Design Controls &
Roadway Capacity Reallocation

Passive vs. Proactive Design

Passive Design

- Uses past or present as basis of design
- Designs for worst-case scenario
- Form follows standards
- Self-fulfilling prophesies (85% design speed, etc)

Proactive Design

- Designs toward desired future conditions
- Designs for realistic scenario
- Form follows function
- Design flexibility/ discretion (context-sensitivity)

Asking the Right Questions

- What is the **community's goals**?
- How would we **measure success**?
- How would we **design the street** (and signals) to achieve those goals/measures?
- What are the **trade-offs involved** in each design decision? Who wins, who loses?

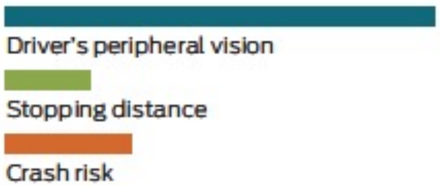
→ Street space and signal time are finite resources. What is their **optimal use**?

Design Speed

Design Speed

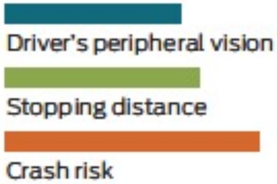
Design Speed

15 – 20 kmh

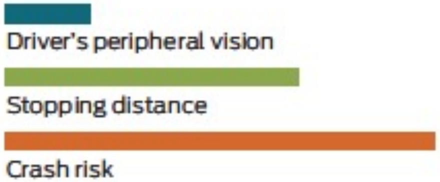


30-40 kmh

50-55 kmh



60+ kmh



Design Speed

Higher speeds =
Higher crash risk =
Higher injury severity =
Lower safety

SPEED (MPH)	STOPPING DISTANCE (FT)*	CRASH RISK (%)†	FATALITY RISK (%)†
10–15	25	5	2
20–25	40	15	5
30–35	75	55	45
40+	118	90	85

* Stopping Distance includes perception, reaction, and braking times.

† Source: Traditional Neighborhood Development Street Design Guidelines (1999), ITE Transportation Planning Council Committee 5P-8.

Reactive:

Operating → Design → Posted

Proactive:

Target → Design → Posted

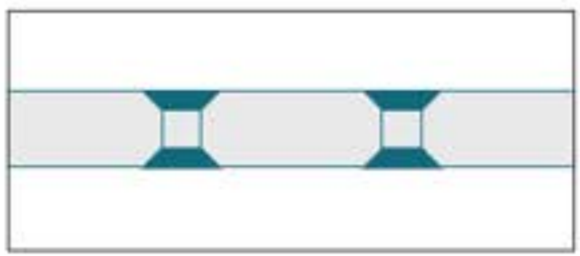
Design Speed

Median
Medians create a pinchpoint for traffic in the center of the roadway and can reduce pedestrian crossing distances.

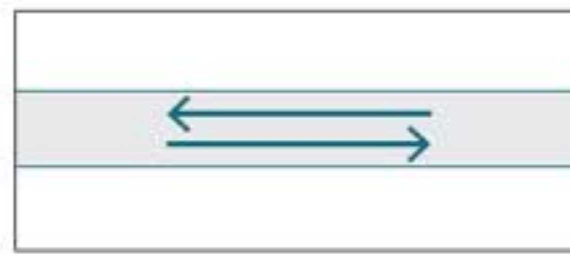
Pinchpoint
Chokers or pinchpoints restrict motorists from operating at high speeds on local streets and significantly expand the sidewalk realm for pedestrians.

Chicane
Chicanes slow drivers by alternating parking or curb extensions along the corridor.

Lane Shift
A lane shift horizontally deflects a vehicle and may be designed with striping, curb extensions, or parking.

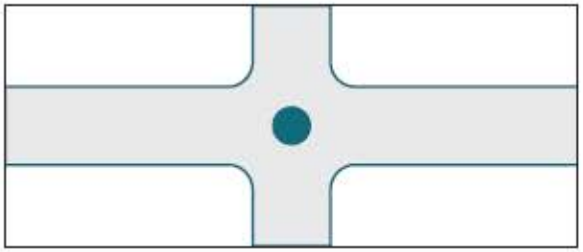


Speed Hump
Speed humps vertically deflect vehicles and may be combined with a midblock crosswalk.

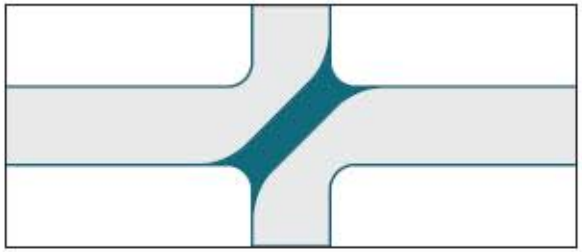


2-Way Street
2-way streets, especially those with narrower profiles, encourage motorists to be more cautious and wary of oncoming traffic.

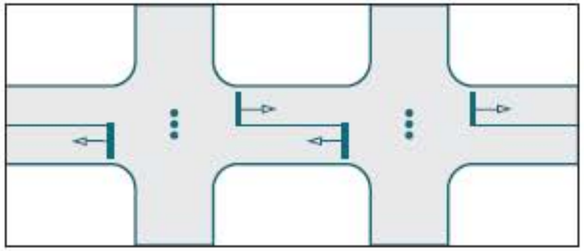
Design Speed



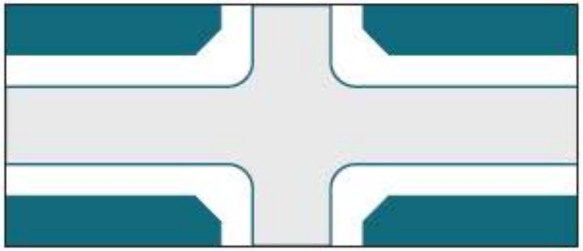
Roundabout
Roundabouts reduce traffic speeds at intersections by requiring motorists to move with caution through conflict points.



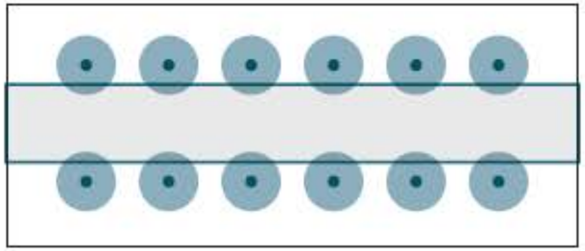
Diverter
A traffic diverter breaks up the street grid while maintaining permeability for pedestrians and bicyclists.



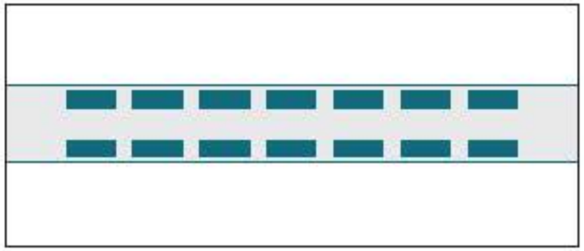
Signal Progression
Signals timed to a street's target speed can create lower speeds along a corridor.



Building Lines
A dense built environment with no significant setbacks constrains sightlines, making drivers more alert and aware of their surroundings.



Street Trees
Trees narrow a driver's visual field and create rhythm along the street.



On-Street Parking
On-street parking narrows the street and slows traffic by creating friction for moving vehicles.

Design Speed

- Maximum target speed for urban arterials is 50 kmh
- Maximum target for urban collector is 40-50 kmh and 30 kmh for local streets
- Use design criteria at or below target speed
- Bring design speed in line with target speed through design elements

Design Speed

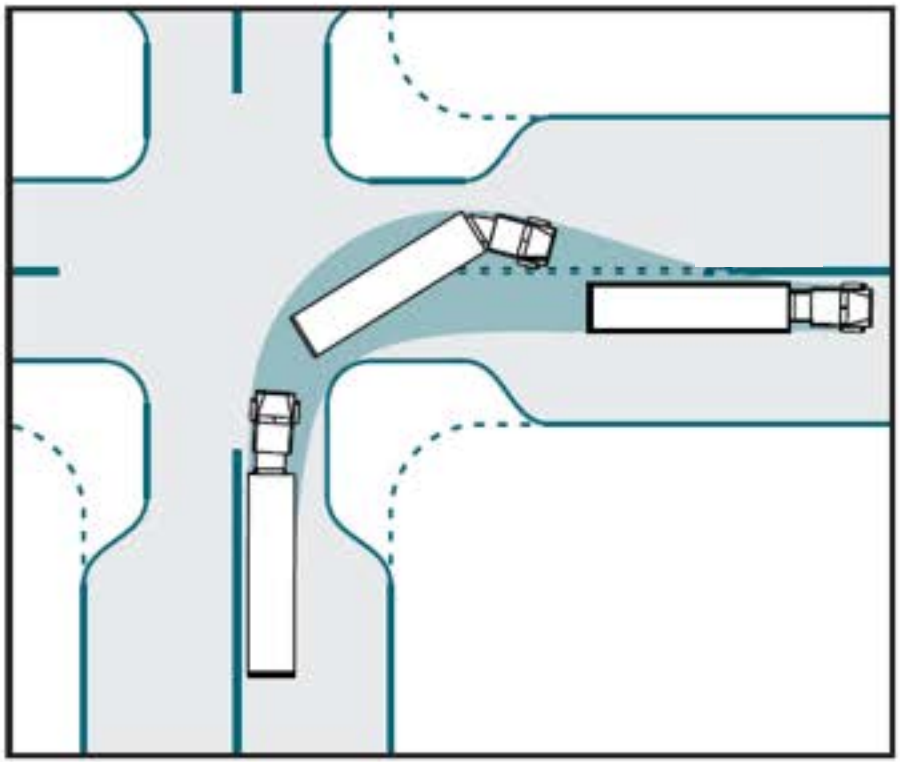
- Use short signal cycle lengths and/or slow progressions in downtown areas with closely spaced signals
- Consider 30 kmh zones in neighbourhoods
- On local or high foot traffic streets, ok to select a design speed below the posted speed limit
- Shared streets/alleys can have target speed as low as 10-15 kmh
- Speed enforcement cameras have proven highly effective

Design Speed

Design Vehicle

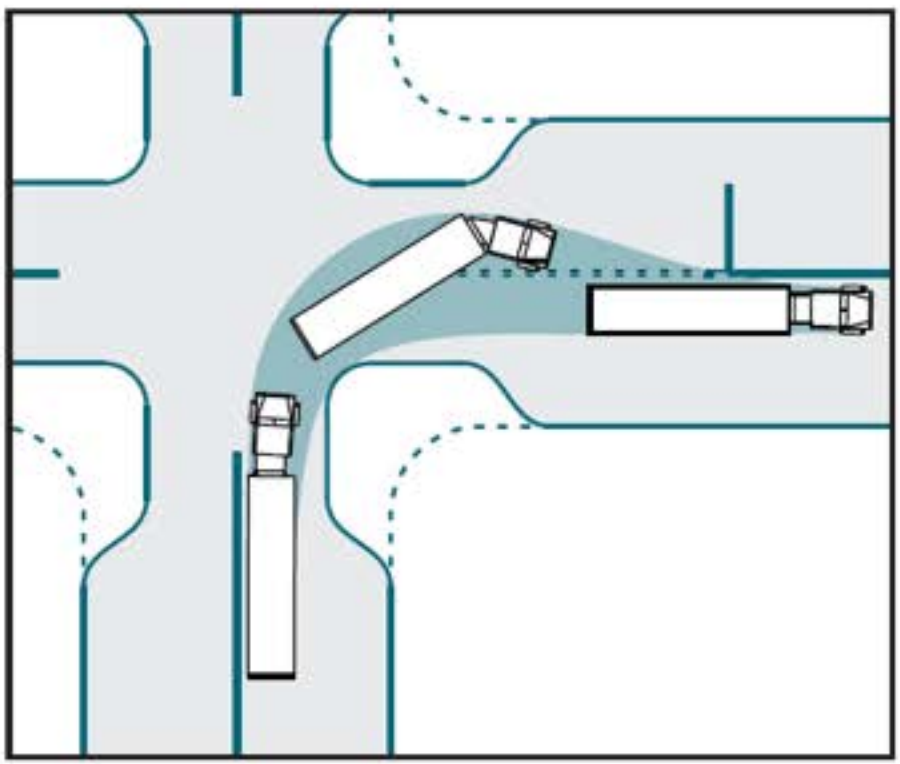
Design Vehicle

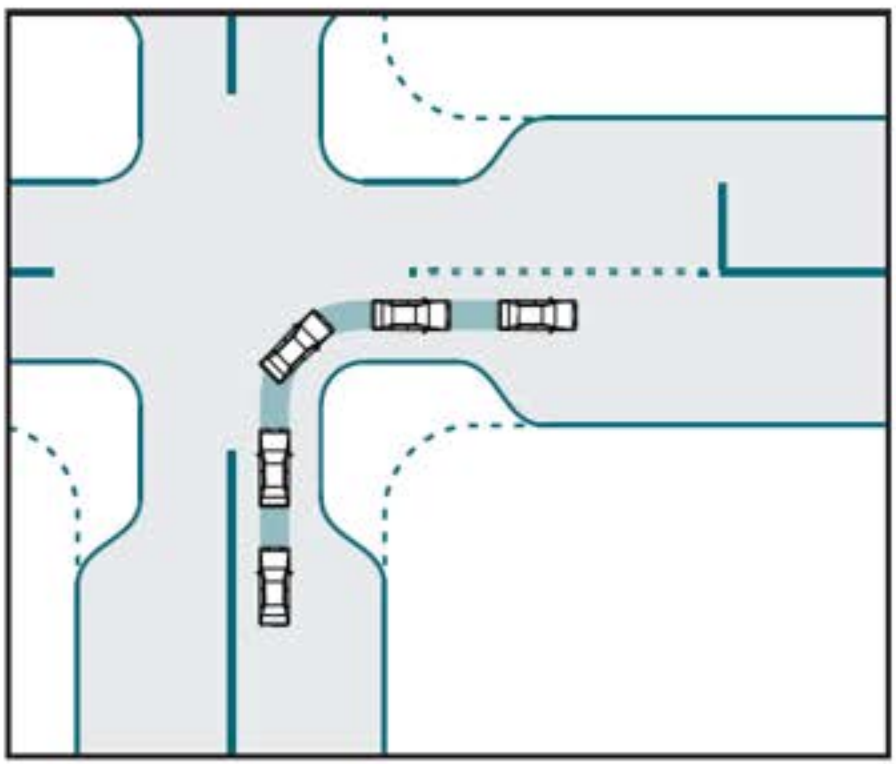
- Change design or change assumptions (or both)?



Design Vehicle

- Change design or change assumptions (or both)?





Design Vehicle

Design Vehicle

Design Vehicle

- Frequent user of a given street
- Dictates the minimum required turning radius
- Design to turn using one incoming and one receiving lane

Control Vehicle

- Infrequent large user of street
- Design to turn using multiple lanes

Design Hour

Design Hour

Reactive

- Look at peak 15 minutes or peak hour
- Motor vehicle volumes/ LOS are primary input for design & signals
- Assumes traffic patterns are unchanging
- Designs entire day based on peak period

Proactive

- Understand volumes over course of day
- Motor vehicle capacity balanced against other needs
- Understands design affects traffic volumes
- Allows flexibility over course of the day

Design Hour

8:00 am

AM PEAK
Signals are adjusted to accommodate rush-hour traffic during the peak hour, metering traffic to prevent gridlock.

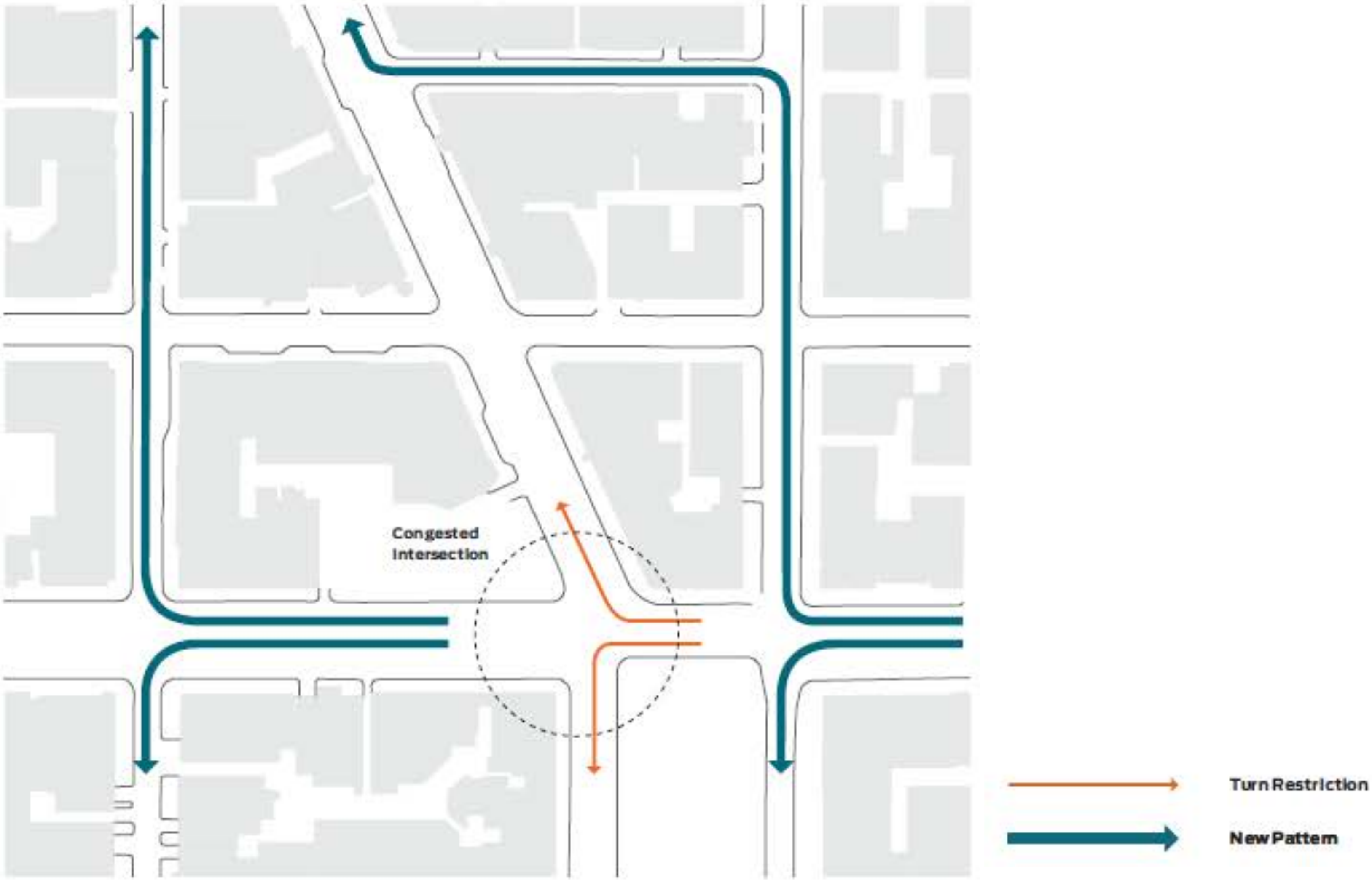
1:00 pm

MID-DAY
Downtown pedestrian volumes reach their peak intensity at lunch hour.

8:00 pm

EVENING
Traffic volumes begin to dip in the evening, after rush hour, while pedestrian traffic in certain areas begins to rise.

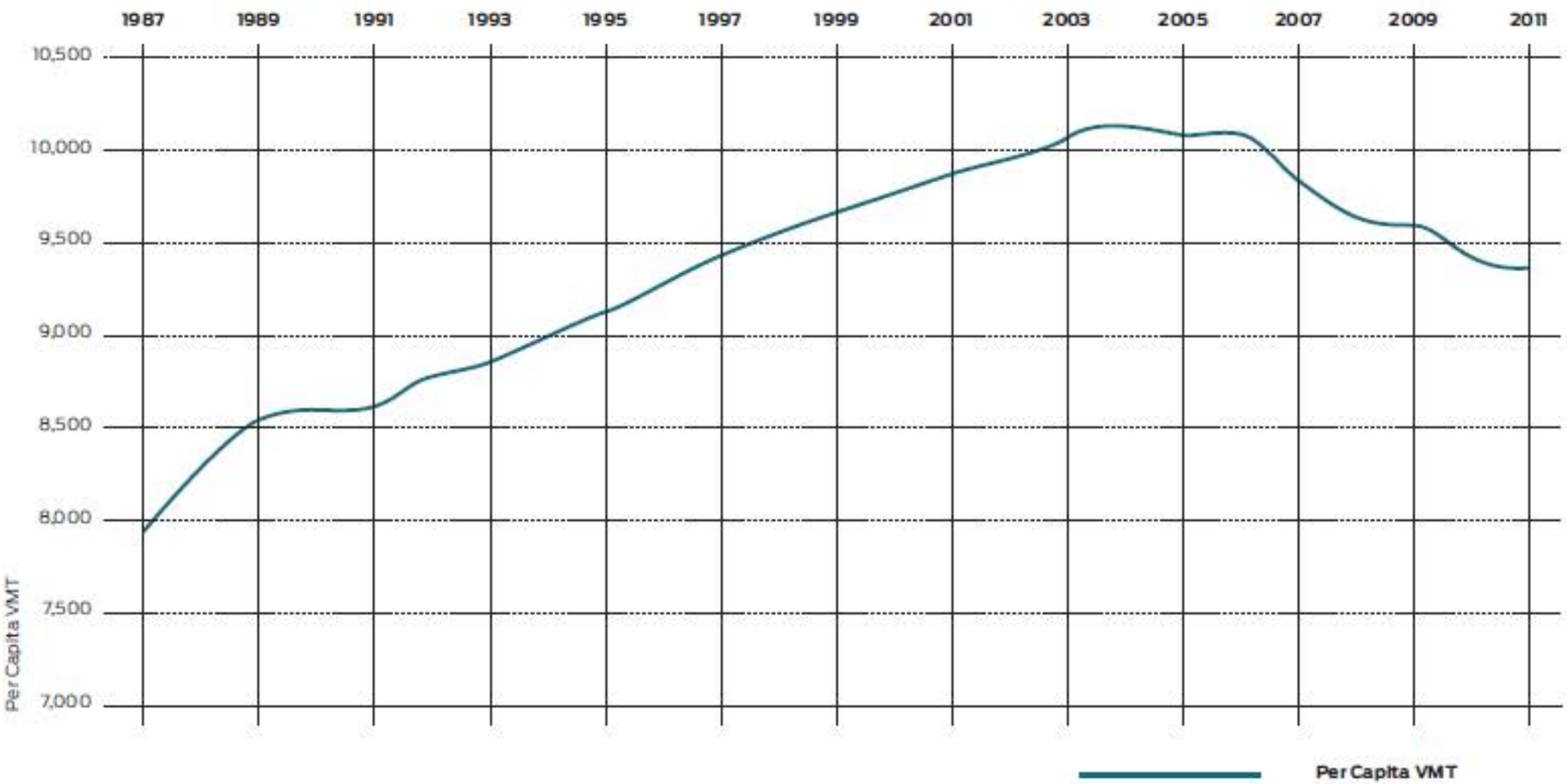
Design Hour



Design Year

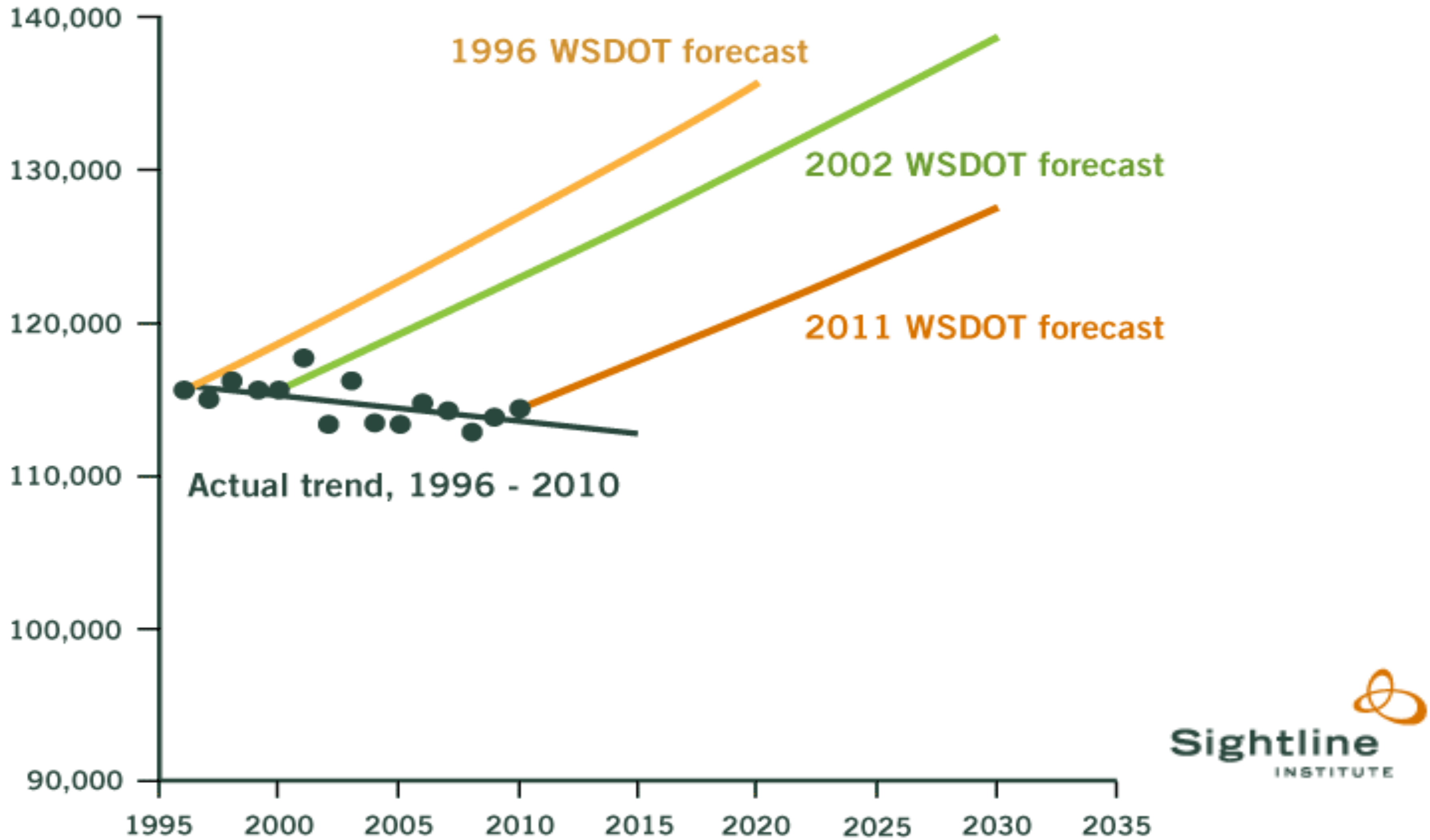

FISKER
SALT LAKE CITY
HAPPY HOLIDAY
SHOP • EAT • PLAY
TROLLEY SQUARE

Design Year



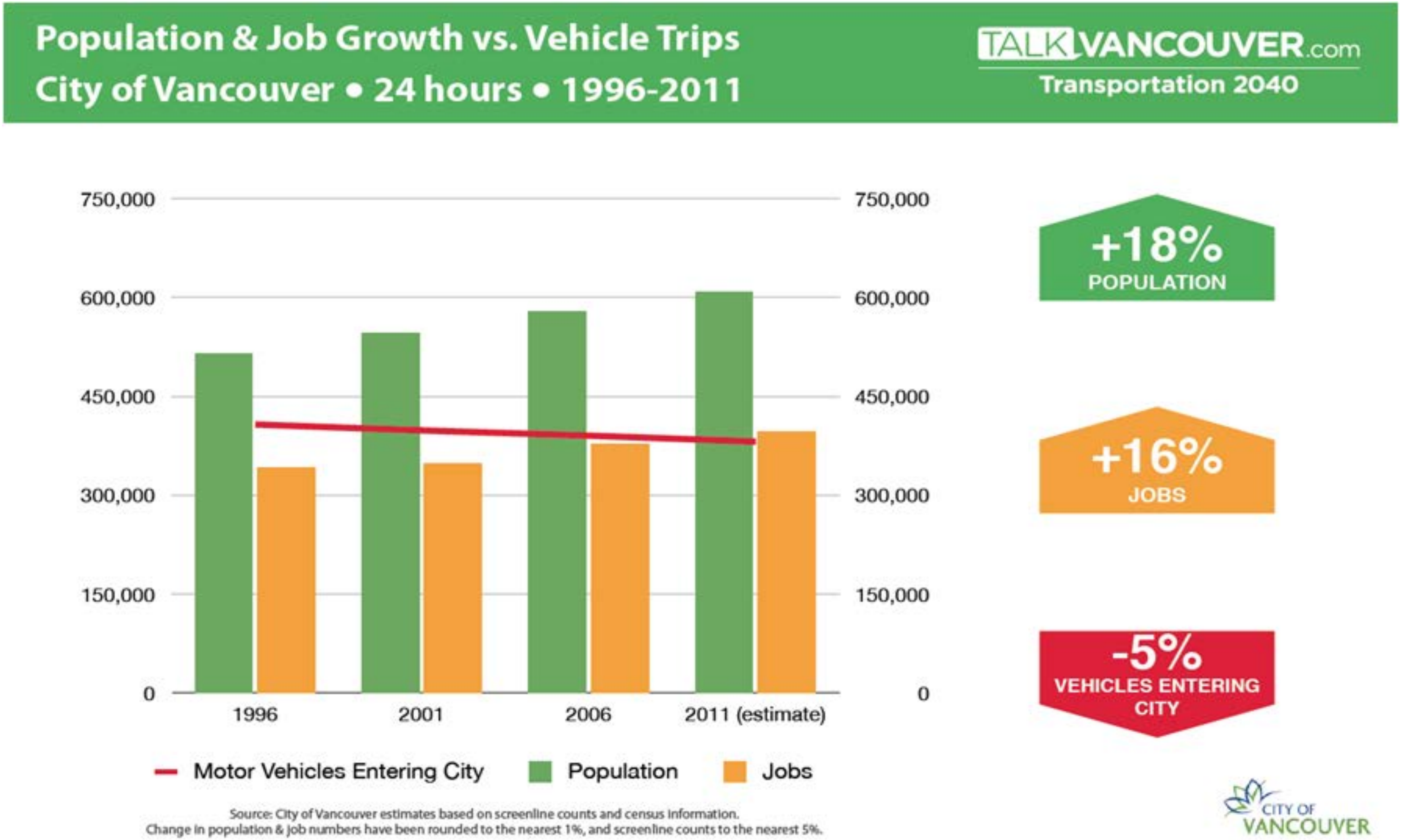
→ 2% compound growth rate **doubles traffic in 35 years**

Design Year



140,000
130,000
120,000
110,000
100,000
90,000
1995
2000
2005
2010
2015
2020
2025
2030
2035
1996 WSDOT forecast
2002 WSDOT forecast
2011 WSDOT forecast
Actual trend, 1996 - 2010
Sightline INSTITUTE

Design Year



Population & Job Growth vs. Vehicle Trips
City of Vancouver • 24 hours • 1996-2011
TALKVANCOUVER.com
Transportation 2040
750,000
600,000
450,000
300,000
150,000
0
1996
2001
2006
2011 (estimate)
+18%
POPULATION
+16%
JOBS
-5%
VEHICLES ENTERING CITY
Motor Vehicles Entering City
Population
Jobs
Source: City of Vancouver estimates based on screenline counts and census information.
Change in population & job numbers have been rounded to the nearest 1%, and screenline counts to the nearest 5%.
CITY OF VANCOUVER

Design Year

- Assumptions should be based on reality
- Are assumptions even the right approach?
- If you design for a particular outcome, you get that outcome
- Proactive Approach takes into consideration:
  – Policy context/goals
  – Demographic/cultural changes
  – Impacts of the project itself, as designed

Performance Measures

THEN

Mobility – Automobile

Safety

Performance Measures

THEN

↓

NOW

- Mobility – Automobile
- Safety

- Access/Mobility – Multimodal
- Public Health
- Economy & Equity
- Environment & Resiliency
- Livability/Quality of Life

Performance Measures

Pedestrians

- Safety: Rate of crashes, injuries, and fatalities (typically based on police records)
- Pedestrian LOS (Highway Capacity Manual)
- Public Life Surveys
- WalkScore (walkability ratings)
- Pedestrian Environmental Quality Index (PEQI)
- Minimal delay at crossings
- Foot-traffic volume

Bicyclists

- Safety: Crash records, injuries, and fatalities
- Bicycle LOS (Highway Capacity Manual)
- Travel Time and Delay
- Bicycle Environmental Quality index
- Bicycle counts

Vehicles

- LOS
- Travel Time
- Corridor Impact Analysis
- Safety: Crash records, injuries, and fatalities

Transit

- On-time performance
- Average speed
- Farebox recovery ratio
- Ridership per revenue hour
- Operating cost per hour

Freight

- Freight delivered by hour
- Time spent loading/unloading

Emergency Vehicles

- Response time

Sustainability

- LEED Neighborhood Development
- STARS
- GreenRoads

Multi-Modal

- Multi-Modal LOS
- Retail revenues and business growth

North Van: Motor Vehicle Capacity Reallocation

- Three Examples
  - West 1st Street - MacKay Rd to Fell Ave
    - Curbside parking to protected bikelanes
  - Brooksbank Ave – Keith Rd E to Main Str
    - 4 general purpose lanes to single GP lanes, 2-way left turn lane & protected bike lanes (interim standard)
  - Mountain Hwy – Keith Rd E to Main Str
    - No major change to vehicle capacity - added wider sidewalks and protected bike lanes

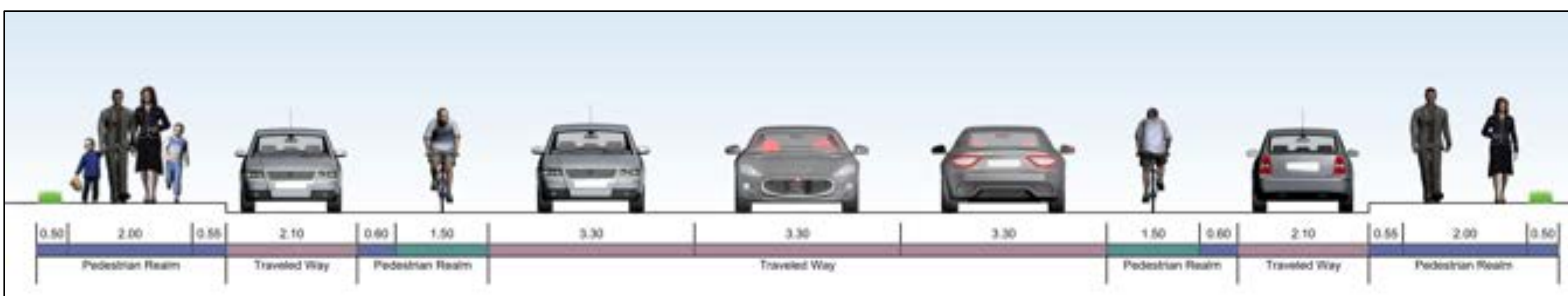
West 1st Street - MacKay Rd to Fell Ave

Curbside parking (2.1m), travel lane each direction (3.3m) & 2-way left turn lane (3.3m), buffer (0.6m), bikelanes (1.5m) Total (18.3m)

March 2018 Traffic Count

- 18,000 Motor Vehicles/Day
- 85% speed = 55km/h
- Fell/1st - 5 collisions involving cyclists 2011-2015
- Threshold protected bikeway = 4,000 ADT & 50 KM/H

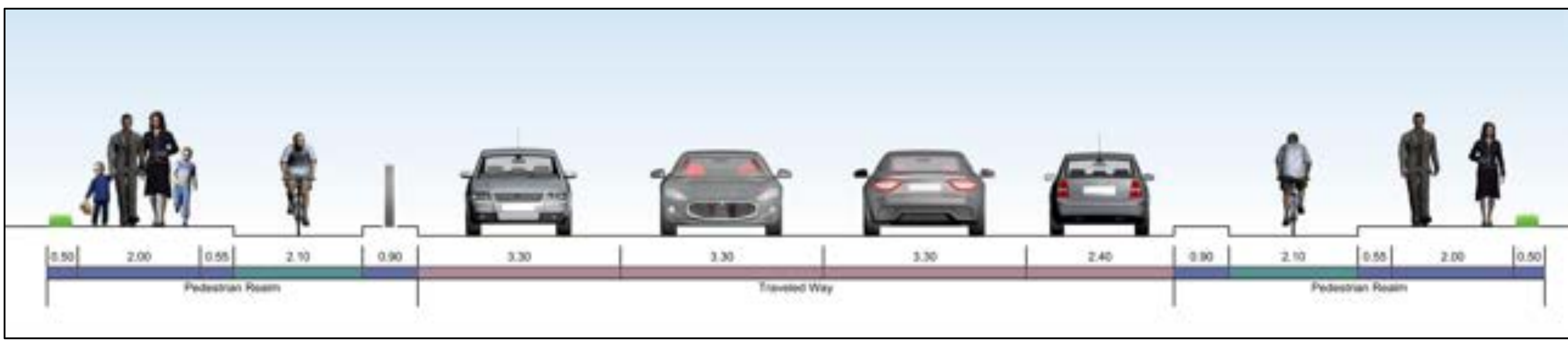
X-SECTION: BEFORE



West 1st Street - MacKay Rd to Fell Ave

- Protected bike lanes (2.1 m)
- Buffer (0.9 m)
- One parking lane (2.4 m)
- Single travel lane in each (3.3 m)
- 2 way left turn bay (3.3 m)
- Total = 18.3 m

X-SECTION: AFTER



West 1st Street - MacKay Rd to Fell Ave

West 1st Street - MacKay Rd to Fell Ave

West 1st Street - MacKay Rd to Fell Ave

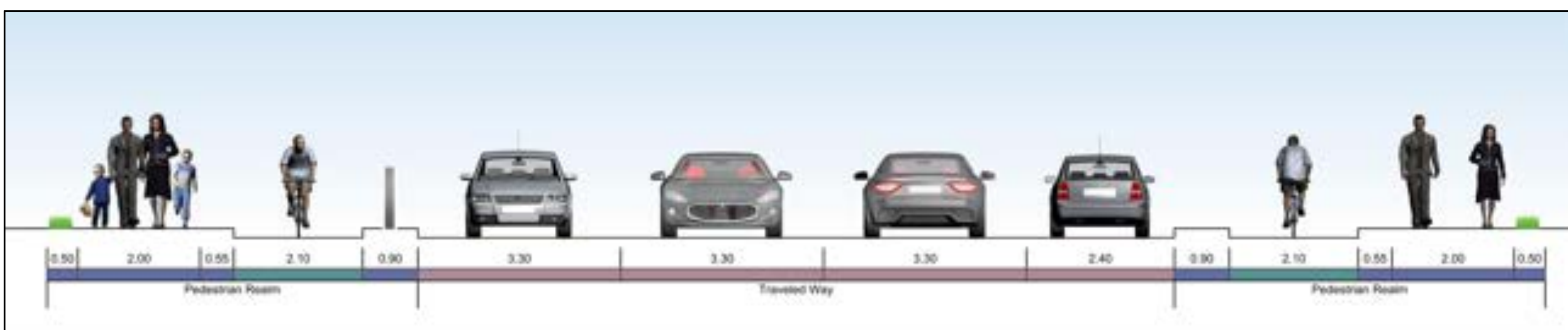
Current Performance

- 85% speeds are lower & cyclist volumes increased
- Collisions involving cyclists are lower (0 in 2020)
- No complaints regarding loss of curb-side parking

Lessons

- Strong resistance to removal of curbside parking
- HUB's Local Committee were key stakeholders
- Small changes can make a big difference for cyclists

X-SECTION: AFTER



Brooksbank Ave – Keith Rd E to Main Str

- 4 General Purpose Travel lanes 3.5 m
- Total = 14 m

X-SECTION: BEFORE

Brooksbank Ave – Keith Rd E to Main Str

- Unidirectional bike lanes (1.7 m)
- Buffer/Flexible Bollards (0.4 m)
- 1 General Purpose Travel lane in each direction (3.3 m)
- Bi-directional left hand turn lane (3.2 m)
- Total = 14 m

X-SECTION: AFTER

Brooksbank Ave – Keith Rd E to Main Str

Brooksbank Ave – Keith Rd E to Main Str

Brooksbank Ave – Keith Rd E to Main Str

Current Performance
- Cyclists increase BUT no increase in collisions involving cyclists
- Volumes unchanged
- Speeds lower

Lessons
- Fewer thru lanes doesn't always mean less capacity
- Changes upstream can prompt changes downstream
- Interim changes are a great place to start

X-SECTION: AFTER

Mountain Hwy – Keith Rd E to Main Str

X-SECTION: BEFORE

<u>Intermittent West Sidewalk</u>
Capacity: 1,800 people per hour

<u>Southbound Peak Hour Bus Lane</u>
Capacity: 17 Buses Per Hour/1309 People
36 Cyclists Per Hour

<u>Southbound General Traffic Lane</u>
Capacity: 1,200 Vehicles Per Hour/1,440 People

<u>East Sidewalk</u>
Capacity: 7,200 people per hour

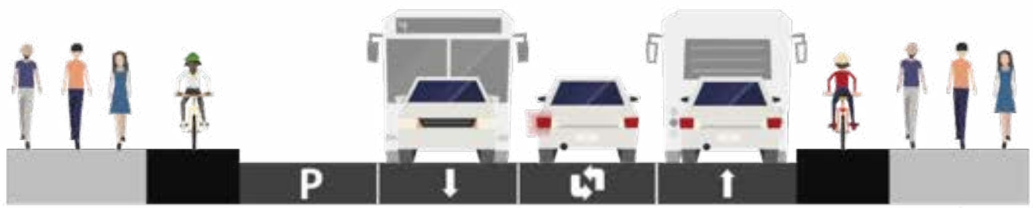
<u>Northbound Parking Lane</u>
Capacity: Zero

<u>Northbound General Traffic Lane</u>
Capacity: 1,200 Vehicles Per Hour/1,440 People
17 Buses Per Hour/1309 People
36 Cyclists per Hour

Total people capacity = 14,570 /hr

Mountain Hwy – Keith Rd E to Main Str

X-SECTION: AFTER



West Sidewalk
Capacity: 10,800 people per hour

West Bike Lane
Capacity: 2,880 people per hour

Southbound Parking Lane
Capacity: Zero

Southbound General Traffic Lane
Capacity: 1,200 Vehicles Per Hour/1,440 People
17 Buses Per Hour/1309 People

Centre Turn Lane
Capacity: 400 Vehicles Per Hour/480 People

Northbound General Traffic Lane
Capacity: 1,200 Vehicles Per Hour/1,440 People
17 Buses Per Hour/1309 People

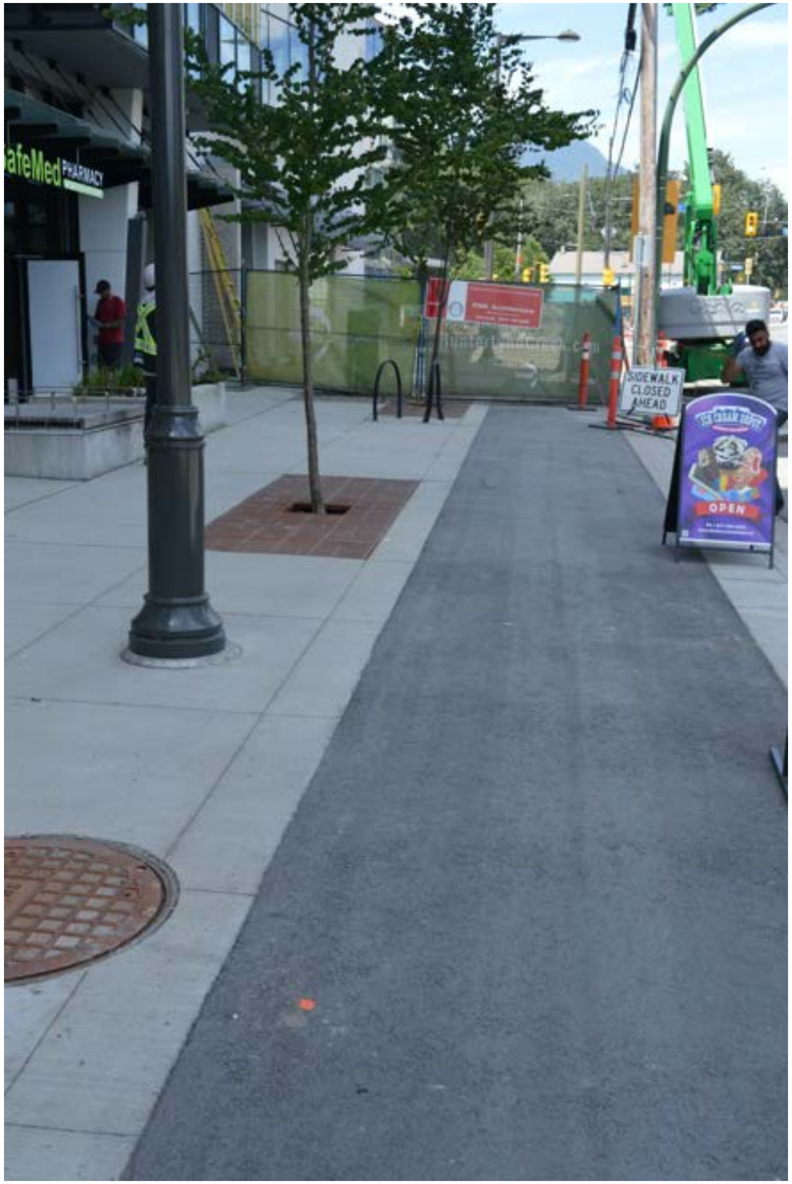
East Bike Lane
Capacity: 2,880 people per hour

East Sidewalk
Capacity: 10,800 people per hour

Total people capacity = 33,338 /hr

Mountain Hwy – Keith Rd E to Main Str

Mountain Hwy – Keith Rd E to Main Str

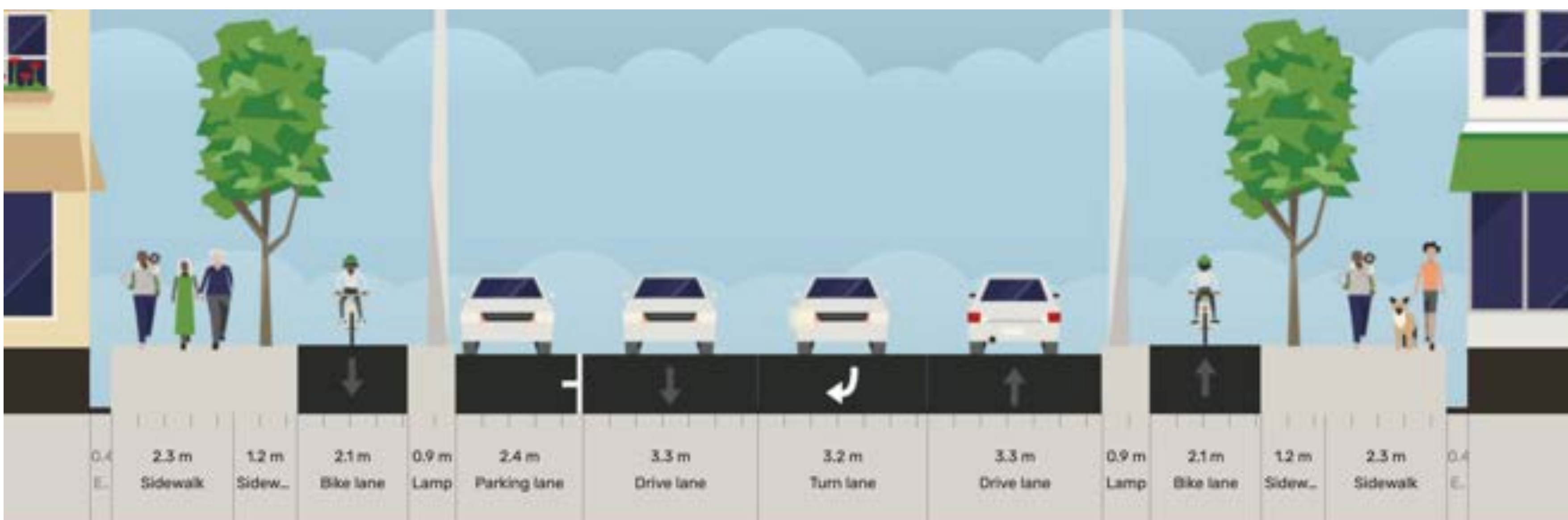


Mountain Hwy – Keith Rd E to Main Str

Lessons

- Consider the entire network, rather than a single route
- Targets for active transportation can influence design
- Active transportation facilities influence capacity most strongly
- Increased density does not always necessitate increased motor vehicle capacity
- Change can take time – so push for interim AT facilities
- LC roles are changing from advocates to facilitators

X-SECTION: AFTER



Discussion: Protected Bike Lane Design

Curbs

Flexible bollards

Considerations

Protected Bike Lane Design: curbs vs flexible bollards?

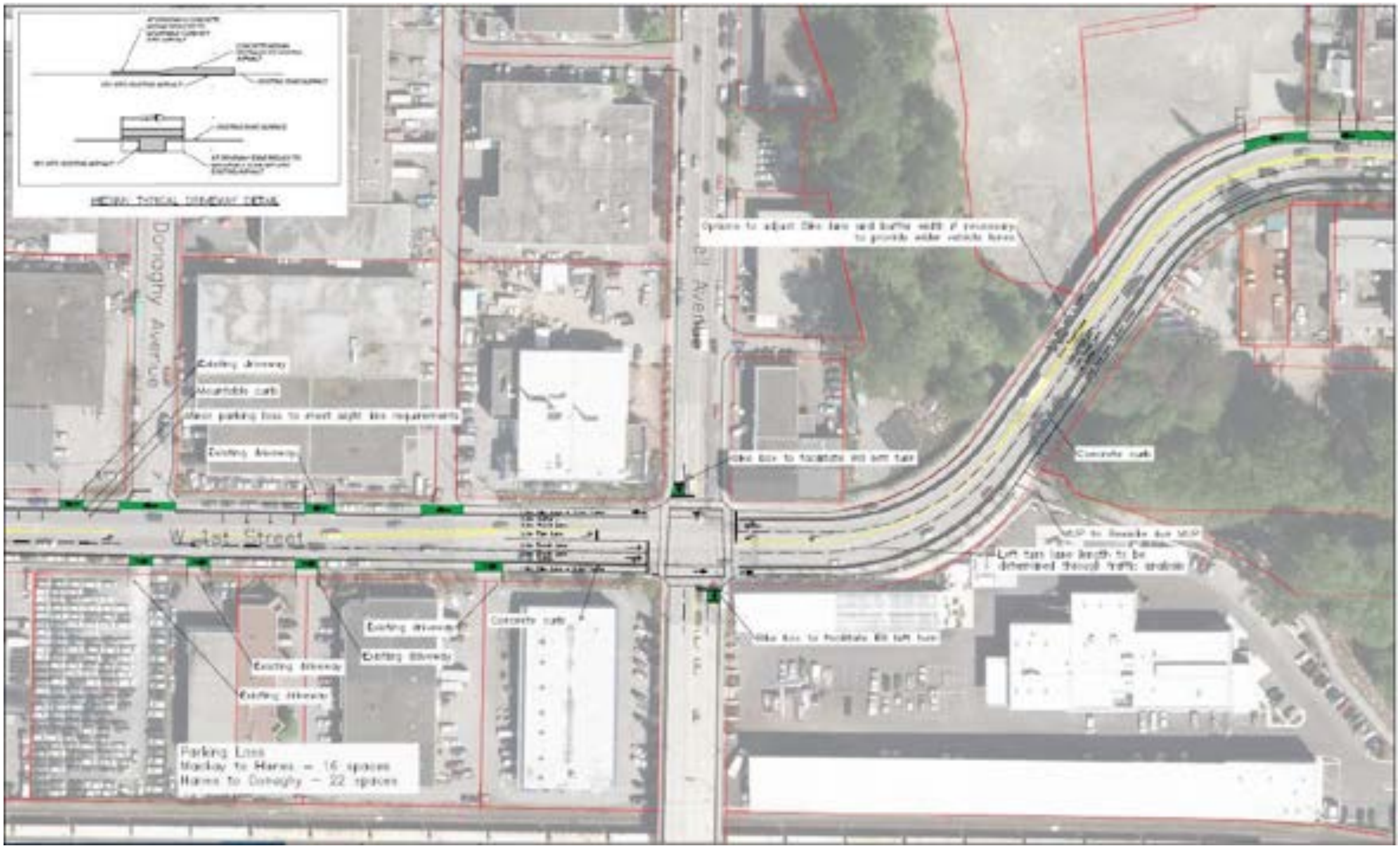
- Safety – perceived and actual?
- Cost and durability – initial and maintenance?
- Passing in bike lanes - < 2.4 m wide?
- On roads w/ many driveways & garbage collection?
- Other concerns and questions?

Discussion Questions

- Protected Bike Lanes: Curbs or flexible bollards?
- Have you seen motor vehicle capacity reallocated in your local area?
- What was your Local Committee involvement?
- What role did you play?
- Were you satisfied with the outcome?
- Do you see your role changing?
- Other concerns and considerations?

West 1st St – MacKay to Fell Ave

W. 1st St @Fell to 2nd St W @ Bewicke



2nd St W @ Bewicke to 3rd St W