



Aplicaciones Exitosas de 'Bus Rapid Transit' (BRT) en este Milenio, y Métodos Innovadores de Financiamiento con Posibles Aplicaciones a Puerto Rico

10 de Marzo de 2016

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Aplicaciones Exitosas de 'Bus Rapid Transit' (BRT)

Planificación y Diseño de Sistemas BRT

Experiencia de Diseño en Canada

APLICACIONES EXITOSAS DE BRT



Based on recent BRT and light rail corridor development costs in the United States, on average, BRT can be ***7 times more affordable*** than light rail, per mile.

25 miles of BRT infrastructure for the same cost of less than **4 miles** of light rail.

APLICACIONES EXITOSAS DE BRT

BRT STANDARD: The Gold Standard

BRT AT ITS BEST:

BETTER SERVICE, FEWER TRANSFERS

With smart, Gold Standard-level planning, BRT is much faster than conventional bus and more versatile than rail.

Multiple routes can be pulled together to run on a single BRT corridor.

Vehicles can then leave that corridor to reach different destinations, reducing the need for transfers.

A central control station orchestrates vehicles to keep them on schedule and avoid irritating bunch-ups

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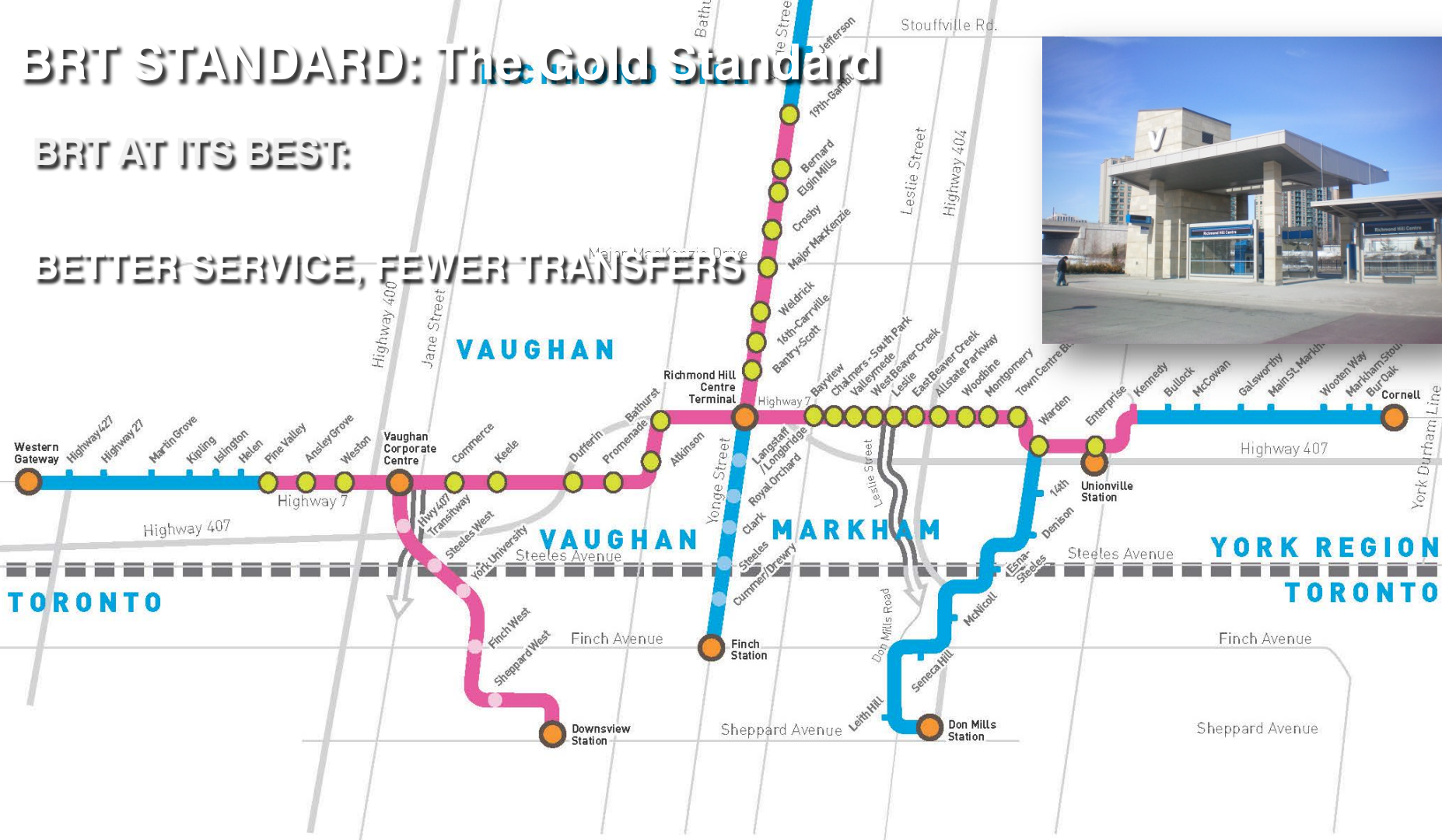
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ENCLOSED, SECURE STATIONS

What if bus stations no longer felt uncomfortable and vulnerable?

One of the most important aspects of Gold Standard BRT is well-designed, enclosed stations.

Cities around the world have built beautiful, modern BRT stations that act as landmarks and provide comfort, security, and protection from the elements.

BRT STANDARD: The Gold Standard

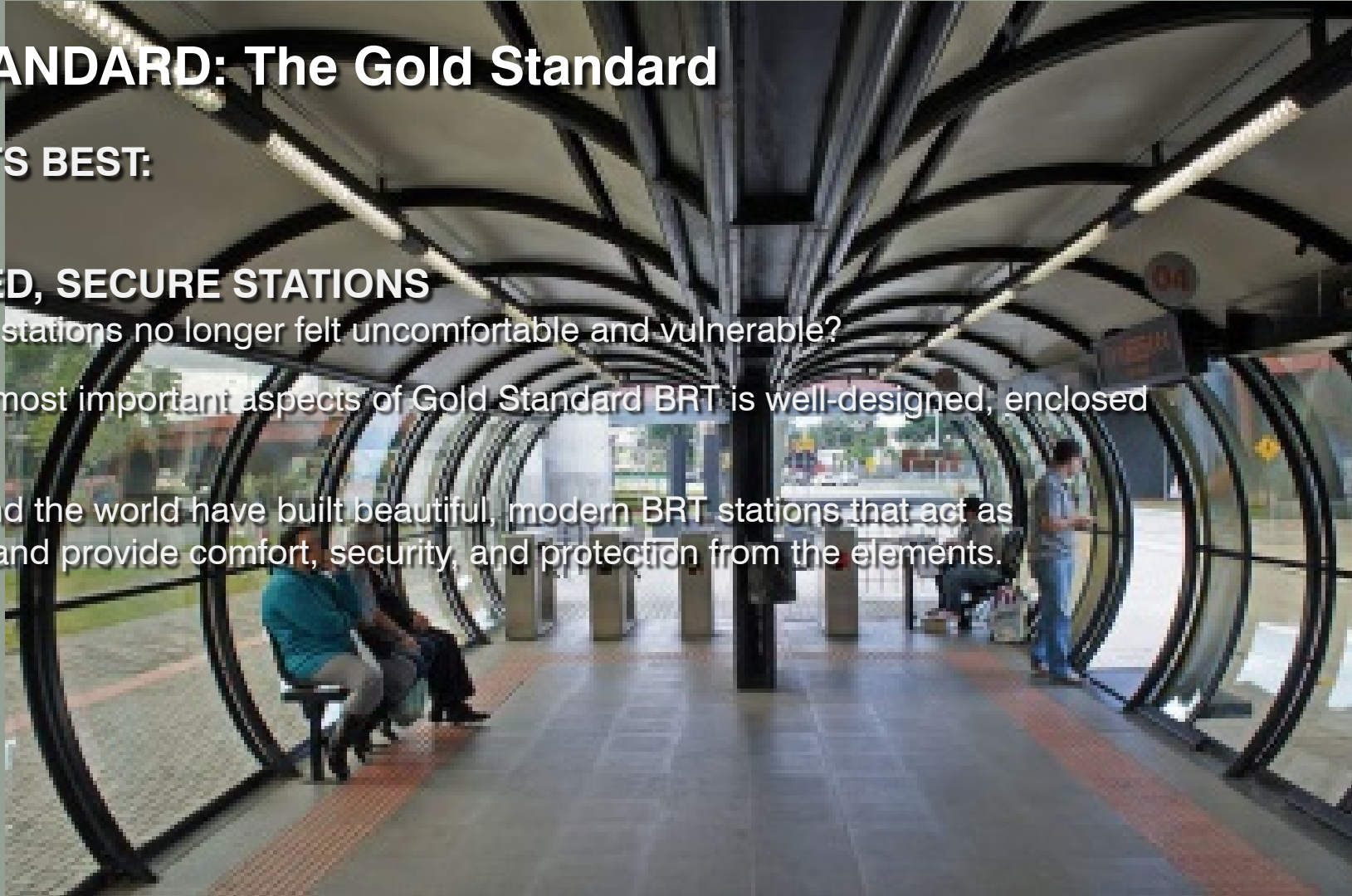
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BETTER ACCESS FOR ALL

Gold Standard BRT uses design approaches that ease use for people with needs of all kind, including people with **disabilities**, but also across age, demographic, and group or family size.

Reaching Gold Standard also means **seamless integration** with other ways to get around, including bikeshare systems, safe bicycle and pedestrian paths, and existing bus and rail.

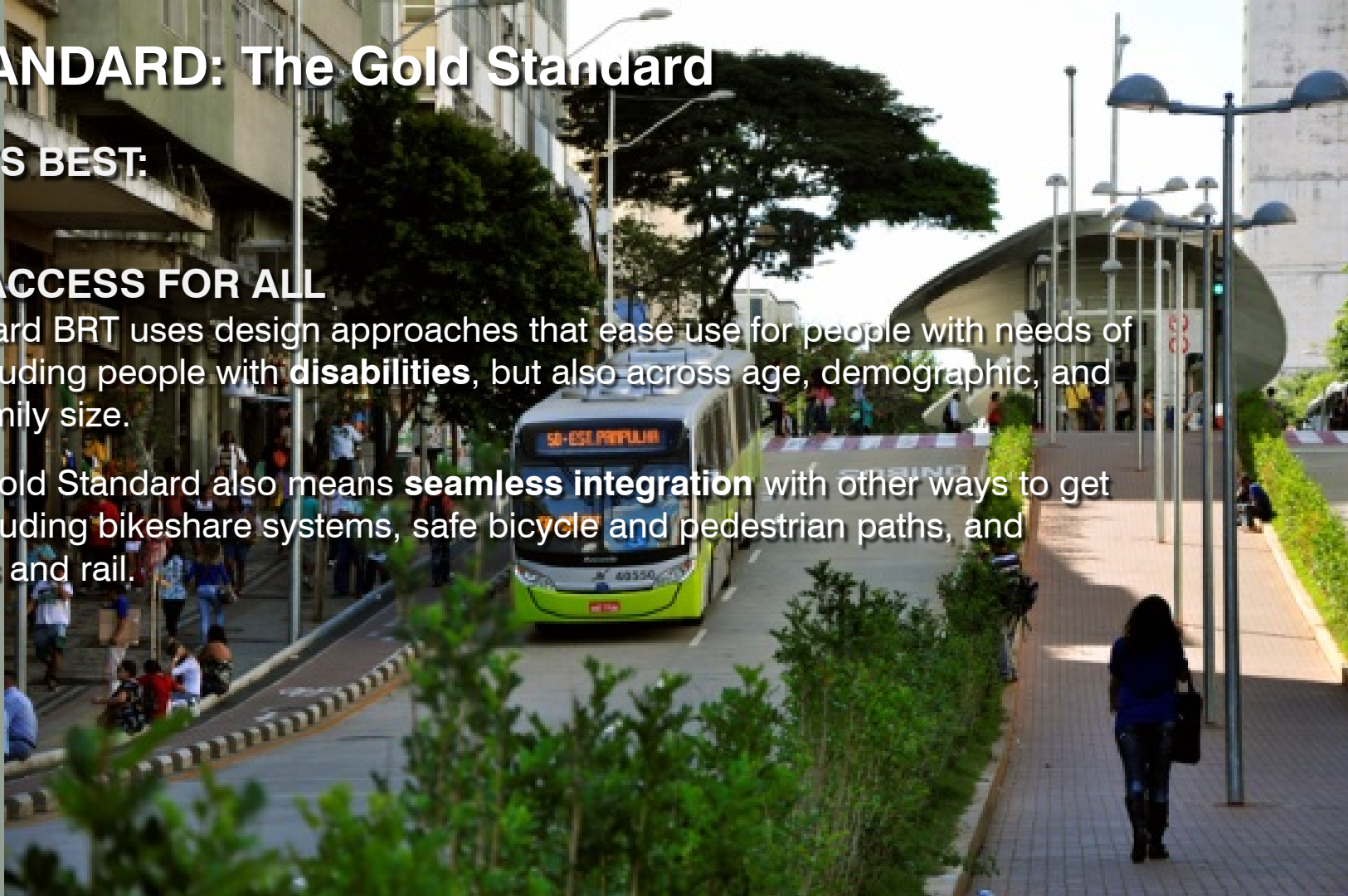
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BRT STANDARD: The Gold Standard



Dedicated Right-of-Way:
Bus-only lanes fully segregated from mixed traffic



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Busway Alignment:

Bus-only lanes aligned to the middle, not the curb, of a road



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Off-Board Fare Collection:

Turnstile-controlled or proof-of-payment fare collection system



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Intersection Treatments:

Mixed-traffic is prohibited from making turns across the busway



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Platform-Level Boarding:

Station platforms level with bus floors when boarding and alighting

APLICACIONES EXITOSAS DE BRT

- **Frecuencia versus Velocidad**

APLICACIONES EXITOSAS DE BRT

- Frecuencia versus Velocidad



APLICACIONES EXITOSAS DE BRT

• Frecuencia versus Velocidad



APLICACIONES EXITOSAS DE BRT

- **Rede Integrada de Transporte**

Curitiba, Brazil. 1974

- **Transmilenio**

Bogotá, Colombia. 2000

- **Silver Line**

Boston, Massachusetts. 2002

- **Viva BRT**

York Región, Ontario, Canadá. 2005

APLICACIONES EXITOSAS DE BRT



Rede Integrada de Transporte, Curitiba, Brazil

APLICACIONES EXITOSAS DE BRT



Rede Integrada de Transporte, Curitiba, Brazil

APLICACIONES EXITOSAS DE BRT

Curitiba

Linhas Expresso Biarticulado

- 203 Santa Cândida – Capão Raso
- 301 Pinhais – Rui Barbosa
- 302 Centenário – Rui Barbosa
- 303 Centenário – Campo Comprido
- 502 602 Circular Sul (horário / anti-horário)
- 503 Boqueirão
- 603 Pinheirinho



Curitiba

Linhas Direta

- 022 023 Inter 2 (horário / anti-horário)
- 105 Tamandará – Cabral
- 204 Pinheirinho – S. Cândida
- 206 Barreirinha – São José
- 208 Aeroporto
- 304 Pinhais – Campo Comprido
- 305 Centenário
- 307 Santa Felicidade – Bairro Alto
- 469 Centro Politécnico
- 505 Boqueirão – Centro Cívico
- 506 Bairro Novo
- 507 Sítio Cercado (horário / anti-horário)
- 605 Fazenda Rio Grande
- 606 Araucária – Curitiba
- 607 Colombo / CIC
- 702 Fazendinha – Tamandará
- 805 Campo Largo – Cabral



Rede Integrada de Transporte, Curitiba, Brazil

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APLICACIONES EXITOSAS DE BRT



Transmilenio, Bogotá, Colombia

APLICACIONES EXITOSAS DE BRT



Transmilenio, Bogotá, Colombia

← APLICACIONES EXITOSAS DE BRT



Transmilenio, Bogotá, Colombia

APLICACIONES EXITOSAS DE BRT



Silver Line, Boston, Massachusetts

APLICACIONES EXITOSAS DE BRT



Silver Line, Boston, Massachusetts

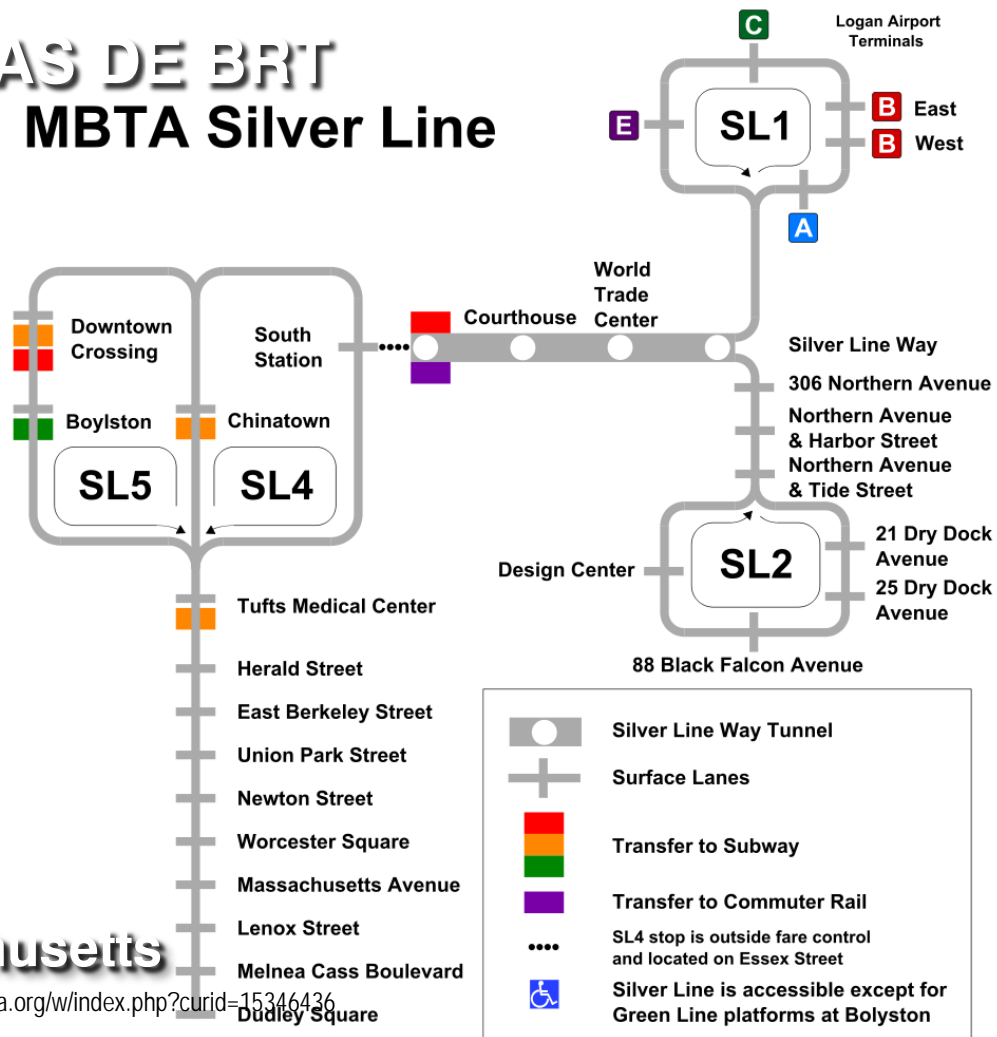
APLICACIONES EXITOSAS DE BRT



Silver Line, Boston, Massachusetts

APLICACIONES EXITOSAS DE BRT

MBTA Silver Line



Silver Line, Boston, Massachusetts

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APLICACIONES EXITOSAS DE BRT

Viva BRT, York Región, Ontario, Canadá



APLICACIONES EXITOSAS DE BRT



Viva BRT, York Región, Ontario, Canadá

APLICACIONES EXITOSAS DE BRT



Planificación y Diseño de Sistemas BRT

APTA BTS-BRT-RP-002-10

BUS RAPID TRANSIT STATIONS AND STOPS



APTA STANDARDS DEVELOPMENT PROGRAM
RECOMMENDED PRACTICE

American Public Transportation Association
1666 K Street, NW, Washington, DC, 20006-1215

APTA BTS-BRT-RP-002-10

Approved October, 2010

APTA Bus Rapid Transit Working
Group

Bus Rapid Transit Stations and Stops

Abstract: This *Recommended Practice* provides guidance for planning and designing stations or stops for bus rapid transit systems.

Keywords: bus rapid transit, stations, stops

Summary: This document provides recommended practices for the planning and development of bus rapid transit (BRT) stations and stops. It is intended to guide transit agencies and their partners in planning and designing stations or stops for a BRT service, based on the experiences of other transit agencies.

Scope and purpose: This *Recommended Practice* provides guidance to transit agencies, local governments, planners, developers and others interested in developing new BRT systems or enhancing existing BRT systems. This document is part of a series of APTA documents covering the key elements that may comprise a bus rapid transit (BRT) system. Each document is intended to guide an organization when implementing a specific BRT system element. Because BRT elements perform best when working together as a system, each *Recommended Practice* may refer to other documents in this series. Agencies are advised to review all relevant reference documents for elements to be incorporated into their BRT service. In addition, there are some BRT system elements that equally apply to non-BRT service, so this document may reference other applicable APTA documents.

APTA BTS-BRT-RP-002-10

BUS RAPID TRANSIT STATIONS AND STOPS

- **The role of stations and stops**

BRT stations and stops play a key role in defining a BRT system and in the system's performance.

APTA BTS-BRT-RP-002-10

BUS RAPID TRANSIT STATIONS AND STOPS

▪ The role of stations and stops

Good BRT station or stop design can do the following:

- Attract new riders.
- Promote visibility and facilitate branding of the system.
- Provide shelter from the weather.
- Ensure safe accessibility for all, including people with disabilities.
- Provide passengers with information, including system maps and real-time arrival information.

APTA BTS-BRT-RP-002-10

BUS RAPID TRANSIT STATIONS AND STOPS

▪ The role of stations and stops

Good BRT station or stop design can do the following:

- Provide passengers with a safe and secure environment by including such items as CCTV cameras, a public address system, public and security telephones, lighting and fencing.
- Enable passengers to board through multiple doors.
- Enable precise berthing at designated stopping points.
- Enable level boarding by matching platform height with vehicle floor height and using precision docking.

APTA BTS-BRT-RP-002-10

BUS RAPID TRANSIT STATIONS AND STOPS

- **The role of stations and stops**

Good BRT station or stop design can do the following:

- Enable passengers to pay their fares before boarding using off-board fare payment equipment.
- Provide passengers with amenities such as newspaper boxes, signage, waste recycling, special lighting, seating and bicycle parking.
- Provide passengers with an attractive environment, using features such as landscaping and public art.

APTA BTS-BRT-RP-002-10

BUS RAPID TRANSIT STATIONS AND STOPS

- **The role of stations and stops**

Good BRT station or stop design can do the following:

- Create a sense of place within the community, encouraging development and other activities to occur near the station or stop.
- Ensure ease of access to users of other modes, including bicyclists, pedestrians and automobile drivers.
- Ensure easy connections with other local and intercity modes of transportation.

APTA BTS-BRT-RP-002-10

BUS RAPID TRANSIT STATIONS AND STOPS

- **Station and stop types**

APTA BTS-BRT-RP-002-10

BUS RAPID TRANSIT STATIONS AND

- **Station and stop types**
 - Basic stop.



Basic bus stop in Pittsburgh.



AC Rapid Transit stop.

2.1 Basic stop

A basic stop ([Figure 1](#)) is a designated point, typically on the side of a road, that provides a location for passengers to board and alight buses. This type of stop may include a small bus shelter but few, if any, additional passenger amenities.

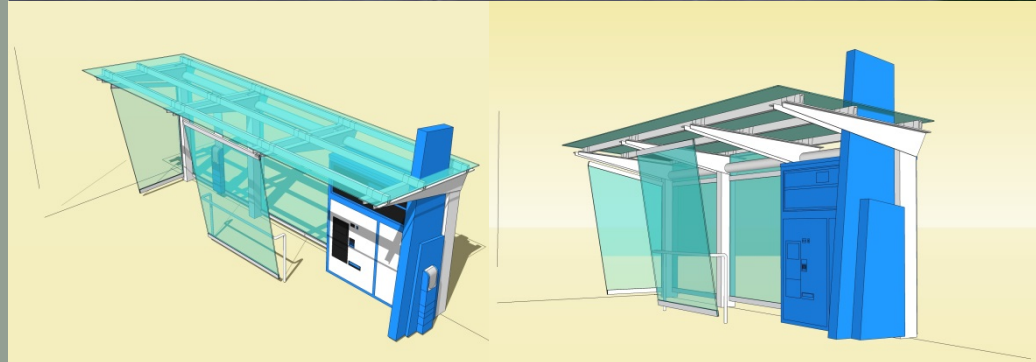
The advantage of basic stops is that they are quick, easy and inexpensive to install. However, they have many disadvantages. They do little to distinguish BRT from traditional bus service and do not communicate permanence. They have low capacity and few, if any, passenger amenities. These features reduce a basic stop's ability to attract choice riders and its ability to encourage transit-oriented development (TOD).

Basic stops generally are not recommended for BRT service, but they may be used for temporary conditions or as a transitional strategy. If they are used, they should include branding elements at a minimum.

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BUS RAPID TRANSIT STATIONS AND STOPS

- **Station and stop types**
 - Basic stop.



APTA BTS-BRT-RP-002-10

BUS RAPID TRANSIT STATIONS AND STOPS

- **Station and stop types**
 - Basic stop.



APTA BTS-BRT-RP-002-10

BUS RAPID TRANSIT STATIONS AND

■ Station and stop types

- Basic stop.
- Enhanced stop.



MetroLink Scotia Square stop (Halifax).



Metro Rapid Stop (Los Angeles).

2.2 Enhanced stop

An enhanced stop ([Figure 2](#)) is a designated point for passenger boarding and alighting that may include a few amenities, such as a small shelter, passenger information, seating, lighting and branding elements. Typically, these stops are smaller in size and scale than stations.

The advantages of enhanced stops are that they are quick and easy to install and inexpensive in comparison to full stations. The disadvantages are that such stops may only moderately distinguish the BRT service from traditional bus service; may offer few, if any, passenger amenities; and may provide limited encouragement for TOD.

Generally, enhanced stops are recommended in the following situations:

- When there is a limited budget or a strong need to save money.
- When quick deployment is a priority.
- When travel demand is expected to be low.
- When space limitations preclude installation of stations.
- When the enhanced stop is planned for short-term use due to temporary conditions or as a transitional strategy.

APTA BTS-BRT-RP-002-10

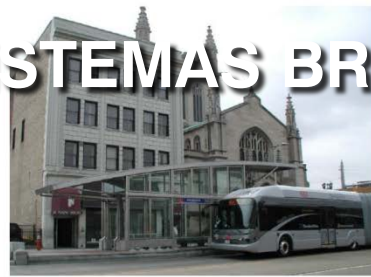
BUS RAPID TRANSIT STATIONS AND STOPS

- **Station and stop types**

- Basic stop.
- Enhanced stop.

PLANIFICACIÓN Y DISEÑO DE SISTEMAS BRT

- **Station and stop types**
 - Basic stop.
 - Enhanced stop
 - Station.



Cleveland HealthLine.



Ottawa Transitway.



Los Angeles Orange Line.



Brisbane South Easy Busway.

2.3 Station

A station (Figure 3) is a substantial facility that can include many of the following attributes: shelter, level boarding, opportunity for advance fare collection, a unique name, a distinctive look and feel, passenger information, lighting and security, seating and other features typically associated with rapid or rail transit stations.

The advantages of stations for BRT are that they are attractive, convey permanence and can provide more substantial passenger amenities than those found in enhanced stops. They also offer higher capacity than simple or enhanced stops and are easy for passengers to identify and locate in a street environment. In addition, they may have enhanced security features.

These features maximize the BRT system image and reinforce the feeling of a rapid transit or “rail-like” system. Well-designed stations can be a major element in reinforcing a system’s brand. They can serve as gateways for the community and can encourage TOD. Stations also may be designed for future conversion to rail stations.

APTA BTS-BRT-RP-002-10

BUS RAPID TRANSIT STATIONS AND STOPS

- **Station and stop types**

- Basic stop.
- Enhanced stop.
- Station.



APTA BTS-BRT-RP-002-10

BUS RAPID TRANSIT STATIONS AND STOPS

- **Station and stop types**

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- Enhanced stop
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APTA BTS-BRT-RP-002-10

BUS RAPID TRANSIT STATIONS AND STOPS

- **Station and stop types**

- Basic stop.
- Enhanced stop
- Station.



APTA BTS-BRT-RP-002-10

BUS RAPID TRANSIT STATIONS AND STOPS

■ Station and stop types

- Basic stop.
- Enhanced stop
- Station
- Transit center.



VIVA Richmond Hill Transit Center (York Line).



MetroLink Portland Hills Transit Center (Halifax).

2.4 Transit center

A transit center ([Figure 4](#)) is a station located on or off a transit line that enables passengers to transfer to another transit line or service, generally without leaving the physical boundaries of the station. It also may function as an end-of-line facility for some routes.

Transit centers can increase convenience for transferring riders, allow for creation of a fare-paid zone that further eases transfers, and maximize the interface of BRT and local services. They also may provide a greater opportunity for commercial and food services and for TOD. Agencies should be aware that transit centers typically require much more space and a greater capital investment.

Transit centers are recommended where the BRT alignment interfaces with other modes and/or other transit services. In many cases, existing transit centers have been converted to support BRT.

APTA BTS-BRT-RP-002-10

BUS RAPID TRANSIT STATIONS AND STOPS

- Station and stop types

- Basic stop.

- Enhanced stop

- Station

- Transit center.



PLANIFICACIÓN Y DISEÑO DE SISTEMAS BRT

The 2003 TCRP Transit Capacity and Quality of Service Manual developed the following chart (Figure 14), which graphically depicts levels of service (LOS) regarding passenger circulation and estimates the area required for each level of service.

FIGURE 14

Level of Service Areas



LEVEL OF SERVICE A

Standing and free circulation through the queuing area possible without disturbing others within the queue.



LEVEL OF SERVICE B

Standing and partially restricted circulation to avoid disturbing others within the queue is possible.



LEVEL OF SERVICE C

Standing and restricted circulation through the queuing area by disturbing others is possible; this density is within the range of personal comfort.



LEVEL OF SERVICE D

Standing without touching is impossible; circulation is severely restricted within the queue and forward movement is only possible as a group; long-term waiting at this density is discomforting.



LEVEL OF SERVICE E

Standing in physical contact with others is unavoidable; circulation within the queue is not possible; queuing at this density can only be sustained for a short period without serious discomfort.



LEVEL OF SERVICE F

Virtually all persons within the queue are standing in direct physical contact with others; this density is extremely discomforting; no movement is possible within the queue; the potential for pushing and panic exists.

LOS	Average Pedestrian Area		Average Inter-Person Spacing	
	(ft ² /p)	(m ² /p)	(ft)	(m)
A	≥ 13	≥ 1.2	≥ 4.0	≥ 1.2
B	10-13	0.9-1.2	3.5-4.0	1.1-1.2
C	7-10	0.7-0.9	3.0-3.5	0.9-1.1
D	3-7	0.3-0.7	2.0-3.0	0.6-0.9
E	2-3	0.2-0.3	<2.0	<0.6
F	< 2	< 0.2	Variable	Variable

PLANIFICACIÓN Y DISEÑO DE SISTEMAS BRT



PLANIFICACIÓN Y DISEÑO DE SISTEMAS BRT

▪ Branding

FIGURE 17
Branding



A dual-purpose logo (Eu-



A distinctive name (Cleveland HealthLine).

gene).



Standardized colors and logos (York Region, Ontario).



Distinctive color palette and name (Los Angeles).



Passenger information on station marker (Kansas City).

6. Branding

Branding (Figure 17) gives a service or product a distinct identity that results in clear and positive public recognition of the service. BRT stations are a key element in reinforcing the brand of the service and should be highly identifiable as a major component of the BRT identity. As the gateway into the BRT service, strong

PLANIFICACIÓN Y DISEÑO DE SISTEMAS BRT

- **Branding**



PLANIFICACIÓN Y DISEÑO DE SISTEMAS BRT

- Branding



PLANIFICACIÓN Y DISEÑO DE SISTEMAS BRT

- Branding



PLANIFICACIÓN Y DISEÑO DE SISTEMAS BRT

- **Level of Service**

Experiencia de Diseño en Canada

vivaNext BRT ,
York Region, Ontario, Canada

Calgary North & South Crosstown BRT's
Calgary, Alberta, Canada

vivaNext Cornell Bus Terminal
Markham, Ontario, Canada

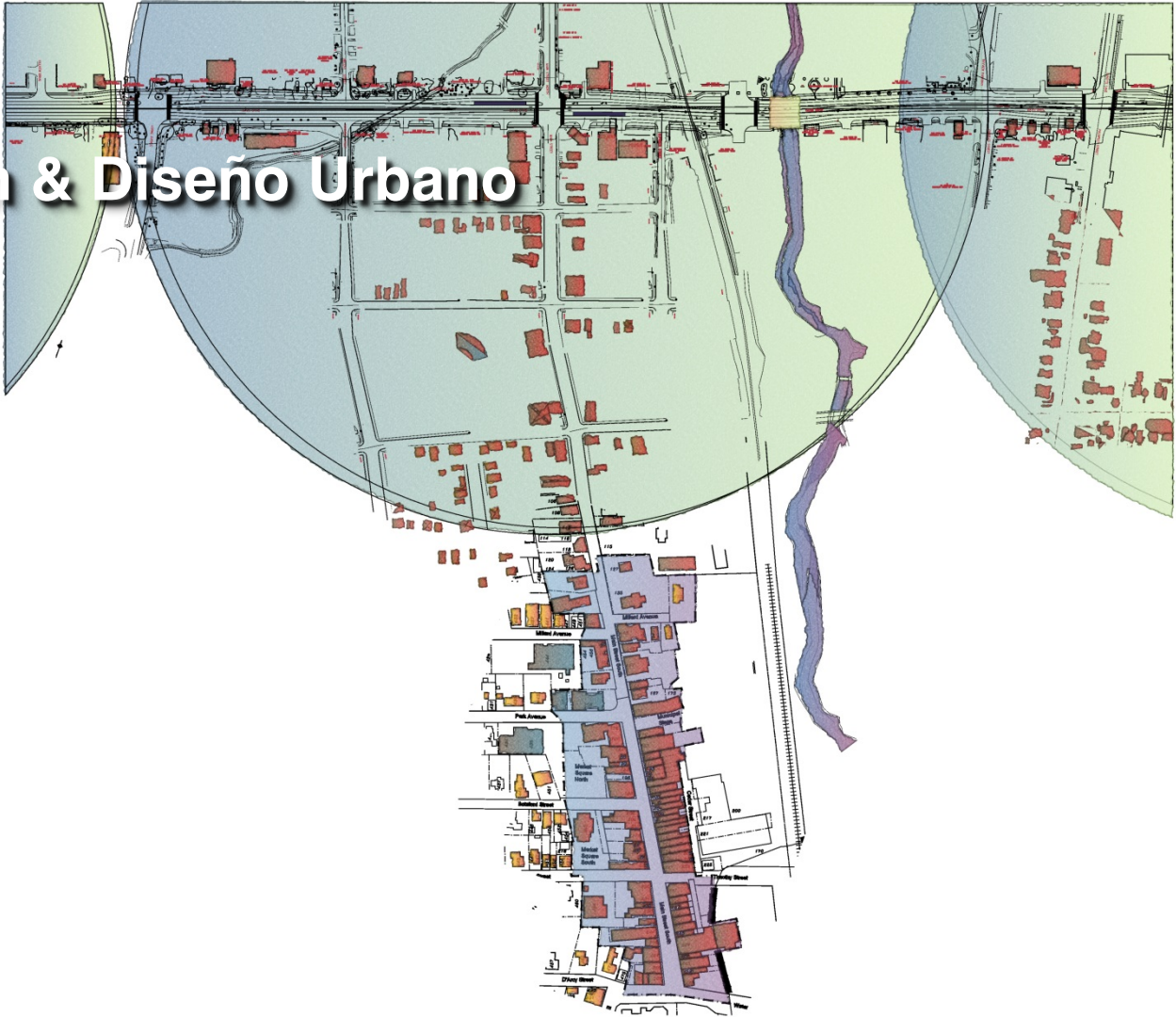
vivaNext BRT, York Region, Ontario, Canada

vivaNext BRT, York Region, Ontario, Canada



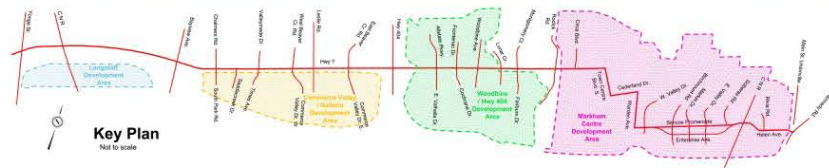
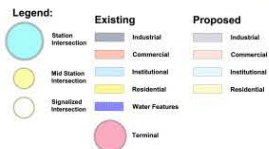
vivaNext BRT

Planificación & Diseño Urbano



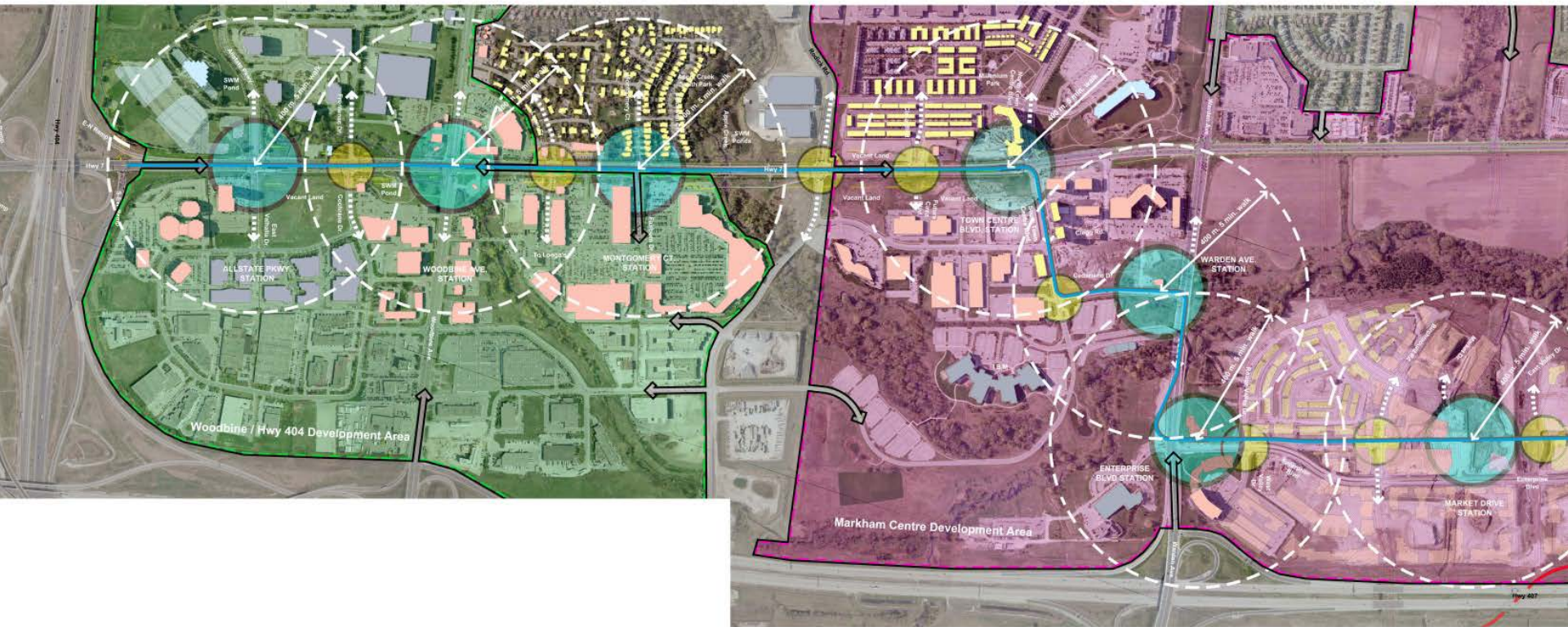
vivaNext BRT

Planificación & Diseño Urbano



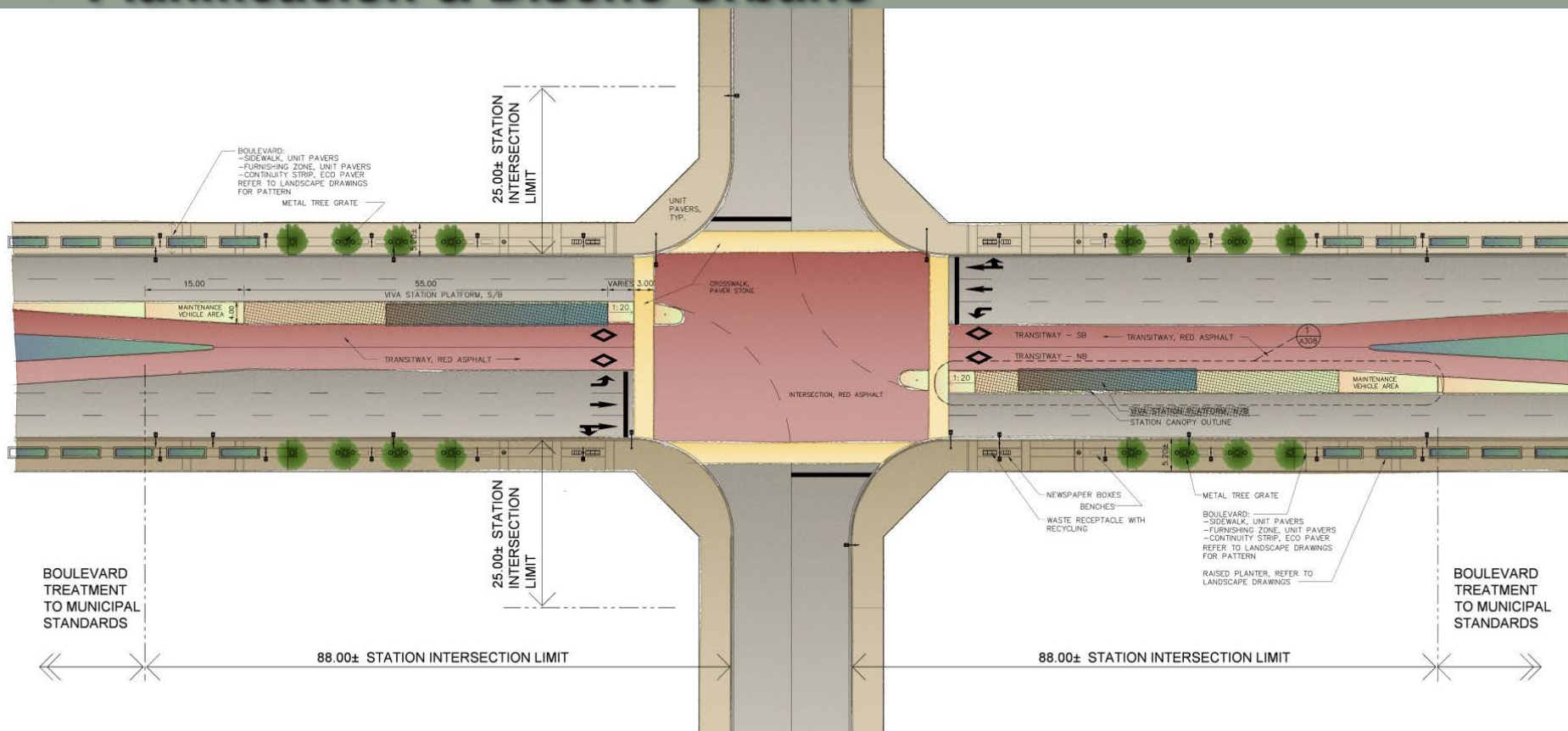
vivaNext BRT

▪ Planificación & Diseño Urbano



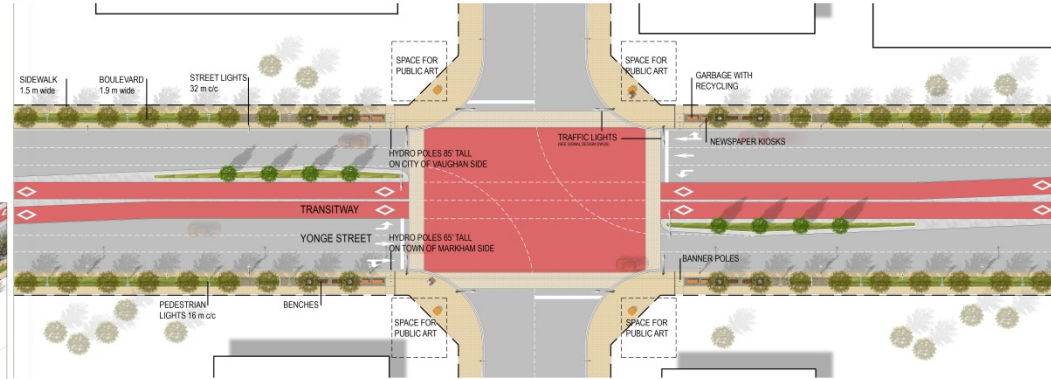
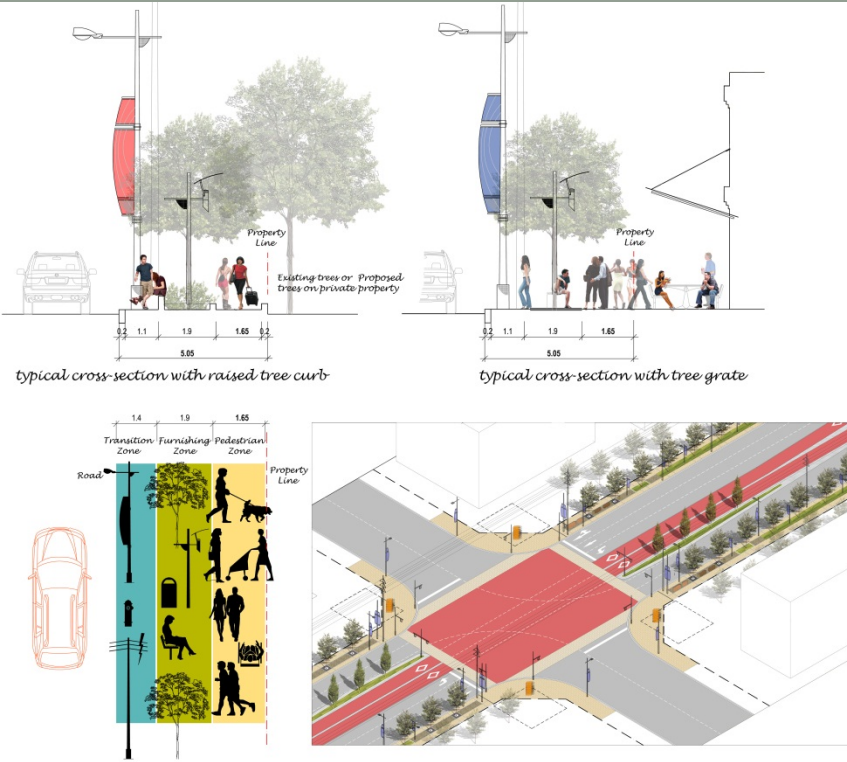
vivaNext BRT

• Planificación & Diseño Urbano



vivaNext BRT

Planificación & Diseño Urbano



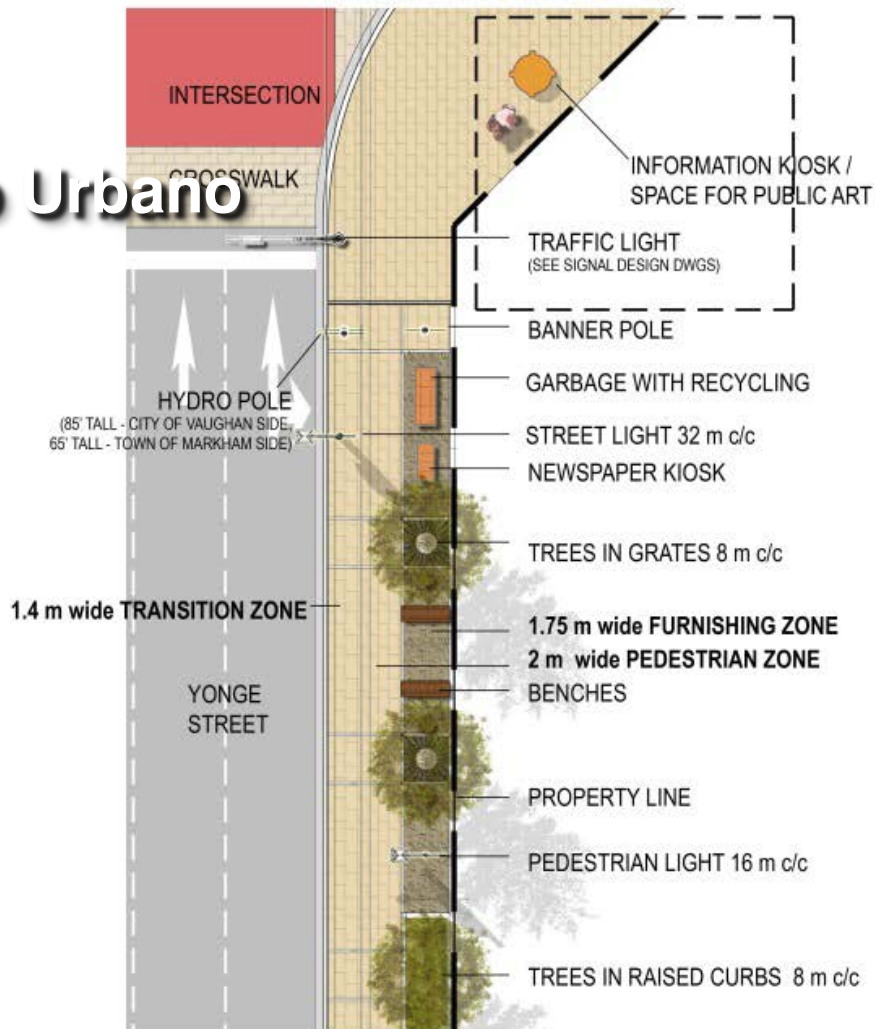
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Planificación & Diseño Urbano



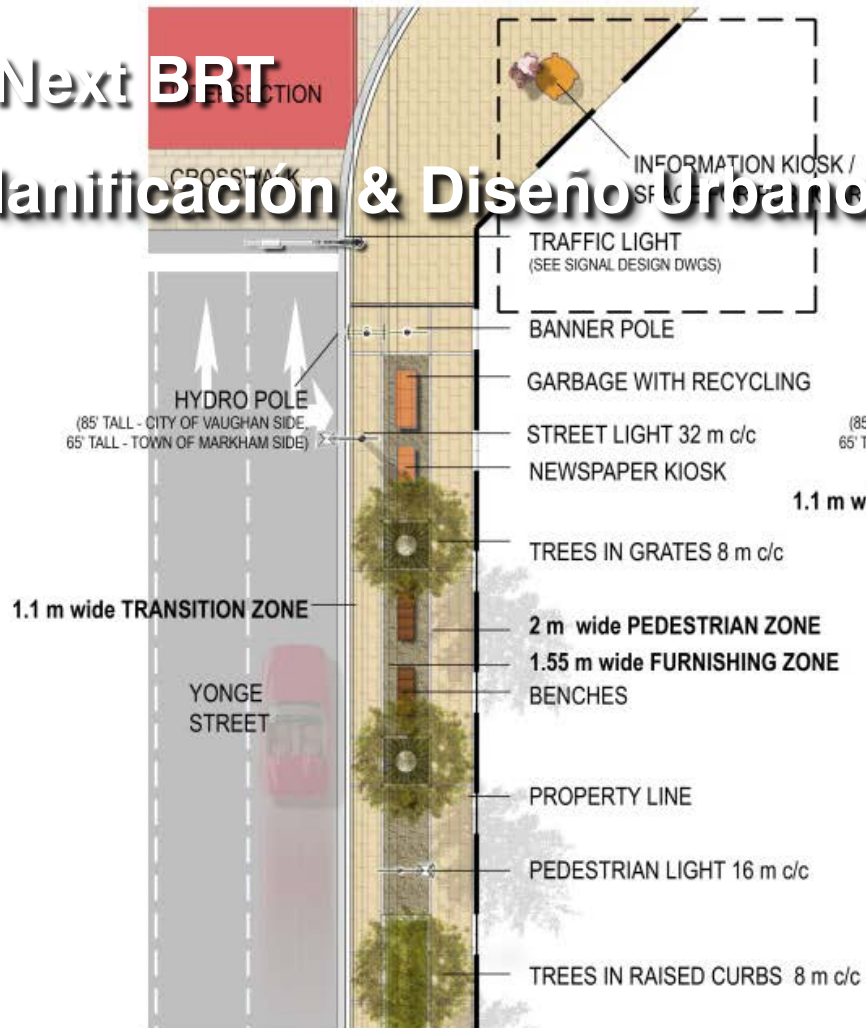
typical sidewalk with trees along the property line

Option A

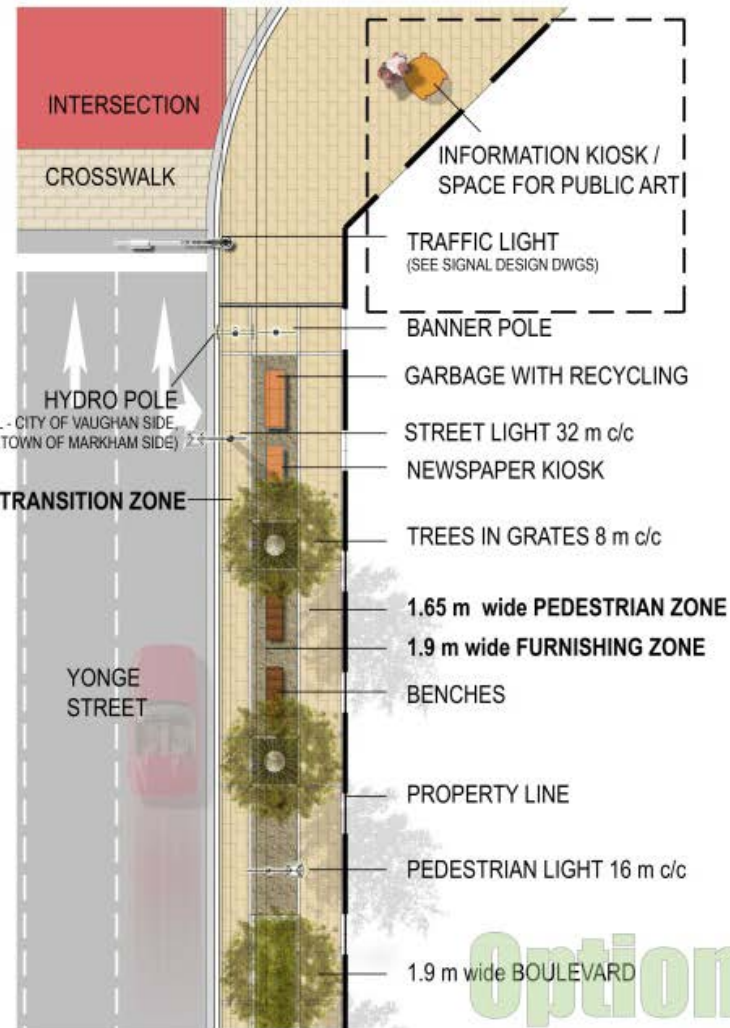


sidewalk at typical Viva-station intersection

Planificación & Diseño Urbano



sidewalk at typical Viva-station intersection

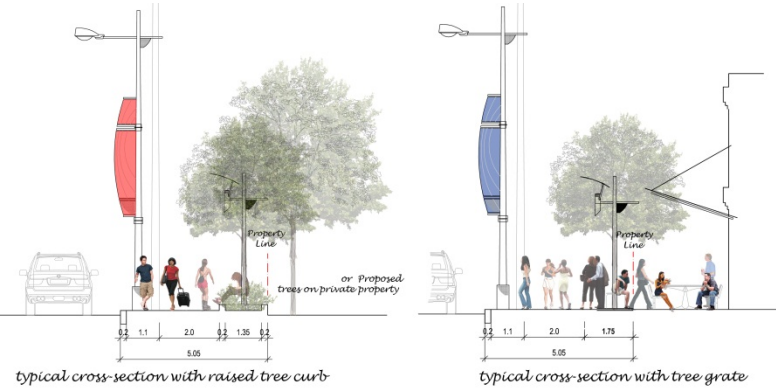


sidewalk at typical mid-block and tertiary intersection

Option B

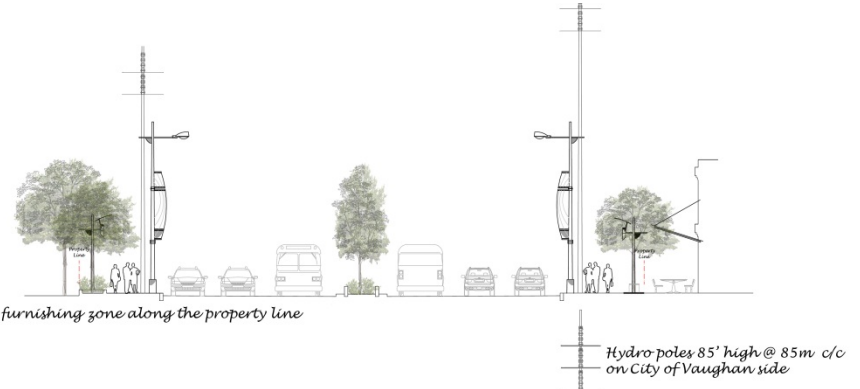
vivaNext BRT

Planificación & Diseño Urbano



Option A

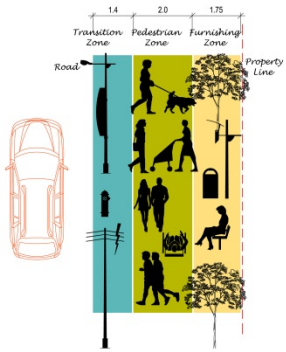
typical cross-section with furnishing zone along the property line



Hydro poles 65' high on Town of Markham side

Option B

typical cross-section with furnishing zone between vehicles and the pedestrian zone



vivaNext BRT

garden street

Planificación & Diseño Urbano



naked street : shared space



San Jose, California



vivaNext BRT

Planificación & Diseño Urbano



vivaNext BRT

Planificación & Diseño Urbano



Planificación & Diseño Urbano



"IS THAT PINKO? THAT EXECUTIVES REALIZE THEY'RE TAKING A MODE OF TRANSPORTATION THAT'S SUSTAINABLE?"
—MARKHAM MAYOR FRANK SCARFITT



Markham mayor Frank Scarnitti

He was not even involved in the 2006 election, says a former senior public-affairs official at the Conservative Party of Canada, who declined to be quoted. "He was just a good friend, someone you could call," says the former Conservative Party official. "He was not involved in the 2006 election." But he was not involved in the 2006 election, says a former senior public-affairs official at the Conservative Party of Canada, who declined to be quoted. "He was just a good friend, someone you could call," says the former Conservative Party official. "He was not involved in the 2006 election."

hence such acts of his mind—achievements that made him proud none of the Dallas Million there. But Ford, "We were the first municipality to participate in the president's lead-in to civil program for green energy," he says, and points out the solar panels on the roof of the building. "These were the going to open the first big solar tax incentives," he says, "and the building is the country." The proud of it.

Stapp's town about the "urban landscape" created in the Council neighborhood by American architecture expert Austin Gray, which "focuses on places for people," not for cars. "It explains that the same kind of pedestrian-friendly planning will be extended across the vast blocks around the city center, where a dense, walkable, and green downtown core will be built over the next 20 years."

And he talks, or laughs, about the "critical road" for eco-friendly transportation. "You just can't do it without

rapid transit," he says, throwing off a series of plans and hopes, attending the New York subway line 110 MacKays, regarding the GO Transit line to support more riders, introducing bus rapid transit along Highway 403. "We will almost get close to the capacity you could achieve with light rail," he says. "It also gives us a chance to introduce more use of bike and pedestrian lanes that we're putting in throughout many of the new areas—we're trying to advance that."

Sustainability? Walkability? Bike lanes? This is what the GO consultants are anti-green town conservatives? I ask if they talk about the "way on the car" in MacKays, or if anyone across the board is being a pecker.

"No," he replies. "Warthorn is a community made up of executives, and any time the GO line has been improved to downtown Toronto, it's filled, you can't get a seat, is that pink?" The executives realize that they're making a kind of *reconciliation* that's sustainable. "We've just happened a *Commune*, which is our sustainability plan. People applied on," he says. "We can't have a strong economy if we're not looking after people socially as well. People see this as creating a healthy, vibrant, prosperous community, and it *exactly* shows that you can pull off one of those scenarios without the others. They're *feeding themselves*."

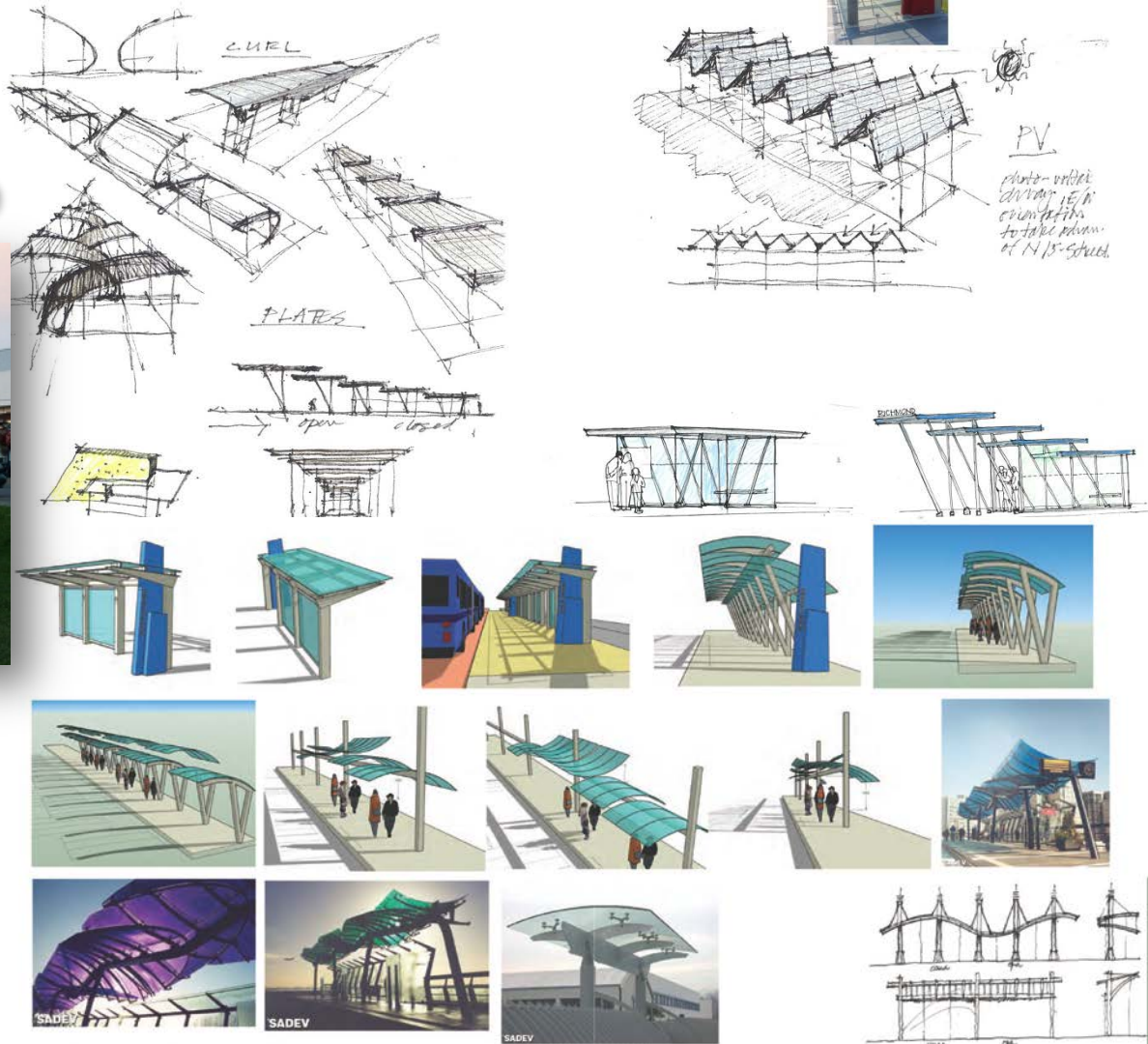
The image shows a framed display titled "Southern Energy". Inside the frame, there is a photograph of a solar panel on the left and a line graph on the right. The graph shows a peak in energy production during the day. Below the graph, there is a small table with two columns: "Time" and "Energy Production". The table has four rows of data. The text "100W Solar Photovoltaic" is visible at the bottom of the frame.

suburban car-hunter classes, English cities." Right now, the story is that Manhattan has figured it out of these things. It's not that they're better off with the city than with no urban infusions. Instead, they are closer to a trope when London or Canada's biggest cities have come to the big city and have to breathe some life into the metropolitan and not any great-grandparents built.

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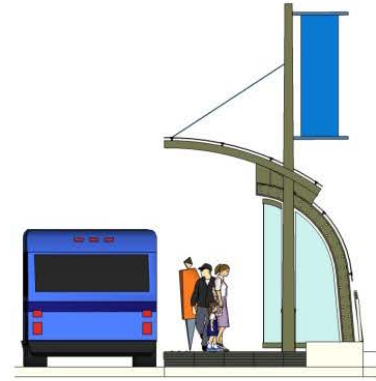
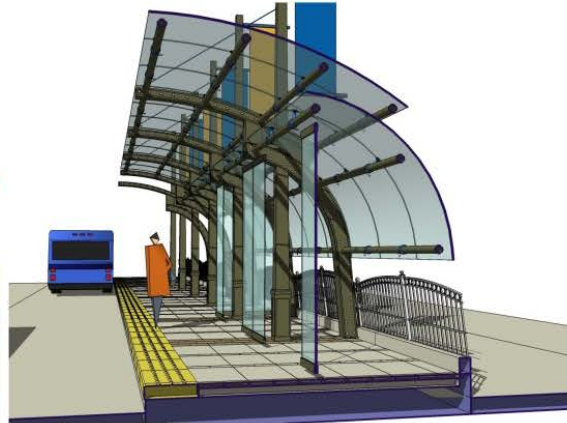
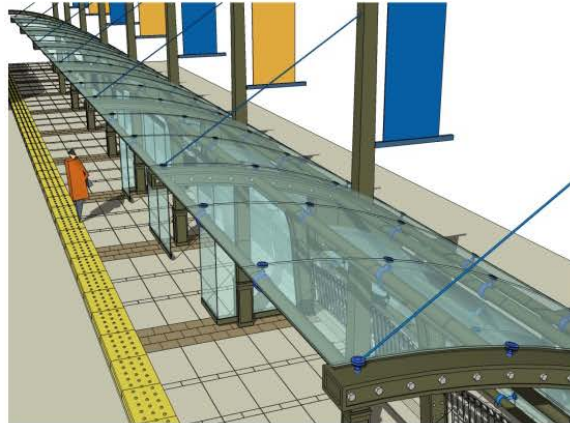
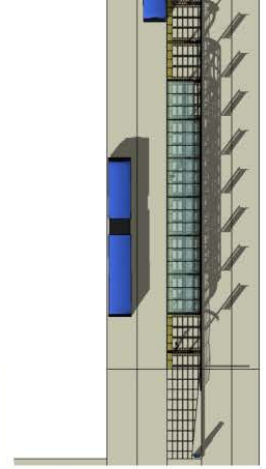
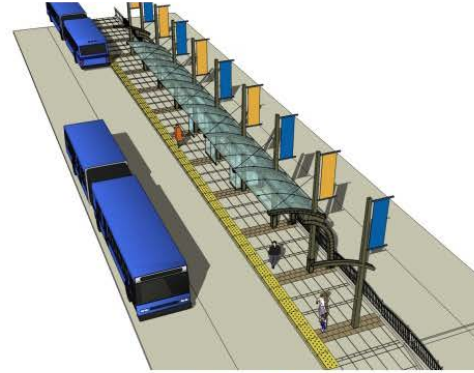
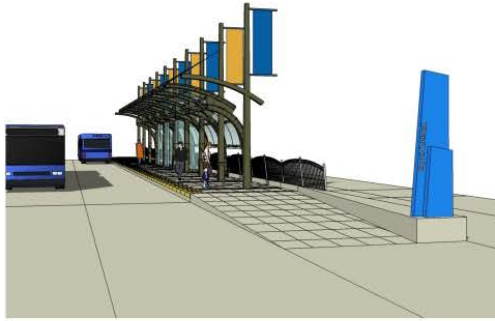
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Platform Canopy Concepts: Heritage Districts



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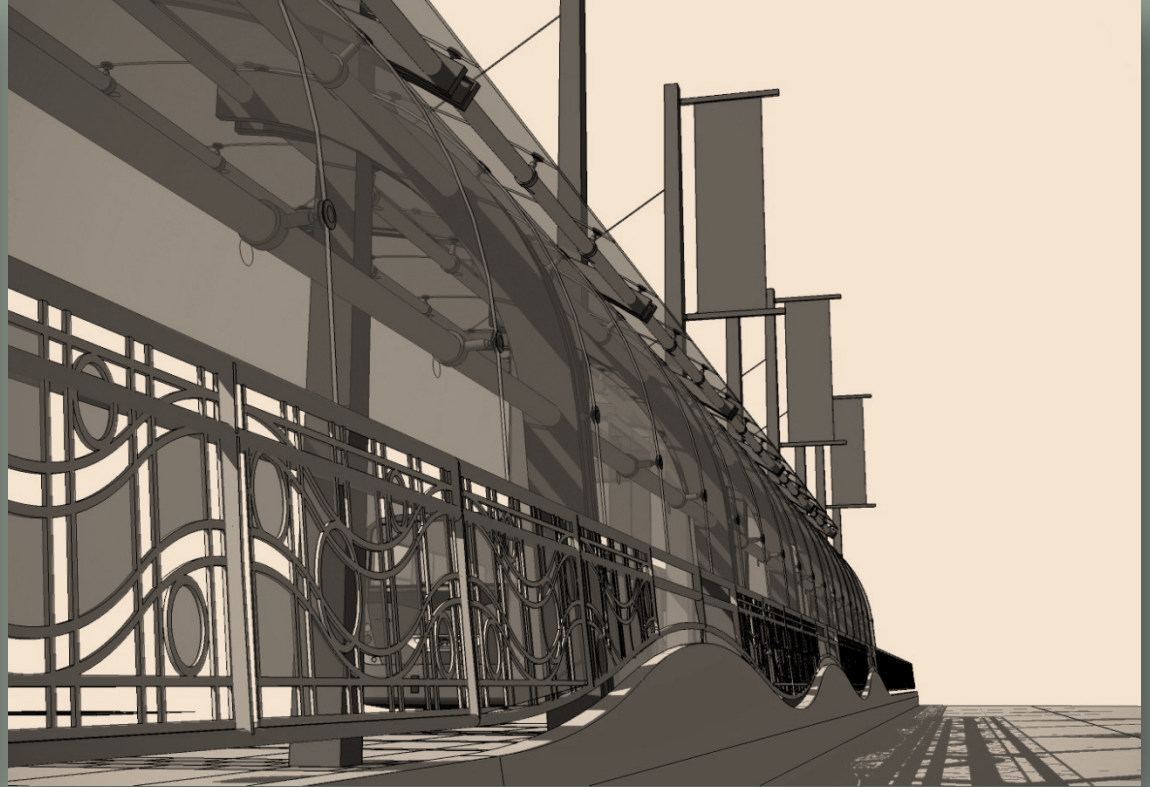
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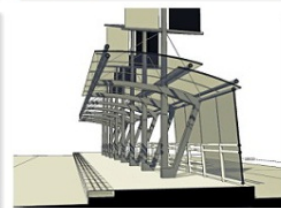
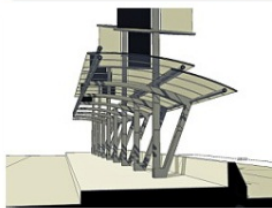
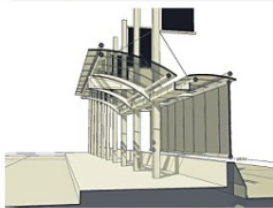
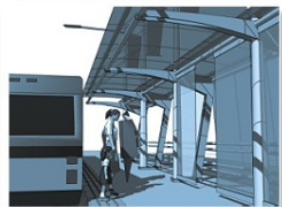
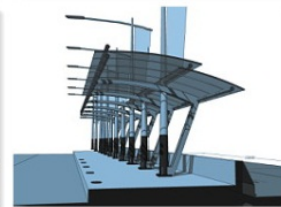
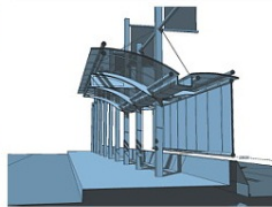
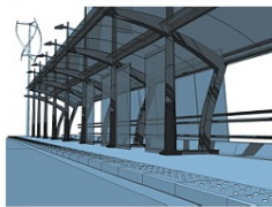
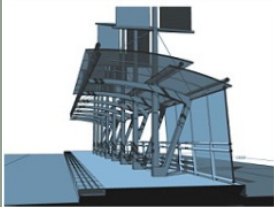
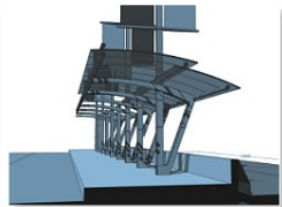
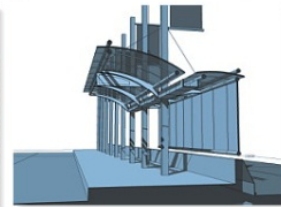
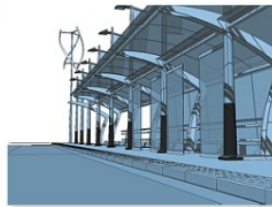
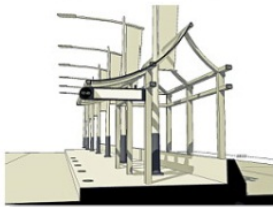
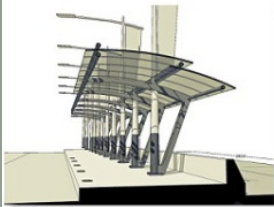
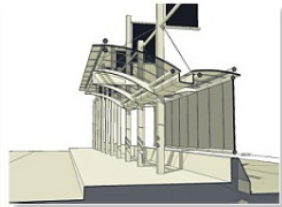
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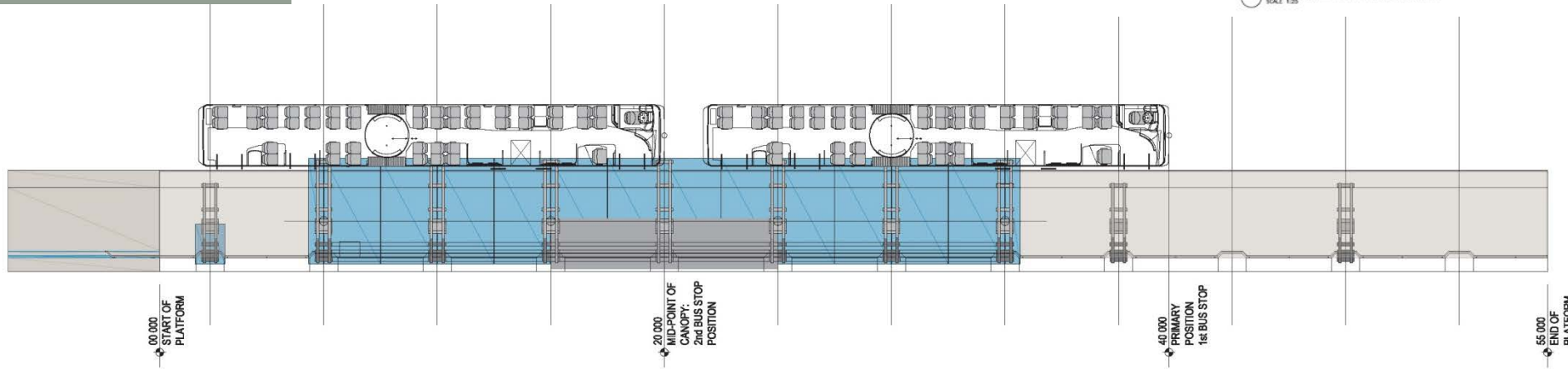
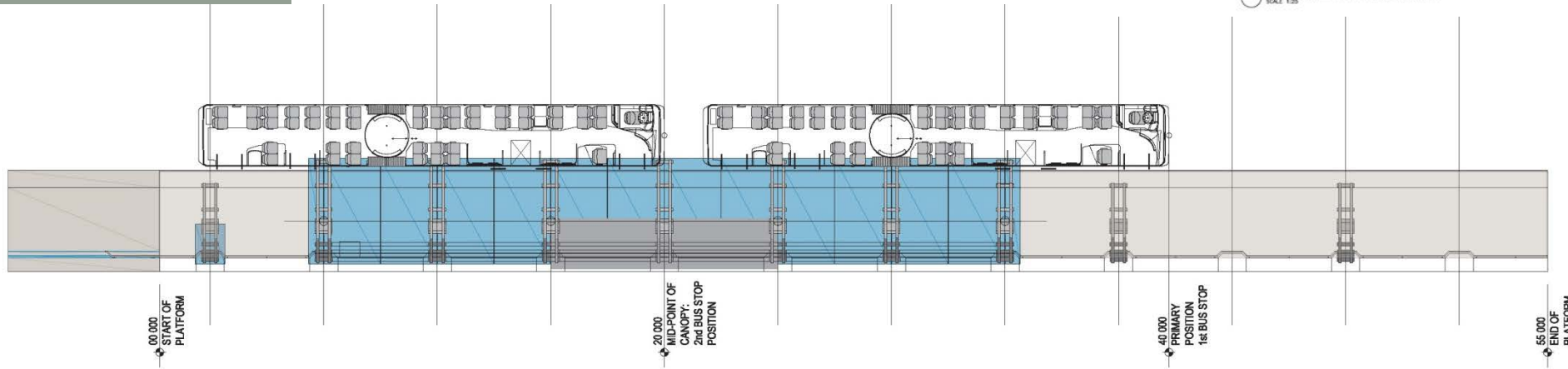


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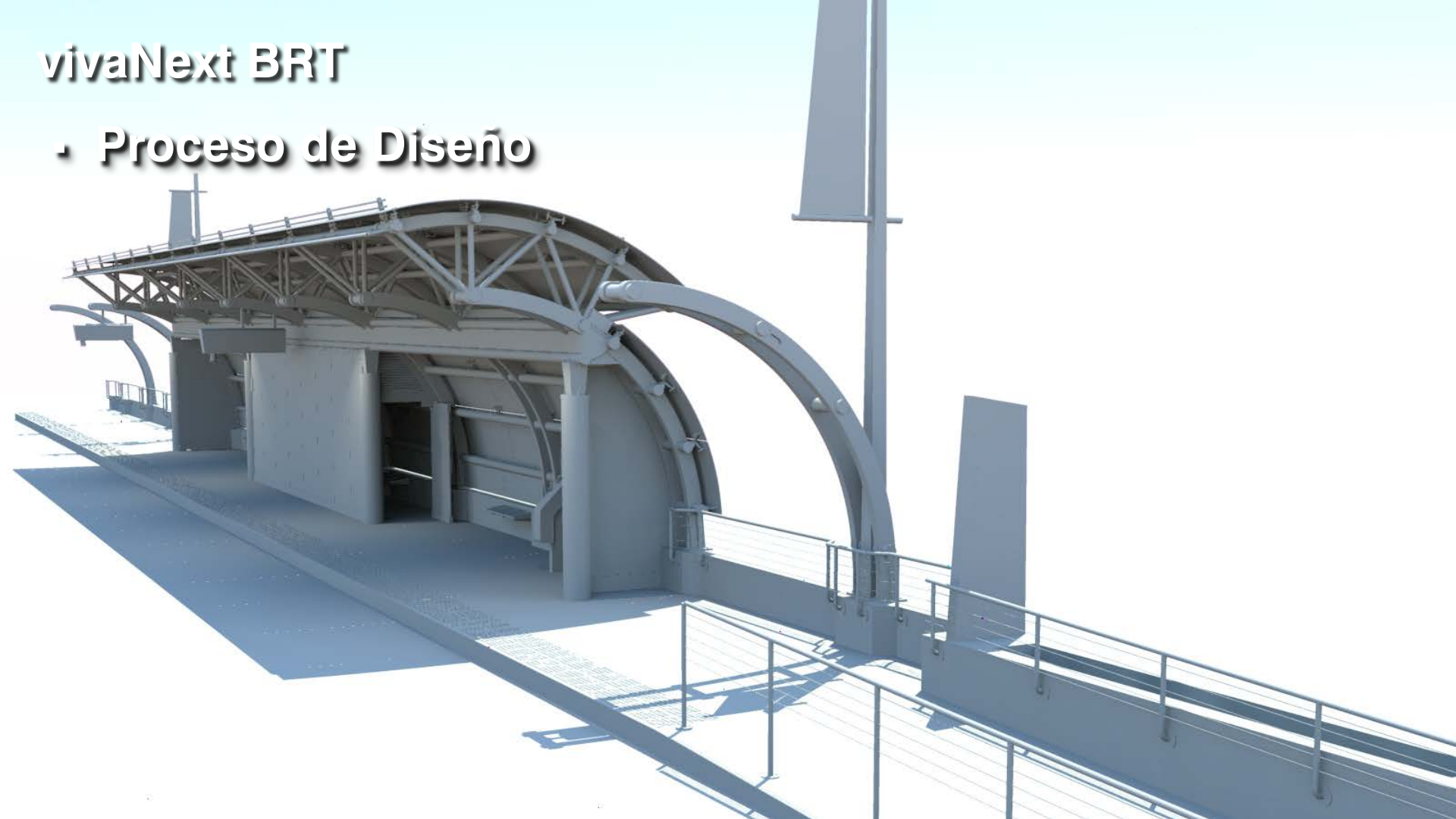


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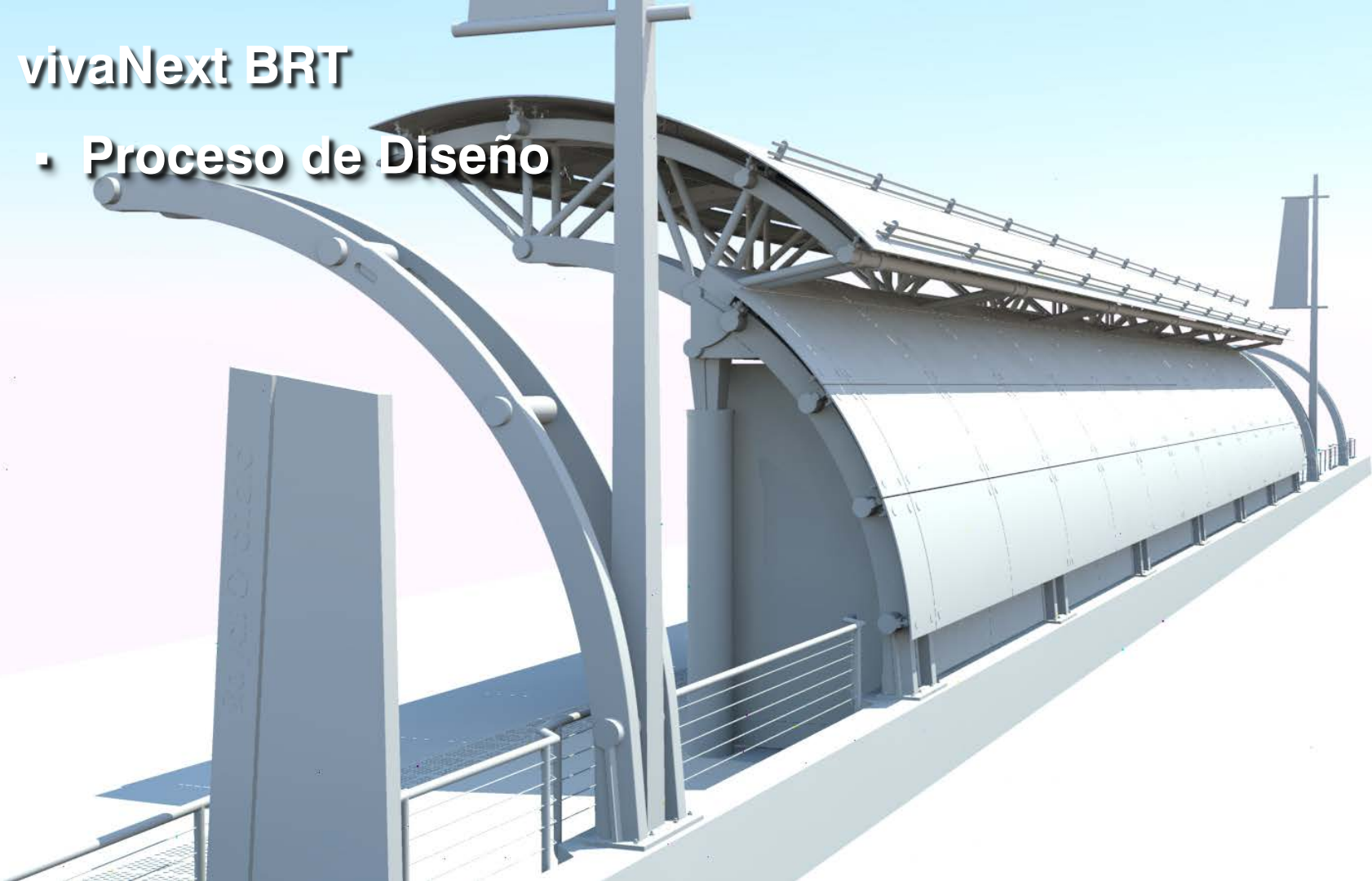
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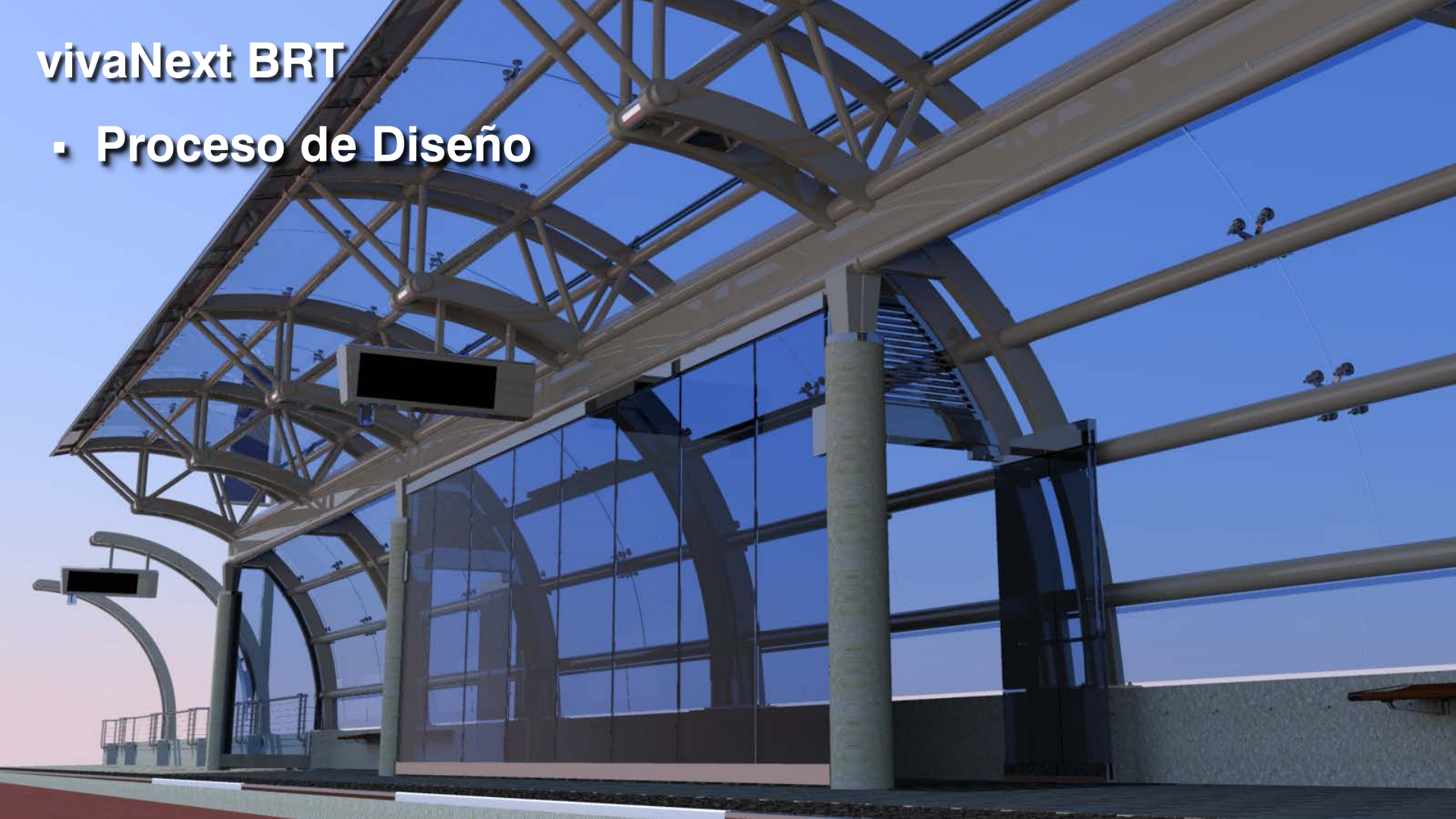
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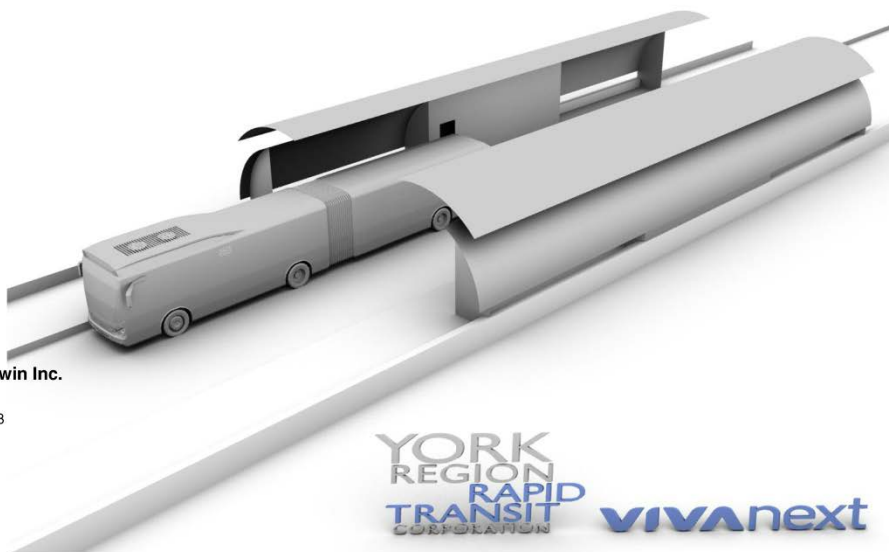
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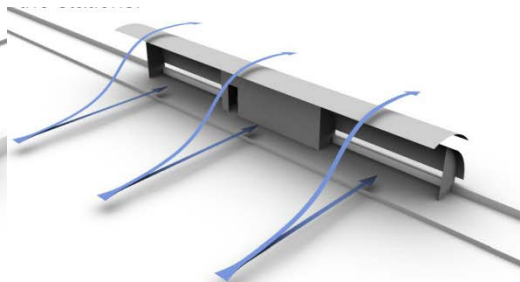
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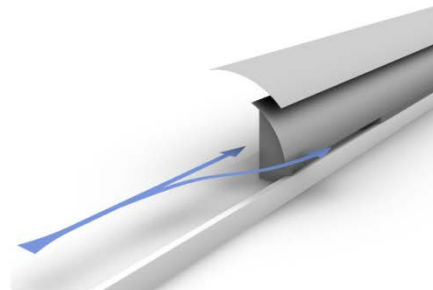
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Generalized Wind Flow Patterns at the Stations



Yonge Street – westerly winds flowing over and around northbound station.



Highway 7 – easterly winds flow around station.

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Scenario 3 – Back Winds

(Wind blowing perpendicular to the back wall, e.g., easterly winds on the north-bound shelters along Yonge Street and southerly winds on the east-bound shelters along Highway 7)

With winds flowing perpendicular to the back wall of the shelters, passengers inside the bus shelter are exposed to rain droplets mainly flowing through the 0.38m high opening under the back wall into shelter. The RRI in these areas are expected to range from 80% to 120%. Other areas under the shelter will be protected.

Rain infiltration into the shelter through the back wall occurs close to the platform level, and is considered to be a minimal concern to passenger comfort. These conditions will improve once the lower openings within the back wall are closed off.

The lower image in Figure 7a shows that the RRI on the road behind the shelter will be in the range of 200%. This is, however, not of concern as pedestrians are not expected in these areas.

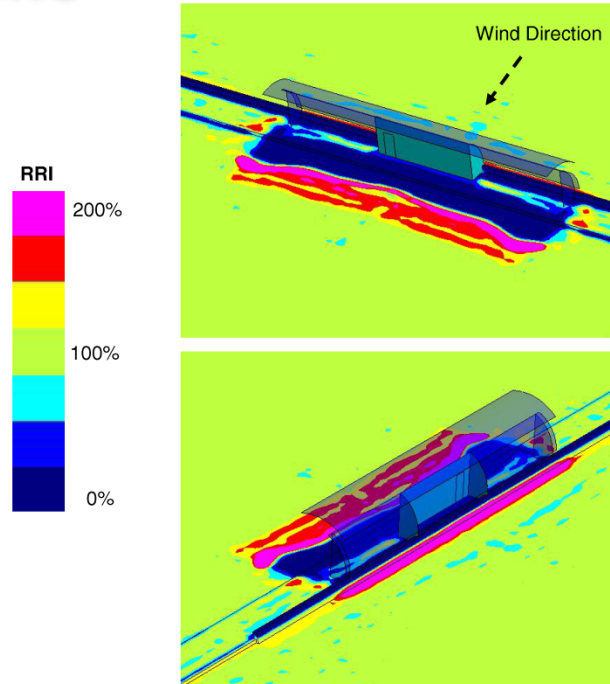


Figure 7a – Relative Rain Intensity – Winds Perpendicular to Back Wall ($V_{10} = 25$ km/h)

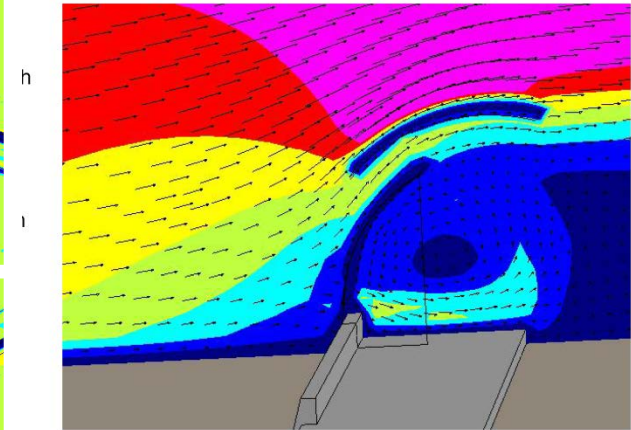
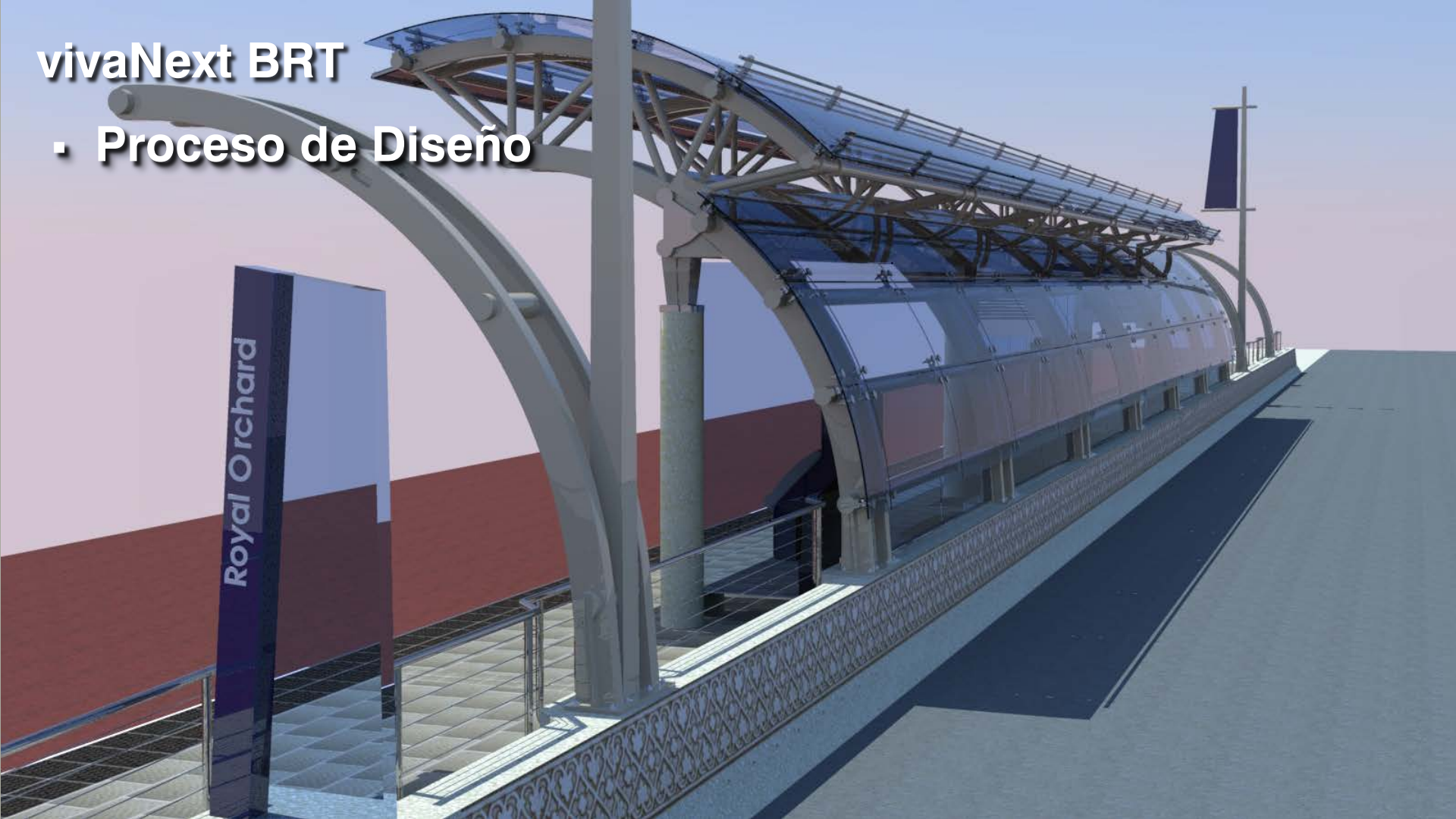


Figure 7b – Vertical Velocity Profile – Winds Perpendicular to Back Wall

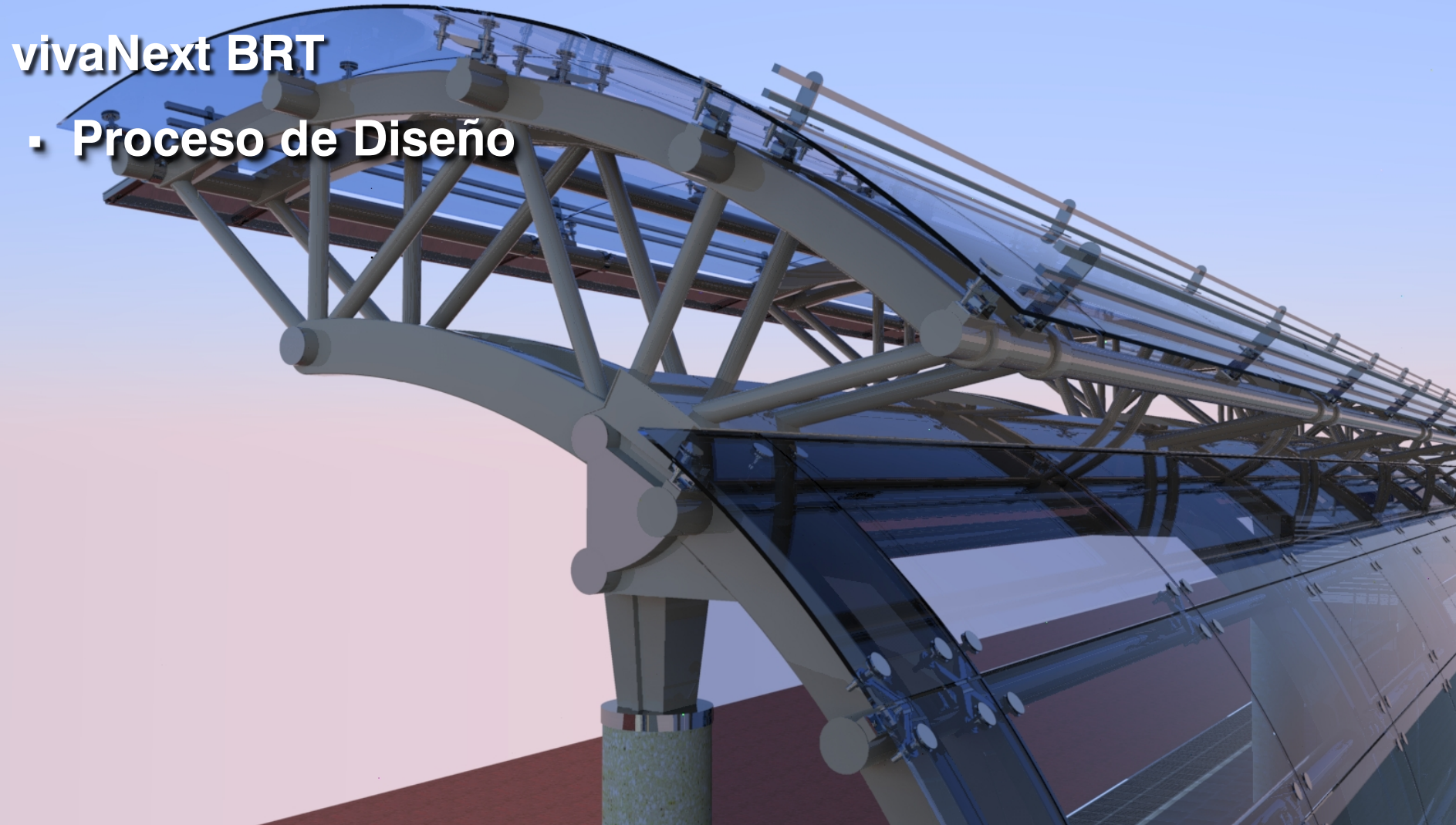
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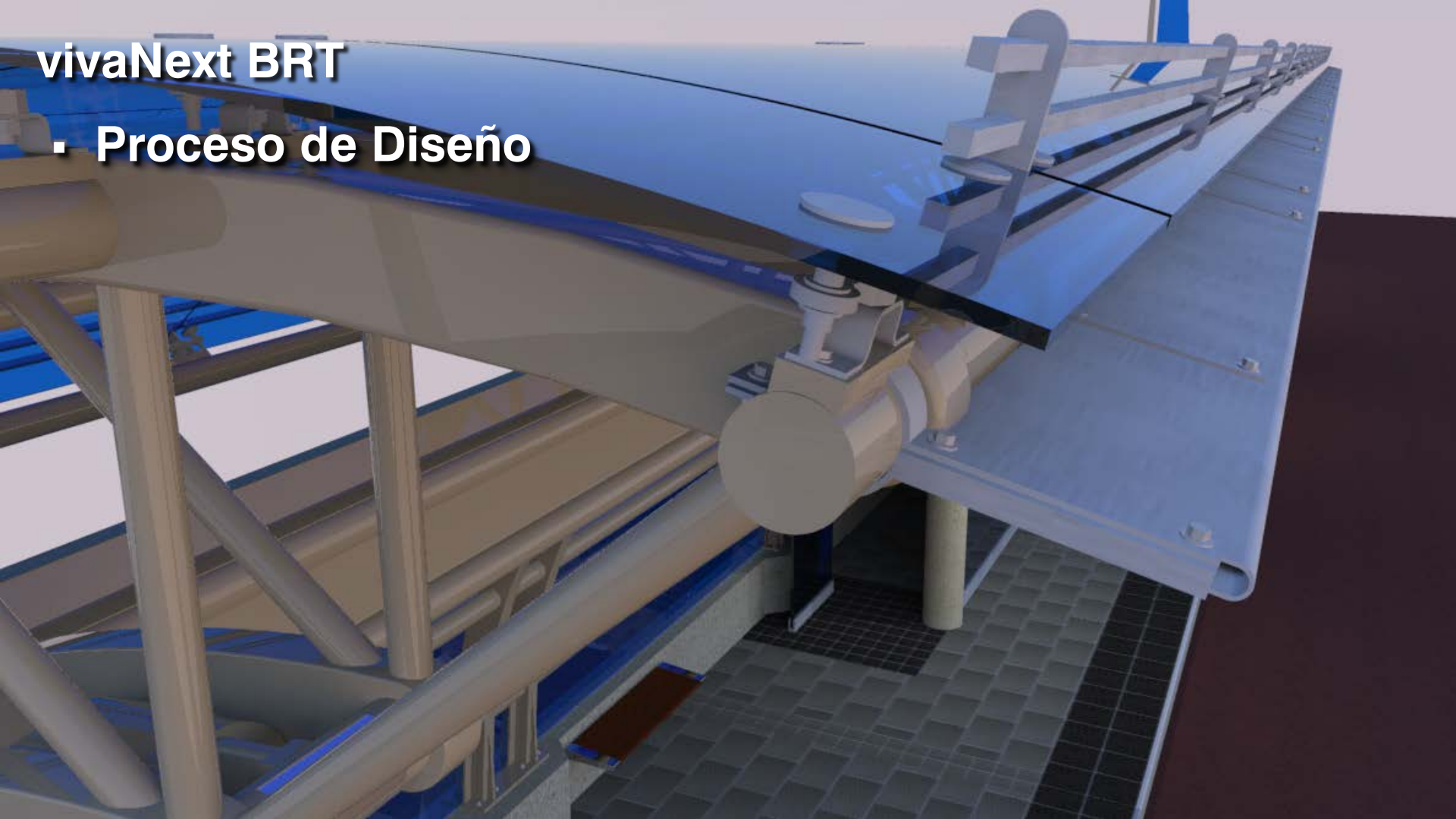
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APLICACIONES EXITOSAS DE BRT

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Calgary North & South Crosstown BRTs, Calgary, Alberta, Canada

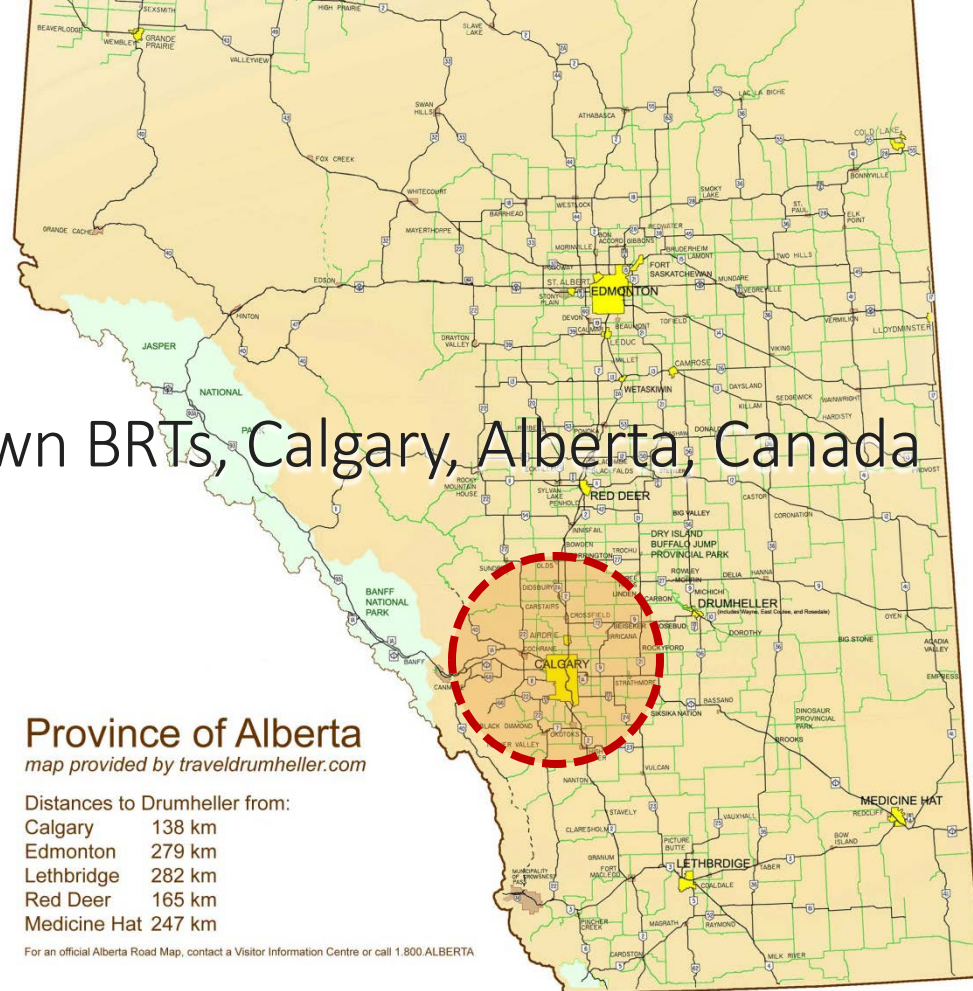
Province of Alberta

map provided by traveldrumheller.com

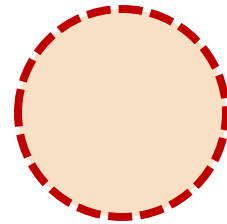
Distances to Drumheller from:

Calgary	138 km
Edmonton	279 km
Lethbridge	282 km
Red Deer	165 km
Medicine Hat	247 km

For an official Alberta Road Map, contact a Visitor Information Centre or call 1.800.ALBERTA



Calgary North & South Crosstown BRTs, Calgary, Alberta, Canada



Calgary North & South Crosstown BRTs

- **Planificación y Diseño**

The North Crosstown route is perhaps one of the most important transit routes in Calgary's primary transit network.

It creates a strong east-west access corridor across the north side of the city, providing essential links between the Northwest, North Central and Northeast LRT lines across the city.

Calgary North & South Crosstown BRTs

▪ Planificación y Diseño

Station and Support Facility
Design Guidelines User Guide

Station and Support Facility Design Guidelines User Guide

A Supplement to the Regional Transitway Guidelines

Metropolitan Council

February 2012

This document supplements the Station and Support Facility Design discussion in the Regional Transitway Guidelines by providing additional information for topics discussed in the Guidelines.

Calgary North & South Crosstown BRIS

■ Planificación y Diseño

Property Acquisition and Remnant
Parcel Reuse or Resale

Context Sensitive Solutions and
Transit Oriented Development

1.1. Transit LRT Fire Life Safety Code

- All local jurisdictional standards and requirements
- [2030 Transportation Policy Plan, Appendix G Transit Standards](#)
- [Metropolitan Council 2030 Park-and-ride Plan](#)

Local jurisdictions may also have zoning and ordinance requirements, design guidance and/or local policies relevant to integrating municipal facilities when transit runningways traverse or cross city streets, sidewalks, and bikeways. Current municipal guidance includes:

- *St. Paul Central Corridor Bicycle and Pedestrian Plan* (<http://stpaul.gov/index.asp>)
- *Access Minneapolis, Street and Sidewalk Design Guidelines* (<http://www.ci.minneapolis.mn.us/publicworks/trans-plan/DesignGuidelines.asp>)
- *Minneapolis Downtown Action Plan*
- *Minneapolis Pedestrian Master Plan*
- *Minneapolis Bicycle Master Plan and Bicycle Design Guidelines*

The section on transit facilities in the *Access Minneapolis, Design Guidelines for Streets and Sidewalks, Pedestrian Facility Design, October 26, 2009* provides a good example of local guidance.

1.2. Property Acquisition and Remnant Parcel Reuse or Resale

Where it is determined that property should be acquired for a transitway station or support facilities, and that such acquisition is feasible and cost-effective, such acquisition should follow all applicable local, state, and federal regulations, including NEPA requirements for environmental clearance before property acquisition.

Where remnant parcels are indicated as unneeded, transfer of ownership should also follow local, state, and federal regulations and procedures. The owning entity should consult with local jurisdictions prior to initiating a transfer of ownership as local considerations for connections to the adjacent community and support for transit oriented development may affect the disposition of remnant parcels.

1.3. Context Sensitive Solutions and Transit-Oriented Development

As stated in Guideline 4.1 Guiding Principles, stations and support facilities should be aesthetically pleasing and complement the character of their surroundings. Consistent with the new Federal emphasis on valuing communities and neighborhoods, stations and support facilities should be designed to take advantage of attractive, existing site features, and be compatible with surrounding land uses and development patterns. Where consistent with land use policies, stations can form the nucleus for transit-oriented development (TOD) which strengthens both the surrounding area and opportunities for economic development. Refer to the Metropolitan Council's Guide on Transit Oriented Development and comprehensive planning guidelines for more discussion of land uses near transitways.

Calgary North & South Crosstown

When new rail corridors and BRT services are added to the existing Twin Cities transit system, three guidelines should prevail:

- Station elements should be consistent with existing stations, updating with improvements where lessons learned from previous implementation indicates better results can be achieved in passenger information, efficient operation, life-cycle maintenance, and operational costs.
- Station area vehicle requirements should be consistent. Bus fleets from multiple operators should be able to access any bus drop off or layover facility within the regional network of transit stations. One corridor's LRVs must be able to use another regional LRT corridor's stations.
- Vehicles serving BRT corridors will be serviced and stored at bus garages serving non-BRT buses. Garage facilities may require modification to accommodate BRT vehicles, and operating procedures may require revision to ensure consistent and correct assignment of BRT vehicles.

Stations and support facilities should be upgraded with more sustainable elements as technology improvements in lighting, coatings, building materials, and construction techniques become cost-effective.

2. STATION DESIGN

Transitway stations fulfill two primary functions: they provide access to the transitway and transit information to customers. To fulfill these functions, transitway planners and designers should carefully consider each station including facilities provided, facility sizing, components and transitway information included, and materials used. Planners and designers should ensure each station fits with and enhances the neighborhood surrounding it in terms of both function and aesthetics.

2.1. Station Facilities

One of the primary functions of transitway stations is the provision of facilities so that transit patrons can access the transitway. All transitway stations should provide:

- Facilities that support access for customers of all ages and abilities
- Facilities that support access for pedestrians and people using wheelchairs or bicycles, including providing bicycle parking
- Station platform(s)
- Waiting shelters for all public transit routes serving the station
- Provision for short-term pick-up/drop-off of transit patrons by shuttle, taxi, etc.

Stations may also include facilities for additional functions listed below. The factors to consider in deciding which additional facilities to provide at each station, if any, are existing and future passenger demand, market needs; transit service plans (transitway and other transit services); capital, operating, and maintenance costs, available right-of-way; and consistency with surrounding development plans and land use policies.

- Transit Center (informally called a hub) - A transitway station may serve as a transit center, which is a place where two or more transit routes make scheduled connections. The center may or may not include transit layover facilities. Transit centers typically serve higher daily passenger volumes as compared to bus stops and have greater investment in the physical infrastructure and amenities.
- Transit Layover - A transitway station may serve as a location where transit vehicles, either bus or rail, layover as they wait to enter service at that location. Bus layover facilities are paved areas, sometimes with separate circulation drives, sized to accommodate the required number of vehicles needed at any one time and their turning requirements. Rail layover facilities are areas of trackage separate from platform-access trackage where trains wait to enter service at that location. Rail layover facilities may be extensions of trackage at the end of terminal stations, or siding tracks adjacent to operating tracks within the transitway.
- Park-and-Ride - A transitway station may include park-and-ride facilities, which provide for daytime (and sometimes limited overnight) parking for transit customers' automobiles and bicycles. A park-and-ride may or may not function as a transit center or include transit layover facilities.

2.1.1. Station Circulation System Hierarchy

Stations include circulation systems, which may include pedestrian, bicycle, bus, auto/taxi pick-up and drop-off, park-and-ride, and bus layover facilities. A hierarchy should be followed to give priority of access – directness of route and proximity to platforms – to transit customers in the following order:

- Pedestrians
- Bicyclists
- Feeder buses and shuttles
- Taxi and auto pick-up/drop-off
- Auto park-and-ride

2.1.2. Pedestrian and Bicycle Access

Special attention should be given to providing convenient and safe access to and through transitway stations for people walking, in wheelchairs, and on bicycles. Bicycle parking should be provided at transitway stations because on-vehicle bicycle storage is limited. Bicycle racks are preferred to lockers except when substantial space and bicycle demand exists because racks provide more storage capacity per square foot and have lower maintenance cost. Covered bike parking and security amenities (such as cameras) may be provided at transitway stations where space and station technology infrastructure are available.

Bicycle and pedestrian access paths to transitway station platforms should:

- Be visible from access drives and parking areas
- Avoid crossing or passing through runningways, vehicular access drives, and parking areas

Pedestrian and bicycle paths should be designed to provide the most direct route, paved, clearly marked, lighted, and buffered to improve bicycle and pedestrian experiences and discourage people

Calgary North & South Cross-town

Transitway stations should be designed to maximize transit patron-friendliness within the development. At transitway stations not incorporated into a transit oriented development the maximum walking distance from parking or drop off space to the nearest platform access point should be 1,000 feet (*source: CCLRT Design Criteria*).

At-grade station access paths, including track and roadway crossings, should be used where feasible and should include improvements. Improved bicycle and pedestrian facilities include features such as more visible crossings using pavement treatments, colors, or markings, pedestrian refuge medians, roadway curb extensions, intersection countdown timers, or crosswalks with passive crossing control. Mid-block crossings between stations and street intersections should be avoided. The Central Corridor LRT figure below illustrates a pedestrian crossing at a non-signalized intersection on University Avenue. For stations in the median of a roadway, access to platforms should be clearly marked and managed with traffic signals at roadway intersections, signage and railing or fencing to discourage patrons from crossing elsewhere. For all types of stations, grade separated bicycle/pedestrian crossings may be considered per the guidance in Section 2.9.



Source: CCLRT Project Office

Roadway modifications that improve bicycle/pedestrian experiences should also be considered and implemented when feasible. Roadway modifications include features such as adjusted intersection traffic signal timings to accommodate bicycles/pedestrians, additional traffic signals, elimination of conflicting turn movements such as free-right turn movements, and intersection modifications to provide more convenient and safe bicycle and/or pedestrian crossings.

2.1.3. Passenger Waiting Area with Weather Shelter

Together with platforms, passenger waiting areas function as primary features of a transitway station. All transitway stations should provide one or more weather shelters for waiting passengers. Shelters and canopies should be constructed to ADA standards and provide protection for passengers from snow, rain, wind, and sun. Shelters are generally free-standing structures, but may be incorporated into other buildings.

Shelter design should consider passenger safety, passenger comfort, functional similarity, and ease of maintenance. Factors to consider in sizing shelters include average peak period passenger usage, length of average wait time, location-specific conditions such as wind, and optimized sight lines. Shelters may be enclosed (provision of enclosure is discussed in Section 2.2), or may consist of overhead canopy alone, overhead canopy with transparent windscreens, or structures with both roof and transparent walls to permit easy surveillance.

Shelters should be designed to maximize the benefit of overhead radiant heat, where heat is provided. Shelters should not impede passenger circulation and ease of movement to platforms.

At transfer points, sheltered waiting areas should be provided for all connecting transit passengers at the location(s) of the connections. Both the local street level and the transitway platform level should be considered equally important when designing two-level stations. As an example, the Franklin LRT station positively integrates the street-level bus stop/waiting area with the LRT station entrance. Waiting areas along local streets for connecting buses should also be designed with clear visibility and sight lines.

2.1.4. Transitway Boarding Areas – Platforms

All transitway stations should include platforms constructed to ADA standards or better that allow passengers to board and alight from transitway vehicles. Platforms may be an existing sidewalk/boulevard like existing local bus stops, or they may be newly constructed facilities dedicated exclusively to transitway service. Due to high costs, grade separated stations should be avoided wherever a feasible at-grade alternative exists.




Center platforms are preferred for LRT and Highway BRT in freeway medians; side platforms for Commuter Rail and Highway BRT inline or offline stations. Both center and side platform access should be provided at each end of each platform. Side platforms may also be accessed along their lengths. Offset (also called split-side) platforms are acceptable in limited rights of way and to accommodate left-turns at roadway intersections. Elevated, open cut or tunnel platforms may be accessed at the ends or by elevators and stairs or escalators within the platform area.

Stations within roadways may be placed near-side or far-side of intersections. Far-side placement typically positions the station for optimal integration with traffic signal priority systems.

Runningway crossings should be at least 30 feet from the end of rail station platforms. Clearance area for BRT stations may be shorter.

Table 2-1 illustrates station platforms may be configured as center, side, or split platforms to fit within the station area context. The solid blocks represent the platform and the lines illustrate runningway, which could be rails or a road.

Calgary North & South Crossstown

Platform Configuration Type	Center	Side	Split
Illustration			
Local Examples (in 2011)	<ul style="list-style-type: none"> Downtown Minneapolis LRT stations Orange Line (I-35W) 46th Street Station I-394 Louisiana Avenue and Plymouth Road Transit Centers 	<ul style="list-style-type: none"> Northstar Elk River, Anoka, and Coon Rapids stations Blue Line (Hiawatha) 46th Street and 50th Street/Minnehaha Park stations Red Line (Cedar Avenue) Apple Valley Transit Station 	<ul style="list-style-type: none"> Blue Line (Hiawatha) American Boulevard Station Green Line (Central Corridor) Snelling Avenue Station (under construction)
Number of Platforms	One	Two	Two
Platform Position Relative to Transitway Runningway	Middle – served by vehicles traveling in both directions	Outside – served by vehicles traveling in one direction only	Outside – served by vehicles traveling in one direction only
Platform Position Relative to Each Other	Not Applicable	Directly Opposite	Offset Opposite

2.1.5. Short-term Transit Patron Pick-up/Drop-off

Transit patron drop-off and pick-up activities (“kiss-and-ride”) should be expected at all stations and should be considered in the design process. As short-term pick-up activity tends to involve longer wait times than drop-off, off-street areas for pick-up should be provided where needed. Where both bus connections and pick-up/drop-off functions are provided, closest proximity to the platforms should be designed and designated for bus patrons.

2.1.6. Transit Center

Transit patrons may transfer to the transitway from local bus routes at some stations. Depending on the scale of the station and the number of feeder buses connecting at the station, bus drop off areas may be located on adjacent streets or facilitated by surface parking along the runningway. Where both bus connections and pick-up/drop-off functions are provided, closest proximity to the platforms should be designed and designated for bus patrons.

2.1.7. Transit Layover

When a transitway station is also the terminus of a transitway or a feeder bus route, off-street bus layover areas should be provided that include bus access drives and layover area with adequate turnaround space. Bus layover facilities should be provided off-street whenever possible and paved with asphalt or concrete.

Rail layover space may be provided through tail track, station platform space (with track crossovers as needed), or other means.

Bus layover facilities should be positioned so as to not impede passenger functions at a station, including access to station platforms.

Depending on transit service plans, station gates may provide layover parking for buses, provided they do not impede revenue service.

Transit operator restrooms should be provided for at stations which function as layover facilities and at terminal stations. Where provided, such facilities should be as described in the *CCLRT Design Criteria* (available from Metro Transit on request). Public restroom facilities are addressed in Section 2.5.6.

2.1.8. Park-and-Ride

Where transitway market analysis demonstrates a need and local policy permits, parking areas for patrons may be provided adjacent to stations. Park-and-ride facilities may be surface lots or multilevel structures. Surface lots are generally preferred for cost reasons, but the type, size, and footprint of the parking facility should be evaluated to achieve the best balance between available space, cost, and funding.

In general, the amount of parking provided at stations is inverse to the density of surrounding land uses; i.e., less parking is provided at stations with higher surrounding populations and employment densities. Urban stations, such as those within the cities of Minneapolis and St. Paul, experience heavy pedestrian, bicycle, and feeder bus demand; park-and-ride facilities do not generally fit within Minneapolis or St. Paul policies or the *2030 Park-and-Ride Plan* and thus are discouraged. Suburban stations are generally located in areas where the development pattern is more widely dispersed, with more customers arriving via auto; park-and-ride facilities are generally recommended where space and local policy permits. Stations in exurban or developing areas usually need park-and-ride facilities as the customer travelshed is generally large and connecting bus service is less available and cost effective than at suburban or urban stations.

The Metropolitan Council’s *2030 Park-and-ride Plan* identifies site selection criteria and three common types of land ownership strategies used for park-and-ride facilities: public right-of-way, joint-use opportunity, and private land. The site selection criteria fall into two groups, essential and preferred.

Essential site selection criteria for park-and-ride sites include:

- In lower-density areas with limited local transit service coverage
- On a major highway corridor to a major regional activity center
- Convenient access to the regional highway system, typically within ½-mile of the nearest interchange or intersection accessing the regional highway system.
- Convenient vehicle access into and out of the facility
- Local area factors including community or land use compatibility, environmental constraints, and economic implications.

Preferred park-and-ride site selection criteria are:

- Congested highway corridors
- Upstream of major traffic congestion

Calgary North & South Crosstown BRTs

2. STATION DESIGN

2.1. Station Facilities 2.2. Enclosures at Transitway Stations

2.3. Sizing Station Facilities

2.4. Station Materials

2.5. Station Components

2.6. Landscaping/Streetscaping

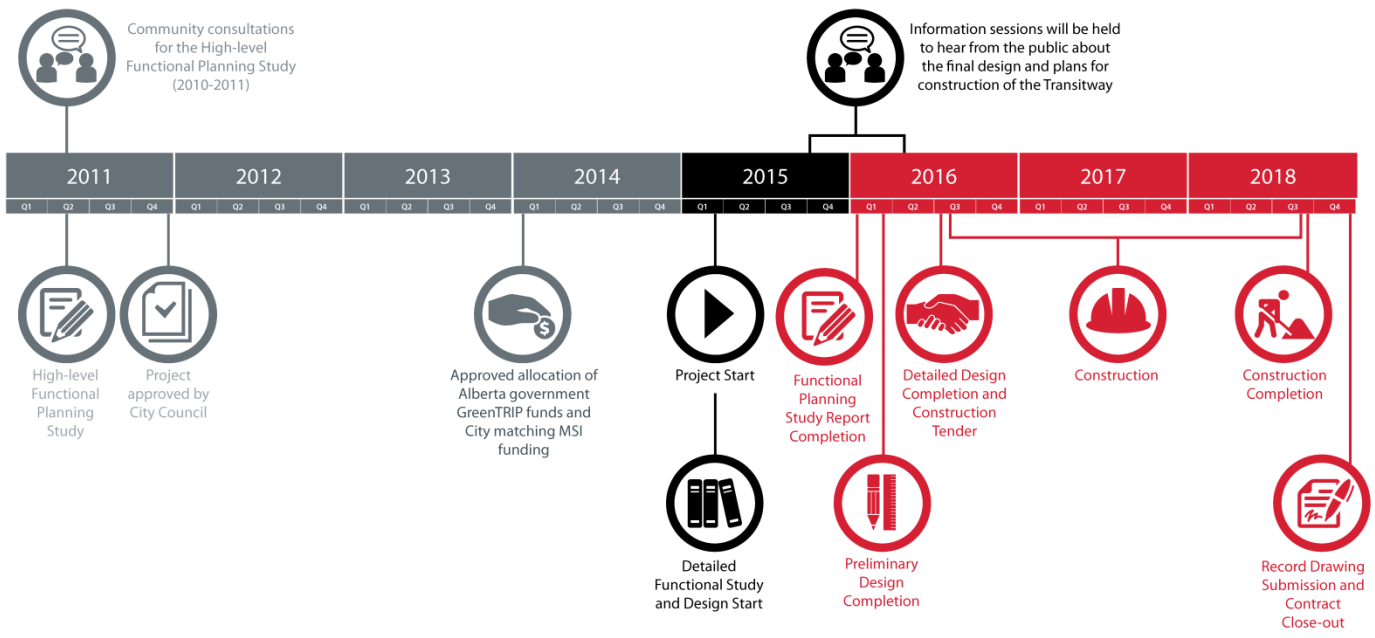
2.7. Public Art

2.8. Transitway Passenger Information

Calgary North & South Crosstown BRTs

Southwest Transitway

Project status



Calgary North & South Crosstown BRTs

Southwest Transitway

Highlights from the 2016 Functional Study

The updated 2015/2016 Functional Planning Study report for the Southwest Transitway Project is now complete. This updated study is a refinement of the original 2011 Functional Planning Study. The designs will continue to be refined through further public engagement as the Preliminary and Detailed Design are completed.

Woodbine Terminal

This aerial plan shows the proposed option for the Southwest Transitway terminal in Woodbine. Buses will use the roundabout to turn around, and there will be a bus station and small operator washroom facility. All construction will take place within the existing road right-of-way, and there are no Park and Ride facilities in this plan.



Calgary North & South Crosstown BRTs

Southwest Transitway

Highlights from the 2016 Functional Study

14 St. S.W. - proposed view



Calgary North & South Crosstown BRTs

Southwest Transitway

Option 1



Hub station



Community station



Daytime



Nighttime

Engage!

Tell us why this is your preferred option:

PLACE STICKY HERE

How could this option be improved?

PLACE STICKY HERE

Calgary North & South Crosstown BRTs

Southwest Transitway

Option 2



Hub station



Community station



Daytime



Nighttime

calgary.ca/swtransitway | contact 311

Engage!

Tell us why this is your preferred option:

PLACE STICKY HERE

How could this option be improved?

PLACE STICKY HERE

Calgary North & South Crosstown BRTs

Southwest Transitway

Option 3



Hub station



Community station



Daytime



Nighttime

Engage!

Tell us why this is your preferred option:

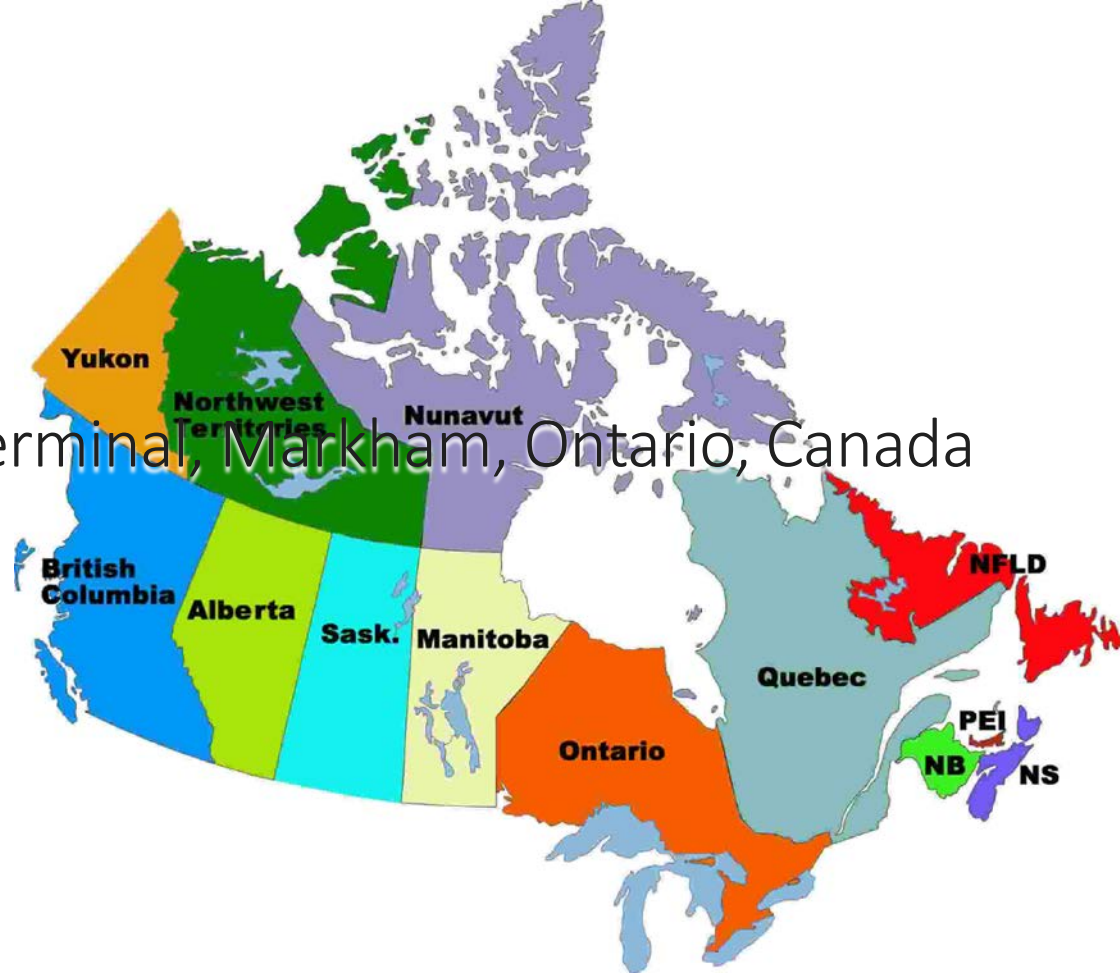
PLACE STICKY HERE

How could this option be improved?

PLACE STICKY HERE

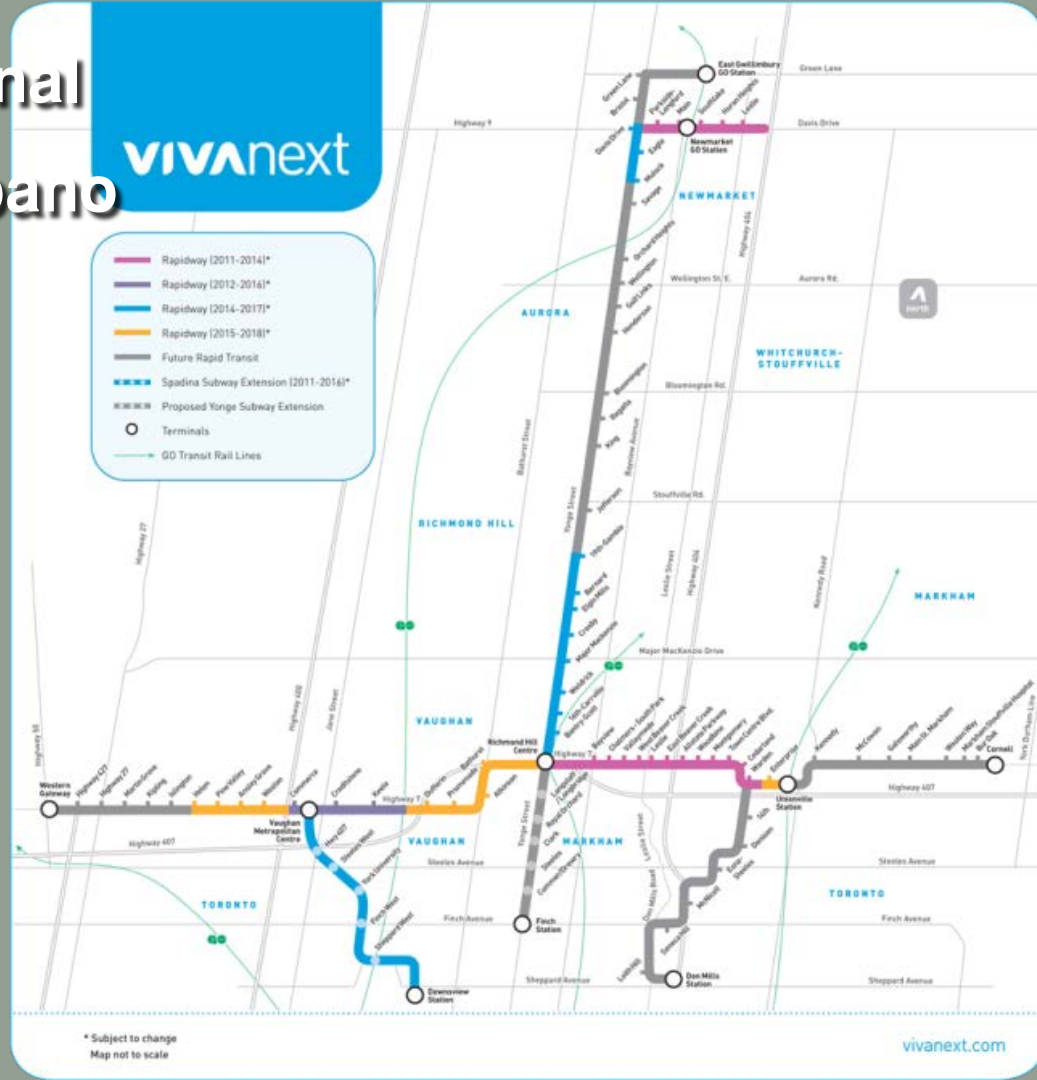
vivaNext Cornell Bus Terminal, Markham, Ontario, Canada

vivaNext Cornell Bus Terminal, Markham, Ontario, Canada



vivaNext Cornell Bus Terminal

Planificación & Diseño Urbano



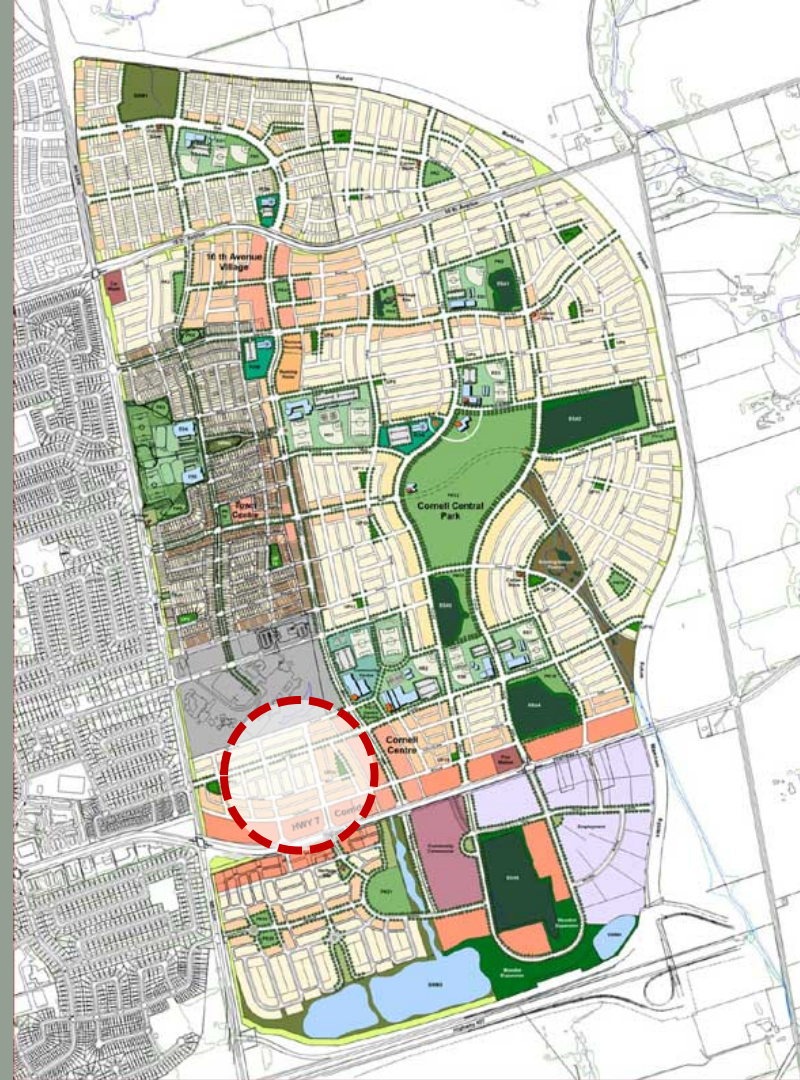
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Planificación & Diseño Urbano



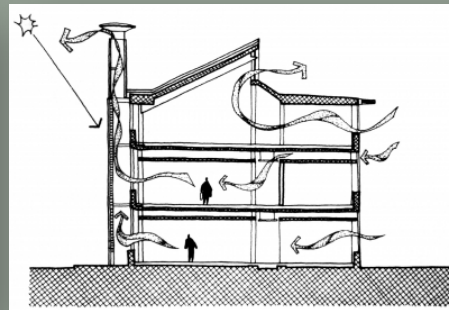
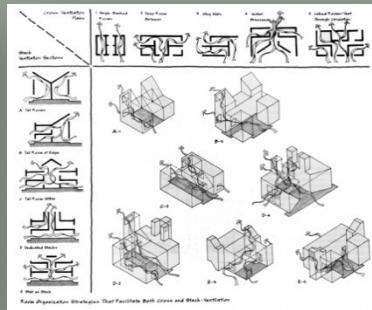
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