that builds in the needs of all three groups. Level 1 with its apprenticeship programs is targeted mainly at group 1 but also as an entry point for group 2. Level 2, involving training to address skill gaps, is aimed at group 3 as an entry point, while for level 3, on-the-job training and mentorship would be completed by all groups (enabling group 4 in particular to have an entry point).

5.3.4 Develop targeted messaging for each potential new recruit group in order to communicate directly to them.

For example, in order to reach group 1, it may be necessary to establish relationships with local high schools to connect with potential new recruits during their senior year while they are considering various educational and career paths. For groups 2 and 3, perhaps there is another industry that a transit agency is trying to recruit from in particular, which may help narrow down ways to market to them. Group 4 may be the most difficult to reach, since they already work at another transit agency. Industry communications targeted at frontline workers may present some opportunities. For all groups, some attention should be given to how to best reach out to them.

5.4 Train frontline employees on new transit technologies

5.4.1 Ensure that the transit agency has educational infrastructure in place so its workers can gain skills in new transit technology.

Jobs in transit have technology integrated into the daily work of transit employees; it is not possible to fully remove technology as a stand-alone workforce element. Therefore, if a transit agency pursues a path with the goal of improving the skills of frontline employees with new transit technologies, that path would initially depend on the quality of the existing situation present at the agency for improving the skills of frontline employees in general. If it is of higher quality, the agency would focus on activities to integrate technology-specific content into the training program—the transition would be more straightforward. If it is of lower quality, or nonexistent, then the training program would need to be established in the first place, or measures adopted to improve the quality—a process requiring planning and implementation work to put a solid working system in place. During the planning process, the agency should ensure that transit technologies are kept front and center, even though the training program’s scope may be much broader than that.

5.4.2 Consider, evaluate, and select training activity options.

Getting feedback from employees as early in the process as possible is key to understanding what they would find most useful for their training and career trajectory. As mentioned in Chapter 3, there are four primary methods for training frontline staff: training through the original equipment manufacturer (OEM), periodic training for existing staff, on-the-job training/mentorship programs, and apprenticeships. An agency may identify others to consider. As mentioned in next step 5.4.1, the quality of the existing educational situation present at the agency would need to be assessed to decide if the activities could be additions to the existing training program or, due to significant gaps in the educational infrastructure, a new training program needs to be put in place. After an agency analyzes its short-, medium-, and long-term workforce development needs, as well as the challenges facing it now and likely to happen in the future, it would be in a position to begin evaluating—and ultimately selecting—various training options.

5.4.3 Develop a detailed plan and research ways to implement the selected options.

Once options have been selected, a set of activities with timeframes can be developed into a strategic or project management plan. There are many activities that may be needed to support the effort such as leading stakeholder coordination, sourcing funding, and identifying external resources.

5.4.4 Support and develop training solutions that work for small transit agencies, including regional training and apprenticeship programs.

In *Building an Apprenticeship and Training System for Maintenance Occupations in the American Transit Industry*, it is stated that “Smaller transit agencies often do not have sufficient scale of maintenance operations to provide training internally. The formation of regional partnerships provides employees at smaller agencies access to training facilities and instruction. Regional institutions also foster and support training that is more likely to be sustained. Such regional arrangements are less likely to depend on the interest of one or two progressive leaders. Further, regional partnerships are both efficient and effective. Expensive training facilities do not have to be unnecessarily duplicated. Joining forces also gives transit agencies greater leverage in dealing with community colleges to offer relevant courses or to use curricula related to transit maintenance. It also makes it more likely that minimum class size requirements will be met. For all of these reasons, the regional approach is simply more efficient through economies of scale in training.”

FTA Report No. 0182, *Transit Vehicle Innovation Deployment Centers (TVIDC) Advisory Panel Overview and Conclusions*, published in 2021, mentions that “Over the past five years, several early ZEB adopters have established regional training efforts in anticipation of industry demand for ZEB workforce development. FTA funding as part of the NFCBP (National Fuel Cell Bus Program) supported efforts at two transit agencies, SunLine and SARTA (Stark Area Regional Transit Authority), which created ZEB Centers of Excellence (CoEs). The CoEs serve as development engines for innovative training serving transit managers, operators, and maintenance staff. Additionally, AC Transit has established a reputation for its in-house ZEB training program, which it provides to other operators on request. LA Metro is launching a similar initiative for a regional ZEB training and resources hub in the Los Angeles region. Other agencies have demonstrated interest in standing up local or regional programs of their own.” The report goes on to explain that although these are certainly positive developments, “these workforce development efforts lack coordination and consistent supporting resources. Federal funding for transit workforce development (49 USC Sec 5314, Technical Assistance and Workforce Development) is divided among all transit modes. Though the FTA Low or No Emission Vehicle Program allows some awarded funding to pay for relevant ZEB operations and maintenance training, this is not a dedicated stream.”

5.4.5 Take part in efforts to establish a comprehensive approach to transit workforce training on federal and state levels, with a special focus on new transit technologies.

There is a great deal of similarity in the skill sets required for common transit industry occupations at transit agencies across the US. Whether in Boise, Idaho or Poughkeepsie, New York, a mechanic works on similar vehicle types and requires

similar skill sets in order to be successful in the role. Therefore, instead of continuing down a path that requires individual transit agencies to solve their own educational problems separately, transit agencies may be better supported if they advocated for a more comprehensive approach to transit workforce development on the federal level—an approach from which all transit agencies could benefit.

As a part of setting up apprenticeship programs, for example, a national, flexible system could be created. This could involve identifying a set of community colleges (with virtual or in-person classes) across the US that any transit agency could work with as an educational partner, general curricula to follow that builds in current best practices, a train-the-trainer program to help experienced staff members become apprenticeship professors locally on-site, and funding. The funding could help support, for example, wages/salaries for new apprenticeship instructors, wages/salaries for apprentices, and wages/salaries for administrative and management positions to oversee new programs. This process should include the national-level involvement of organized labor as well, to help scale up the lessons learned through their involvement in various programs across the US to date.

As an example of a promising development, the 2019 GAO report *Transit Workforce Development* mentioned that “The Transportation Learning Center organized three industry consortiums to develop national standards-based courseware—Rail Car, Signals, and Elevator/Escalator Technicians... For example, under the Signals Training Consortium, 25 new courses have been developed covering the inspection, maintenance, and troubleshooting of transit and commuter rail signaling equipment. The curriculum is planned to include both classroom and on-the-job training.”

In the FTA Report No. 0182 from 2021, *Transit Vehicle Innovation Deployment Centers (TVIDC) Advisory Panel Overview and Conclusions*, a national solution for ZEB training is called for specifically. The following is stated, “FTA should establish a dedicated program to directly support ZEB workforce development. This program should take advantage of the investment FTA has made to date on the ZEB Centers of Excellence (CoEs) as part of the National Fuel Cell Bus Program... Expand NTI’s programming to incorporate ZEB training and workforce certification. FTA should consider directing the National Transit Institute (NTI) to incorporate ZEB technologies into its workforce development programming, with the aim of building a national ZEB workforce certification program.”

As explained in the 2019 GAO report, *Transit Workforce Development*, the US transit industry currently lacks a comprehensive transit workforce strategy in general, of which training is only a part. Without a solid, comprehensive training framework already in place, it is challenging to address technology needs specifically. The GAO made three recommendations to FTA in the report, one of which is to “develop a comprehensive transit workforce strategy.” GAO states that DOT concurred with this recommendation. If this recommendation is carried out, the process of ensuring frontline employees have the skills they need to be successful with new transit technologies could benefit; these

technology-specific strategies could become part of a broader and more comprehensive effort.

[California Transit Works](#), a consortium of transit industry partners, is a promising state-wide example in California.³⁴ On its website, its mission is stated, “We educate, advocate, and advise transit agencies and unions in building worker centered training partnerships, as a key strategy in meeting industry demand for qualified workers to provide reliable and effective clean energy transit services for our communities.”

5.5 Establish apprenticeships for new transit technologies

5.5.1 Get input from frontline employees on apprenticeship programs.

In *Equity from the Frontline*, Deb Moy, a workforce development expert, explains that organizations interested in apprenticeship “need an approach that is about asking questions of the workers. There is no checklist or template. Everything needs to start from the workers. All of our (TAPCA) programs started because workers pointed out what was needed. They have the power to say ‘This is our work. This is what it means to be a professional.’ Most recently, the overhead line folks said to train track workers to move into the job because they already know about working on the track.”

5.5.2 Seek out technical assistance and peer networking with professionals who are experienced with setting up new apprenticeship programs.

As mentioned in section 4.1, the Transit Workforce Center (TWC) was recently established with the aim of providing technical assistance to transit agencies who would like to set up apprenticeship programs for the maintenance and operations of public transit. In addition, an initiative called the American Transit Training and Apprenticeship Innovators Network (ATTAIN) was also recently established that will connect those interested in setting up an apprenticeship program with other professionals who have experience and can help advise.

5.5.3 Leverage existing curricula in an effort to not “reinvent the wheel.”

Since many occupations in the transit industry are similar across multiple agencies (e.g., mechanics and bus operators), it is important to keep in mind that agencies new to apprenticeship may want to ask other agencies if it is possible to use their curriculum as a draft to begin developing their effort. Perhaps as a part of ATTAIN or other technical assistance, forming these kinds of connections is possible. The Competency-Based Occupational Framework for Registered Apprenticeships [provided by the Urban Institute](#)³⁵ for the [transit industry](#) (i.e., Transit Bus Technician and Transit Coach Operator) may be a good resource for some transit agencies to leverage.³⁶ ZEB-related technologies are referenced in the Transit Bus Technician framework, though this is not the primary focus.

³⁴ <http://www.catransitworks.org>

³⁵ <https://www.urban.org/policy-centers/center-labor-human-services-and-population/projects/competency-based-occupational-frameworks-registered-apprenticeships>

³⁶ <https://www.urban.org/policy-centers/center-labor-human-services-and-population/projects/national-occupational-frameworks-registered-apprenticeships/transportation>

5.5.4 Support efforts to establish national, centralized approaches to transit apprenticeships, with a special focus on new transit technologies.

An American Federation of Labor and Congress of Industrial Organizations (AFL-CIO) [press release from 2015](#)³⁷ mentions partnering with the ITLC in relation to work they would carry out with a grant, “The International Transportation Learning Center was awarded a \$5 million grant for the National Public Transportation Partnership for Apprenticeship project. The funds will support the implementation of new registered apprenticeships for Signals Maintainers and Transit Coach Operators, as well as for the expansion of existing programs. A total of 1,297 frontline workers in the public transportation/electro-mechanical industry in metropolitan areas of the US will be trained. Private sector partners include Wider Opportunities for Women and Amalgamated Transit Union.” It appears that the grant referred to is an [American Apprenticeship Initiative grant](#);³⁸ the project is described on the ITLC’s website.³⁹ An online search for the phrase “National Public Transportation Partnership for Apprenticeship,” at the time of this Guidebook’s publication, brings up references to the grant—not a final product under the same title. It appears that this funded project may have transitioned into ITLC’s [National Training Standards](#)⁴⁰ effort and the related [Transit Training Network](#).⁴¹

In Building an Apprenticeship and Training System for Maintenance Occupations in the American Transit Industry, published in 2009, a “National Joint Steering Committee for Transit Apprenticeship” is referenced. “In conjunction with this work, the industry has formed a National Joint Steering Committee for Transit Apprenticeship to coordinate the development of national apprenticeship standards in the industry. With equal representation from labor and management, the members of this ten-person committee come from some of the most successful joint apprenticeship programs in North America: AC Transit, Chicago Transit, Sacramento Regional Transit and San Diego Transit and Trolley in California, SEPTA, TriMet, Utah Transit, Washington Metro in the District of Columbia, as well as Calgary Transit in Alberta, Canada. This work is supported by national leaders in labor, management, the non-profit sector, and the US Department of Labor.”

The report goes further to explain that “In spring 2007, the first meeting of this group was held in Nashville, Tennessee in conjunction with the American Public Transportation Association’s National Bus and Paratransit Conference. During the meeting, members discussed the benefits of a federally registered national system of

³⁷ <https://aflcio.org/press/releases/millions-dollars-new-department-labor-grants-support-apprenticeship-programs>

³⁸

<https://obamawhitehouse.archives.gov/sites/default/files/docs/americanapprenticeshipinitiativegrantsawardsummariss.pdf>

³⁹

https://www.transportcenter.org/images/uploads/publications/National%20Public%20Transportation%20Partnership%20for%20Apprenticeship%20Summary.pdf?utm_source=Copy+of+WU5.14.2015&utm_campaign=WU5.21.2015&utm_medium=email

⁴⁰ https://www.transportcenter.org/resource_center/national_training_standards

⁴¹ <https://www.transittraining.net/about>

apprenticeship for transit maintenance and briefly surveyed the difficulties involved in moving towards standardization in such a heterogeneous industry. Following this meeting, committee members began collaborating on a draft version of a national apprenticeship standards document. Members of the committee agreed that the central goal of this collaboration should be to create a national system of standards that is: (1) mutually beneficial to labor, management, and the industry as a whole; (2) capable of embracing diverse practices in the industry; and (3) oriented towards encouraging continued improvements in training. The group plans to meet two to three times a year until it can resolve these issues.” An online search for the phrase “National Joint Steering Committee for Transit Apprenticeship,” at the time of this Guidebook’s publication, primarily brings up the 2009 report (along with an [ITLC report](#) from the same timeframe⁴²) with no links to current updates for 2022.

5.5.5 Advocate for a reciprocal registration/certification system for transit industry apprenticeships across the US.

As more and more apprenticeship programs are developed in the transit industry, consideration should be given to transit industry workers who would like to have job flexibility across states and transit agencies. Currently, it can be difficult to plot such moves, since apprenticeship certificates are generally not accepted at agencies that were not a part of the program. Frontline employees who have earned apprenticeship certificates should also be able to build a more mobile career; currently, that is limited. This next step relates to next step 5.5.4; the two could be combined into a connected effort.

5.5.6 Avoid problems documented from past failed apprenticeship programs.

In *Building an Apprenticeship and Training System for Maintenance Occupations in the American Transit Industry*, it is stated that “Transit apprenticeships must also address the problem of sustainability. While there are several long-standing and well-established apprenticeship programs in the industry, many have been short-lived. The exact reasons for such failures are varied and often have as much to do with external factors as with the quality of the program. In many cases, failure can be traced back to a shortfall in funding or a breakdown in the labor-management relationship at the local level... One standard already emerging in the transit industry is that labor and management must each help build — and then respect — a “wall of separation” between training or apprenticeship programs and the broader context of labor-management relations. A national framework spelling out expectations for the industry as a whole, developed through labor-management consensus, should help move local practice over time in a more stable, practicable direction.”

⁴² https://www.transportcenter.org/images/uploads/publications/Working_Together.pdf