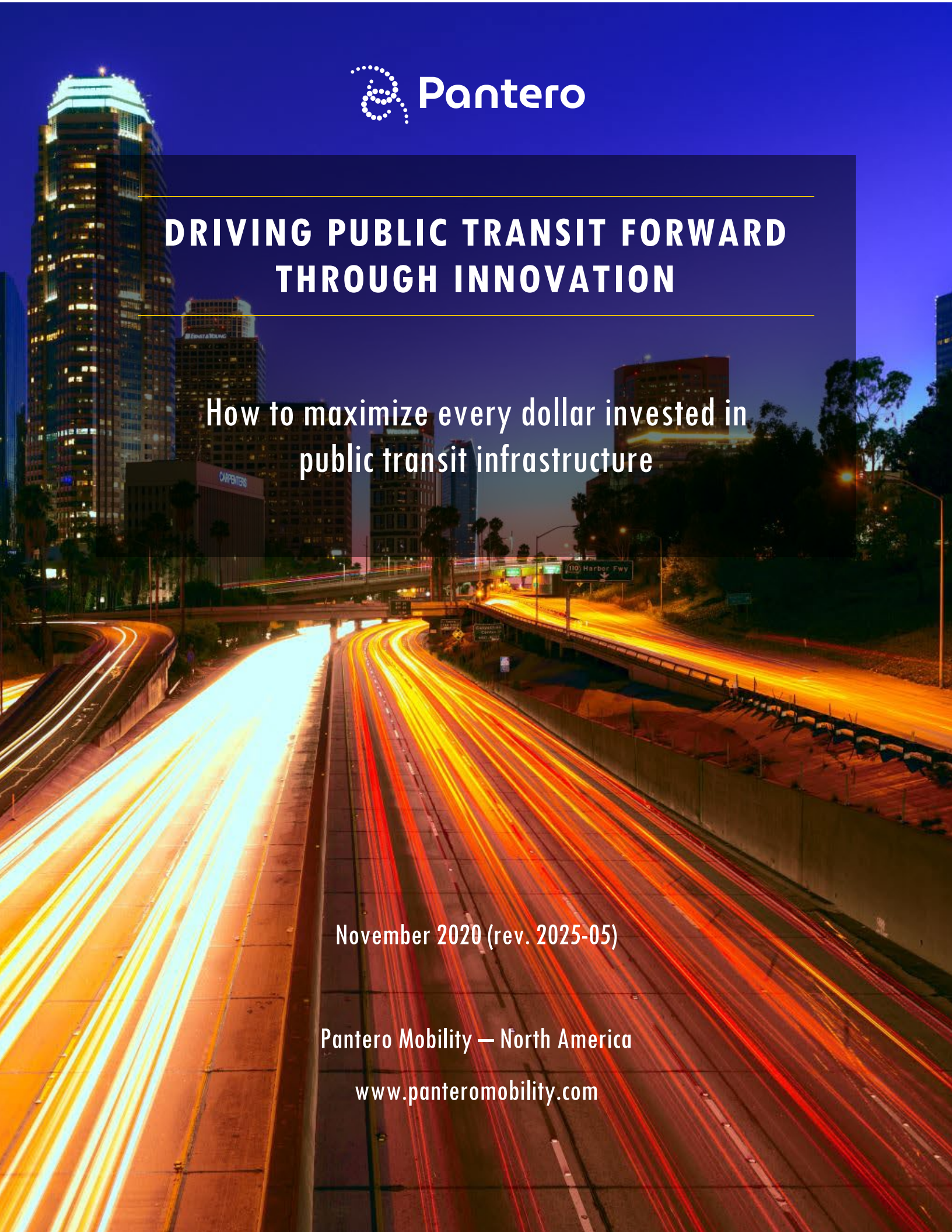
Pantero
DRIVING PUBLIC TRANSIT FORWARD THROUGH INNOVATION
How to maximize every dollar invested in public transit infrastructure
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Pantero Mobility — North America
www.panteromobility.com

ABOUT PANTERO

We are an emerging company on a mission to take on climate change and world urbanization. Our warhorse? Revolutionary advancements in public transportation. Built on years of experience in vehicle development in both the urban bus and rail sectors, Pantero positions itself at the convergence of these two universes.

We are developing a new vehicle platform that will revolutionize the urban bus market and reframe the very definition of a *trambus*. We are creating the first *RoadTram.*

PANTERO *ROADTRAM*

We firmly believe our design will usher in a new era. Unprecedented on the world stage, our vehicle is a bus and tramway hybrid made possible through several product innovations. Our *RoadTram* design brings forth a new category of vehicles that features the best of everything its predecessors had to offer and does away with all their limitations.

We are proposing a vehicle that completely changes the positioning of on-road and rail transportation in public transport infrastructure development.

CONTEXT

Our project's aim is quite simple. **We intend to promote the development of more impactful public transit solutions at a viable, socially acceptable cost.** We believe this goal must be built into the strategic development plans of public transit authorities.

The financing of major public transportation projects raises issues that must be put forward and publicly debated. The cost of prioritized projects must be discussed on the basis of their expected results and beneficial outcomes.

The fundamental, oft-neglected question is: how can we maximize every dollar invested in mass transit infrastructure?

For example, let's compare the deployment of a 30 km capacity-building tramway network to that of an equally capacity-building 100 km *RoadTram* system of equal cost. The latter's achievable goals with regard to the aggregate increased offer of service, ridership, and car ridership conversion to public transportation (and subsequent reduction in GHG emissions) will be much higher.

Competition between rail and bus transport solutions is nothing new. In North America, the appeal of Bus Rapid Transit (BRT) has largely been spoiled by the political class. Perceiving BRT as a cheap solution, political authorities have tended to underinvest in the infrastructures and facilities required for it to flourish. On the other hand, tramway projects generally come with massive investments in the urban renewal of the neighbourhoods where they are to be deployed, enhancing their public image.

In light of the innovations we wish to bring to fill in the gap between buses and light rail systems, we think it worthwhile to put into perspective certain arguments that promote BRT services as real, sustainable transport solutions.

BRT VS. RAIL

The idea of Bus Rapid Transit (BRT) was put forward to use buses in order to imitate light rail services.

However, in North America, two factors have so far limited the full development of this concept: 1) the inadequate deployment of several projects due to an approach favouring lower costs over high quality, efficient solutions; and 2) limitations in bus capacity that make it difficult for them to provide the same level of service as rail solutions.

But first, let's adequately define the notion of BRT because the term has been much abused. According to the official industry standard, BRT is:[1,2]

- "a high-quality bus-based transit system that delivers fast, comfortable, and cost-effective services at metro-level capacities. It does this through the provision of dedicated lanes, with busways and iconic stations typically aligned to the center of the road, off-board fare collection, and fast and frequent operations."

The industry uses a scoring system to define several deployment levels ranging from *basic* to *bronze*, *silver* and *gold*.[1,2] In Canada and the United-States, no *gold* level project has ever been commissioned. Most are classified *bronze* or *basic*. There are two *silver* projects in the U-S. It should be noted that many projects purporting to be BRTs do not meet the minimum standards of the *basic* level.

Much more than a simple improvement in bus services, a true BRT service provides **infrastructure investments** and an operating model that promote **speed** and **efficiency**.

Sustainable Transportation and Economic Viability

The undeniable advantage of BRT over light rail is definitely its cost. Rail services cost more because of the extensive infrastructure they require, namely: rails and switches; stronger roadbeds (due to the weight of railway cars and its impact on underground networks); catenaries and related equipment; special depots linked to the system by rail tracks; extra labour to satisfy the demands of rail constraints (large radius curves requiring more road work and restructuring, tunnels to avoid steep grades, etc.).

Although each situation presents several unique factors that can strongly influence its cost, the median price of a light rail project hovers around 50-100M$/km, while a quality BRT project (ITDP *gold* standard) is in the order of 15-30M$/km.[1,3,4]

> *While a light rail network project of about 30 km would cost between 1.5 and 3 billion dollars, the price of an equivalent BRT of comparable quality could run between 450 and 900 million dollars.*

At a time when society must make socially responsible choices, **each public dollar invested in mass transit should maximize benefits in terms of enhancing user services and promoting a shift from private vehicle use to public transport.**

Although light rail projects currently enjoy great popularity in Canada and the United-States, such massive investments are not sustainable in the long term. They are particularly not economically justifiable for many agglomerations that are considerably more spread out and less dense than large urban centres.

> *There must be a better mix of transit alternatives, and we offer a game-changing solution.*

A Few Myths About BRTs

Let's set aside vehicle characteristics and capacity for a moment to look at other issues at the heart of the bus/rail competition. Over the years, several studies have been carried out comparing BRT services to rail alternatives. Although we can learn a great deal from various cases' successes and failures, several myths still need to be debunked.

Myth #1: People prefer rail solutions

Despite the fact that several public figures are trying to build up this idea, the reality is much more subtle and nuanced than they would have you believe. An in-depth analysis of the issue shows that a quality BRT service can replicate both the functionality and the attractiveness generally associated with rail services. Moreover, even a minimal, low-investment service performs remarkably well per dollar invested. In fact, the choice between a rail service or a quality BRT has only a secondary influence on popular perception of desirability. It is not the tramway itself, but the efforts made toward revitalizing an urban area set to receive a project that enhances positive public perception.[5]

Myth #2: Passengers are more comfortable travelling by rail

An analysis of this issue shows that passengers perceive the comfort of BRT services as equal to that of light rail systems.[3] This is especially true nowadays considering the electrification of vehicles and the smart systems like driver assistance and acceleration and braking controls with which they may be equipped. That said, the main comfort factors that have been identified are the quality of stations and the number of passengers on board, with crowded vehicles being a significant source of annoyance.

Myth #3: Only rail solutions stimulate investments and urban development

BRT services are often seen as better suited to sparsely populated areas. However, experience shows that under the right conditions, they can promote urban development and more sustainable growth just as well as rail systems.[4] The ITDP conducted a study of 21 BRT or light rail corridors in 13 North American cities.[6] Its research shows that BRTs generate more transit-oriented development (TOD) investments per dollar than light rail systems. Public policies favouring TOD approaches are actually the best tokens of success. Therefore, the perceptions held by city planners in developed countries to the effect that rail systems bring about more development than high-quality bus systems appear to be unfounded.[3]

Present Limits of BRT Services

Two factors limit BRT services: the service capability of the vehicles themselves and, by extension, the possibility of commissioning a sufficient number of vehicles during a given period. It is these discriminatory factors that justify choosing rail over BRT.

A 12 m long North-American bus can accommodate about 80 passengers. An 18 m articulated bus can take approximately 130 passengers, while a 24 m long bi-articulated bus (rarely seen in North America) can carry up to 180. Data that sometimes indicate much higher theoretical numbers are not practically realistic in the North American context. Comparatively, trams measuring 25 m to 50 m in length have a typical passenger capacity of 170 to 350 passengers. For their part, LRT vehicles can accommodate up to 600 passengers or more.

And now, the crux of the matter. **The cost of drivers typically represents 50% of the operating budget of a public transit authority bus network**. It may seem easy to simply double the network's capacity by doubling the number of buses in service, but the impact on the operating budget makes this generally impossible and uneconomic. Most public transit networks are under pressure to maintain a balanced budget and passenger fares make up only a small part of their financing.

Consequently, added revenues derived from increased ridership do not cover the increase in operating costs.

This is one of the important factors explaining why cities wishing to increase their transit services favour light rail systems, and especially trams. Since higher government levels shoulder the high capital costs of building rail infrastructure through specific financing instruments, municipal authorities take on only direct operating expenses, which remain reasonable. The current financing model therefore significantly influences which projects are prioritized by elected municipal officials.

> We take a sustainable development approach that considers the economic viability of investments to be a fundamental criterion. By pioneering road vehicles with capacities comparable to those of a wide range of trams, all perfectly adapted to dense urban environments, we are considerably changing the game and ushering in a new era for BRT services.

THE NEW ROADTRAM ERA

Some only dream of achieving the perfect fusion of trams and buses. Others loosely throw around the term *trambus* without actually creating anything new to back it up. And then there is Pantero, ahead of the pack. Thanks to a unique blend of engineering expertise and proprietary innovations, we are the most advanced in creating a *RoadTram* worthy of the name. We have already re-engineered a new vehicle platform from the ground up, have patented several technologies, and have convinced automotive leaders to join us in making the impossible possible.

So Much More Than a Public Transit Solution

The *RoadTram* is the result of years of planning, designing, and taking the time required to create a modular mode of transportation that offers our communities a great deal more. It is a sustainable transportation solution that meets their continually evolving needs; it is an alternative that takes into account environmental protection and the notion of economic viability. Less expensive than tramways and more efficient than buses, our *RoadTram* can be deployed faster and more economically. It enhances urban centres' quality of life and can promote sustainable urban and transit-oriented development (TOD).

A Flexible System Designed for Evolving Cities

Our vehicles are available in several configurations of 2, 3 or 4 modules (call them *trambuses* or *RoadTram*s according to their format), relegating articulated buses to history. They fill the gap between buses and mid-range tramways. The four-module version is 37 metres long — the size of an average tramway — and can carry up to 260-340 passengers. Equipped with up to 8 electric drive motors and a smart steering system, this vehicle outperforms all others. It even does well where others run into problems, such as in dense urban areas, on steep inclines, and in intense Canadian winter conditions.

All it takes to launch a project is a bit of paint on the road. When a more elaborate, dedicated infrastructure is wanted, more can be invested to improve user experience and quality of service rather than to provide the nuts and bolts needed to meet the constraints of rail service systems. The *RoadTram* is a more affordable efficient public transit solution for all communities, small or large.

A Serious Option for Tramway and LRT Projects

A *RoadTram* network is adaptable and flexible and can serve as an alternative system or as an essential complement to feeding and expanding rail services. It can be developed along with existing infrastructure and adapt to the ever-changing needs of urban centres.

A Movement Whose Time Has Come

Better for the environment More than a mere electric vehicle, the Pantero *RoadTram* is highly optimized for unmatched energy efficiency. Because it is lighter per axle than conventional city buses, it causes less damage to roads, a source of significant hidden costs for all cities. Its carbon footprint is much less than that of any rail solution. Simply put, it is clean, sustainable public transit at its finest.

Better for the economy The *RoadTram* can be put into service without depleting public funds. No need to build a rail network. It is a much more reasonable investment that allows for the faster deployment of an extensive, efficient transit system.

Better for the community Everyone should be able to enjoy efficient public transportation. The flexibility and speed at which the Pantero *RoadTram* can be deployed make it an affordable solution for all communities. It can go places where traditional articulated buses have difficulty manoeuvring. It inexpensively services areas where the installation of rail infrastructure is too complicated or makes no economic sense.

On the whole, a perfect solution The Pantero project is ready to roll. More than a mode of transportation, it is a movement. A movement that reminds us that we must better manage today's environmental, economic and societal challenges.

We bring our many years of high calibre experience in the bus and rail industries to this movement. With the strong support of our international partners, we are ready to pave the way forward.

Join us as we redefine the future of mobility and urban transport.

FREQUENTLY ASKED QUESTIONS

Isn't the *RoadTram* just a longer version of an articulated bus?

No. The architecture of Pantero's *Trambuses* and *RoadTrams* is very different from that of articulated or bi-articulated buses as we know them. Moreover, many innovations give our vehicles better manoeuvrability and improve their performance. For example, each *RoadTram* "module" is equipped with two axles and a smart propulsion and steering system. The articulation module is also unique and not at all like the accordion seen on articulated buses. The interior is designed to provide more usable space and features an integral flat floor from end to end. These are just a few of the improvements built into our *RoadTram* design.

How does a *RoadTram* compare to a tramway?

Tramways typically are between 24 m and 50 m long. The four-module version of the Pantero *RoadTram* measures 37 m. It corresponds to a mid-sized tramway or two articulated buses. Its maximum theoretical capacity is 260-340 passengers compared to the 240-290 passenger capacity of an equivalent tramway. It typically holds between 109 and 137 seats, compared to the 60-100 seats available on a tramway, and a similar number of doors (on one or both sides). Its turning radius is less than 12 m, compared to 18-25 m for a tramway. Roughly speaking, it is 45% lighter than a comparable tramway.

Can the *RoadTram* really manoeuvre in downtown cores?

Contrary to what people may think, Pantero's *Trambus* or *RoadTram* is actually easier to handle than an ordinary bus. The vehicle's architecture and unique design allow for better manoeuvrability and can make turns in narrower roads. Integrated advanced driver-assistance systems make the vehicle particularly easy to drive.

Can the *RoadTram* handle our tough winters?

Yes. Each *Trambus* or *RoadTram* module has two electric motors that help propel the vehicle. Thus, a four-module *RoadTram* has eight electric motors distributed along its length. This, combined with a design that ensures a better weight distribution on the axles, results in unparalleled road handling even in heavy snow and under challenging road conditions. Contrary to articulated buses, each module is equipped with an intelligent active steering system, which adds greater stability despite the vehicle's

length. In fact, our vehicles are much better suited to Canadian or Northern Europe winters than articulated or bi-articulated buses or tramways.

Won't a *RoadTram* block intersections?

No. *RoadTram*s are deployed similarly to tramways of the same length. They run on reserved lanes or, ideally, on lanes physically separated from other traffic. To avoid interference, traffic light control systems and regulations limiting or orchestrating the turns of other vehicles are usually also implemented.

Aren't rails more durable than roads?

When comparing rails to roads, it is true that the condition of thoroughfares directly impacts passenger comfort levels. It is also true that buses and trucks cause much damage to our roads. Electric buses are particularly bad in this regard. Accordingly, our vehicles have been completely redesigned to significantly reduce their weight, ensure a better weight distribution on the axles and minimize weight transfer toward the front when braking. We have also eliminated double-wheel axles that cause ruts on the roads. When deployed on dedicated lanes, our *Trambuses* and *RoadTram*s cause much less damage, leaving the roads in better condition and, ensuring better passenger comfort.

Is the *RoadTram* accessible to people with reduced mobility?

Our vehicles are designed to meet the most stringent accessibility standards. Their floors are low and flat from one end to the other (contrary to those of many buses and tramway cars). The aisles are wider throughout the vehicle's length. The seat modules are multifunctional and equipped with wheelchair anchoring systems, and there is an access ramp at the front door.

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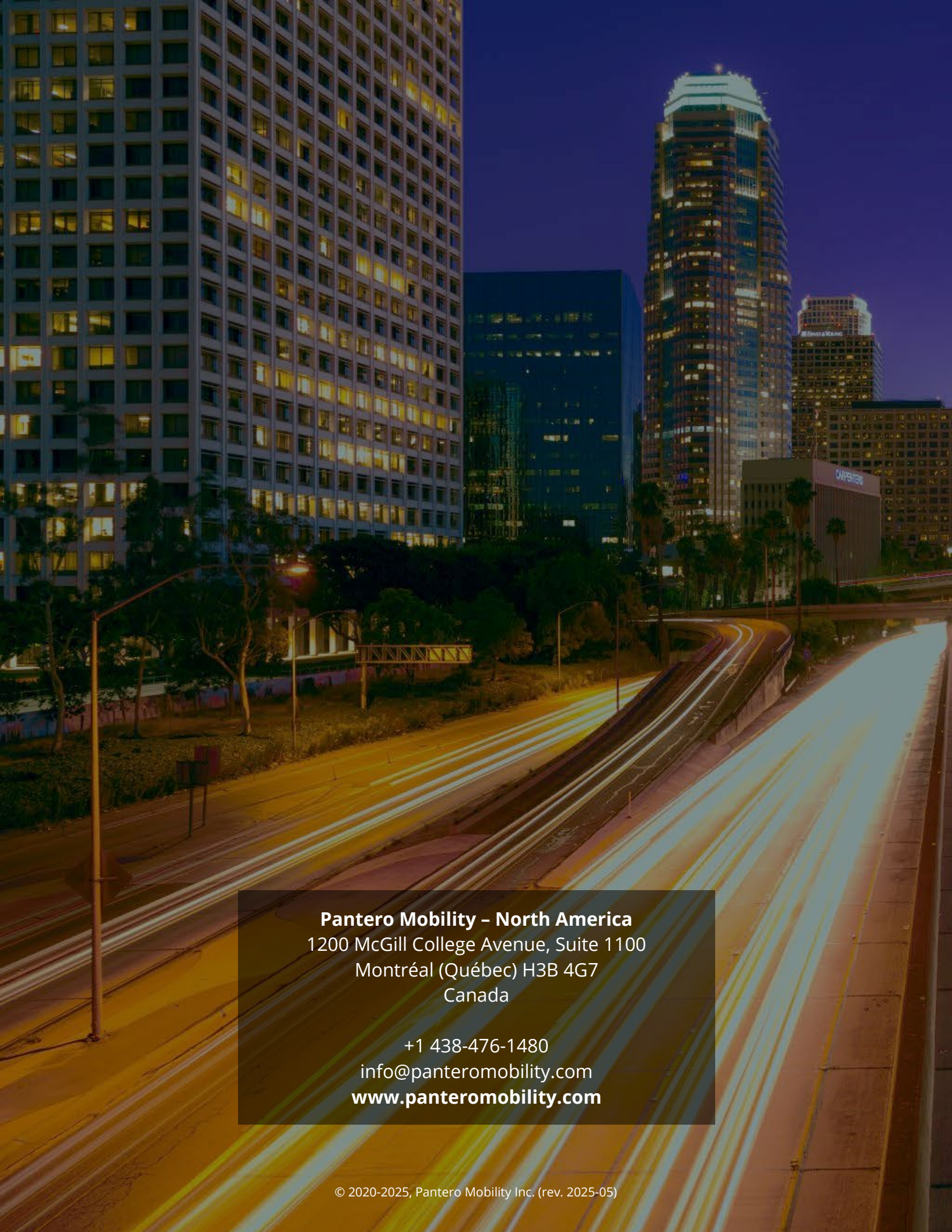

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