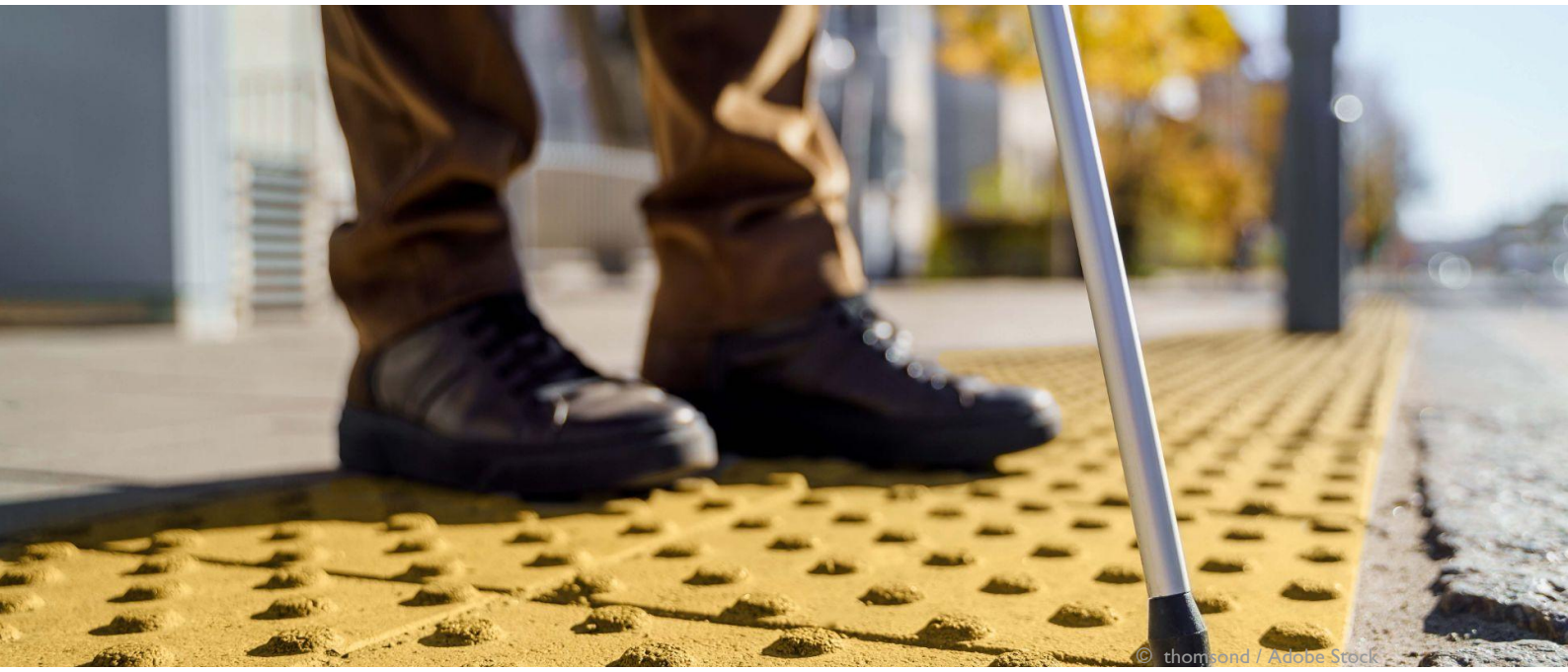

Blind person standing on tactile texture holding a support cane to cross a street

ADVANCING A MODERN, CLEAN, AND ACCESSIBLE BUS SYSTEM

OVERVIEW

Ecuador is taking steps to reduce greenhouse gas emissions from public transport in the cities of Quito, Guayaquil, and Cuenca. As part of that commitment, Ecuador passed an "**Organic Law on Energy Efficiency**" which establishes that 'As of 2030 all vehicles that are incorporated into the urban and inter-parish public transport service, as well as commercial vehicles in mainland Ecuador, must only be 100% electric or zero-emission...'. Ecuador also instituted a Universal Accessibility Plan requiring that all buses and bus stations are accessible to persons with disabilities.

Through the Energía Sostenible para Ecuador (ESE) project, the United States Agency for International Development (USAID) and Empresa Pública Metropolitana de Transporte de Pasajeros de Quito (EPMTPQ) partnered to advance a more modern, clean, and accessible bus system in Quito. USAID experts conducted technical studies to support EPMTPQ in strengthening its existing infrastructure and equipment and improving its electric mobility and accessibility strategy. USAID also assists EPMTPQ to purchase and optimize electric buses and trolleybuses and the accompanying infrastructure, such as charging stations and handicap access at bus stops. To support this process, ESE works with the National Council for Disability Equality and the National Federation of

Ecuadorians with Physical Disabilities to understand the disabled community's public transportation needs and access concerns. The lessons learned fall into three categories: retrofitting of diesel buses; selecting the appropriate electric buses for the conditions; and understanding accessibility requirements. These findings will assist transportation operators and municipalities to make strategic investments in electric buses and bus stations that are accessible to people with disabilities.

LESSONS LEARNED

Retrofitting of Buses

Via a process known as retrofitting, several factors are considered when converting bus fleets with diesel engines to electric engines. This includes criteria such as bus safety and the lifespan of the vehicle, economic return throughout the life of the bus, applicable regulations and standards, whether there is a reliable supply chain for parts, and availability of experienced and credible retrofit companies.

Retrofitting bus fleets utilizes locally sourced materials and contributes to environmental sustainability and lower emissions. It also encourages the training of the local workforce and can stimulate the local economy by generating jobs to meet the demand for services. However, there are also risks. After thorough research, inspection of buses, and discussions with technicians, ESE identified insights that are useful in Ecuador's public transport context.

Value Chain

There are presently no reputable or experienced companies in Ecuador that perform large-scale public bus conversions for a fleet of similar size to EPMTPQ. Lack of experience can result in vehicle reliability issues, spare part supply challenges, and higher maintenance and operational costs. In Ecuador, the retrofitting process is not subject to specific regulations and therefore not mandated to adhere to quality assurances. Local companies that offer retrofits are small and do not provide warranties.

Investment

It is more cost efficient to acquire a new electric bus than to retrofit an existing bus that still has a reasonable lifespan. New electric buses offer up to 30 percent lower total cost of ownership (TCO) per kilometer than retrofit buses and have lower insurance premiums. The capital expenditure for the acquisition of a new 18-meter electric bus is estimated to be up to $390,000, while retrofitting an 18-meter bus will cost about $315,000. However, the TCO for a retrofitted 18m bus is $0.90/km vs $0.70/km for a new one.

Operational Risks

Converted electric buses generally have batteries that result in a much smaller operating range than what is available in new electric buses of the same size. Additionally, the converted buses may have potential technological, safety, and efficiency issues, as well as a limited remaining service life and no manufacturer's warranty. For a company that mobilizes a high volume of passengers per day, this poses high operational and reputational risks.

Selecting Electric Buses for Public Transport

Variables To Determine The Characteristics Of A New Electric Bus Fleet

Technical

Key considerations when selecting the appropriate bus for a specific route are the current conditions, such as kilometers per day, maximum gradient, operating schedule, and temperature variation where the buses will operate. In Quito, the routes analyzed have gradients of up to 15 percent which will slightly increase bus costs. There is little annual variation in temperature, which fluctuates between 10 to 15 degrees Celsius per year. This means that buses can operate without the use of A/C or heat. The maximum daily distance traveled will determine the size of the battery or charging system. Slope and air temperatures also influence electricity consumption.

Financial

A new electric bus fleet involves financial challenges, especially when transitioning from diesel fleets. Operators will face a higher capital investment cost per vehicle, plus investments in the charging system and potential acquisition of land on which to place the charging stations. However, the overall operating costs for electric buses are lower than diesel buses, as discussed above.

Operational

The deployment of a new electric bus fleet involves new operational considerations. The operator will need to transition from traditional fossil fuel stations and establish contracts with utilities for the supply of power and familiarize with owning and operating electric charging stations. It will also need staff who have the technical qualifications to maintain the fleet. In Quito, the routes analyzed for EPMTPQ indicate that buses could benefit from a single charge during the night and the deployment of a modular charging station for the fleet at one of the main bus stations.

Potential Climate Finance

The replacement of diesel by renewable energy can lead to a reduction of approximately 90 tons of carbon dioxide per year for each bus in Quito. These emission reductions can potentially be monetized in the carbon markets, including under Article 6 of the Paris Agreement, which emerges as one of the most promising alternatives in terms of pricing. This will require institutional arrangements because Ecuador does not yet have a bilateral agreement with any country to market this type of carbon credit. The government will also need to develop provisions for Ecuador to use Article 6 that define the use of carbon credits in international transactions.

Accessibility

By incorporating key insights on types of disability, regulatory compliance, inclusive participation, interagency coordination, political and budgetary commitment, ongoing training, and long-term vision, the EPMTPQ's Universal Accessibility Plan for the Trolleybus Corridor positions itself as a model for creating more accessible urban environments across the country. Based on a thorough analysis of the Quito Universal Accessibility Plan; in-person field visits to the Quito Trolleybus Corridor bus stops, terminals, and stations; and an exhaustive analysis of Ecuador's regulations on universal accessibility, ESE identified numerous lessons learned. This plan is a significant step toward

a more inclusive and accessible public transport in the city of Quito. It also sets an important precedent for future urban accessibility initiatives.

Compliance With The Technical Regulations Of Universal Accessibility

It is essential to incorporate the parameters of accessibility and universal design in the initial phases of design for terminals, stations, and stops, as well as during the acquisition of new transport units and the implementation of information and communication strategies. This will avoid additional costs due to subsequent adaptations.

Inclusive Participation

The active participation of people with disabilities is essential to identify needs and validate the recommendations made by technicians. Citizen participation can be formalized through a diverse working group that monitors the implementation of the plan as well as its regular update and improvement.

Inter-Institutional Coordination

Collaboration between public and private entities, such as transportation operators, municipal authorities, and social inclusion organizations, is critical to ensure the success of the universal accessibility plan. This coordination can facilitate a holistic and comprehensive response to the needs of people with disabilities, uniformity in the design of the signage, and optimization of technical and financial resources.

Commitment and Budget

Elected officials need to be committed to the goals of the EPMTPQ's Universal Accessibility Plan for the Trolleybus Corridor, including coordinated planning and sustained budget allocation to maintain the plan over time and overcome possible political risks.

Training and Continuous Improvement

Ongoing training of customer service, infrastructure, and communication staff on topics related to accessibility and customer feedback is essential to improve accessibility and quality of service. Moreover, the appointment of a champion or division that leads the implementation and monitoring of progress will increase its success.

First Big Step For Accessibility Throughout a City

EPMTPQ's Universal Accessibility Plan for the Trolleybus Corridor can serve as an example for development of a Universal Accessibility Plan for the Metropolitan District of Quito that considers other public services, public spaces and buildings, and sectors like health, education, tourism, recreation, sports, and art to ensure equal access to all citizens.

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Checklist: Measures to Improve Accessibility in the Transport System

Following is a checklist of accommodations to be made at bus and bus stops in order for people with physical, cognitive, and sensory disabilities to safely and efficiently use public transport.

PHYSICAL DISABILITY

- [ ] Address the gap between the bus platform and the bus by having the bus descend to meet the platform during embarkation and disembarkation. While the regulation allows a maximum gap of 10 centimeters between the platform and bus, there is typically a gap that is 30 centimeters or more. This hinders the autonomous access by those in wheelchairs, and can cause falls that result in serious injury.
- [ ] Designate preferential spaces on the bus and at bus waiting facilities for people with wheelchairs or individuals with limited mobility.
- [ ] Adjust the ticket counter height to accommodate individuals in wheelchairs.
- [ ] Add handrails to ramps with a slope greater than eight degrees.

SENSORY DISABILITY

- [ ] Add tactile signage at stations and terminals and repair worn or damaged tactile signage at stops.
- [ ] Repair floors that are not uniform or that are uneven.
- [ ] Provide auditory information on buses and at bus stops and terminals. Repair broken audio features on screens.
- [ ] Provide Braille lettering in access areas.
- [ ] Provide digital devices that create a tactile experience by applying forces, vibrations, or motions to the user.

COGNITIVE DISABILITY

- [ ] Provide sign language, captioning, or uniform text on information signs, videos, and other materials in bus stops, stations, and terminals, particularly on glossy surfaces. Materials should use uniform and easy-to-see colors and typography, be in a visible location, and have the most up-to-date information.
- [ ] Provide clear visual information about the bus stop and upcoming stops.
- [ ] Use colors to improve orientation within the bus system.
- [ ] Create public service announcements that encourage commuters to wait for all passengers to get off and then on the bus, and respect preferential spaces for people with disabilities.
- [ ] Train bus drivers and customer service representatives on the needs and accommodations for persons with disabilities and reduced mobility.

Scan the QR code to access the complete documentation of the technical study and the EPMTPQ Accessibility Plan.