NACTO DESIGNING CITIES DENVER 2023

Biking in a Material World

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#NACTO2023

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Sustainability in Roadway Construction

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NACTO May 2023

Sustainable Roadway Construction Practices

Best Practices

1) Recycled Asphalt Pavement (RAP)
2) Warm Mix Technology
3) Incorporation of Recycled Waste Products (Tire + Plastic)
4) Pigmented Asphalt Pavement
5) Synthetic Asphalt Binder

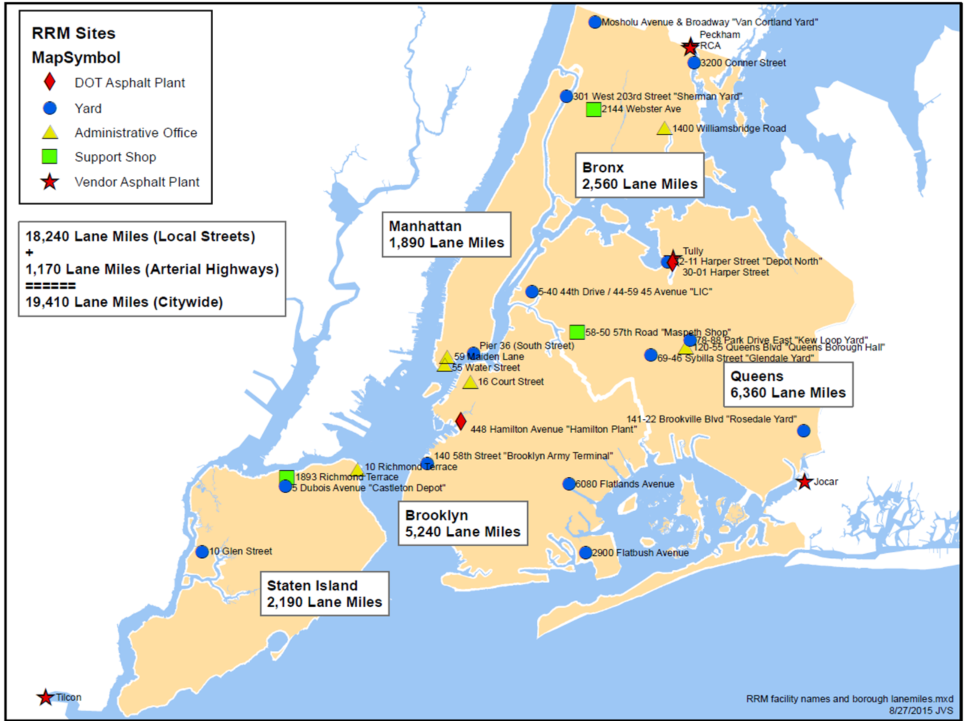
Sustainable Street Resurfacing

Recycled Asphalt

- NYCDOT is a national leader in the use of recycled asphalt pavement (RAP).
- By incorporating recycled content, the City saves on new material and the costs associated with transport and landfill fees.
- The milled material is reprocessed and reconstituted with new materials before use in subsequent paving.
- The new Harper Street Asphalt Plant will allow DOT to increase its use of RAP from 30% to 50%.
- By producing more recycled asphalt, the City will avoid two million miles of annual truck trips that are used to carry milled asphalt to landfills – reducing congestion, pollution and wear and tear on our streets.
- Reduction of approximately 13,200 to 15,400 metric tons of carbon dioxide annually

NYCDOT owens and operates two Asphalt Plants

- Hamilton Avenue
  New plant - Rebuild 2014
  Annual production of >450K tons
  45% RAP = More than 200K tons annually
- Harper Street
  - >30 years old plant
  Annual production of > 280 K tons
  30% RAP = 84K tons annually
  - Up for capital renovation in 2023
  Increase of recycling capacity to 50-55%
  Increase annual recycling to 250K tons



Warm Mix Technology

Warm Mix

- Warm mix asphalt is used during winter cold weather months.
- Lower production temperature by 50° F
- Reduction of energy amount needed for asphalt production
- Warm-mix asphalt a reliable approach to decrease carbon emissions
- Extended paving season
- It would allow for consistent use of RAP through out the year – Especially cold winter months.
- A longer paving seasons with warm mix technology means better roads, quicker response time for pothole repair.

Use of recycled waste tires in production of Rubberized mixes

Pros:
- Roadways with heavy traffic loads
- Increases the durability/longevity of the pavement.
- Reduction of traffic noise.
- Decreases the amount and severity of pothole formation during the freeze/thaw cycle.
- Environmentally responsible approach
- Approximately 2,000 used tires for every mile of asphalt road paved thereby reducing the footprint of tire disposals.

Cons:
- Cost increase associated with production and plant modification.
- Comes at the expense of using RAP

Recycled Waste Plastic Technology

Waste Plastic

- The use of plastic additives derived from plastic waste has the potential to solve our growing plastic waste problem.
- Improving the overall performance of conventional Hot Mixed Asphalt.
- Substitution for virgin polymers and liquid asphalt cement.
- Recycling plastic waste without impact to RAP usage
- Approximately 6,960 pounds of waste plastic, 92,459 of plastic bottles for lane mile of asphalt road paved thereby reducing the footprint of plastic disposals.
- Reduction of approximately 10,798 pound of Carbon dioxide (CO_2) per lane mile.

Synthetic Asphalt – Colorless Binders

Pigmented Asphalt

- Pigmented asphalt conventional AC
- Synthetic Asphalt binder from non-crude oil-based resin blend.
- Idea for Pigmented asphalt
- Possible substitution to conventional asphalt cement

Challenges:

- Sourcing
- Quality

Thank You!

Questions?

NYCDOT nyc_dot nyc_dot NYCDOT

QUICK BUILD TO PERMANENT BIKE SEPARATION, AND EVERYTHING IN BETWEEN

2023 NACTO DESIGNING CITIES (DENVER)

ERIC HU, PRINCIPAL TRANSPORTATION ENGINEER

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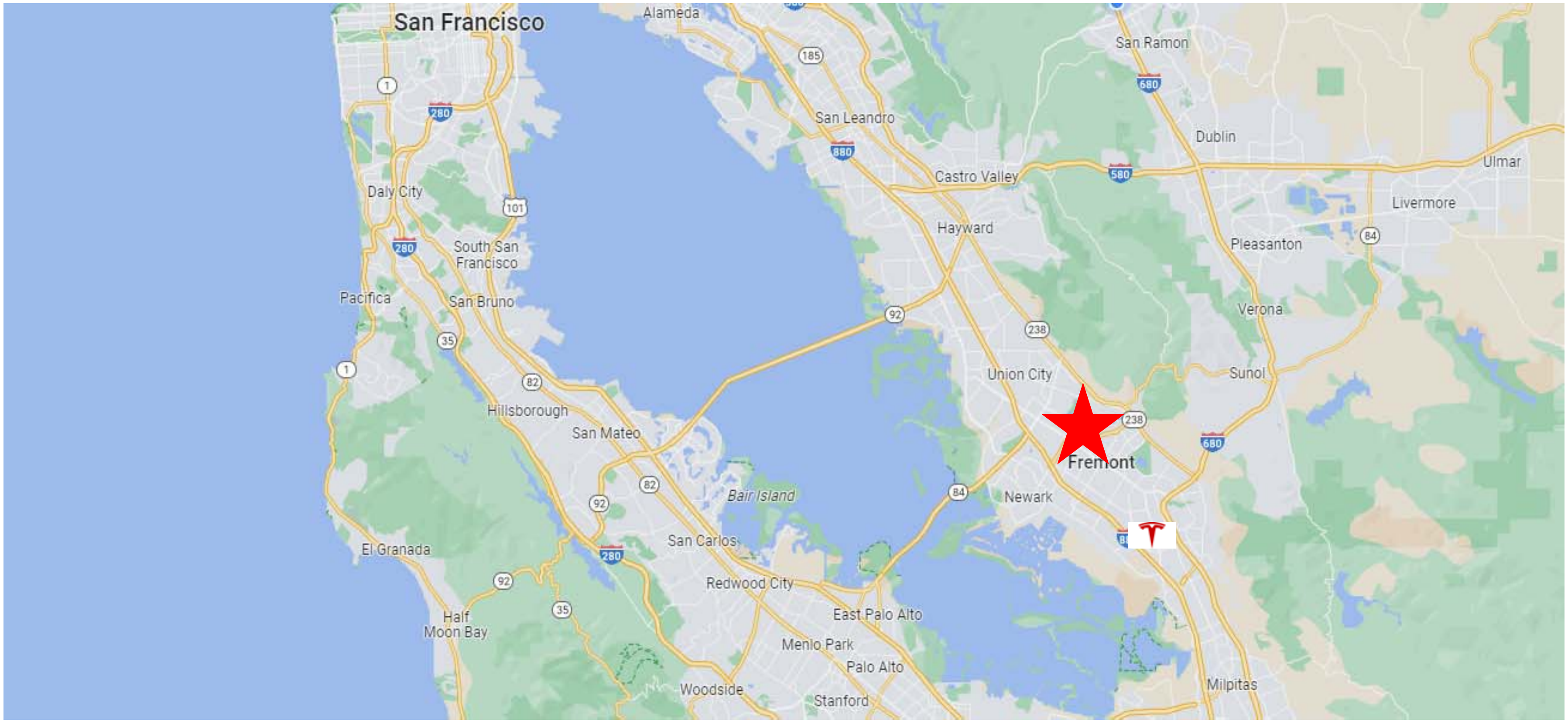
CITY OF Fremont



Where is Fremont?

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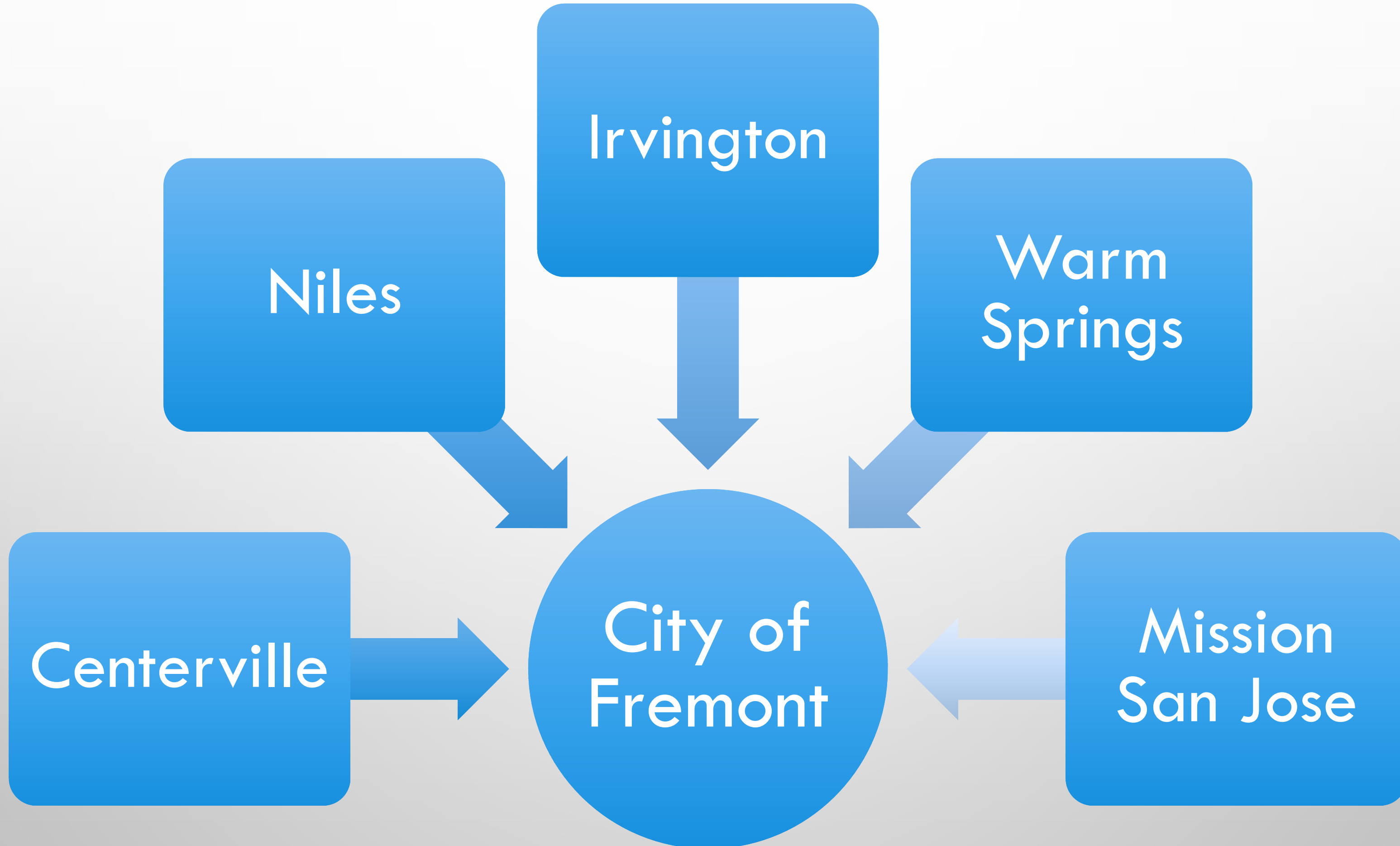
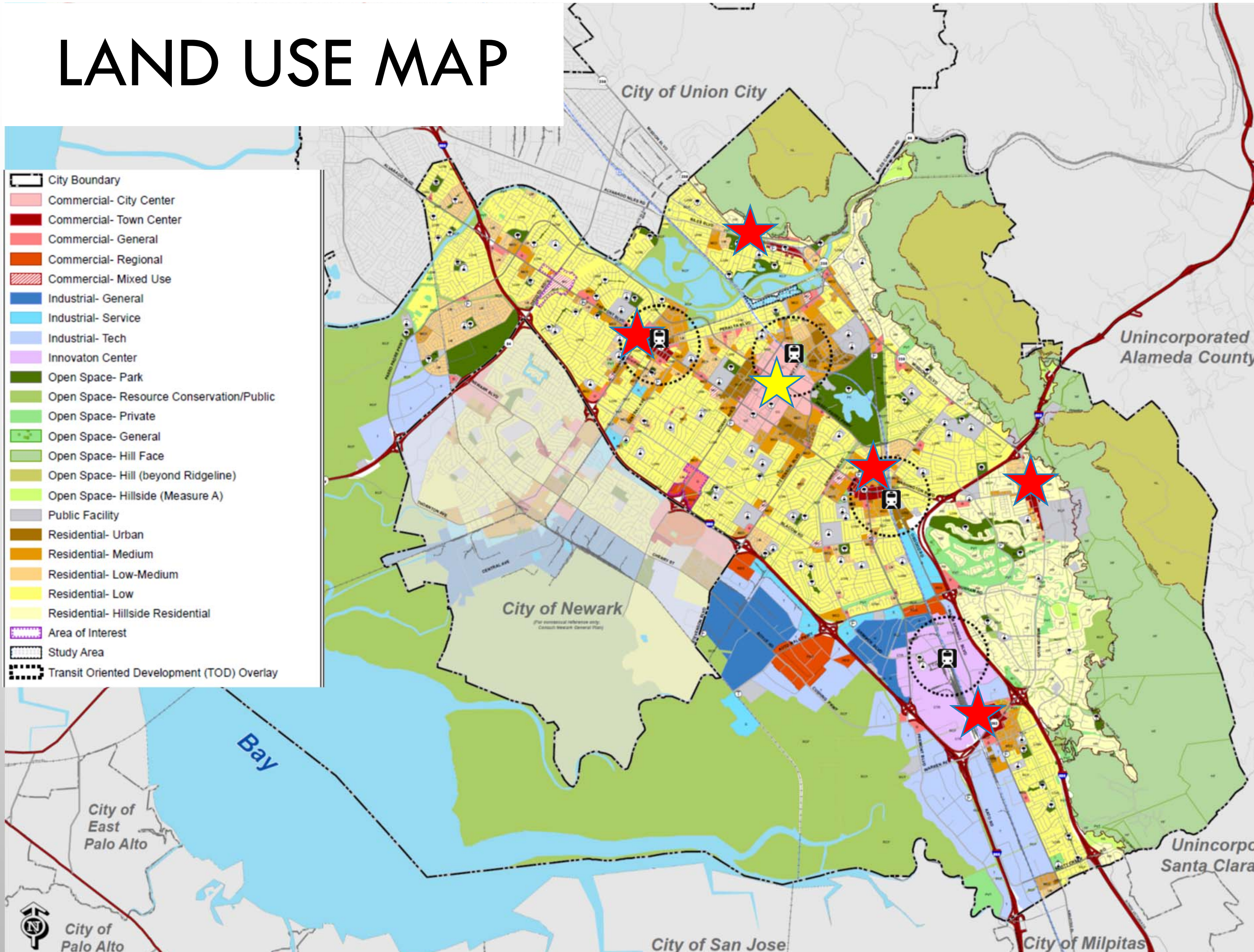
LOCAL CONTEXT



LAND USE MAP



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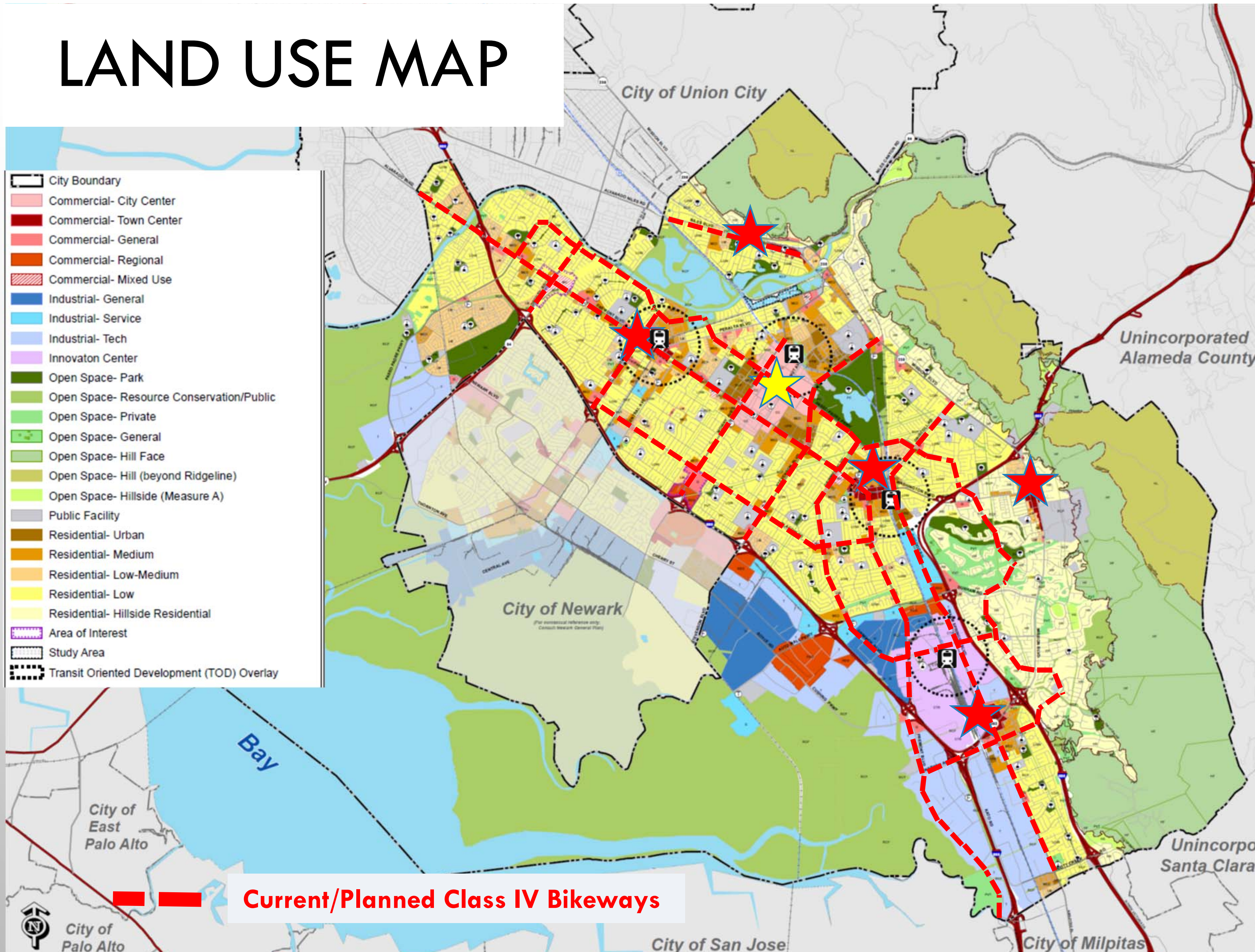
LAND USE MAP



CITY OF Fremont

IMPLEMENTATION CHALLENGES

Long Network Distance

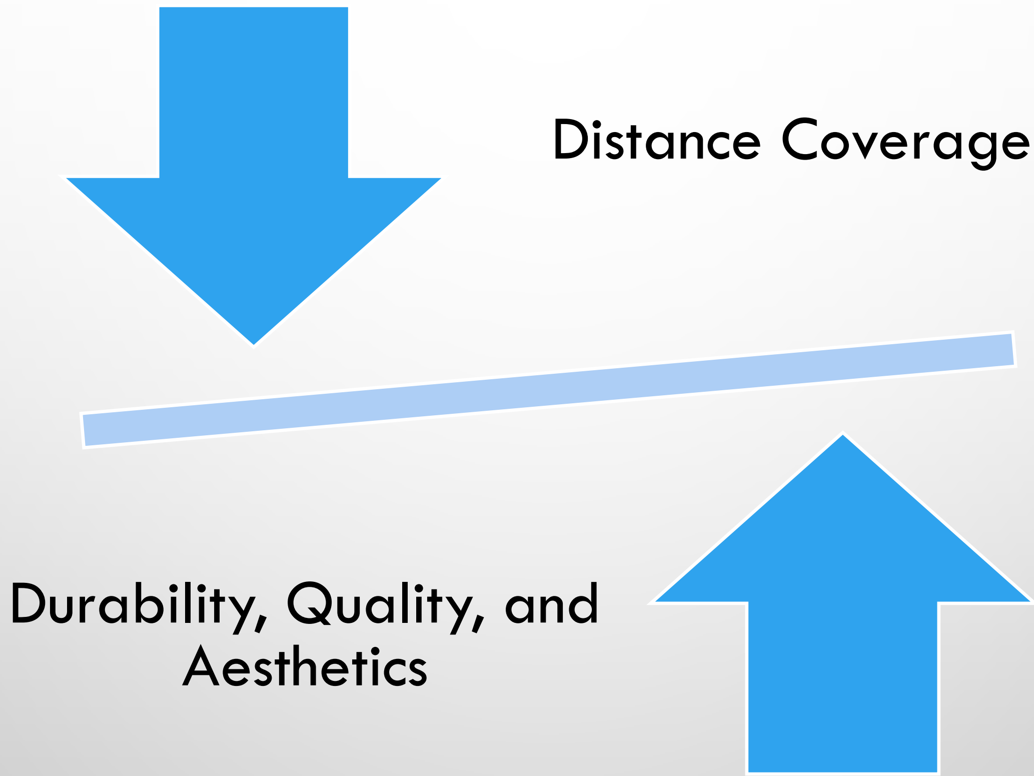
Diverse Land Use Context (Commercial, TOD, and Residential)

Accommodate Access for Street Maintenance, Fire Department, and Garbage Service

Limited Budget (~$400K to $500K per year)

What's Good Enough?

BALANCING GAME



SEPARATION DEVICES COMPARED

Device Type	Implementation Cost	Ease of Implementation	Durability	AAA User Comfort/Safety	Drainage Redesign Needed	Maintenance	Aesthetics (Context Sensitive)
Channelizers	Low	Fast	Low	Low	No	High	Low
K71 Bollards	Low	Fast	Low	Low	No	High	Low
Tuff Curb	Low	Fast	Low/Moderate	Low/Moderate	No	High/Moderate	Low/Moderate
Armadillo	Low	Fast	Moderate/High	Low/Moderate	No	Moderate/Low	Low/Moderate
Portable Planter Boxes	Medium/High	Moderate	Low	Moderate	No	Moderate/Low	High
Precast Concrete Curb	Medium	Moderate/Fast	Moderate/High	Moderate/High	No	TBD	Moderate
Traditional Concrete Island	High	Slow	High	High	Maybe	Low	Moderate/High
Grade Separation	High	Slow	High	High	Yes	Low	Moderate/High

Quick Build Applications

Semi-Permanent/Permanent Treatments

Permanent Design, usually part of roadway redesign projects

DEVICES EVALUATION CRITERIA

Roadway Factors	Context Factors	Device Factors
• ADT • Traffic Speeds • Bike Buffer Widths • Street Lighting Level • Need for accommodation for street sweeping, Fire access, and curb side garbage pickup.	• Surrounding Land Use (Downtown vs. TOD vs. Sub-Urban Commercial Strip vs. Residential) • Aesthetics • Potential for Vandalism	• Overall Visibility (Daytime vs. Nighttime) • Durability (knockdown vs. vandalism) • Consider pairing of different device types to complement pros and cons of different devices.

PHASED IMPLEMENTATION APPROACH

Prioritizing Coverage/Distance → Prioritizing Durability/Quality

Phase 1 - Reprioritizing Roadway Widths

- Through the annual pavement maintenance project.
- Narrower vehicle lanes.
- Road diets
- Stripe buffered bike lanes as much as possible (maximize buffer widths).

Phase 2 – Upgrade Class II to Class IV

- Through separate bikeway improvement project and annual pavement maintenance project.
- Utilize lower cost/faster implementation devices (e.g. channelizers and K71 bollards)
- Continue restripe roadways through annual pavement maintenance project.

Phase 3 – Improve Quality of Separation Devices

- Supplement existing lower cost devices with more permanent/durable options (e.g. pre-cast concrete curbs).
- Look at sub-phases within this phase due to high implementation cost (e.g. start with larger spacing gaps between devices and densify in future budget cycles)

Continue to Develop/Construct High Quality Separation Facilities separately from these three-phase bikeway enhancement effort through major capital projects (e.g. concrete island separated bikeways, grade separated bikeways, protected intersections, signal upgrades, trails)

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SAMPLE BIKEWAY PHOTOS
(BI-DIRECTIONAL CYCLE TRACK NEXT TO META CAMPUS)

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SAMPLE BIKEWAY PHOTOS

(BI-DIRECTIONAL CYCLE TRACK NEXT TO AMERICAN HIGH SCHOOL)

SAMPLE BIKEWAY PHOTOS
(HIGH SPEED ARTERIAL ROADWAY & HIGH ADT)

Just K71
(after 6 months)

Combine K71 w/ Armadillo and Pavement Reflectors
(after 6 months)

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SAMPLE BIKEWAY PHOTOS

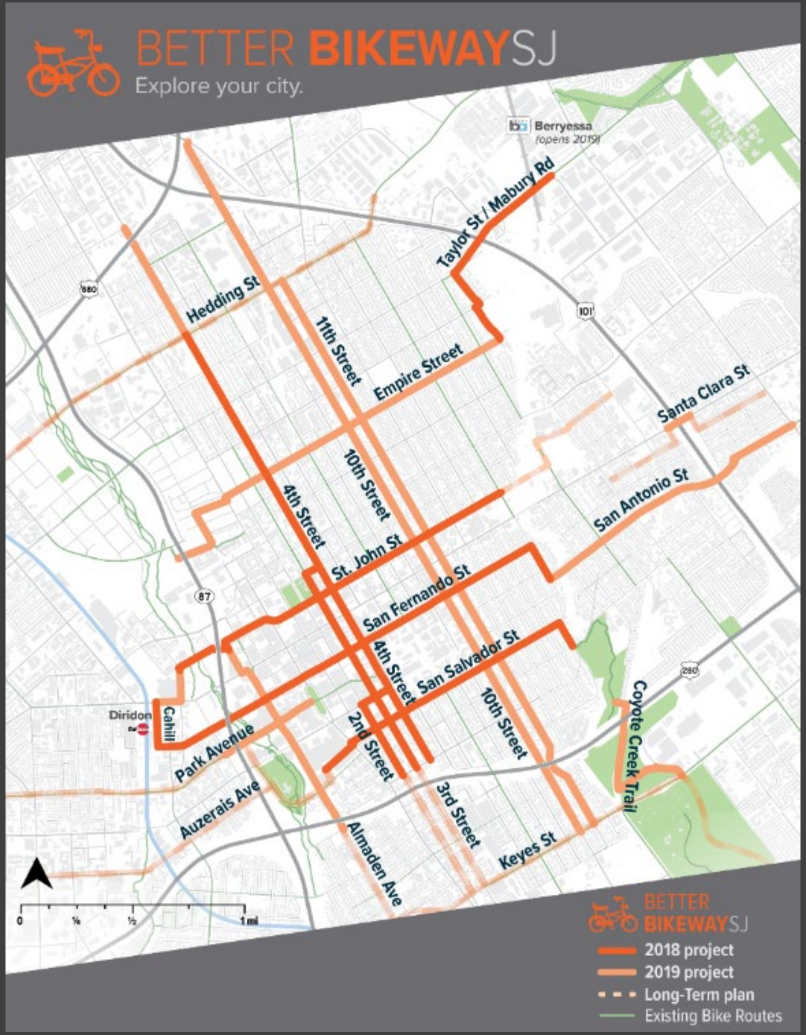
(UPCOMING BIKEWAY SEPARATION ENHANCEMENT)

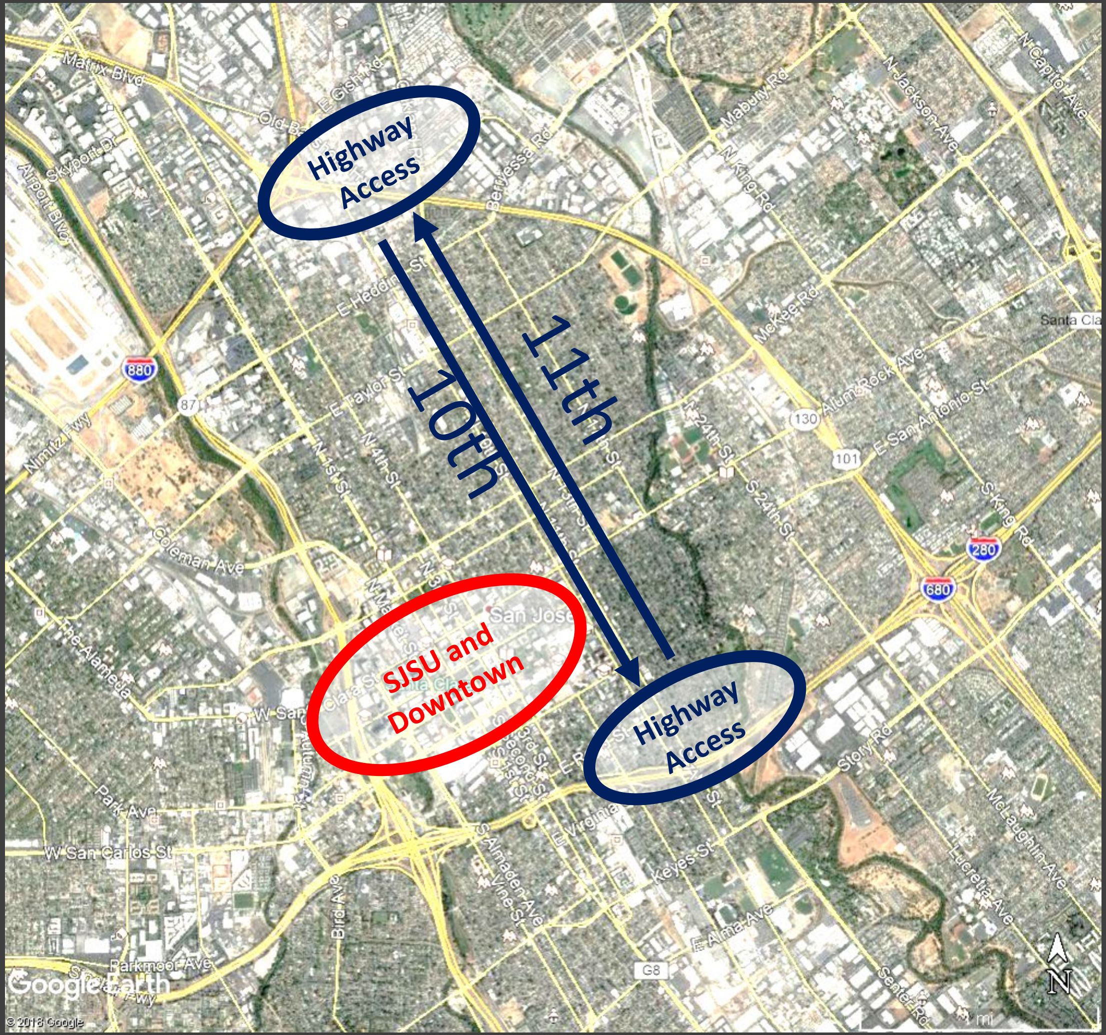
(SUMMER 2023)

ANY QUESTIONS?

10th and 11th Street Frontage Lane

Context Map





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CAPITAL OF SILICON VALLEY

Previous Configuration

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Existing Challenges

- 5-Year Crash History
  - 4 Fatalities
    - 2 pedestrian
  - 11 Severe Injuries
    - 3 pedestrian, 1 bicycle
- Speeding
  - 34 mph 85th
  - 30 mph posted
- Double Parking, Stopping to Load, Driving and Garbage Bins in Buffered Bike Lane
- Added Bus Services
- High Parking Demand
- Frequent Driveways

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Three Design Ideas

Couplet Conversion Plus Roundabouts

Frontage Lane Bike & Parking

Upgrades to Existing

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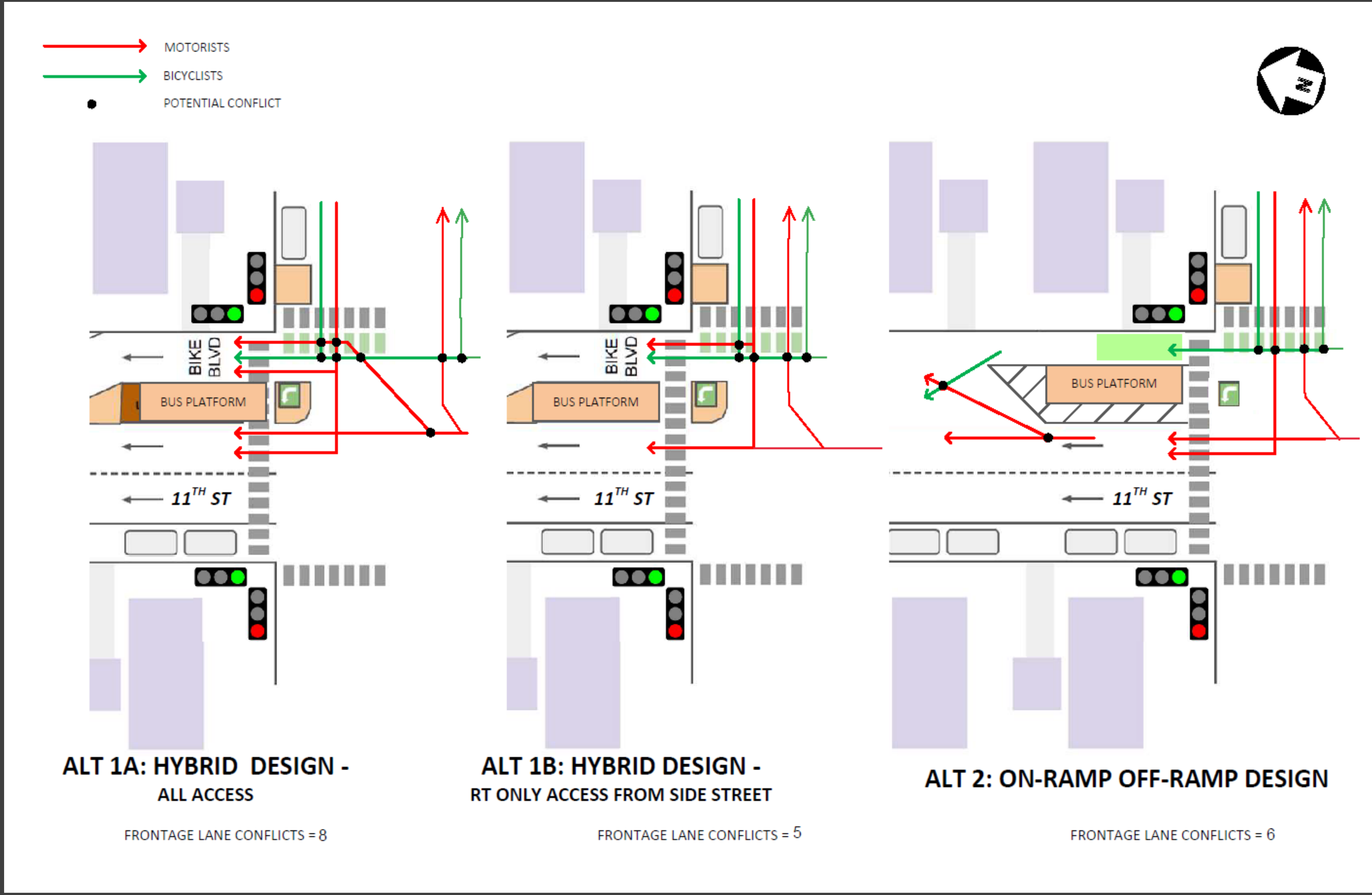
Frontage Lane Access Alternatives



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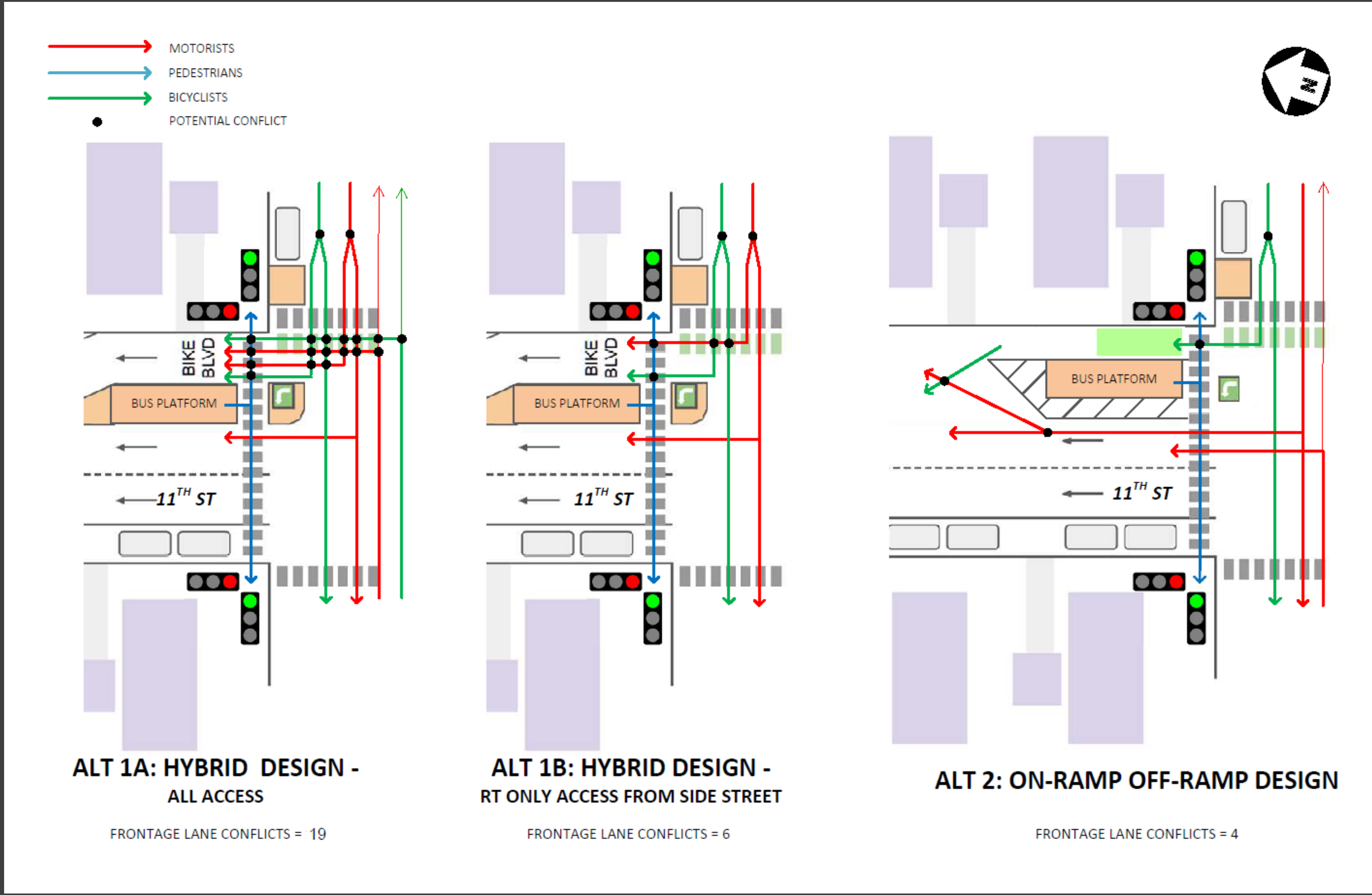
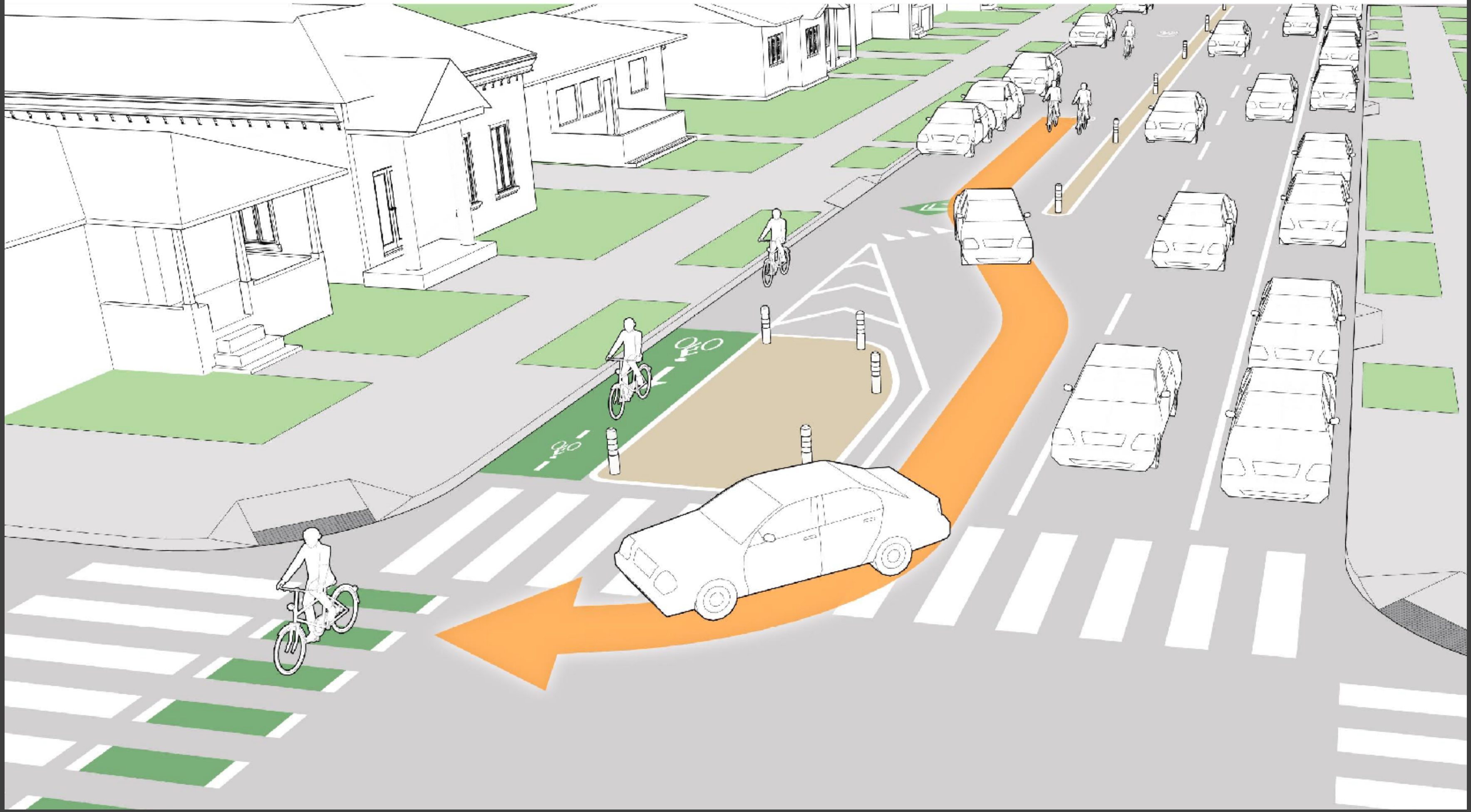
Frontage Lane Access Alternatives



Outreach

How to Make a Right Turn



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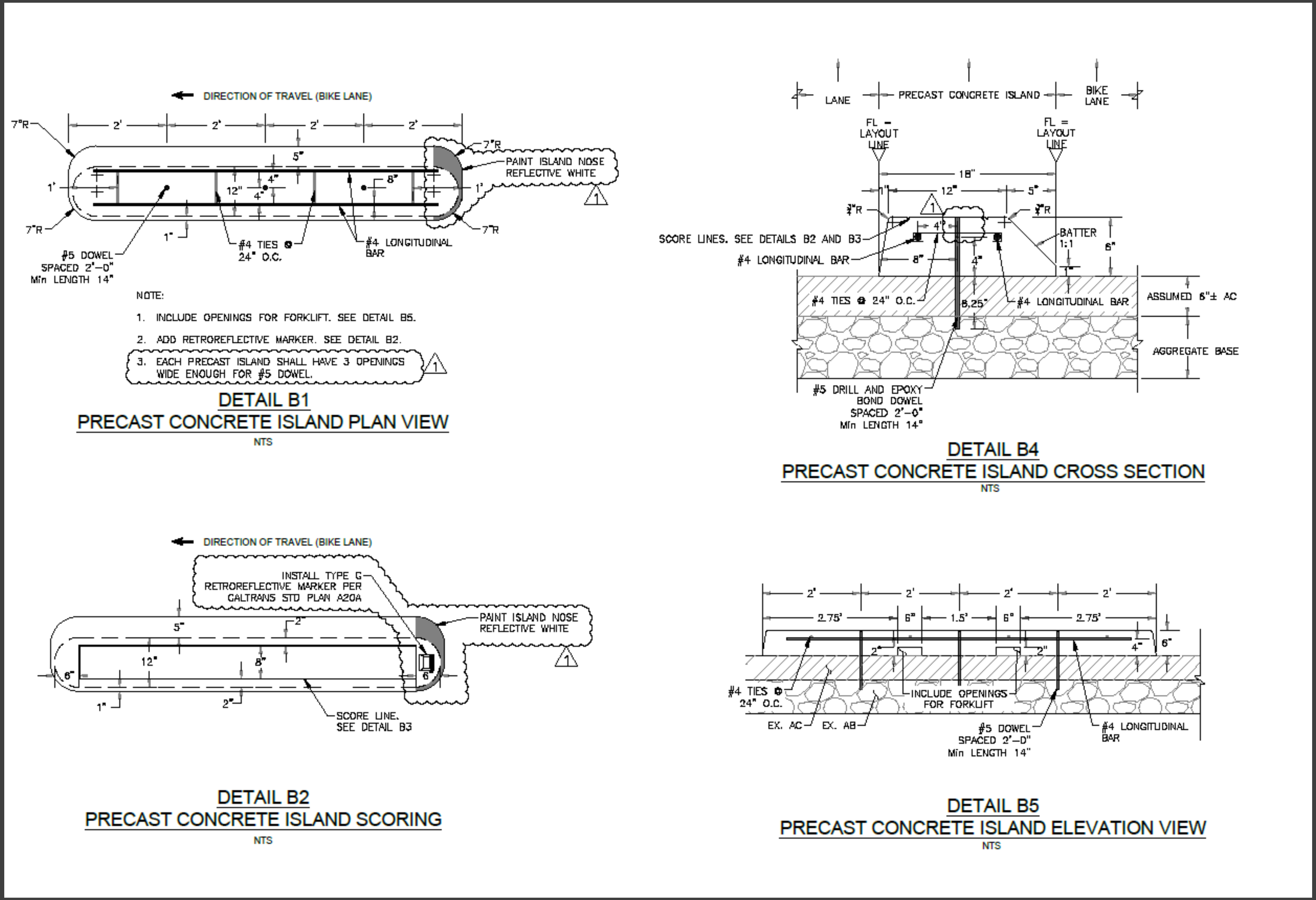
Separator Details



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Phase 1 Construction – Extruded Curbs

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Phase 1 Construction – Extruded Curbs

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Phase 2 Construction – 16 Bus Boarding Islands

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Challenges During Construction

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2020 Cost Comparison/Breakdown

Extruded Concrete

Phase 1 Total Cost:	**$700K**
Extruded Curb Cost:	$494K (71%)
Personal Services:	$143K (20%)
City-wide Overhead:	$35K (5%)
PW Cap:	$26K (4%)

Transit Boarding Islands

Phase 2 Total Cost: $1.5 Million

- 16 Bus Boarding Islands (13 on 10th and 11th St)
- Bulb-outs at 25 intersections

Flexible Delineators

- Assume 2.3 miles, 20 ft spacing
- $40 Material
- $44.13/Hr Labor, assume 3 workers
- Assume 8-Year Cycle, 50% replacement rate

Initial Cost:	**$65K**
Replacement Cost:	**$33K**
Total Estimate:	**$98K**

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Lessons Learned

- **Cast-in-place is highly effective for longer corridors**
- **Street redesign slowed down traffic - from 34 mph to 33 mph**
- **TBI handrail breakaways**
- **Strategic use of separators to prevent maintenance and sweeping challenges**
- **Landscape bulb-out challenges**

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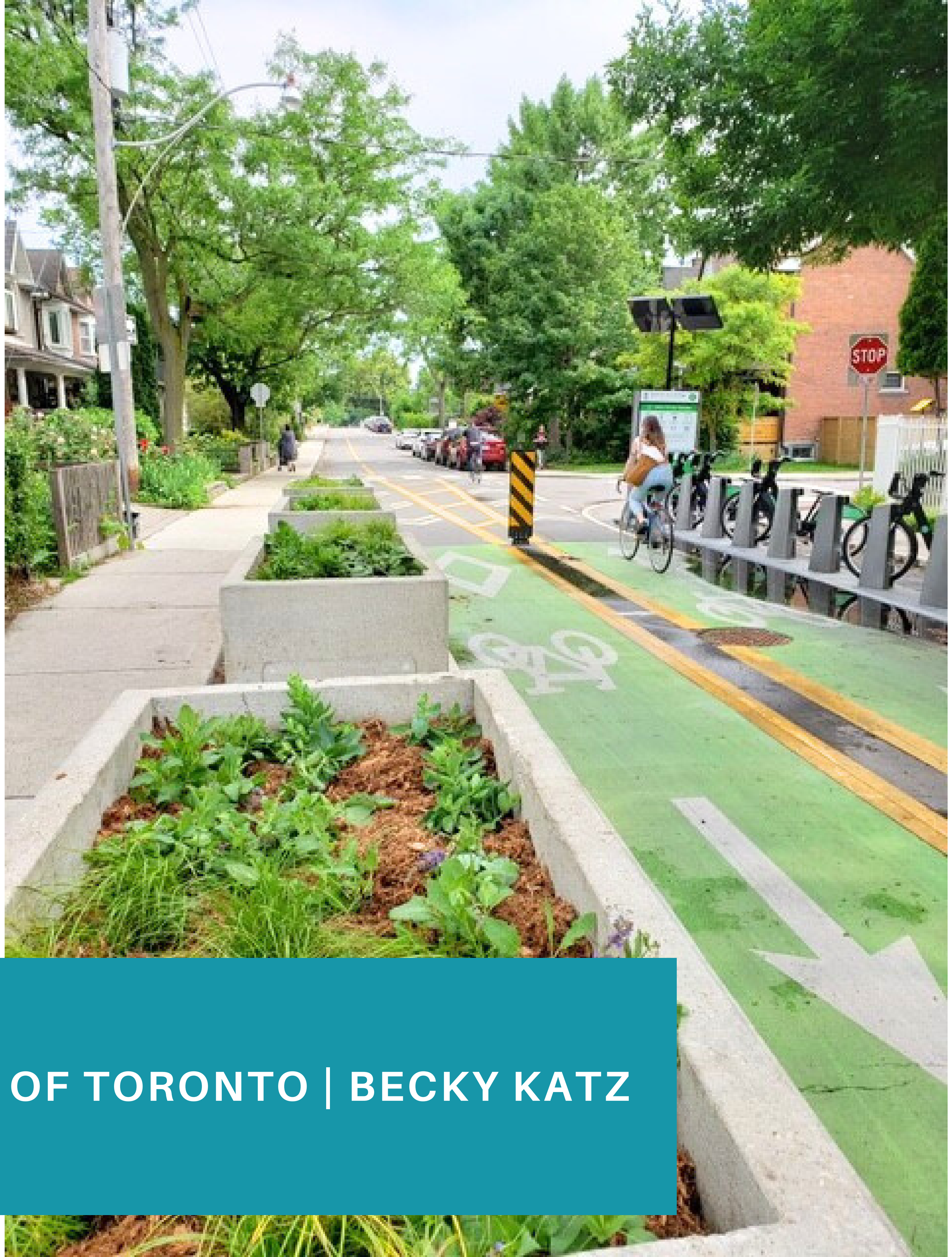
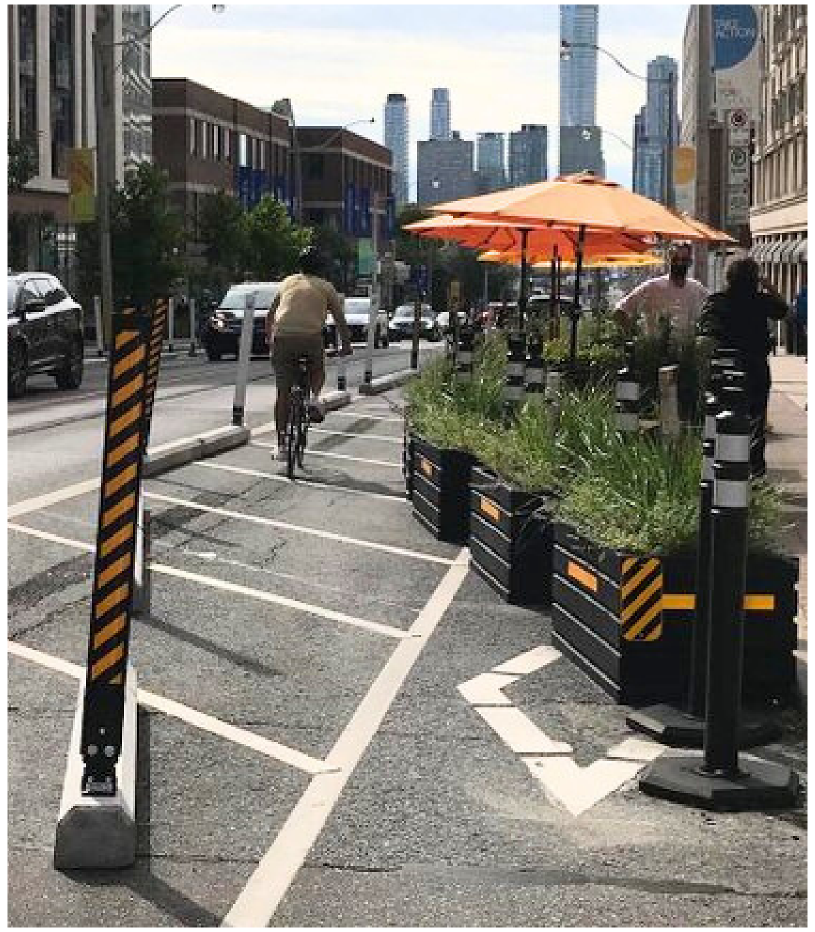


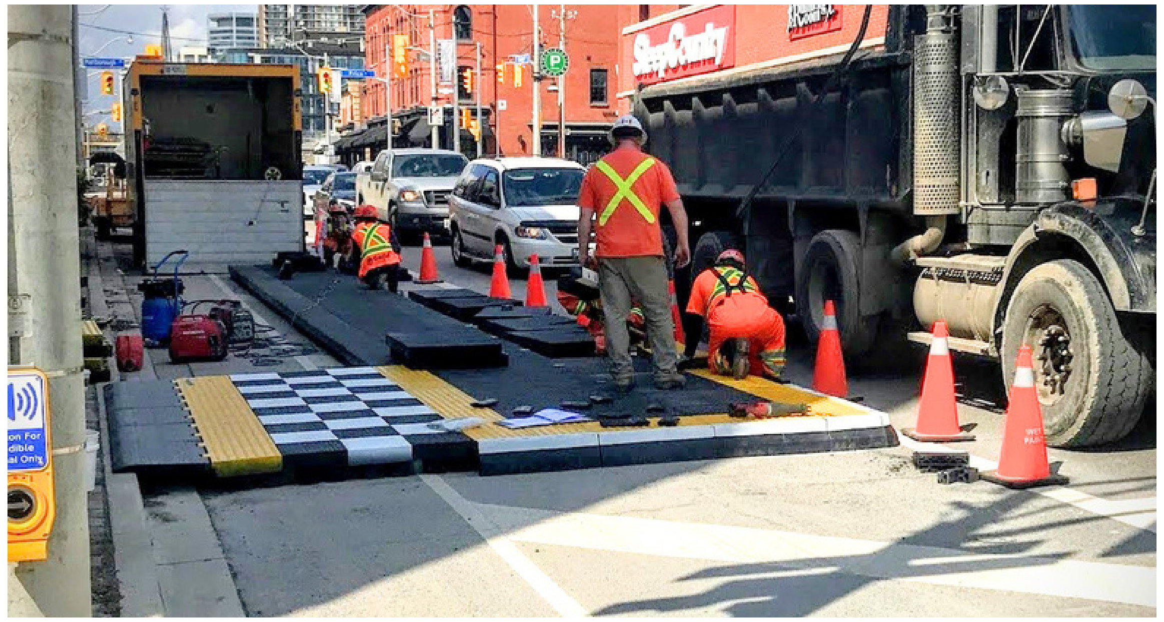
CITY OF TORONTO | BECKY KATZ

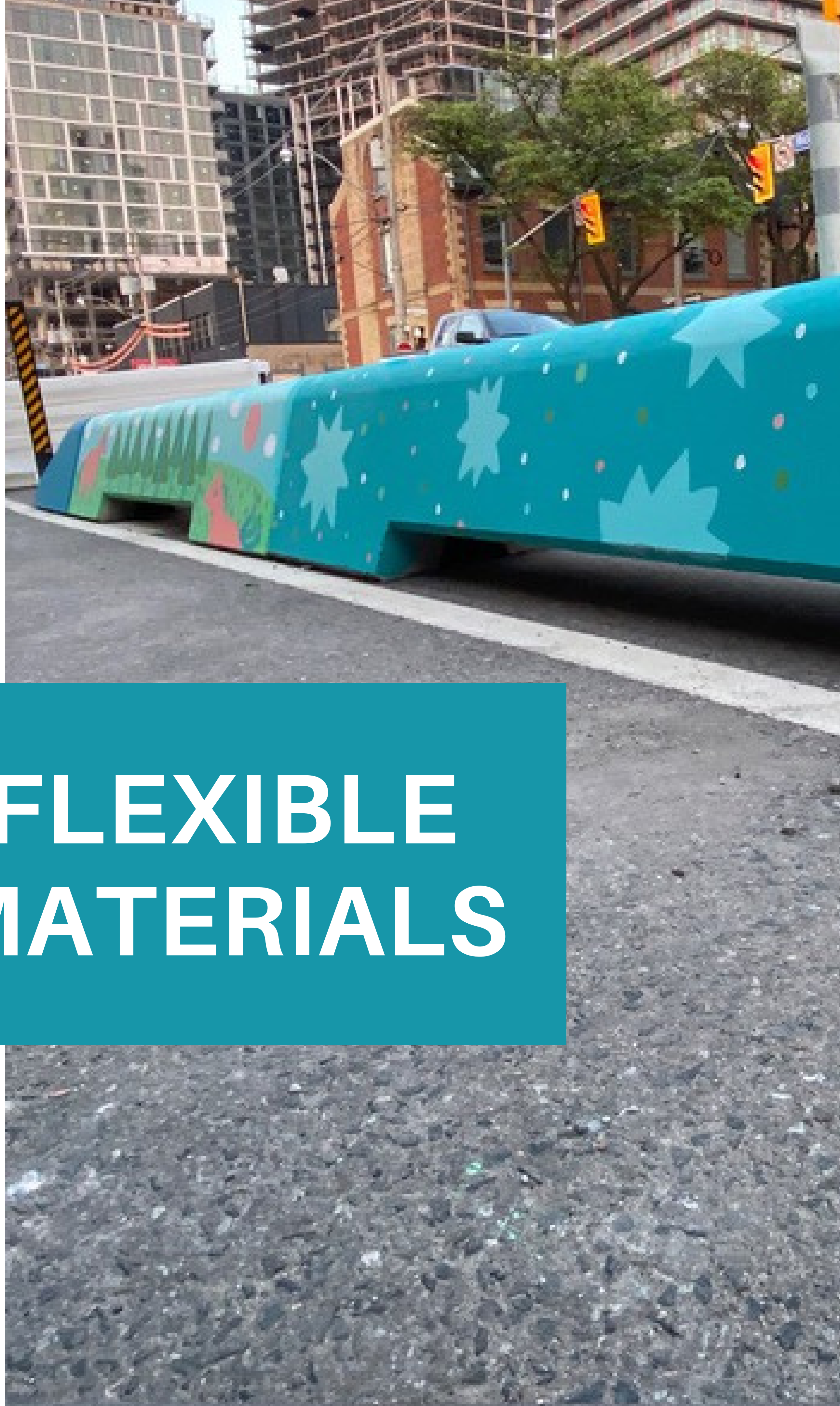
Biking in a Material World

NACTO 2023 Conference

TORONTO







FLEXIBLE MATERIALS

PROCUREMENT AND MAINTENANCE

BLANKET/SUPPLY&INSTALL CONTRACTS

PROACTIVE INSPECTION AND MAINTENANCE IN-HOUSE VS. CONTRACTING (OR BOTH)

THE HEAVIER THE MATERIAL, THE MORE IMPORTANT IT IS TO MAINTAIN

EXPERIMENT AND THEN SELECT A MATERIAL PALLETTE AND SCALE

PERM. MATERIALS

PROCUREMENT AND MAINTENANCE

CONSTRUCTION TENDERS

BUNDLE WITH ROAD/WATER WORKS

INSPECTIONS MATTER!

THE DETAIL DETAILS

DEVELOP SPECIFICATIONS

INTERIM MATERIALS

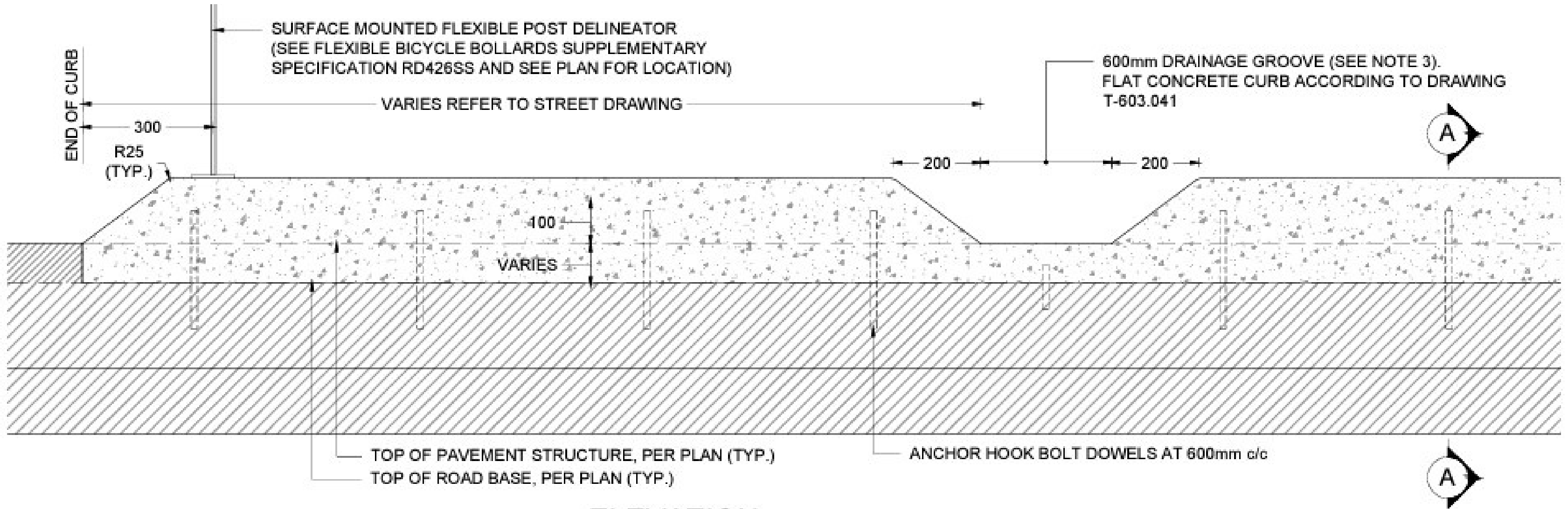
PROCUREMENT AND MAINTENANCE

CONSTRUCTION ROSTER

BLANKET CONTRACTS/IDIQ

EXPERIMENT, BUT THEN ADOPT SPECIFICATIONS/STANDARDS

DRAINAGE



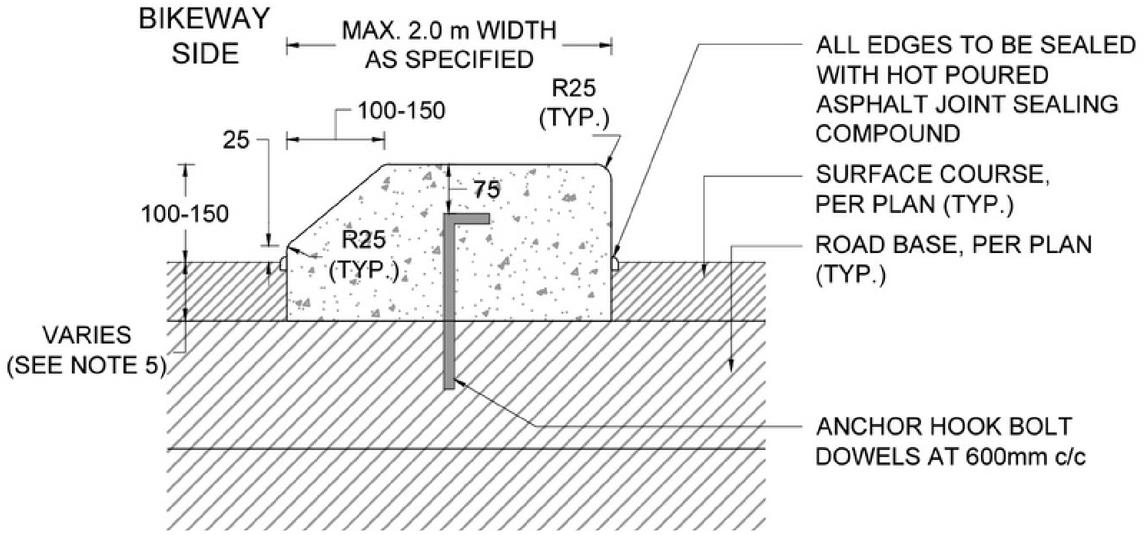
ELEVATION

CONTEXT MATTERS

Raising the cycle track here may look good, but falls below the guidance for multi-lane, high speed arterial. The setback from motor vehicle traffic is more important than the material itself. So don't be swayed simply by aesthetic.

THE DETAIL DETAILS MATTER

When folks in your Division are concerned about new standards or designs, it could be because there is a lack of detail. And the detail details matter. We applied a new bevel curb standard on a bull-nose median island and honestly the standard was cumbersome to implement. Being apart of the construction will make you a better practitioner.



Have a plan to upgrade, where it matters

If you are scaling up your flexible material projects, develop a plan for upgrades to improve safety, accessibility and reduce maintenance needs. Accessibility features and intersections are a key locations to consider.

Before and after

Material Success

CONTEXT

Materials should be determined by motor vehicle speed and volume.

THE DETAIL DETAILS

Developing specifications and being apart of construction will make you a stronger practitioner.

HAVE A PLAN FOR MAINTENANCE AND UPGRADES

If you are scaling up use of flexible materials, have a plan to upgrade

INVEST WHERE IT COUNTS

Interim projects have a lot of merit, invest in accessibility, safety and to resolve maintenance issues.

Thank you!
Photos and Specifications

1. Shaw at Essex
2. Yonge at Walker, Danforth Ave at Luttrell
3. Scarlett at the Humber Trail entrance
4. Sherbourne St, Bloor St, Murray Ross Pkwy, Cummer Ave, Bathurst at Adelaide
5. Six Points Intersection
6. Lake Shore Boulevard, Gerrard St, Woodfield, Danforth at Kelvin, Argyle St,
7. Danforth at Kelvin, City Standards
8. Six Points Intersection
9. Woodfield at Gerrard
10. Richmond at Brant, Cherry at Mill
11. York U Accessibility Site Visits
12. Murray Ross Pkwy