CUSTOMIZATION, COMPETITION, AND COSTS:

Findings and Recommendations for the U.S. Transit Bus Industry

Eno Center for Transportation

CALSTART

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Executive Summary

This report examines one of the most important but least understood factors shaping the U.S. transit bus market: customization. Unlike automobiles, which are produced in large volumes with limited variation, U.S. transit buses are often manufactured in small batches to meet agency-specific requirements.

Transit agencies customize nearly every aspect of a bus, from panel door screws to seating configurations. One manufacturer has approximately 800 distinct parts associated with bus operator seats because agencies specify different colors, seat belts, armrests, lumbar supports, fabrics, and other features.

Customization is not inherently bad. A bus that works well in one region may not meet the needs of another. Transit agencies in Phoenix, Boston, and San Francisco must account for very different climates and topographies. Agencies also have legitimate reasons to specify bus components already used in their existing fleets: consistency can lower inventory costs, minimize additional training requirements, and make new buses easier to integrate with an agency's existing hardware and software systems.

The problem is that reasonable agency-level decisions are creating large industry-wide costs. When transit agencies specify non-standard components, manufacturers must manage more engineering work, more suppliers, more parts, and more risk. Manufacturers often must adjust tools, materials, and work processes throughout production to reflect each agency's specifications. That slows down production and increases the likelihood of errors.

These inefficiencies are ultimately reflected in higher bus prices and longer delivery times. They can also lead to fewer bids and a market that is harder for new manufacturers to enter. Customization creates another, less visible problem: it reduces demand for more standardized products, making it harder for industry to achieve economies of scale.

Resources already exist to help reduce procurement burdens and encourage more standardized approaches. The American Public Transportation Association publishes *Standard Bus Procurement Guidelines*, commonly known as the White Book, which suggests model specifications, as well as model terms and conditions, for federally funded bus purchases. State contracts allow agencies to purchase buses without issuing their own requests for proposals.

But these resources have not been sufficient to minimize unnecessary customization. Many agencies understand the benefits of standardization but remain skeptical of it. They worry that standardization could increase maintenance and training costs, or force them to accept components that have not worked well in their fleets. As one interviewee put it, "Everybody wants a standard as long as it's their standard."

The bus market's structure in the U.S. makes these problems especially difficult to solve. The U.S. transit bus market is small compared with the automobile industry; fewer than 5,000 heavy-duty transit buses are sold in the U.S. in a typical year compared to nearly 16 million cars, SUVs and light trucks. It is further divided by bus length and propulsion type (diesel, compressed natural gas, hybrid electric, battery-electric, and hydrogen fuel cell buses).

The research team's pricing analysis shows changes in bus prices over time and how these prices vary by propulsion type. Between 2015 and 2025, transit agencies paid a median price of $501,000 for diesel buses, $553,000 for CNG buses, $727,000 for diesel-hybrid buses, and $995,000 for battery-electric buses (these prices are normalized to 2023 dollars). While the team's procurement dataset cannot isolate the cost of individual specifications, it does highlight the importance of improving price transparency and making procurement data easier to compare across agencies and vendors.

Other countries have figured out how to purchase buses at lower costs. For example, Italy's national purchasing center is paying about $900,000 for a battery electric bus, while San Francisco's Muni is paying about $1.4 million. Likewise, when five cities in India jointly purchased buses, they found the price difference was more than 30 percent lower than other bids for similar buses in India received during that time.

Less customization and larger bus orders work together to reduce bus costs. In Europe, many cities outsource bus operations and procurement to private operators, which often have greater purchasing power and can purchase the same or similar buses for use across multiple cities and countries. European manufacturers also benefit from greater economies of scale because the European bus market is about nine times larger than the U.S. market.

Four case studies reinforce this report's main findings. King County Metro demonstrates how relationships with manufacturers and early market engagement can help encourage competition. MTA New York City Transit shows how the requirements of the nation's largest bus operator influence the broader industry and complicate efforts to encourage standardization. Two historical examples suggest that standardization efforts can produce benefits when they are flexible, industry-supported, and attentive to local needs.

This report does not recommend eliminating all customization or creating a one-size-fits-all bus. Instead, it presents the following six broad recommendations to reduce unnecessary transit bus customization, lower costs, improve delivery, and strengthen competition in the U.S. bus manufacturing market.

1. Federal Transit Administration (FTA) should help agencies build stronger procurement capacity through education, training, and workforce development.
2. FTA should increase transparency in pricing and its programs.

3. FTA should require agencies to disclose major departures from standard practice and summarize their cost implications.
4. Congress and the U.S. Department of Transportation should support ongoing industry standardization efforts and advance new initiatives to develop bus, technology, and interface standards.
5. Federal laws and policies should give transit agencies financial incentives to purchase more standardized buses.
6. Other promising policy options should be explored in future research.

These recommendations are complementary and intended to work together. Education and transparency will provide agencies with information they need to make more informed procurement decisions. Disclosure requirements will encourage agencies to identify and justify major departures from standard practice. Developing shared specifications will create common standards for buses, while changes in federal law will reward agencies that adopt those standards and use more efficient procurement approaches. Other policy options may be promising but require further research and analysis.

The U.S. transit bus market is too small and fragile to absorb unnecessary complexity indefinitely. As buses become more technologically complex, if left unchecked, customization is likely to become more extensive, and its consequences more significant. Since no single entity can solve the problem alone, implementing these recommendations will require coordinated action by Congress, U.S. Department of Transportation, Federal Transit Administration, American Public Transportation Association, transit agencies, and manufacturers.

Introduction

U.S. transit agencies collectively spend about $6 billion per year purchasing new buses, representing almost one-quarter of all transit capital expenditures. But they are making these investments in an inefficient market that is under strain. As a result, agencies face high prices, long delivery times, and limited competition.

One reason for these problems is that large transit buses (typically 40-foot or 60-foot long) are produced more like a Rolls-Royce than a Ford. Rather than being highly standardized, buses are typically manufactured in small batches to agency-specific specifications. Transit agencies customize nearly every aspect of a bus, from the number of seats to the screws on a panel door. They also customize the contractual terms and conditions under which buses are purchased, including provisions related to indemnification, inspection, insurance, payment schedules, diagnostics, warranties, and other requirements.

At a Ford or Toyota factory, standardization limits the number of unique parts these manufacturers must stock and install, enabling higher-volume production, lower costs, faster delivery, and more consistent quality. By contrast, ultra-luxury manufacturers such as Rolls-Royce embrace extensive customization. Buyers can tailor vehicles to their individual preferences, but they pay a premium and accept longer wait times.

Less customization and more standardization in the bus industry could lower costs, speed delivery, enhance quality, and strengthen competition.

Customization is not inherently bad. Transit agencies operate in regions with different climates, terrain, and ridership patterns. Their riders, bus operators, and mechanics may be accustomed to particular vehicle layouts, features, and technologies. Labor concerns, safety risks, and legal obligations can also give rise to customized requirements, many of which serve legitimate purposes. A corrosion-resistant bus makes sense in a snowbelt city. A familiar component may reduce staff training and spare parts costs. A preferred operator seat may improve comfort and morale.

The problem is that individually reasonable decisions, stacked together, lead to higher industry-wide costs. When each agency specifies different components and technologies, manufacturers must manage more parts, more suppliers, more risk, and more engineering work. That raises costs, slows delivery, impairs quality, discourages bidding and competition, and makes it harder for new manufacturers to enter the U.S. market. Moreover, ordering customized components reduces demand for more standardized products, which diminishes the industry's economies of scale.

Industry stakeholders have long been concerned about the consequences of customization and have developed resources to encourage more standardized approaches. The American Public Transportation Association (APTA) publishes the *Standard Bus Procurement*

Guidelines (commonly known as the White Book), which suggests model specifications as well as model terms and conditions for federally funded bus purchases. States have also developed blanket contracts that transit agencies across the country can use to purchase buses without having to issue their own full RFPs (requests for proposals). Joint procurements offer another way to reduce duplication, shorten timelines, and support more consistent procurement practices.

But these resources have done little to reduce customization. In fact, buses are becoming more customized as agencies incorporate new technologies for vehicle operations, maintenance, and communications. Moreover, many agencies remain skeptical that standardization would reduce the cost of buses. They also worry it could disregard local operating needs, increase training costs, or force them to accept components that have not worked well in their systems. As one interviewee put it, "Everybody wants a standard as long as it's their standard."

Building upon work previously done by the Federal Transit Administration (FTA) and bus manufacturing task forces set up by APTA, this report provides a set of pragmatic recommendations to lower bus costs and strengthen the bus manufacturing industry. These recommendations are organized into six broad categories—education, transparency, disclosure, standards development, federal financial incentives, and additional research needed.

Research Approach

The research team combined prior research, interviews, procurement data, and policy analysis to better understand the underlying causes of bus customization and its consequences. In the study's first phase, an advisory panel was set up with representatives of transit agencies, manufacturers, and industry stakeholders. The research team then compiled and assessed relevant documentation relating to federal procurement requirements, the White Book, state contracts (also known as state schedules), bus testing, customization, and technologies. The team consulted more than 75 sources, including academic publications, federal reports, trade association materials, and prior industry studies.

The second phase involved quantitative analysis of bus procurement data. The team developed a national procurement dataset and analyzed more than 2,000 procurement records. This work provided an empirical baseline on bus pricing by propulsion type, fleet size, and geography.

Third, the team interviewed more than 65 representatives of 37 organizations, including transit agencies, manufacturers, suppliers, trade associations, government officials, and other stakeholders. Insights from these interviews were used to understand how procurement decisions are made, why agencies customize buses, how manufacturers

respond to agency requirements, and what barriers exist to greater standardization and stronger competition.

The final phase of the work focused on synthesis and refinement. The team prepared draft reports on issues and challenges, quantitative pricing analysis, and 24 potential recommendations, and presented those materials to the advisory panel. Based on the advisory panel's feedback, the recommendations were further refined into six broad recommendations.

How this report is organized

The first four sections of this report describe the U.S. transit bus industry and procurement process, explain why transit agencies customize their buses, and examine the consequences of those decisions. Sections 5 and 6 present the research team's pricing analysis and draw lessons from relevant historical and international standardization efforts. Sections 7 and 8 examine key standardization issues and present the study team's recommendations.

This report contains four valuable case studies that illustrate how procurement practices, agency needs, and standardization efforts have shaped the U.S. bus industry. The first two examine contemporary agency approaches -- King County Metro's collaborative procurement strategy, and MTA New York City Transit's highly detailed specifications -- and their implications for the bus industry. The final two case studies examine historical standardization efforts: one covers the Presidents' Conference Committee streetcar, and the other examines the Transbus and advanced design bus programs.

The appendices contain background materials on the bus industry and federal procurement of transit buses as well as a detailed pricing analysis, the bibliography, and list of organizations interviewed.

1. U.S. Transit Bus Industry and Policy Context

The U.S. transit bus market is small, fragmented, and difficult to serve efficiently. Unlike the automobile industry, which sells approximately 16 million vehicles a year in the U.S., the transit bus industry produces less than 5,000. The bus market is further divided by vehicle length and propulsion type (diesel, compressed natural gas, hybrid electric, battery-electric, and hydrogen fuel cell buses). Limited production volumes make it difficult for manufacturers to achieve the economies of scale found in larger and more standardized industries.

In recent years, the industry has also become much more concentrated. The number of firms producing most heavy-duty transit buses fell from ten in 2004 to four in 2013. Today, only three remain. Gillig and New Flyer are the two dominant manufacturers, with ElDorado National California (ENC) resuming manufacturing after a pause in production.[1]

The market is also being reshaped by digital technologies. Buses are becoming more electronically integrated and more software driven. Firms are offering innovative new products, and agencies are specifying more proprietary systems, whether for fare collection, communications, security, or vehicle controls. This has led to more customization, which now affects nearly every component of the bus, as well as every stage of production. As customization spreads, buses become more expensive and standardization harder to achieve.

This section of the report provides an industry and policy context for the customization issues discussed throughout the rest of the report. It first describes the shrinking and fragile bus manufacturing base. It then explains how federal funding, bus testing, Buy America, and other requirements shape the market. Next, it examines why manufacturers face high barriers to entering the U.S. transit bus market. Finally, it reviews recent federal and industry efforts to encourage procurement approaches that are less burdensome and more standardized.

1.1 A shrinking and fragile bus industry

All the transit agency leaders and staff interviewed for this study are concerned about the shrinking number of U.S. bus manufacturers. Many stakeholders perceive New Flyer as having a near-monopoly position for larger agencies that issue complex RFPs, because Gillig often declines to bid on such contracts. Interviewees, such as AECOM's Paul Kaufmann, ticked off the names of companies that have left the market over the course of their careers, including Eagle, National, Flxible, NABI (North American Bus Industries), Neoplan, Orion (Daimler), Proterra, and TMC (Transportation Manufacturing Corporation). Interviewees were especially concerned about certain segments of the market where only one U.S. company still manufactures certain vehicle types, such as 60-foot articulated buses and trolley buses.

Industry contraction has not been limited to vehicle manufacturers. Just as agencies are concerned about the financial stability of transit bus manufacturers, manufacturers are worried about the financial stability of their suppliers. For example, Cummins is currently the only supplier of diesel bus engines able to meet U.S. emissions requirements. And in 2025, New Flyer and Gillig jointly acquired the assets of the only U.S.-based transit bus seat supplier, after the company struggled with production delays, supply chain issues, and rising costs.

Both the literature and the interviews suggest that a market with a shrinking number of manufacturers and suppliers, and too little volume, leaves transit agencies more vulnerable to price increases, delivery delays, supply chain disruptions, and the loss of technical support and replacement parts.

Although all the transit agencies interviewed would like to see a more competitive market, several interviewees cautioned that too much competition in such a small market might be counterproductive. One agency executive said, "Competition can be valuable, but it might not be healthy. The private sector needs to make a profit, and the market is so small." Several expressed concern about the financial condition of the remaining manufacturers. Interviewees also noted the transition to electric and fuel-cell buses has increased production complexity and costs for both agencies and manufacturers.

1.2 Federal funding and requirements

Federal policy has enormous influence over the transit bus market because transit agencies rely heavily on federal funds to buy buses. Typically, transit agencies pay 20 percent of the cost of buses while the FTA covers the other 80 percent. That funding structure gives the federal government significant leverage over procurement practices through legal requirements, guidance, incentives, and program priorities.

Transit agencies purchasing buses with federal support must comply with a series of federal requirements, including those relating to vehicle safety, durability, inspections, and domestic content ("Buy America"). These regulations are intended to protect public funds and ensure reliable buses, but they can also add time, cost, and uncertainty to the procurement process.

The FTA requires large, heavy-duty transit buses to remain in service for 12 years or 500,000 miles before they can be replaced using federal funds. To help agencies purchase durable buses, federal law requires testing of all new bus models before they are eligible for FTA assistance. The testing center in Altoona, Pennsylvania evaluates reliability, safety, structural integrity, durability, and other factors. Before buses can be tested at Altoona, manufacturers must first receive authorization from the FTA, a step that has recently taken as long as six months. The testing process itself then takes at least another six months.

Buy America requirements mandate that federally funded buses undergo final assembly in the U.S. and that domestically produced components and subcomponents account for more than 70 percent of total component costs. As a result, firms from other countries seeking to enter the U.S. transit bus market must set up a plant in the U.S. and establish a U.S.-based supply chain. This adds costs and creates challenges, since many foreign firms rely on less expensive, off-the-shelf components and systems from Europe and Asia.

The federal government, therefore, plays two roles at once. It helps sustain demand by providing funding that makes bus purchases possible. At the same time, it creates a procurement environment that can increase complexity, slow delivery, and make market entry more difficult.

The federal government's numerous and at times conflicting goals—encouraging public transportation, minimizing costs, enforcing environmental standards, protecting federal investments, fostering a competitive market, and supporting U.S. manufacturing—help explain why the issues discussed in this report are so difficult to solve. Meanwhile, transit agencies are focused on their own short-term interests within a procurement system that would work more efficiently over the long term if buses were more standardized. These tensions sit at the center of the transit bus procurement problem.

1.3 Challenges of Attracting New Manufacturers

To better understand the challenges facing the U.S. bus manufacturing sector, the research team interviewed representatives of firms that have exited the U.S. market, industry leaders who have advised potential entrants, and transit agencies that have attempted to attract new manufacturers.

Nova Bus was the most recent bus manufacturer to shut down its U.S. bus manufacturing operations, closing its New York manufacturing facility in 2025 to stabilize its finances and consolidate production in Canada. The company continues to serve U.S. customers from its Canadian facilities, and maintains an established parts and service network across the United States. In an interview with the research team, Nova Bus indicated it could consider opening a new U.S. manufacturing facility, if it saw predictable demand, efficient procurement practices, and a stable operating environment. In other words, the company would need to see a strong pipeline of orders and a clear path to profitability before making a major investment.

John Walsh, former president of PhoenixEV and ElDorado said, "There's a high barrier of entry coming into the U.S. I worked with many European companies, but it was too expensive for them to come in. The numbers didn't pencil out." Interviewees identified the following five barriers that deter manufacturers from entering or expanding in the U.S. transit bus market.

- *Regulatory requirements*: Altoona testing and Buy America requirements were cited as barriers to new manufacturers. Also cited were emissions testing requirements needed for diesel buses (both mandatory federal regulations and California Air Resources Board standards that have been adopted by many other states).
- *Contractual barriers*: Potential manufacturers are uncomfortable with many transit agencies' contractual terms and conditions, such as payment terms and performance bond requirements. These provisions often require manufacturers to absorb substantial financial and legal risk, and cover production costs for well over a year before being reimbursed.
- *Global competition*: An interviewee from the International Association of Public Transport noted that fierce competition from China is affecting European manufacturers' decisions. They are now more focused on protecting their home markets and less interested in expanding into the U.S. market. (Note that U.S. law

prohibits transit agencies from using FTA funds to purchase rolling stock from Chinese manufacturers.)

- *Market size and demand uncertainty*: Many manufacturers do not see the U.S. market as large enough to justify the investment required to establish domestic production. Several interviewees also noted that federal support for bus purchases appears less predictable in the U.S. than government support in Europe.
- *Zero-emission bus policies:* In Europe, most new buses sold are battery electric. Several European companies have expressed an interest in selling these buses to the U.S., but American transit agencies are ordering fewer of them because of changing federal priorities, reliability issues, inadequate infrastructure, and insufficient agency staff training.

The second appendix provides additional background information on the U.S. transit bus industry.

2. How Transit Agencies Procure Buses

Transit agencies have several ways to purchase buses, but the traditional approach is to develop their own specifications and issue a request for proposals (RFP). Bus manufacturers then respond with proposals. Agencies can also purchase through a state contract or participate in joint procurement. Agency-issued procurements provide the most control to individual agencies, while the other approaches can reduce administrative burdens, shorten timelines, and encourage more standardized vehicles.

2.1 Agency-issued RFPs

At the larger transit agencies, the procurement process usually begins with the development of technical specifications and contract terms. This work is typically carried out by internal teams that include staff from operations, maintenance, safety, training, legal and technology departments, with procurement staff coordinating the overall process. Internal discussions can take considerable time because agencies are not simply selecting a vehicle. They are also deciding how much financial and legal risk to accept, how closely new buses should match the existing fleet, and what legal and contractual protection they want from the manufacturer.

In developing specifications, agencies usually consult APTA's *Standard Bus Procurement Guidelines*, commonly known as the White Book. The White Book serves as a template for technical specifications and contract documents for buses procured with federal funds. It acts as a voluntary standard, and its specifications and performance measures do not identify specific vendors. However, even within the White Book "standard," agencies have many choices. For example, the White Book indicates that the default operator's seat has

no armrest, but offers three alternatives: one armrest on the right side, one armrest on the left side, or two armrests.

The White Book is developed and regularly updated by an APTA working group that includes transit operators, bus manufacturers, component suppliers, and procurement specialists. Like other APTA standards, it is developed through a consensus-based process that reflects broad industry expertise. The document is more than 300 pages long and establishes a common structure for bus procurements, including technical specifications, contract terms, warranties, payment provisions, and other procurement requirements. It helps agencies save time, reduce drafting burdens, and align their procurements with industry practices. At the same time, the White Book is not a single standardized bus specification. It gives agencies a common starting point, but its many options allow significant customization to continue.

Interviewees indicated that smaller agencies rely more on the White Book, using roughly 85 to 95 percent of its language, while larger agencies use between 50 and 75 percent. That difference reflects the fact that larger agencies are more likely to revise specifications and language to match their own operating practices, experience, legal requirements, and preferences.

Once an agency has developed its technical specifications and terms and conditions, it issues an RFP. During the question-and-answer phase of the procurement process, manufacturers often identify components they would like to substitute and then ask the agency to approve them as equals. These “approved equals” requests can become burdensome for both agencies and manufacturers, especially when an agency’s specifications are highly detailed or call for unfamiliar components. Manufacturers may submit dozens or even hundreds of approved-equal requests, each of which must be evaluated by the agency.

From the manufacturer’s perspective, developing a bid in response to RFPs can be costly and time-consuming. Manufacturers must review not only the technical specifications, but also the agency’s legal terms and conditions. If an agency requires a component or system that does not fit the manufacturer’s standard design, the manufacturer may have to evaluate potential engineering changes, supplier relationships, compatibility issues, and warranty risks before deciding whether and how to bid. Interviewees emphasized that agencies are often unaware of how much work can be triggered by what appears to be a modest customization, and how all these costs are ultimately passed on to the transit agencies.

Manufacturers may need to test new components and determine how they will integrate with their existing systems.[2] A component could have an unintended consequence, such as emitting wireless signals that interfere with other components or causing a cabinet to

overheat because it has too many electronic products. Manufacturers must validate their suppliers, and consider the risk that a supplier could go out of business and be unable to supply replacement components.

Adding a new component or feature can have cascading effects on other parts of a bus. For example, one agency discussed how it wanted a feature on its customer phone app that allows riders to see whether there is available space for a bicycle before the bus arrives. This requires manufacturers to install and test a bike rack with sensors that communicate with the bus's computer systems. Engineering drawings must be updated, the wiring harness (as shown in Figure 2.1) needs to accommodate a new cable, and technical publications must be revised.

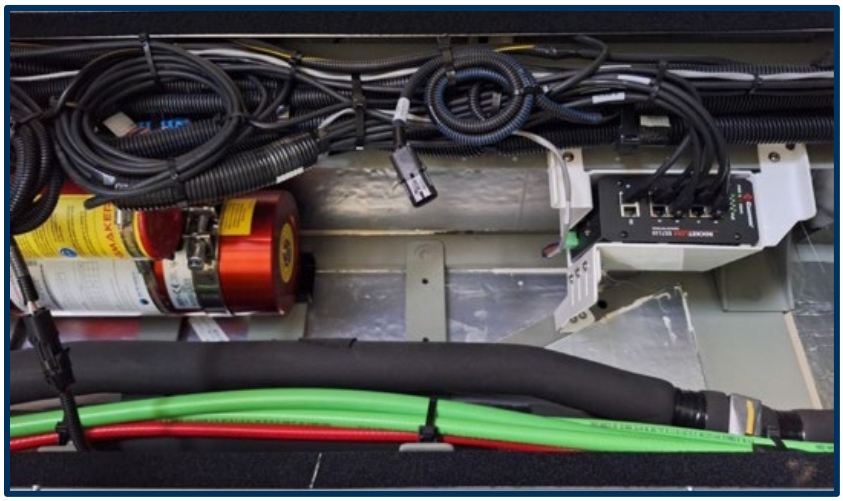

Figure 2.1. Wiring Harness.
Manufacturers customize harnesses to meet each bus's specifications; they can be 40 to 60 feet long with up to 70 different wires and connectors.

Transit agencies typically wait more than three years from the time they begin preparing an RFP until the first bus arrives, according to interviewees. The three-year period starts with preparing and issuing an RFP, which often takes 10 to 12 months. Contract award and execution add another 6 to 12 months. Then, manufacturers usually need 9 to 18 months to complete the first bus, including the time required to define the final configuration and acquire parts. After the first bus in an order is completed, transit agencies inspect buses at the manufacturing facility before testing them in their service areas, steps that can often take another six months.

Traditionally, transit agencies have paid for buses upon delivery, which can occur 24 months or more after an order is placed. To minimize manufacturers' financing costs, some agencies now provide progress payments when certain production milestones are met.

2.2 State contracts and joint procurements can reduce procurement burden

Although agency-issued RFPs remain common, transit agencies are increasingly using state contracts to simplify procurement. Under this model, a state conducts a competitive procurement and establishes a contract that multiple transit agencies may use. Transit agencies can then choose from the contract's available manufacturers and models without having to develop and issue a full RFP themselves.

During this study's interviews, the research team found that not every agency was aware of how state contracts work. Likewise, some interviewees did not know that, since 2015, FTA grantees can use an approved state contract executed by any state, not just the state in which the transit agency is located.

State contracts offer several advantages to transit agencies as well as to manufacturers. For agencies, using a state contract allows them to review specifications, pricing, option lists, and warranty information in advance. State contracts reduce the administrative burden of preparing a solicitation and shorten the procurement timeline, in some cases by as much as a year. They also give agencies earlier insight into likely costs and avoid the risk of issuing an RFP and receiving no bids.

Interviewees offered concrete examples of the savings associated with using state contracts. When one agency last issued its own RFP, it received 400 approved-equal requests and had to devote substantial staff and consultant time to reviewing them. After switching to the State contract, it saved roughly $100,000 in staff costs and $250,000 in technical and legal costs. However, it did not significantly change the actual cost of buses.

For manufacturers, the advantages of state contracts can also be significant. The state contract structure allows manufacturers to build buses for multiple agencies without having to respond to individual RFPs, which can be very resource intensive. Both manufacturers and agencies also appreciate how state contracts allow them to have more discussion and collaboration compared to an RFP process, which has very strict communications restrictions.

Several interviewees pointed to the State of Washington's contract as being the most widely used. When agencies use Washington's contract to purchase heavy-duty buses, contractors pay a modest administrative fee (0.15 percent of the total purchase price) to the state.

When used in conjunction with the White Book, state contracts can encourage more standardization. However, state contracts do not eliminate customization. Agencies can still select from numerous options and may also request additional modifications. Manufacturers are often willing to add custom features that are not listed on the standard

options list. For example, the Washington State contract for one bus model lists 16 different bicycle racks. It also includes a 17th option, "Other Option – Specify."[3]

Some agencies, especially larger ones, prefer issuing their own RFPs rather than state contracts, because it gives them greater control over specifications and contract terms. Agencies that have the staff and expertise to manage the process can tailor the procurement to obtain exactly what they want.

Joint procurements offer another way to reduce costs and encourage common specifications. In these arrangements, two or more agencies combine their purchasing power and conduct a shared procurement. This approach can lower administrative costs and support more standardized vehicles. However, agencies often specify different configurations or customize the buses within their portion of the order. Joint procurements also present coordination challenges. Agencies must align funding cycles, replacement schedules, local regulatory requirements, and technical preferences. These obstacles help explain why joint procurements are often discussed as a promising strategy but are not as widely used as state schedules.

2.3 Recent policy reform discussions

Recent federal and industry efforts have tried to encourage procurement approaches that are less burdensome and more standardized. They have encouraged transit agencies to use performance-based specifications, advance (or progress) payments, state contracts, joint procurements, and base bus models with fewer custom features.

In 2024, the White House convened a roundtable on clean bus manufacturing to discuss challenges facing the U.S. bus manufacturing industry and identify ways to strengthen it. The FTA then used its 2024 Low or No Emission Bus Program to encourage applicants to use joint procurements, standard vehicle models, and progress payments.

APTA has recently set up two bus manufacturing task forces. The first, established in 2023, focused on the financial and operational pressures facing the bus manufacturing industry after the COVID-19 pandemic. This task force recommended immediate steps to stabilize the industry, including progress payments and price-adjustment mechanisms. The second issued a December 2025 report with a set of recommendations discussed in Section 6.

The FTA has also highlighted procurement challenges faced by smaller agencies in particular. Many smaller agencies lack dedicated procurement staff and do not have the technical, legal, and administrative capacity to manage complex bus procurements on their own.

The third appendix provides additional background information on the federal procurement of transit buses.

3. Bus Customization

Any attempt to minimize customization must be based on an understanding of what components are customized and what motivates agencies to do so. Informed by the research team's interviews, this section answers these two critical questions.

3.1 What is customized

Nearly every aspect of a bus may be customized, including doors, seating layouts, windows, window tints, floor coverings, and even whether a screw will be covered or not. Agencies can order interior panels made of different materials in numerous shades of gray. Some buses have upper ventilation windows that open and close, some have windows that slide, while many buses have windows that do not open at all. One bus manufacturer revealed that it produces 95 unique bus window configurations in a single year and must support each configuration for a minimum of 12 years.

Even a small component, like the protective cover over the air-conditioning belt, is specified differently across three of the largest transit agencies. One agency requires a hinged, yellow powder-coated guard. The second specifies a bolted guard with a zinc-rich gray, powder-coated primer, while the third relies on the vendor's recommended configuration which uses a support bracket with conventional fasteners.

Figures 3.1 through 3.4 show how New Flyer Xcelsior buses built within weeks of each other in February 2026 can feature different stop-request devices, operator instrument panels, side consoles, seats, and seat belts.

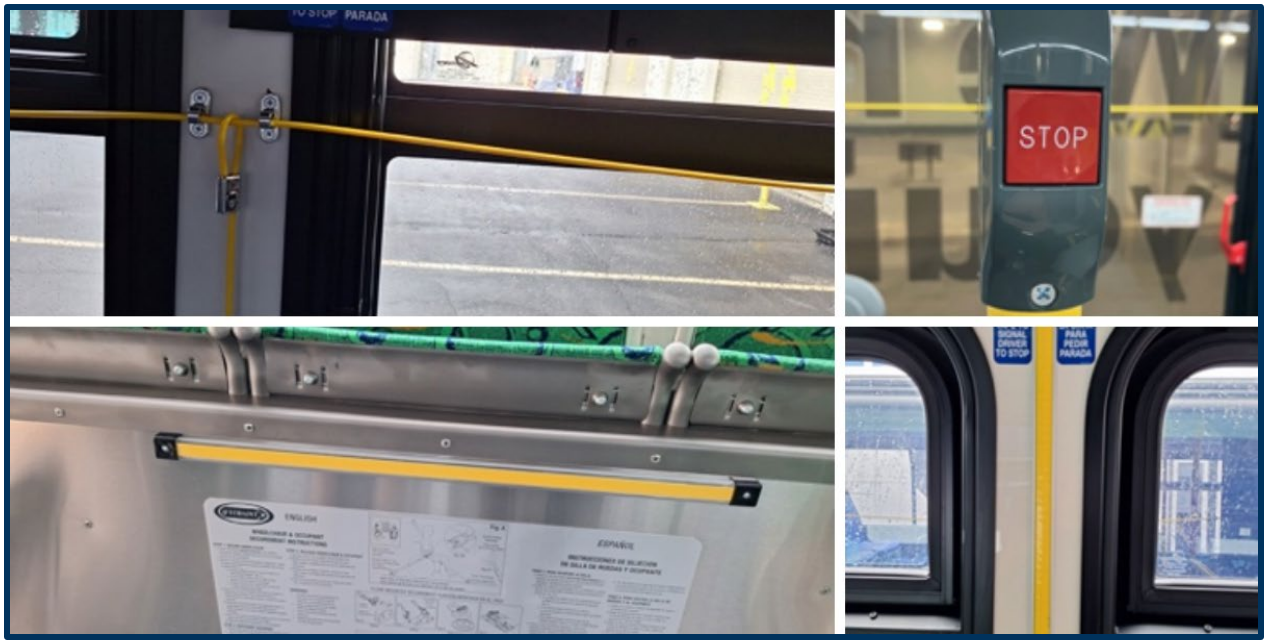

Figure 3.1. Different ways customers can request the next stop. The top two photos show a pull cord and stop button. The bottom two photos show a strip under a folding seat and a strip on an interior panel.

Figure 3.2. Four different instrument panels

Figure 3.3. Four different driver's side consoles (instruments on left side of operator).

Figure 3.4. Operator's seats and seat belts.
New Flyer manages roughly 800 distinct parts associated with operator seats. For example, agencies can specify a lap-only seat belt or one with a shoulder harness. Seats can come with or without armrests and lumbar support. They are finished in various materials including fabric, fabric with leather trim, synthetic leather, and microfiber. Some agencies prohibit manufacturer logos on their seats.

Photo credits: All photos in Figures 3.1 through 3.4 were taken by the research team at New Flyer's manufacturing facility in Anniston, Alabama on February 11, 2026, except for the stop-button photo, above, which was taken by Gogerr in January 2026.

3.2 Why agencies customize

Customization is in the eye of the beholder. One manufacturer interviewed for this study said, "Everyone has their own interpretation of customization. It's even hard for me to figure out how much of a bus is customized." Agencies and manufacturers may not agree on whether an item is an option, a necessary customization, or an excessive customization. While one manufacturer can offer a feature as an option, another might consider it to be unnecessary. While agencies' choices may serve legitimate needs, they increase manufacturing complexity and limit opportunities for standardization across the industry.

This section identifies eight major reasons why agencies customize buses (i.e., why they select features, components, or configurations that are not typically sold by a manufacturer):

- local needs and operating conditions
- safety and legal liability
- fleet consistency to minimize costs
- customer preferences and branding
- operator preferences
- clarifying White Book standards
- integrating technologies
- reducing risk and protecting financial interests.

3.2.1 Local needs and operating conditions

Many agencies customize buses based on hard-earned experience operating their fleets. Past breakdowns, safety incidents, rider behavior, and maintenance data all shape new specifications. For example, an interviewee working in a large urban area lamented the poor condition of his city's streets and revealed that his operators seem to hit nearly every conceivable object from curbs, potholes, street poles, and garbage cans to cars and even other buses.

A bus that works well in one region may not meet the needs of another. Transit agencies in Phoenix, Boston, and San Francisco must account for very different climates and topographies. In Boston, the MBTA's senior director of vehicle engineering, William "Bill" Wolfgang, requires stainless steel structured buses because they better protect against rot and corrosion. He says buses operating in the snowbelt "go through hell" because of the salt used to melt snow and ice on the city's streets. Many of MBTA's buses are also parked near the ocean, where salt air compounds the problem.

Demographics and safety concerns also shape specifications. Agencies serving large numbers of teenagers may require more durable interiors, while crime patterns can prompt added safety features for operators. Operational and maintenance practices further drive customization. Some large agencies do not want fuel gauges on their buses because they want maintenance workers to refuel the buses every day, rather than check how much

fuel remains before deciding whether refueling is necessary. Some agencies also prohibit operators from adjusting cabin temperature, and have modified the fuel fillers to reduce the risk of sabotage.

3.2.2 Safety and legal liability

Agencies often add safety features after serious incidents. One agency required a latch on the operator's window after someone jumped through it and assaulted a driver. Following a horrific pedestrian accident, a New England transit agency began equipping its buses with an audio warning system to alert pedestrians when a bus begins to turn.

Many interviewees noted that some customized specifications stem directly from lawsuits or legal risk. For example, one transit agency agreed to install exterior lights at specified heights on all buses as part of a legal settlement. Another agency, at the insistence of its legal department, now equips each bus with 14 interior and exterior cameras. The footage can be used in investigations following accidents or assaults.

After an accident, union officials often look to blame the bus rather than the operator. They might point to mirror placement, blind spots, and other design features -- rather than operator performance -- as contributing factors to the accident. This makes transit agencies sensitive to certain design features. Similar concerns arise relating to potential lawsuits, a major concern for both agencies and manufacturers. For instance, a jury awarded $5 million to a pedestrian hit by a SEPTA bus in Philadelphia. Both the agency and manufacturer were found negligent because a side mirror allegedly obstructed the operator's view.[4]

3.2.3 Consistency to minimize costs

Many transit agencies select bus specifications based on life-cycle costs, which include purchase price as well as operations, maintenance, training, supplies, inventory, and ongoing subscription fees. To minimize these costs, agencies often customize buses to maintain consistency across their fleets. Standardizing components within an agency reduces spare parts inventory needs, minimizes the need for additional training, and allows maintenance staff to use their existing tools and expertise.

Likewise, agencies may favor components from vendors with whom they have had positive experiences. For example, NJ Transit's Omar Elmessalamy notes that an agency might prefer a particular component because the vendor's proximity to a depot allows it to provide better and more timely support. Ironically, efforts to maintain consistency within an agency's own fleet reduce consistency across transit agencies, resulting in higher costs for all of them.

3.2.4 Customer preferences and branding

Transit agencies seek input from passengers, advisory committees, and advocacy groups about their buses. A bus's specification can be the result of a trade-off between various local interests. For example, after soliciting extensive input, the MBTA customized its seating configuration so that its buses would best accommodate wheelchairs, open strollers, and scooters without impeding the flow of its other passengers.

Many interviewees noted that interior design elements can influence how riders perceive comfort, cleanliness, and safety. Lighting choices, seat layouts, interior panel materials, and other aesthetic details can shape the overall passenger experience. Once riders become accustomed to certain features, agencies are often reluctant to change them. Transit agencies are also protective of their branding, such as exterior colors, because it helps reinforce an agency's visual identity and makes vehicles easily recognizable.

3.2.5 Operator preferences

Transit agencies frequently customize buses to accommodate the needs and preferences of bus operators. Agencies recognize that vehicle design can influence comfort, safety, operator performance, and job satisfaction. As one interviewee put it, "The bus is a mobile office." If buses are poorly designed or uncomfortable, operators may become frustrated, which can affect morale and interactions with passengers.

According to interviewees, transit agencies typically consult a range of operators before making decisions about changes to seating, controls, visibility, climate systems, and other aspects of the operator's environment. Although unions are usually not directly involved in the bus specification process, union-represented employees are typically consulted.

One interviewee said, "Our operators have a big say and a large voice, and they should. They sit in the seat for eight hours or more a day." Some agencies are especially cautious about changing operator-seat specifications and pilot changes before adopting them.

3.2.6 Clarifying White Book specifications

Agencies often modify language from the White Book to clarify specifications. While transit agencies may view these changes as minor clarifications, manufacturers might regard them as customization because they alter the standard specification or require different materials, finishes, or components.

For example, the White Book states: "Bumper material shall be corrosion-resistant and shall withstand repeated impacts of the specified loads without sustaining damage. These bumper qualities shall be sustained throughout the service life of the bus." One agency's

specification adds: “Visible surfaces shall be black. The coloring of this shall be impregnated in the bumper material, painted bumper surfaces are not acceptable.”

3.2.7 Integrating Technologies

Some interviewees remembered that decades ago, customization of buses involved relatively minor features such as colors, logos, and interior finishes. Today, customization increasingly involves complex technology systems and integrated components. What once was largely cosmetic now often affects the underlying architecture of the vehicle. Even relatively modest changes can require additional engineering, new wiring, software adjustments, testing, and coordination among multiple systems and suppliers.

Modern buses rely on more integrated electronics, more software, more sensors, and more proprietary systems than buses did in the past. For example, buses may require multiple cellular phone subscriptions, and a manufacturer may need to install as many as 12 separate antennas on a single bus to support different systems.

Intelligent Transportation Systems (ITS) have significantly increased vehicle complexity and are among the most customized elements of a transit bus. They must integrate with an agency’s existing systems that are used to maintain and monitor vehicles. Because these technologies are often proprietary and rapidly changing, they pose one of the biggest barriers to reducing customization.

At the center of these systems is the main onboard computer—often referred to as the Integrated Vehicle Unit or Integrated Vehicle Network. This central computer connects and manages virtually every other electronic system on the bus, including destination signs, event recorders, emergency alarms, fare collection equipment, next stop announcements, passenger counting systems, stop request systems, security cameras, two-way radios, and vehicle diagnostics. The main computer also connects with the Computer-Aided Dispatch/Automatic Vehicle Location (CAD/AVL) system, which integrates GPS tracking with dispatching software to monitor vehicle locations and track schedule adherence.

Changing platforms can be extremely expensive because it can involve replacing hardware, reconfiguring software integrations, modifying back-office systems, retraining staff, and adjusting maintenance procedures. As a result, agencies frequently require bus manufacturers to install specific products and configurations.

Rapid advances in technology are adding to this complexity. For example, some buses now have virtual mirrors that use exterior cameras and interior displays, instead of conventional mirrors. Advancements in sensor technology are expected to expand autonomous functions, and make vehicles more connected and software-driven. An ITS

supplier explained that hardware and software components change so often that every bus order is different, sometimes even within the same production run.

3.2.8 Reducing risk and protecting financial interests (customizing terms and conditions)

Transit agencies deviate from the White Book's terms and conditions just as they customize the physical components of their buses. They add language relating to a wide range of issues including indemnification, performance bonds, inspection, insurance, and other clauses. One agency official candidly acknowledged, "Our terms and conditions choke the hell out of manufacturers. We try to cover our asses."

Agencies are often required to add terms and conditions because of requirements or pressure from local and state governments. Bus manufacturers consider many customized terms and conditions to be onerous. For example, one agency recently asked for 180 rugged diagnostic laptop computers with its 1,620 bus order.

In their contracts, agencies vary in how willing they are to address one of the industry's biggest problems: manufacturers' cash-flow challenges associated with long production timelines. Both the FTA and APTA have emphasized the importance of advance (or milestone) payments; however, not all agencies have been willing to provide payments before a bus is delivered.

4. The Consequences of Customization

Customization is not driven by one bad habit or one misunderstanding. It reflects the structure of the transit industry itself. Agencies face different terrain, weather, labor concerns, political pressures, legal exposure, and technology platforms. They are judged on safety, ridership levels, and service quality -- not on whether the national bus industry becomes more standardized. That is why customization persists. The choices are often rational at the agency level, even when they create costs and inefficiencies at the industry level.

In policy terms, the transit bus industry faces both a collective action problem and a coordination problem. It is a collective action problem because individual organizations make choices that are reasonable for themselves, but those choices add up to a worse outcome for the industry as a whole. It is also a coordination problem because the industry would benefit from greater standardization, but agencies, manufacturers, and suppliers have struggled to agree on common specifications and procurement practices.

These dynamics have real consequences for cost, quality, delivery, and competition. Some of those consequences are obvious, while others are less visible. Interviews with transit

agencies and manufacturers for this study reveal the following recurring problems associated with customization: manufacturing inefficiency, greater supplier influence on agency specifications, persistence of outdated requirements, less flexibility for manufacturers, and a broader trend in which buses are becoming more customized over time rather than less.

4.1 Manufacturing inefficiency

The most immediate consequence of customization is that it makes manufacturing less efficient. Buses could be built more efficiently if manufacturers produced large, identical batches and made only limited changes at the end of the process, such as applying paint and adding decals. Instead, manufacturers often must adjust tools, materials, and work processes throughout production to reflect each agency's specifications. That slows production, reduces worker productivity, and increases the likelihood of errors. As one interviewee put it, customization creates a "parts nightmare" because manufacturers must stock a wide range of components for different agencies and keep additional inventory available for repairs and accidents.

Customization also limits the benefits of scale that manufacturers might otherwise achieve. One interviewee said a typical U.S. transit bus factory produces about 12 to 15 buses per week, while a school bus factory may produce 50 to 75 in the same period. School buses are built with far fewer variations, which is one reason why they can be purchased from a dealer for roughly half the cost of a transit bus.

4.2 Greater supplier influence on agency specifications

In the transit bus industry, the component suppliers market directly to agencies. One interviewee said, "At conferences, you can see almost every component: wheelchair ramps, doors, and other systems. They display a lot of good things. The bus procurers are like kids in a candy store." Suppliers also tout their products directly to agency executives at various venues.

Because transit agencies write highly detailed specifications, suppliers have a strong incentive to persuade agencies to incorporate their products (or products with their specifications) into procurement documents. This differs sharply from the automobile market, where suppliers of components, such as cameras and mirrors, do not typically advertise directly to car buyers.

The relationship among suppliers, bus manufacturers, and transit agencies has created a dynamic that is pushing the industry toward greater customization. Because agencies customize their buses, suppliers have an incentive to market directly to them. This direct marketing, in turn, encourages agencies to specify additional customized features, which leads to even more marketing and more customization.

This dynamic is similar to pharmaceutical companies advertising directly to consumers, which can lead patients to request specific drugs from their doctors. Studies have shown this type of marketing can influence prescribing patterns and increase demand for newer or more expensive products, even when lower-cost alternatives are available. In the bus industry, supplier marketing is similarly increasing pressure to specify newer, more specialized, and sometimes more expensive components.

4.3 Persistence of outdated requirements

Another consequence of customization is that requirements tend to accumulate. Once a feature, vendor, or design element is added to a specification, it often stays there. One maintenance director told the research team that "the old customizations become the new base for the bus." Another interviewee observed that transit agencies have long memories. If an agency had a bad experience with a component, it can shape procurement decisions years or even decades later, even after the original problem has been eliminated or the technology has changed.

This persistence matters because agencies do not always revisit why a requirement was added in the first place. Manufacturers may see a specification and have no idea whether it reflects a current operational need, an old maintenance preference, a legacy legal concern, or simply institutional habit. Without that context, it becomes harder for manufacturers to suggest equivalent alternatives or for agencies to identify opportunities to simplify their specifications.

4.4 Limiting manufacturers' flexibility

Some agencies identify specific component makers in their specifications, which can limit the flexibility of bus manufacturers. FTA, APTA, and bus manufacturers would rather agencies use *performance-based specifications*. For example, APTA's White Book requires windshield wipers to have at least two speeds, one of which is 45 cycles per minute. With this performance-based specification, a bus manufacturer can use components it deems to be most optimal to meet this specification.

Customization narrows manufacturers' room to maneuver and reduces competition among suppliers. When agencies specify particular components and vendors, manufacturers lose the ability to rely on their preferred designs, standard suppliers, and established production methods. They may need to redesign parts of the bus, test new components, validate unfamiliar suppliers, revise engineering drawings, and retool a production process. Manufacturers view this as increasing cost and compromising quality, even though their business models have long depended on accommodating customer preferences.

Agencies may include a specific component maker in their specifications because they already use that company's product, or because validating alternatives is difficult and time consuming. An interviewee noted that even if an agency issues an RFP with performance-based specifications, it could still reject a manufacturer's proposed supplier and only accept proposals that include components from its preferred vendor.

This loss of flexibility also affects competition. Manufacturers are more likely to bid on RFPs when they can rely on familiar subsystems, standard production methods, and manageable contractual risks. They are less likely to bid when an agency's specifications or its terms and conditions require extensive changes and greater risk. This helps explain how customization can reduce the number of bidders, deter potential new entrants, and make the market even more concentrated.

4.5 Technology leading to more customization

As buses become even more connected, software-driven, and electronically integrated, the consequences of customization are likely to grow. Without greater interoperability, a change to one component will affect its compatibility with other onboard systems, making it harder for manufacturers to standardize designs and increasing the likelihood that agencies will lock in proprietary configurations over time. This suggests that, if left unchecked, customization will become even more difficult and expensive to manage.

This trend raises the stakes. When customization involved relatively simple features, the costs and risks were easier to contain. When customization involves interconnected systems, the consequences spread across engineering, procurement, maintenance, training, and reliability. This is why efforts to reduce customization are about more than lowering price. They are also about improving manufacturability, reliability, and the health of the market itself.

Customization does not merely add a few options to a bus. It changes how buses are designed, built, priced, and supported. Many individual customization decisions may be reasonable on their own. But taken together, they reduce manufacturing efficiency, reinforce outdated practices, and strengthen supplier pressure for new features. That is why customization sits at the center of the bus procurement problem.

5. Pricing Analysis

In addition to conducting interviews that revealed agencies' decision-making processes and manufacturers' responses, the study team conducted a pricing analysis to identify trends in bus prices. The analysis found substantial price variation by propulsion type and considerable price dispersion within each category. It also identified areas where additional data would be needed to better understand the industry and trends.

The research team developed a national procurement dataset to examine pricing patterns in the U.S. transit bus market. The analysis reviewed more than 2,000 procurement records, which were then reduced to 1,544 validated records spanning 2015 through 2025, across 42 states. Pricing data was normalized to 2023 dollars to allow consistent prices across different years. The purpose was to establish a baseline describing transit bus pricing by propulsion type, fleet size, and region.

The first and clearest finding is that propulsion type matters a great deal for price. Median prices rise significantly as buses move from conventional propulsion to zero-emission technologies. The data, as shown in Table 5.1, reveals median prices of about $501,000 for diesel buses, $553,000 for CNG buses, $727,000 for diesel-hybrid buses, and $995,000 for battery-electric buses. The data also shows a wide range of prices within each propulsion type. Battery-electric buses have the widest dispersion, due to the differences in battery capacity, configurations, and the early-stage nature of the zero-emission market.

Table 5.1. Bus prices between 2015 and 2025, inflation adjusted.

Propulsion	*Validated Records*	*First Quartile Price*	*Median Price*	*Third Quartile Price*	*Difference between 1st and 3rd Quartiles*
Diesel	690	$464,156	$501,067	$573,830	$109,674
CNG	398	$513,396	$553,189	$596,635	$82,239
Diesel-Hybrid	195	$670,514	$727,293	$792,505	$121,991
Battery-Electric	240	$901,966	$994,802	$1,124,607	$222,641

Figure 5.1 shows price changes (adjusted for inflation) over the last decade within these four propulsion categories. The cost of diesel buses increased 12.9 percent, diesel-hybrid rose 13.9 percent, and CNG increased 14.2 percent. In contrast, the cost of battery-electric buses decreased as the industry has matured, although they remain the most expensive.

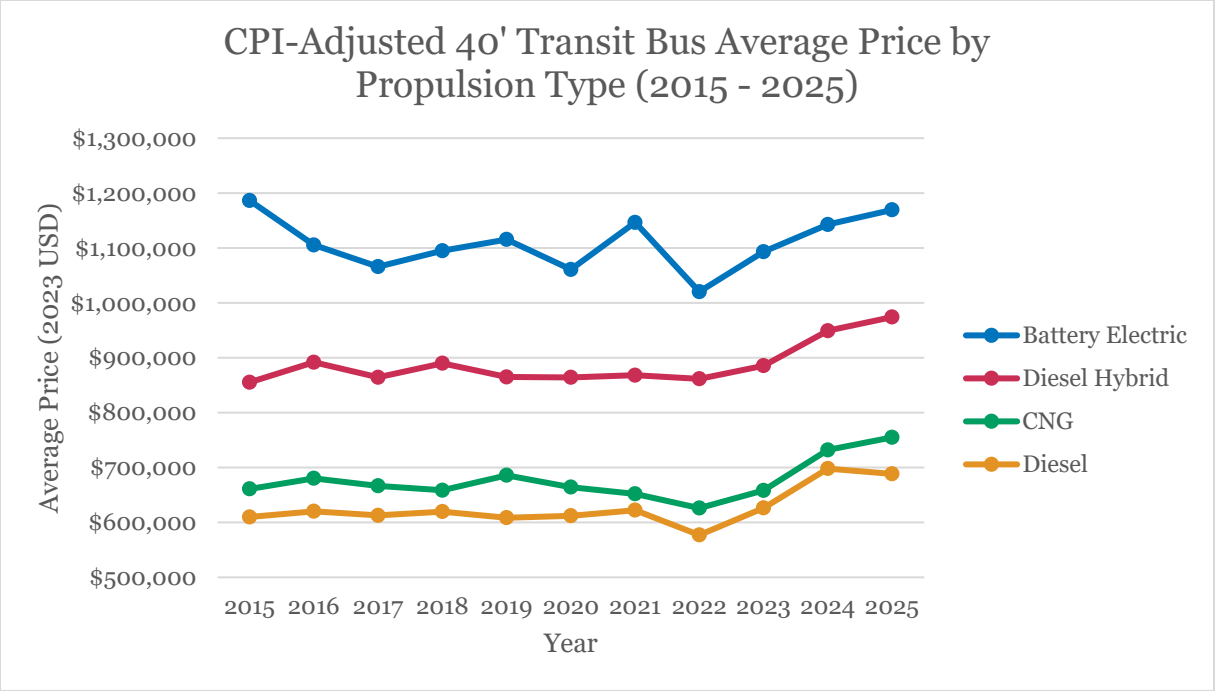

Figure 5.1. Price Changes for 40-foot transit bus by propulsion type (2015 to 2025).

The analysis did not find any evidence that geography consistently explained price differences. Likewise, there were no clear or consistent price advantages across small, medium, and large fleets.

Although agencies often point out the need to customize for local climate conditions, the pricing data does not show large, systematic regional pricing differences. As shown in Figure 5.2, when propulsion type is held constant, median prices are generally comparable across the U.S. Although the data shows slightly higher prices in the Northeast, this variation is modest and likely reflects differences in procurement scope and configuration choices rather than a clear structural regional premium.

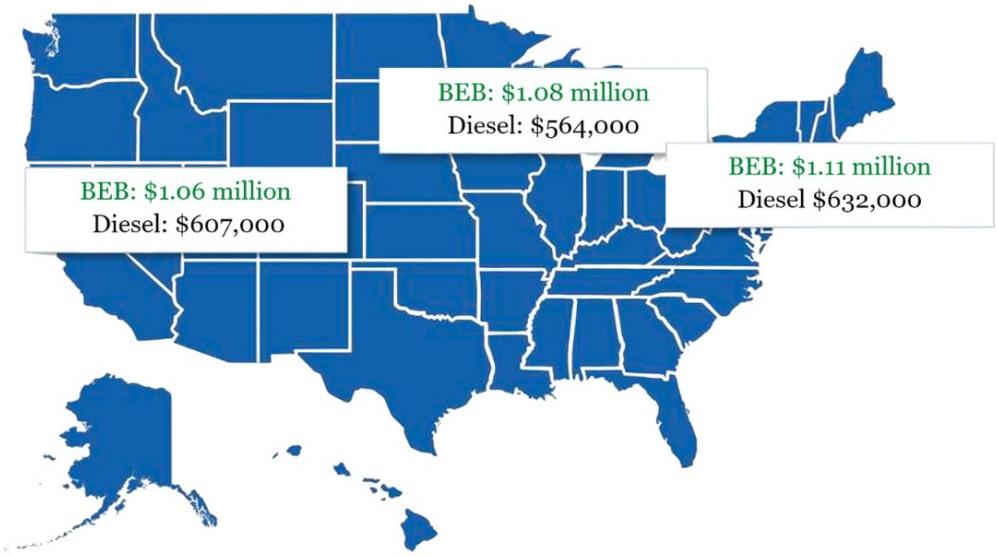

Figure 5.2. Price comparison by region (West, South, Northeast, Midwest) for diesel and battery electric buses (BEB)

The analysis provides evidence that options and configurations do affect costs. Compared with base pricing in a state contract, agency-reported bus prices were consistently higher by roughly 6 to 14 percent, depending on propulsion type. The 6 to 14 percent spread reflects differences in the quantity of vehicles ordered, and selected configurations (e.g., ITS systems, safety systems, HVAC).

The analysis also identified examples of specific configurable subsystems that can materially affect price. HVAC upgrades can add roughly $20,000 per bus. Fare collection systems can add $18,000 to $20,000. Optional or customized seating configurations can add $15,000 to $19,000. Enhanced driver protection can add more than $13,000. In total, agency-specific selections can easily add $100,000 per bus, even within standardized cooperative contracts that already include option catalogs.

Table 5.2 shows some of the standard options that are available in the Washington state contract for a 40-foot bus. The base price of the bus is $593,031. The prices have been relabeled using generic subsystem terms.

When it comes to state contracts, it is important to distinguish between manufacturer options and agency-specific customizations. A manufacturer option is a feature offered to any customer and appears on an options list in a state contract. By contrast, an agency-specific customization is a feature, component, configuration, or contract term that is not part of the manufacturer's options list. The cost of a single standard option that is offered

by a manufacturer can be easily quantified. However, the costs of the agency-specific customizations are rarely made available to the public.

Table 5.2. Selected option prices from a state contract

Option/Subsystem	Unit Price
Electrical HVAC System	$20,722
Farebox	$19,701
Video Surveillance	$15,638
Diagnostic Software/Equipment	$12,713
Communication/Radio System	$10,233
Electronic Destination Sign System	$10,076
Automatic Passenger Counter	$8,161
Driver Protection	$7,491
Total:	**$104,735**

The limitations of the available procurement data are just as important as the findings. First, it is not possible to precisely calculate the cost of an agency's customization choices because the records do not provide sufficient detail. Second, comparing costs across agencies is problematic because definitions and details are not consistent. Third, given that lack of detailed and consistent data, it is not possible to quantify the cumulative effect of many different customization choices across many agencies.

Just as importantly, the data does not quantify the potential cost savings from a different procurement structure. For example, it does not calculate the potential cost savings from larger production runs that generate economies of scale, standardization that results in faster delivery schedules, or cooperative purchasing across multiple agencies.

These data limitations help explain what the quantitative analysis can and cannot do. It can show broad national patterns and that propulsion type has a major effect on price. It can show that there is substantial price dispersion within broad categories, and that agency-specific options can add meaningful cost.

But it cannot, on its own, explain why a specific agency paid more for a specific bus. Nor can it fully capture the engineering burden, supplier constraints, legal requirements, or institutional habits described in the interviews. Most importantly, it cannot reveal how the costs of customization are incurred by both agencies that do and do not extensively customize their buses because of the manufacturing inefficiencies inherent in the industry.

To overcome these data limitations, the research team's recommendations emphasize the need for more industry transparency.

The fourth appendix provides additional information on this pricing analysis.

6. Lessons from Earlier and External Efforts

Efforts to reduce customization and encourage more standardization are not new. Previous efforts in the U.S., along with recent developments abroad, suggest that standardization can lower costs and strengthen the market. However, they also show the difficulty of developing and enforcing standards -- when agencies want flexibility, manufacturers need to minimize their financial risk, and no single institution has the authority, expertise, and credibility to impose lasting change.

6.1 Earlier U.S. efforts

Policymakers and transit agencies have been grappling for decades with many of the same concerns addressed in this report: too few manufacturers and production inefficiencies. In the 1930s, numerous companies in the U.S. built buses, but the industry soon came to be dominated by five major manufacturers. By the 1960s, two companies, General Motors and Flxible, dominated transit bus production, similar to the situation in the U.S., today.

The federal government took a much larger role in bus procurement starting in the late 1960s as Congress increased transit funding and looked for ways to modernize vehicles, strengthen the manufacturing base, and make transit more attractive. Federal officials were not simply trying to help agencies buy more buses. They were also trying to influence what kinds of buses were built and how the market functioned.

The most ambitious federal standardization effort was the Transbus program in the 1970s. The U.S. Department of Transportation (USDOT) set out to create a standardized 40-foot bus, but the program failed for reasons that remain highly relevant: the bus specifications were technically demanding and kept changing; manufacturers believed the required technologies were too risky and expensive; and transit agencies worried that the buses would be difficult to maintain and operate. As discussed in the fourth case study, USDOT awarded more than $191 million (in 2026 dollars) to build prototypes, but a Transbus was never put into service.

The lesson is not that standardization is impossible. It is that standardization imposed from the top, without sufficient flexibility and without broad support from both agencies and manufacturers, is unlikely to work. Transbus tried to produce one federally defined bus for the whole country. That was too rigid, too risky, and too far removed from the realities of how transit agencies procure buses and how manufacturers manage production.

An earlier effort highlights a more successful transit example: the PCC streetcar (Electric Railway Presidents' Conference Committee). That 1930s effort, discussed in the third case study, was driven by streetcar operators and manufacturers rather than by a federal mandate. It focused on a set of core design features and subsystem interfaces, but still

allowed local variation in areas such as size and door placement. Standardization worked better when it was driven by industry needs, focused on areas where common solutions were feasible, and allowed some room for local adaptation.

6.2 Recent industry efforts

Recent standardization efforts have been more modest than Transbus, but they face many of the same obstacles.

In the past few years, two APTA bus manufacturing task forces and related federal efforts have tried to respond to the shrinking number of manufacturers, the financial stress on the industry, and the costs of excessive customization. The 2024 APTA Bus Manufacturing Task Force focused on stabilizing the industry, while the 2025 APTA Bus Manufacturing Task Force 2.0 focused more directly on customization. Its recommendations included using the White Book's updated terms and conditions, reducing vehicle options, standardizing inspections and acceptance, adding a cybersecurity section to the White Book, and giving Low-No applicants additional points for relying on APTA technical specifications and terms and conditions.

Some efforts to reduce customization have run into transit agency resistance. Several interviewees described a recent effort in which large agencies from Chicago, Boston, New Jersey, New York, Philadelphia, Toronto, and Washington worked with New Flyer to identify opportunities for greater standardization. The agencies had hoped to agree upon a standard window frame but that proved to be problematic. Some wanted framed aluminum windows, others preferred black anodized aluminum windows, while others insisted on clamp-ring windows.

After reviewing roughly 1,300 line items, the agencies were only able to agree on a small number of items, such as having the indicator light turn green when an exit door opens, and using a magnetic plug for the power steering drain. They could not agree on many other issues, including windows, bike racks, interior materials, stop-request devices, and more standard inspection protocols.

Still, interviewees associated with this interagency effort said the agencies might have moved forward with their standardization efforts, if it would have led to significant cost savings. However, as one interviewee reported, "New Flyer didn't give any indication that a bus would be cheaper, only that it would be better for them." After that, the meetings gradually stopped.

This episode is instructive and offers some valuable lessons. First, even agencies that indicate support for standardization may resist changes once specific features are put on the table. An interviewee explained that changing the style of windows would have triggered complaints from customers to elected officials. Second, standardization becomes

much harder when it moves from general principle to concrete choices. Third, future initiatives may need to focus first on high-impact items where agreement is most achievable, rather than trying to settle every disputed line item at once. Fourth, the agencies had neither a requirement to cooperate nor a financial incentive to do so. They expected New Flyer to continue accommodating their specifications and they did not see how standardization would save them money.

Fifth, the initiative appears to have petered out because decision makers at the agencies were not helping to guide the standardization effort, resolve disagreements, and help staff overcome internal resistance. Since agency leaders are protective of bus procurement decisions that affect customers and their employees, the agency representatives had limited autonomy to standardize elements on their own.

6.3 Lessons from abroad

Experiences in Europe, India, and Canada provide examples of how procurement practices and market structure can affect cost and standardization.

Because comparable data is not available, the prices of equivalent buses in the U.S. and other countries cannot be directly compared. Procurements differ in what they include. For example, a U.S. bus manufacturer might provide on-site service, training, and an extended warranty. Transit agencies also install a wide range of technological features. Furthermore, because regulations relating to bus emissions, safety, and structural testing differ, buses are built to different specifications.

Although no database exists that compares the cost of similar buses in Europe and the U.S., by all reports, European operators pay substantially less. For example, Italy's national purchasing center is buying 290 battery electric buses for 223.6 million euros which is about $900,000 per bus.[5] By comparison, the San Francisco Municipal Transportation Agency is purchasing 5 battery electric buses.[6] The cost (not including spare parts, training, special tools, and regulatory mandated changes) is approximately $1.36 million per bus.

The usefulness of this comparison is somewhat limited because the Italian order consists of nearly 60 times as many buses. However, it does suggest the potential cost benefits associated with cooperative purchasing.

Interviewees who were familiar with the differences between the U.S. and European industry noted that European buses are less customized and that their manufacturers have greater economies of scale. They also agreed on the following reasons why buses cost less in Europe:

- The European bus market is about nine times larger. Approximately 40,000 buses are purchased each year in Europe compared with 4,500 in the U.S.

- European operators typically purchase more buses in an order.
- European firms can more easily purchase components from lower-cost countries, such as China.
- Many European cities outsource their bus operations and procurement to private operators, who have greater purchasing power and purchase the same buses across multiple cities and countries.

India's experience also shows the potential benefits of consolidated purchasing. The cities of Delhi, Calcutta, Surat, Bengaluru, and Hyderabad are jointly purchasing 5,450 electric buses. They found the price difference was more than 30 percent lower than bids for other buses in India received during the same time period.[7]

Canada may be the most relevant comparison because its market is most similar to (and somewhat interconnected with) the United States. The Canadian Urban Transit Association (CUTA), which is the Canadian equivalent of APTA, is looking to explore the development of bus design standards. CUTA recently set up a Bus Manufacturing Task Force that is looking at similar issues to the U.S. There are only two major bus manufacturers left in the country, and they are having payment and cash flow challenges.[8] Some view the Canadian and U.S. markets as part of a single market, due to similarities in buses and overlap with manufacturers (New Flyer is headquartered in Canada).

U.S. policy makers should keep a close eye on CUTA's progress, especially since the Canadian association reports another similarity:

> "Transit agencies have traditionally relied on highly customized bus specifications, which drive up costs, slow production, and create supply chain inefficiencies. This level of customization also leads to delivery delays, as unique configurations require additional time for procurement, testing, and integration. The introduction of new zero-emission bus technologies further complicates system integration, making customization even more challenging and expensive. Additionally, the procurement process does not promote standardization, resulting in a fragmented market with significant operational inefficiencies."

6.4 What these efforts suggest

Taken together, these earlier and international efforts point to several lessons. First, the transit industry should be skeptical of any effort to impose one standard bus on the entire country. Second, narrower forms of standardization are more promising, especially when they focus on areas where agencies and manufacturers can see clear mutual benefits.

Third, collaboration matters. More successful examples have relied on cooperation among operators, manufacturers, and industry groups rather than on rigid mandates alone. Fourth, leadership matters. The PCC streetcar was created by a presidential-level committee, while the recent attempt by large transit agencies did not have that same level of support. Fifth, scale matters. The European and Indian experience suggest that larger and more coordinated procurements can lower costs.

7. Moving Toward Standardization

Interviewees cited numerous potential benefits of standardization, including attracting more manufacturers, improving supply-chain reliability, and lowering the costs of acquisition, inventory and training. One interviewee noted that if components were standardized, more manufacturers might produce replacement parts.

This section discusses some wariness about standardization among many interviewees, and then considers who could determine and enforce standards.

7.1 Wariness of Standardization

One long-time transit leader referred to the standardization of buses as an "elusive ring." Another interviewee succinctly described how many people in the industry seem to feel: "Everybody wants a standard as long as it's their standard."

Standardization is not in everyone's short-term interest. Many large transit agencies do not appear willing to give up control over their customized specifications. Although the two major U.S. manufacturers would like to limit customization, especially last-minute changes that wreak havoc with their production schedules, they have built their businesses around accommodating agency preferences. Greater standardization would make buses more of a commodity and could upend their business models.

Many interviewees expressed their concern that standardization could stifle innovation and limit choice. The benefits of innovation may outweigh the inefficiencies associated with customization. One transit operator said: "standardization is too much of a risk with moving technology." She added, "You can't have too few choices because not every operating environment is the same. One camera might have a better enclosure for uneven streets like Baltimore's cobblestone streets."

One interviewee noted, "There's a push for more safety-related technology that's new to the market. We don't want standards that would preclude things." Another said, "You could develop a standard on an ITS system and be obsolete in a year." Many changes are taking place in the bus industry from autonomous vehicles to new propulsion systems. For instance, the Amalgamated Transit Union is trying to develop a "bus of the future." The union is working on barrier designs to better protect operators from assault, seats that

would help reduce back problems, ventilation systems to improve air quality, and bus layouts that would reduce blind spots.

In interviews, many transit agencies were skeptical that limiting customization and adopting uniform standards would reduce the cost of buses by more than a few percentage points. This opinion was expressed both by small agencies and those large agencies who joined together with New Flyer on its standardization efforts. One APTA bus manufacturing task force member discussed how his group evaluated how customizing doors was impacting costs. They found that even if they got rid of all the doors on a bus, it would only reduce the cost of a bus by a very small percentage.

Another interviewee pointed out that there might be thousands of different flooring options, but if a manufacturer limited it to three shades, there would be minuscule savings. He said, "You won't find anything that will save hundreds of thousands of dollars." He also warned that standardization could save an agency money on the purchase price, but increase its maintenance and training costs.

Part of this skepticism stems from the fact that thousands of components on a bus can be customized. Reducing the number of customized components by 10 or 20 percent will not fundamentally change how manufacturers build buses or allow them to achieve meaningful economies of scale. Agencies also appear to be wary because they are not fully aware of the cost implications of their choices for their buses or for the industry as a whole. More education, transparency, and targeted financial incentives could help overcome their concerns.

7.2 Leading standardization efforts

No one has estimated how much a transit bus would cost if there was one standard bus that worked across the industry (allowing for differences based on climate and terrain). The research team can speculate that if every single bus were the same, the price could be 20 to 30 percent less, closer to the price of buses in Europe. But to get there would require wholesale changes for both manufacturers and their customers.

Several interviewees suggested that the industry should begin by standardizing components where consensus might be easier to reach (such as doors and windows). Although some said that technology products would be the hardest to standardize, others said standard connections and interoperability would be very helpful.

Many interviewees agreed that moving toward a more standardized bus would require support from many parts of the industry, especially large transit agencies. But the interviews also revealed a fundamental problem: no entity (not transit agencies, manufacturers, FTA, or APTA) is in a strong position to lead, adopt, and enforce standardization efforts.

Most *transit agencies* interviewed for this study do not want to lead standardization efforts for all the reasons they customize buses in the first place. Currently, many of them do not believe the benefits of standardization outweigh its costs. Instead, they are looking to manufacturers to take the lead on any standardization efforts.

Manufacturers, however, are also not well positioned to lead standardization efforts, because they are trying to accommodate agencies' requests and they benefit from limited competition. One transit official said, "The private sector will do what clients want. They will move off a standard, if they can sell 300 buses to one agency." An interviewee from a bus manufacturer made a similar point: "We could spend a lot of money to come up with a standard. But, what happens when a customer puts in an option. We'll put the option in." One manufacturer said, "If FTA wants it, FTA has to lead it."

At this time, the *FTA* does not appear interested in mandating standards on the bus industry, preferring that the manufacturers and agencies work through the issues. Based on discussions with advisory panel members and interviewees, this position appears to reflect a philosophical preference for industry-led solutions, a view that the federal government should play a limited role in setting standards, and practical constraints related to limited staff and resources.

APTA also faces constraints. Many interviewees appreciate that its standards are developed through a consensus-driven process among APTA members, which include bus manufacturers, suppliers, transit agencies, and government agencies. However, because APTA represents such a wide range of players, it is in a delicate position trying to develop standards because they could create an advantage or disadvantage for certain members. Attempting to enforce those standards against one of its own members would be an even greater challenge.

Taken together, these findings suggest that any meaningful progress will require building consensus around specific components and practices, and relying on federal policy to reinforce those efforts. The absence of a clear leader helps explain why standardization has remained so elusive.

In theory, the public sector could develop a single standard bus that works across the country (with possible differences based on terrain and climate). However, achieving this goal would require wholesale changes for both manufacturers and their customers, and as mentioned previously, they have little appetite for this approach.

A more realistic goal is to reduce unnecessary variation where possible, strengthen incentives for using tools such as the White Book and state contracts, encourage agencies to align around common approaches, and focus first on the parts of the bus and the procurement process where standardization is most likely to produce real savings without

undermining legitimate local needs. Achieving this goal will depend upon making changes to standards, procurement incentives, transparency levels, and educational programs.

8. Recommendations

This section describes the following six recommendations to reduce unnecessary transit bus customization, lower costs, improve delivery, and strengthen competition in the U.S. bus manufacturing market. The recommendations build on the study's analysis and recent APTA recommendations. Advisory-panel feedback helped distinguish five recommendations that appear ready for near-term action from the sixth that requires additional research and analysis.

- FTA should help agencies build stronger procurement capacity through education, training, and workforce development.
- FTA should increase transparency in pricing and its programs.
- FTA should require agencies to disclose major departures from standard practice and summarize their cost implications.
- Congress and USDOT should support ongoing industry standardization efforts and advance new initiatives to develop bus, technology, and interface standards.
- Federal laws and policies should give transit agencies financial incentives to purchase more standardized buses.
- Other promising policy options should be explored in future research.

The recommendations are complementary and intended to work together. Education and transparency will provide agencies with the information they need to make more informed procurement decisions. Disclosure requirements will encourage agencies to identify and justify major departures from standard practice. Standard-setting will create a more common baseline for buses and their technology systems. Changes in federal law will then reward agencies that use more efficient procurement approaches. Additional policy options may be promising but require further research and analysis. Table 8.1 identifies the key elements of each recommendation, and describes the problem the recommendation is intended to address.

Table 8.1. Overview of the six recommendations

Problem and Recommendation	Principal elements
<u>Problem #1:</u> Transit agencies often lack the training, staffing capacity, and shared understanding needed to make cost-effective procurement decisions that support both agency needs and the health of the industry.	(i) Education on standardization, industry structure, contract risk, state schedules, and the White Book. (ii) Offer NTI bus-procurement course.

<u>Recommendation #1:</u> FTA should help agencies build stronger procurement capacity through education, training, and workforce development.	(iii) Share lessons from other countries' approaches to standardization and cooperative purchasing. (iv) Support agency staff in building technical expertise.
<u>Problem #2:</u> Agencies, manufacturers, policymakers, and potential entrants often lack clear information about pricing, FTA decision-making, and testing timelines that could improve procurement decisions, lower customization costs, streamline bus testing, and encourage greater standardization. **<u>Recommendation #2:</u> FTA should increase transparency in pricing and its programs.**	(i) Create a federal repository for bus procurement documents. (ii) Disclose how procurement-related priorities are applied in discretionary grant programs. (iii) Publish information on FTA authorization times and Altoona testing timelines.
<u>Problem #3:</u> Agency boards, manufacturers, policymakers, and the public often lack clear information about why agencies depart from standard specifications and how those choices affect cost, complexity, and standardization. **<u>Recommendation #3.</u> FTA should require agencies to disclose major departures from standard practice and summarize their cost implications.**	(i) Agency specifications should identify how and why major elements differ from standard features in the White Book or state contract. (ii) When a transit agency seeks approval from its governing body, it should provide a high-level summary of major non-standard elements and cost implications, to the extent possible.
<u>Problem #4:</u> The transit bus market lacks sufficiently accepted common bus, technology, and interface standards, contributing to greater variation, incompatible systems, higher costs, and less efficient manufacturing. **<u>Recommendation #4</u>: Congress and USDOT should support ongoing industry standardization efforts and**	(i) FTA should continue supporting APTA's efforts to update the White Book and convene industry participants. (ii) Advance standards for transit bus technology and interfaces. (iii) Establish an advisory committee of transit agencies to build on the White Book.

advance new initiatives to develop bus, technology, and interface standards.	
<u>Problem #5:</u> Transit agencies do not have enough financial incentives to choose more standardized buses that could reduce costs and improve manufacturing efficiency. **<u>Recommendation #5:</u> Federal laws and policies should give transit agencies financial incentives to purchase more standardized buses.**	(i) Offer incentives for agencies that purchase buses through eligible state contracts. (ii) Provide stronger incentives for multi-agency joint procurements. (iii) Apply procurement-related priorities used in the Low or No program to other bus-purchase grant programs. (iv) Set a maximum reimbursement amount per bus, with appropriate flexibility, tiers and periodic updates. (v) Allow local transit agencies to purchase standard buses through U.S. General Services Administration (GSA) contracts.
<u>Problem #6:</u> Some additional policy ideas could improve competition and enhance standardization, but require more analysis. **<u>Recommendation #6:</u> Other promising policy options should be explored in future research.**	(i) Assess whether FTA should allocate funds to manage and promote its Joint Procurement Clearinghouse. (ii) Consider allowing limited and temporary exceptions for Buy America requirements. (iii) Evaluate potential of USDOT or GSA establishing a bus formulary. (iv) Consider providing incentives to agencies that use performance-based specifications. (v) Determine how FTA could reimburse for the cost of "standard bus" with standard terms and conditions. (vi) Consider requiring agencies procuring a small number of buses to use a state contract or joint procurement.

8.1 Recommendations in Detail

#1. FTA should help agencies build stronger procurement capacity through education, training, and workforce development.

Many leaders and staff at transit agencies understand the impacts of customization and the challenges manufacturers face. However, many others are not fully aware of these problems and potential opportunities to address them. The level of understanding varies between agencies, between departments within an agency, and within individual departments. This recommendation has four key elements.

i. *Fund and deliver agency education on standardization, industry structure, contract risk, state schedules, and the White Book.*

Congress should provide funding that the FTA, APTA, or another implementing entity could use for webinars, workshops, peer exchanges, and regionally based sessions. FTA could also train regional office staff and host sessions through its regional offices for local transit agencies and industry participants. This effort should explain how agency-specific requirements affect the cost of the bus, how risk is allocated through contract terms, why limited competition in the current market matters, and how tools such as the White Book and state contracts can be used more effectively.

ii. *NTI should offer a bus-procurement course.*

The National Transit Institute (NTI) offered a two-day "Bus Procurement Workshop" course before the COVID-19 pandemic. However, the course is no longer provided because it was not well attended. Now that most of NTI's courses are held online, there may be more interest in such a class. FTA and NTI should assess whether there is sufficient demand for a revised bus-procurement course. If so, they should update the curriculum so that it incorporates issues discussed in this report, and commit resources to promote its availability. The course should help agencies understand how their procurement choices, such as using a state contract, can help them save money and improve outcomes. A description of the "Bus Procurement Workshop" from 2015 is available at NTI Online (www.ntionline.com/bus-procurement-workshop-2).

iii. *Convene research, workshops, or webinars to draw lessons from other countries' approaches to standardization and cooperative purchasing.*

FTA should provide funding for research, workshops, and webinars to share lessons from international experience and broaden transit agencies' perspectives. Insights from Europe, Asia, and elsewhere would show how other countries have used standardization, joint purchasing, and policy coordination to reduce costs. These lessons would inform U.S. efforts while still recognizing the distinct features of the American market.

iv. *Support agency staff as they build technical expertise.*

FTA should support more workforce development so agencies have the capacity to adopt more standardized buses and new procurement approaches. Training costs, staffing constraints, and insufficient technical expertise can make it harder for agencies to change longstanding procurement practices or introduce new vehicle configurations and systems. Workforce support could include technical assistance, peer learning, and training for staff responsible for engineering, maintenance, procurement, and operations.

#2. FTA should increase transparency in pricing and its programs.

More transparency would help agencies compare procurements, understand the cost implications of different components and customization choices, and see how federal

incentives are being applied in practice. It would also make the market easier to understand for firms considering entry into the bus industry. This recommendation has three key elements.

i. *FTA should create a federal repository for bus procurement documents and pricing. If a full clearinghouse is not immediately feasible, FTA should regularly publish pricing information.*

Agencies that receive FTA funds should be required to submit core procurement materials such as requests for proposals, specifications, award documents, contracts, and pricing information, subject to appropriate protections for confidential materials. Even a more modest step, such as collecting and publishing annual price information (with base bus prices, propulsion types, order sizes, and major options) would be an invaluable resource. Greater transparency would help agencies better understand cost drivers and provide useful information to firms considering entering the bus market.

ii. *Disclose how procurement-related priorities are applied in discretionary grant programs.*

Greater transparency is needed in FTA grant programs. For example, the Low or No Emission Grant Program gave priority to applicants who used procurement methods intended to reduce customization, such as joint procurements or standard bus models, and to those that offered advance or progress payments. However, the FTA has not reported on how those priorities have been applied. The FTA should disclose the relevant grant application submissions, evaluation factors, and outcomes, and should report whether applicants followed through on the procurement approaches they proposed. Greater disclosure would also make discretionary grant programs more useful as learning tools, allowing policymakers and stakeholders to evaluate which procurement approaches are most effective at reducing customization and lowering costs.

iii. *Publish information on FTA authorization times and Altoona testing timelines so agencies and manufacturers can better understand schedule risks.*

FTA has reportedly taken as long as six months to provide manufacturers with the authorization they need to test their buses. Staffing constraints at FTA, including personnel reductions, have reportedly been a significant cause of these delays. Publishing information about FTA response times and Altoona wait times would help policymakers assess whether existing FTA staffing and Altoona testing capacity are sufficient, and would provide important information to bus manufacturers.

#3. FTA should require agencies to disclose major departures from standard practice and summarize their cost implications.

This recommendation would require transit agencies to disclose their major departures from the White Book or a state contract, and to summarize the cost implications of those choices at a high level. This recommendation has two key elements.

i. *When agencies prepare specifications and terms and conditions, they should be required to identify how and why their major elements differ from standard features in the White Book or a state contract.*

When agencies issue an RFP or prepare the specifications and terms and conditions for a bus purchased through a state contract, they should identify how and why they differ from the standard features in the White Book or a state contract. This would help manufacturers respond more effectively to agency-specific requests, encourage agencies to think more carefully about why they are making particular changes, and help reveal outdated or unnecessary specifications. APTA should support implementation by developing a template or form that identifies major elements by category -- such as structural features, doors and windows, seating, and advance payments -- and allows agencies to report them in a consistent way.

ii. *When a transit agency seeks approval from its governing body (e.g., board of directors), it should be required to provide a high-level summary of major non-standard elements as well as cost implications, to the extent possible.*

When agencies seek approval from their governing boards, they should provide a concise summary of major non-standard elements, such as differences from the White Book or a state schedule. They should also estimate the cost implications of these major elements, where readily available. Manufacturers should support this requirement by providing clear pricing information for major non-standard elements. Board members could receive an executive summary that helps them understand the cost consequences of major customization choices, not an extensive technical list of every specific change. APTA should support implementation by developing a template or form that identifies major elements, and allows agencies to report them in a consistent way.

#4. Congress and USDOT should support ongoing industry standardization efforts and advance new initiatives to develop bus, technology, and interface standards.

This recommendation supports efforts to standardize bus specifications, procurement practices, and technology interfaces. It builds on the White Book as the best standard for bus procurement specifications, RFPs, and contractual terms and conditions. This recommendation has three key elements.

i. *FTA should continue supporting APTA's efforts to update the White Book and convene industry participants.*

FTA should continue participating in APTA's efforts to update and promote the White Book, educate stakeholders about its benefits, and provide the APTA with relevant federal policy and procurement information.

ii. *USDOT should advance standards for transit bus technology and interfaces, especially where proprietary systems and poor interoperability add significant cost and complexity.*

Greater standardization of ITS and communications interfaces could reduce engineering complexity, simplify bus configuration, and lower costs. USDOT should lead an initiative to develop standards that make it easier for electronic systems, no matter the supplier, to communicate with each other. This is a complex undertaking that extends beyond the FTA's jurisdiction and the transit industry, since many relevant standards are shaped by suppliers and manufacturers serving a wide range of motor vehicles.

iii. *Congress should establish an advisory committee of transit agencies to build on the White Book, develop additional performance-based specifications, and identify opportunities to reduce unnecessary agency-specific requirements.*

Federal advisory committees are often formed, per the Federal Advisory Committee Act of 1972, to provide advice and recommendations to federal agencies. This committee would recommend specifications for possible FTA adoption, and it would receive funds and FTA support to carry out its work. This approach would encourage greater cooperation than the recent effort undertaken by seven large transit agencies and a manufacturer, because it would give the work greater prominence and elevate the issue to agency leaders.

#5. Federal laws and policies should give transit agencies financial incentives to purchase more standardized buses.

This recommendation's five elements use FTA funding to encourage transit agencies to use widely accepted, standardized transit bus specifications with standard terms and conditions.

i. *FTA should offer incentives for agencies that purchase buses through eligible state contracts.*

Congress and the FTA should provide meaningful incentives for agencies that use eligible state contracts to purchase buses. For example, FTA could increase the federal funding share from 80 percent to 90 percent for bus purchases made through state contracts.

ii. *Congress and the FTA should provide stronger incentives for multi-agency joint procurements.*

Similar to the previous element, the FTA can provide incentives for joint procurements. The incentive could increase with the size of the bus order, giving agencies a stronger reason to participate in larger pooled purchases.

iii. *Apply procurement-related priorities used in the Low or No program to other bus-purchase grant programs.*

The FTA's Low or No Emission Grant Program provides an incentive for procurement practices intended to reduce customization and support manufacturers' cash flow.

Extending these priorities to other bus grant programs would encourage approaches that can lower costs, reduce manufacturers' risk, and improve manufacturing efficiency. This element is closely linked to the transparency recommendation above, since agencies should have access to clearer information about how these priorities are actually being applied.

iv. *Congress and the FTA could set a maximum reimbursement amount per bus, with appropriate flexibility, tiers and periodic updates.*

Rather than covering a fixed share of a bus cost, the federal government could reimburse up to an amount capped by law, with transit agencies responsible for costs above that level. This approach would encourage greater cost discipline and reduce incentives to add expensive non-standard features. Caps could vary by bus size and fuel type, and possibly have limited adjustments for unusual operating conditions, such as extreme climate or topography. This approach has some risks. It could lower costs and encourage more standardized designs, but it could also reduce quality or shift costs to agencies if the cap is set too low.

v. *Congress should allow local transit agencies to purchase standard buses through U.S. General Services Administration (GSA) contracts.*

Currently, federal agencies can purchase transit buses through contracts administered by the GSA.[9] Local transit agencies, however, may not use these contracts even though access to them could help agencies buy buses more quickly and at lower cost. To encourage greater standardization, GSA should use the specifications and the terms and conditions in the White Book to the greatest extent possible when developing these contracts.

#6. Other promising policy options should be explored in future research.

This final recommendation includes six elements that have the potential to significantly increase competition, standardization, and procurement efficiency. However, advisory panel members raised legitimate questions about their feasibility, effectiveness, and potential unintended consequences. That is why these should be explored further through additional research, targeted pilot efforts, and further consultation with transit agencies, manufacturers, and other stakeholders.

i. *Assess whether FTA should allocate funds to manage and promote its Joint Procurement Clearinghouse.*

The 2015 FAST Act directed FTA to establish a clearinghouse that would allow grantees to aggregate rolling stock purchases and identify joint procurement participants. FTA subsequently created a website that allows transit agencies to post information about potential joint procurement opportunities. However, the clearinghouse has seen little use, in part because FTA was not allocated resources to effectively promote and manage it. FTA should reassess whether additional funds to promote and actively manage the clearinghouse would improve procurement coordination or whether promoting state contracts would be a more effective use of resources.

ii. *Consider allowing limited and temporary exceptions for Buy America requirements.*

To reduce one of the major barriers facing firms considering entering the U.S. transit bus market, Congress could waive or reduce the Buy America requirements for a limited period of time. Congress could also consider a law that provides a lower federal share for buses that do not comply with Buy America. This idea should be approached cautiously to minimize impacts to firms that have already invested in domestic production.

iii. *Evaluate potential of USDOT or GSA establishing a bus formulary (a list of standard bus models).*

Under this approach, manufacturers would apply to a formulary, which would start with existing bus models that are widely used. Then, companies could propose adding bus models to the formulary, if they meet defined standards. FTA would then give priority to agencies purchasing buses from the formulary. Important issues must be studied further, including how bus models would qualify and whether a formulary would limit agencies' flexibility.

iv. *Consider FTA providing incentives to agencies that use performance-based specifications.*

FTA's guidance states that recipients should, whenever practicable, describe their requirements in terms of the "functions to be performed, or the performance required."[10] The FTA should consider providing financial incentives (such as a higher reimbursement rate) to further encourage agencies to use performance-based specifications. Although incentives might encourage agencies to adopt them, it might only have limited effectiveness because the requirement may be easy to circumvent. For example, an agency could issue an RFP with performance-based specifications, but then reject manufacturers' proposed suppliers and only accept proposals that include components from the agency's preferred vendors.

v. *Determine if and how FTA could reimburse for the cost of "standard bus" with standard terms and conditions.*

FTA should consider the feasibility of reimbursing only up to the cost of a standard bus, while the transit agency would be responsible for paying the additional cost of customized features. One way to implement this approach would be through a sliding scale based on the degree to which an agency's specifications align with the White Book or another recognized standard. To simplify implementation, the determination could just be done for major elements such as windows and seating configuration. Another way to implement this would be to determine the cost of a standard bus and then not reimburse for anything over that amount.

vi. *Consider requiring agencies procuring a small number of buses to use a state contract or joint procurement.*

This recommendation would consider eliminating FTA funding for small standalone procurements, although the FTA would need to carve out exceptions for pilot programs. Advisory panel members were hesitant about this recommendation, preferring incentives that encourage the use of state contracts and joint procurements, rather than regulations that require them.

9. Four Case Studies

The following four case studies illustrate how procurement practices, agency needs, and standardization efforts have shaped the U.S. bus industry. The first two examine contemporary agency approaches: King County Metro's collaborative procurement strategy, and MTA New York City Transit's highly detailed specifications and its implications for the bus industry. The final two case studies examine historical standardization efforts: one covers the Presidents' Conference Committee streetcar, and the other examines the Transbus and advanced design bus programs.

9.1 King County Metro: Lessons about Partnering

King County Metro operates 24/7 service across hilly terrain, through heavy rainfall, and on rough road conditions in the Seattle region. Metro has developed specifications to meet these conditions for its fleet of nearly 1,600 buses. For example, it requires enhanced water-intrusion testing that is more rigorous than the White Book's standards, since Seattle experiences approximately 150 rainy days per year.

Metro's fleet procurement team is led by Will Haber, who reports both to the head of the Capital Division and directly to the General Manager. He said that Metro is willing to take greater risks than most large transit agencies because of its organizational structure. Haber has autonomy to evaluate risk-benefit tradeoffs rather than defaulting to cautious approaches that can limit competition and innovation.

His team conducts extensive front-end work with manufacturers to make sure they understand Metro's operating environment and its needs. To ensure an open competitive process, outreach occurs before RFPs are released and includes all qualified builders in the market.

Haber said, "It has taken a lot of work to maintain a productive partnership with manufacturers because large agencies tend to have very detailed requirements, some of which are quite challenging." Although Gillig has not bid on many of the RFPs issued by the nation's largest transit agencies, it has sold buses to Metro. Haber said, "We have a relationship built around trust and a clear understanding that we'll be reasonable."

Haber explained, "Lots of agencies don't understand how important relationships are. I wish that were not the case." When manufacturers hear stories about a large U.S. agency

with very onerous terms and conditions, it can hurt other agencies because manufacturers will be less likely to consider entering the U.S. market.

Metro provides progress payments to bus manufacturers and has taken liquidated damages only once in the past 10 years. Haber said, “In our view, although there are situations where taking liquidated damages becomes unavoidable, if our agency took liquidated damages that is a failure of both parties.” From Metro’s perspective, such disputes can harm manufacturers and ultimately weaken the bus industry.

About five years ago, King County Metro reached out to bus builders who were considering coming to the U.S. The procurement team was hoping to encourage manufacturers from other countries to set up new facilities in the U.S. and was interested in setting aside some local funds to purchase buses from them. By using its own funds, Metro could purchase the buses without triggering Buy America requirements.

Metro ultimately awarded a contract for the purchase of four zero-emission buses from Solaris, with capacity for other agencies to piggyback on the contract. The buses, which will be manufactured in Poland and delivered in 2026, will not be used for revenue service. Instead, the agency will conduct in-depth testing on them. Metro is excited about Solaris because the company also builds trolley buses (only one company currently builds trolley buses in the U.S.). Metro is disappointed though that it has been unable to lure another European manufacturer.

Haber understands how smaller agencies can benefit from using state contracts. Although many transit agencies across the country use the State of Washington’s contract to purchase buses, ironically, the state’s largest transit agency prefers not to use it. Metro issues its own RFP because, according to Haber, past procurements have shown that doing so yields lower bus prices. The agency typically waits about three and a half years after it begins preparing an RFP until receiving its first bus. Then, the agency pilots the bus for approximately six months before full production begins.

Haber has found that Metro saves money when it conducts its own procurement because manufacturers trust that it will have a productive partnership with the agency. He said, since state contracts are open to everyone, manufacturers must plan to sell to agencies that are more difficult to work with, which adds to the manufacturers’ uncertainty and risk, and translates into higher prices.

If a bus manufacturer does not have a relationship with the transit agency, the manufacturer must accept greater risk, according to Haber. For example, a manufacturer may accommodate an agency with a customized component, but the agency may later reject that component. If that happens, the agency may delay acceptance of its buses and delay payment to the manufacturer.

Not all agencies recognize the value of building collaborative relationships and partnerships with bus manufacturers. In a supplier-constrained market like ours, Haber said, adversarial relationships increase risk and cost. To help manufacturers, Metro provides progress payments; otherwise, a bus manufacturer might not get paid until it has already built dozens of vehicles. He explained why manufacturers charge Metro less than they do other large agencies: “They know we will be reasonable with them.”

9.2 The MTA: Unique in its Uniqueness

Metropolitan Transportation Authority (MTA) New York City Transit is by far the largest bus agency in the U.S. According to APTA’s most recent *Fact Book*, it had 459 million bus passenger trips in 2023, which was more than the next three agencies (LA Metro, Chicago Transit Authority, and New Jersey Transit), combined.

Everything at NYC Transit is big. The agency purchases more than 400 buses per year (nearly one in ten of all transit buses purchased in the nation), and it has more than 30 depots and shop facilities. While some smaller agencies might have one or two people with expertise preparing bus specifications, NYC Transit can assign specialists to be responsible for updating specifications for each major component (i.e., one person for brakes, another for air conditioning, etc.) Because of the size of the agency’s fleet orders, its large engineering staff, and its detailed specifications, the agency influences the features found in many transit agency buses across the country.

One interviewee said, “The MTA is unique in its uniqueness.” Making changes at the MTA, an organization with more than 70,000 employees, can be challenging and expensive. For example, changing a brake system could require retraining approximately 12,000 bus operators.

Its specifications include many safety features that bus manufacturers do not usually incorporate into buses for other agencies. For example, NYC Transit designed a brake interlocking system that prevents buses from moving under certain conditions. It requires exterior panels to include a secondary unlocking mechanism to reduce the risk that a door could inadvertently swing open and strike a pedestrian or object. And, after a series of incidents where thrill-seekers rode on top of buses, the agency started requiring roof-hatch alarms. It also wants a custom-made enclosure for its operators who in recent years have been punched, stabbed, spit on, hit with wrenches, sprayed with chemicals, and scalded by hot coffee.

Problems with previous generations of NYC Transit’s buses have influenced the design of current buses across the country. For example, in 1980 the MTA removed 837 of its Grumman Flxible buses from service after many of them had developed cracks in their undercarriages. The problems were traced in part to the city’s potholes and other operating

conditions. That incident later led the federal government to require transit buses to undergo durability testing in Altoona.

In 1996, the agency faced another major bus problem. Buses that had been built three years earlier by Bus Industries of America had fractures in the beams and plates that held up the flooring. At the time, the *New York Times* wrote the following:

> In the bus industry, the Transit Authority is widely regarded as the toughest customer in the country. Largely because of the demands on city buses -- heavy passenger loads, pothole-scarred streets, frequent stops and starts and 24-hour operation -- the authority has more stringent specifications for construction than any other transit agency. Only two manufacturers' buses have met its standards in recent years, and most bus makers refuse even to try.
>
> "We think some of their requirements are unreasonable," an official of one bus company that has not bid on a New York contract in many years said on condition of anonymity. "But to some degree, they just have to insist on higher tolerances than anyone else because of the punishment the buses have to take."[11]

Referring to frequent stops and high passenger loads, an official at MTA NYC Transit said the agency puts its "buses through hell." NYC Transit is one of the few agencies that require buses to be tested on a shaker table, a testing platform that subjects a bus to intense vibrations and repeated structural stresses. The test simulates the pounding and twisting forces that vehicles experience during years of operation on rough roads and potholes with frequent stop-and-go service.

In a discussion about these shaker table tests, the FTA noted in its 2007 report, *Useful Life of Transit Buses and Vans*: "If all buses were designed to meet the severe service environments that NYC Transit simulates, it could result in vehicles that are over-designed for their needs at a higher cost with operating penalties of increased weight and/or reduced passenger capacity. In fact, most transit buses in the U.S. are now designed to meet structural requirements that were influenced by New York's operating environment."

Several interviewees noted that the MTA is not known for having collaborative partnerships with vendors and contractors, like King County Metro does. For example, the MTA has been hesitant about providing advance payment to struggling manufacturers.

The purchase of buses is often the largest capital expense at many transit agencies, but that is not the case at the MTA because it has so many other large capital projects. (The MTA

also operates the Long Island Rail Road, Metro-North Railroad, and New York City's subway). That is why the MTA does not always use federal capital funds to purchase buses. For example, in 2025, the MTA modified an existing contract to purchase, without using any federal funds, 161 diesel-electric hybrid buses and 58 diesel buses.[12] Because the MTA relies less on federal funds for bus purchases than most other agencies, federal policies designed to encourage more standardized buses may have less influence on its procurement strategies.

9.3 Presidents' Conference Committee (PCC) Streetcar

In the 1920s, streetcar ridership fell sharply as bus ridership increased and private automobile use surged. Recognizing the need for modernization, the Electric Railway Presidents' Conference Committee (PCC)—representing 25 major systems—launched a coordinated effort in 1929 to develop a more efficient, standardized streetcar. After five years of research, they introduced the PCC streetcar. More than 5,000 were built between 1934 and 1952, and the design was adopted in cities across North America and abroad.[13]

The PCC car offered clear improvements over existing rail cars and is widely considered a timely, innovative and successful program. Riders and operators noted that it was faster, quieter, smoother, and less costly to maintain than earlier models. These gains came from a set of shared design features: a lighter steel body, better heating and ventilation, rubber-cushioned wheels, and improved acceleration and braking.[14]

Yet standardization did not eliminate local variation. The PCC program never relied on a single, rigid specification. Agencies routinely adapted the design to local conditions. Variations in such factors as length, width, and door placement were accommodated in a car with standard performance and subsystem interfaces.

The PCC's history is often cited as a strong example of the benefits of standardization in transit. Three lessons stand out. First, the effort was driven by industry, responding to clear cost and service pressures. Second, the standards focused on components where technological improvements were both feasible and widely applicable. Third, the framework allowed for enough flexibility to accommodate local needs without undermining the core efficiencies of the standardized design.[15]

Figure CS-1. PCC streetcars operating in Philadelphia in 2005 (Photo by Daniel Marvin.)

9.4 The Transbus Program and Advanced Design Buses

In the 1960s, General Motors (GM) controlled roughly 85 percent of the U.S. transit bus market with Flxible holding about 15 percent. With falling transit ridership and a near monopoly market, the federal government responded through three actions.

First in 1964, Congress created the Urban Mass Transportation Administration (UMTA), the predecessor to the FTA, and then six years later substantially increased funding for transit agencies to purchase new buses. Second, the Department of Justice reached an antitrust settlement with GM in 1965 to open the market to new competitors. Third, USDOT launched the Transbus program in 1970 to stimulate innovation and establish a standardized, modern bus.

The Transbus initiative to create a standardized bus drew inspiration from the PCC streetcar initiative from four decades earlier. Federal officials hoped a federally guided standard bus could bring similar benefits. Their goal was to produce a standardized 40-foot bus that would promote competition in the bus industry, lower lifecycle costs, offer faster journey times, enhance reliability, improve passenger comfort and safety, increase ridership, and minimize environmental impacts.

Development and Early Problems

In 1972, UMTA awarded three contracts of $8 million each (a total of $191 million in 2026 dollars) to three bus manufacturers: GM, Flxible (Grumman Flxible), and AM (American Motors) General to design and build prototype buses. Note that AM General had been inspired to enter the bus business because of federal bus funding and the Transbus

program. Three prototypes were completed in 1973 with the intent of combining the best features into a national standard.[16]

The program quickly became mired in management instability and unrealistic expectations. Over the life of the program, four UMTA administrators and 18 different project managers oversaw Transbus, repeatedly revising its goals and technical specifications. Although UMTA had declared that a fleet of 100 Transbuses would undergo extensive testing in real-world conditions, that never occurred. Another change in the middle of the program was Congress's 1973 requirement that all federally funded buses accommodate passengers with disabilities. This complicated engineering and cost considerations.[17]

In 1975, UMTA announced that its grantees would be required to purchase buses that conformed with Transbus, and that it would develop a performance specification for the new bus that would be a composite of the three prototypes.[18] However, transit agencies were wary of committing to fleets of buses with new technologies that they couldn't keep on the road or run, economically. The manufacturers' response was more problematic. As Transbus stalled, GM and Flxible moved forward with their own "advanced design buses."

While Transbus remained the federal government's preferred long-term model, UMTA allowed agencies to purchase advanced design buses with federal funds on an interim basis if they conformed with its newly issued White Book. Unlike Transbus, the White Book did not create a single new bus model. Instead, it established baseline specifications that allowed advanced design buses to qualify for federal funding.

The White Book offered only a limited number of options, and UMTA would only allow agencies to deviate from the specifications if the change could be made by both U.S. manufacturers. For example, if a transit agency wanted to specify a full sliding window, UMTA would not have approved it since both U.S. manufacturers did not offer that feature at the time.

Examples of the White Book's requirements included dimensions that specified bus lengths of 35 or 40 feet, weights of less than 26,000 pounds, and passenger doors which could be completely opened or closed in 1 to 1.5 seconds. The specifications also accommodated some degree of customization and special requirements, including color and destination signs, a choice of hard or padded seating, and whether or not the bus would have air conditioning.

In 1977, the Secretary of Transportation issued a mandate that all full-sized buses purchased with federal aid after September 1979 were to comply with Transbus specifications.[19] All buses offered for bid were required to have a floor height of less than 22 inches, kneel to 18 inches, and have a boarding ramp.[20] In 1979, the Transbus reached its climax. The first bid based on Transbus specification was issued. Transit agencies in Los

Angeles, Miami, and Philadelphia jointly issued a solicitation for 530 vehicles. However, not a single manufacturer submitted a bid.[21] Soon afterward, UMTA formally abandoned the Transbus program, ending the nearly decade-long program.

Consequences

In the late 1970s, the bus manufacturers gave the following reasons for not bidding on a bus that would meet the Transbus specification:

- It would cost more to buy and operate than the advanced design buses.
- Onerous warranty terms for which the bidders had to assume all the risk, including guarantee of service life and performance.
- The low floor did not provide adequate ground clearance for the vehicle.
- Transbus required that unproven, experimental components be used for critical systems, such as axles, wheels, tires and brakes.
- Estimated maintenance costs were extremely high, and a greater number of parts were required.
- Seating capacity was reduced.
- The standards set specific design criteria, rather than giving performance-oriented standards.
- Time frame presented in the mandate was insufficient, particularly in light of the time needed to develop and test the many major new components.
- USDOT's insistence on low-bid procurements would preclude introduction of high-quality innovations.
- Transbus would be less fuel efficient.

Transbus was widely regarded as a failure. It consumed significant resources and attention without delivering a workable bus or achieving its intended standardization. It neither increased competition nor produced a standard vehicle for the nation’s transit agencies. Instead, it highlighted the pitfalls of trying to design a new vehicle through a federal mandate without an effective collaboration between government agencies and manufacturers.

The advanced design buses had their own set of problems. Transit agencies complained that the buses had fewer options, fewer seats, and brakes that were more expensive to maintain. More importantly, transit agencies experienced considerable maintenance and reliability problems. (At that time, UMTA did not require standardized independent testing.)

Grumman's advanced design buses had widely publicized problems, including frequent air conditioning and transmission failures, doors that fell off their tracks, windows that popped out, and fuel tanks that dropped off the bus while in motion. Notably, in 1980 the MTA removed 837 of its Grumman Flxible buses from service after many of them had

developed cracks in their undercarriages—the problems were related to potholes and other operating conditions in New York.

In March 1981, President Ronald Reagan's Secretary of Transportation, Drew Lewis, told the *New York Times* that he intended to rescind the agency's White Book bus specifications for the advanced design buses because "the federal government should not be in the bus business to the degree we were and are."[22] (Note that APTA subsequently took over the White Book.)

UMTA later reported that rescinding the requirement that agencies use the White Book specification could encourage more competition, greater innovation, and give transit agencies greater flexibility in specifying buses that would meet their particular needs. This action was also seen as consistent with the new administration's policy of eliminating unnecessary federal intervention in local and state decision-making.

An UMTA staff member said while the specifications once served to assure competition, they were now artificially constraining new manufacturers from bidding since the specifications were based on the General Motors and Grumman Flxible buses. However, he warned that without the White Book's specifications, agencies would require a number of minor component modifications that ruled out certain manufacturers and drove up the cost of buses. Likewise, a Grumman spokesman said eliminating the White Book requirement would reduce production efficiency and increase the cost of buses.

The Transbus and the advanced design bus sagas also led to an industry shakeup. AM General exited the bus market and Grumman's acquisition of Flxible ended in bankruptcy. GM sold its bus line to Motor Coach Industries (later part of New Flyer) and Gillig entered the bus market in the late 1970s.

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