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01 EPASS Corridor Characteristics

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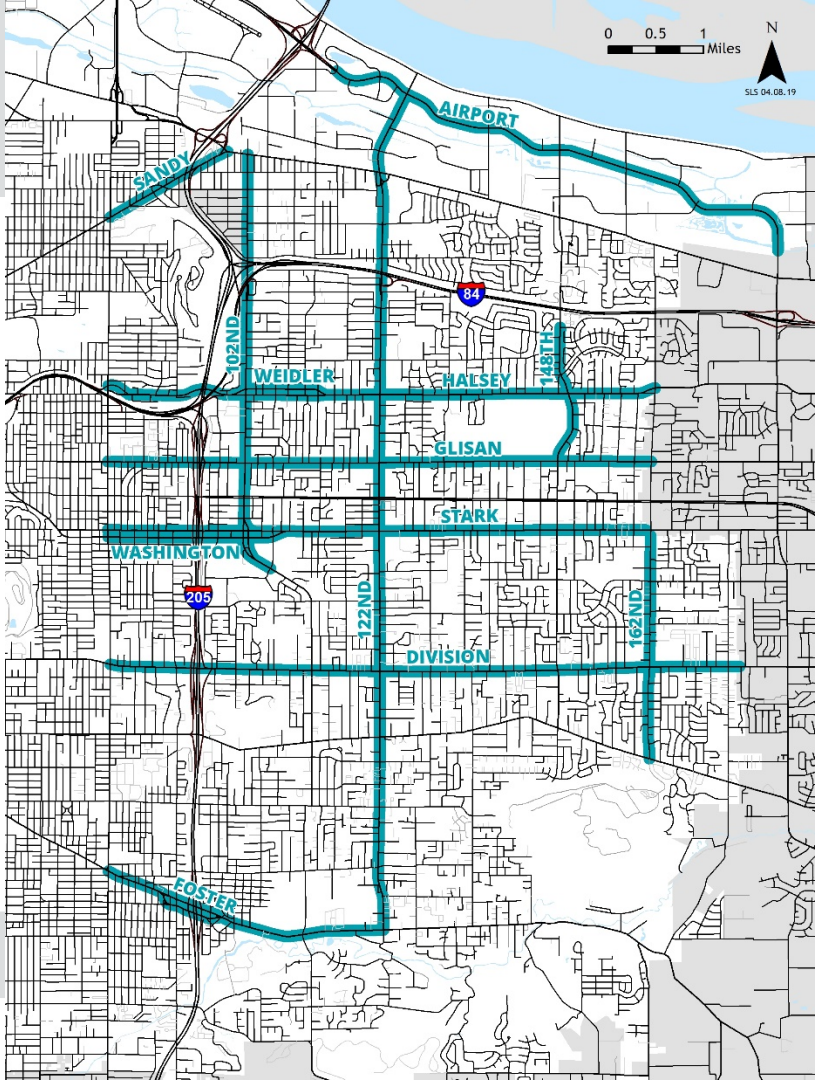
EPASS Corridors

- 11 major arterials in the East Portland area
- 33 centerline miles
- Roadway typologies:
  - 66’ curb-to-curb, 5 lanes, curb-tight sidewalks
  - 76’ curb-to-curb, 5 lanes, bike lanes & parking, curb-tight sidewalks
  - Couplets
  - Airport Way
- Land use contexts:
  - Mixed-use medium density corridors
  - Single-family residential and open space
  - Industrial

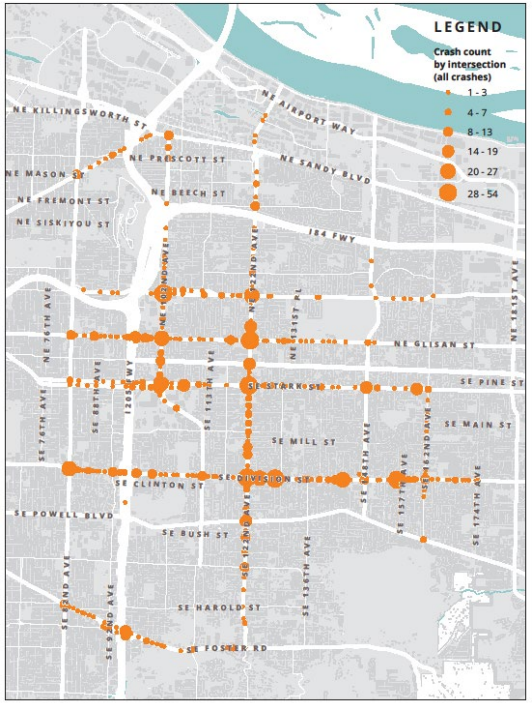


EPASS Corridors

- 11 major arterials in the East Portland area

Over a ten-year period on the network:

- 878 crashes resulted in serious injury or fatal
- 49 of the injuries were fatal
- Additional 441 crashes involving a cyclist or pedestrian where the vulnerable user was not injured
- Pedestrian crashes were most common -43% of injury crashes on EPASS corridors
- Injuries per corridor range from 3 on 148th to 220 on Division



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Crash type by mode and corridor

- Bikes crashes are most often turning movements; followed by angle crashes (70%)
- Pedestrians are most often hit by vehicles moving straight (59%)
- Vehicle crashes are most often turning movements or rear-ends) (30% each)

Mode	Crash Type	NE/SE 102nd	NE/SE 122nd	NE 148th	SE 162nd	NE Airport	NE Sandy	NE Halsey	NE Glisan	SE Stark	SE Division	SE Foster
Bike	Angle	1	20	-	-	-	1	6	6	7	10	8
	Backing	-	-	-	-	-	-	-	-	-	-	-
	Fixed object	-	-	-	-	-	-	-	1	-	-	-
	Head-on	-	-	-	-	-	-	1	-	-	-	-
	Parking maneuver	-	-	-	-	-	-	-	-	-	1	-
	Pedestrian	-	-	-	-	-	-	-	-	-	-	-
	Rear-end	-	1	-	-	-	-	1	-	2	1	1
	Sideswipe - O/M	-	2	-	-	1	1	1	-	-	2	2
	Turning movement	10	**41**	-	5	4	3	11	17	17	32	10
	Other/non-collision	-	-	-	-	-	-	-	-	-	-	-
Bike Total		11	64	-	5	5	5	20	24	26	46	21
Pedestrian	Angle	-	-	-	-	-	-	-	-	-	-	1
	Backing	-	-	-	-	-	-	-	-	-	1	-
	Fixed object	-	1	-	-	-	-	-	2	-	1	-
	Head-on	-	-	-	-	-	-	-	-	-	-	-
	Parking maneuver	-	-	-	-	-	-	-	1	1	-	-
	Pedestrian	-	-	-	-	-	-	-	-	-	-	-
	Rear-end	1	-	-	-	-	-	1	-	1	1	-
	Sideswipe - O/M	-	-	-	-	-	-	-	-	-	1	-
	Turning movement	21	30	-	3	2	4	16	12	38	29	9
	Straight movement - un	4	39	-	2	-	15	10	22	28	**68**	11
	Other/non-collision	-	1	-	-	-	-	-	1	-	-	-
Pedestrian Total		26	71	-	5	2	19	27	38	68	101	21
Vehicle	Angle	2	3	-	-	-	1	5	5	15	7	8
	Backing	-	-	-	-	-	-	-	-	-	-	-
	Fixed object	-	3	2	2	8	-	3	6	4	8	4
	Head-on	-	1	-	-	-	-	1	2	-	-	-
	Parking maneuver	-	-	-	-	-	-	-	-	-	-	-
	Pedestrian	-	-	-	-	-	-	-	-	-	-	-
	Rear-end	4	4	-	2	2	-	4	10	13	**40**	7
	Sideswipe - O/M	1	-	-	-	-	1	1	1	-	2	1
	Turning movement	7	8	1	2	3	1	15	12	15	14	4
	Other/non-collision	-	-	-	-	2	-	1	2	-	2	1
Vehicle Total		14	19	3	6	15	3	30	38	47	73	25
TOTAL		**51**	**154**	**3**	**16**	**22**	**27**	**77**	**100**	**141**	**220**	**67**

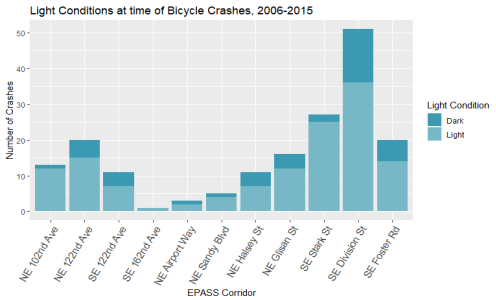
Bike Involved		-	64	-	2	-	1	1	3	4	3	1
Pedestrian Involved		24	69	-	3	1	4	1	35	40	163	22

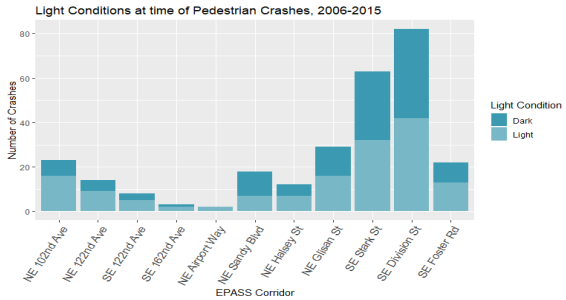
Crash type rates by corridor

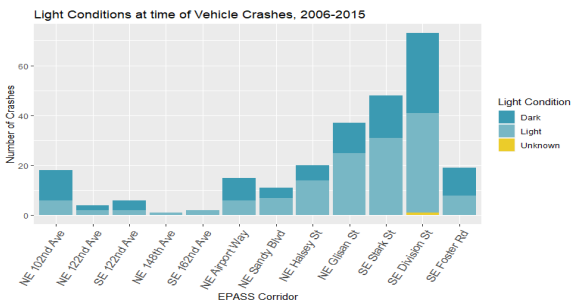
	NE/SE 102nd	NE/SE 122nd	NE 148th	SE 162nd	NE Airport	NE Sandy	NE Halsey	NE Glisan	SE Stark	SE Division	SE Foster	TOTAL
Corridor Length (mi)	3.47	6.20	1.03	1.64	3.77	0.99	4.80	4.01	5.34	4.65	2.66	**38.57**
Ped Crashes Per Mile	7.50	11.45	-	3.05	0.53	19.15	5.63	9.47	12.74	21.72	7.90	**99.13**
Bike Crashes Per Mile	3.17	10.32	-	3.05	1.32	5.04	4.17	5.98	4.87	9.89	7.90	**55.71**
Vehicle Crashes Per Mile	4.04	3.06	2.91	3.66	3.97	3.02	6.25	9.47	8.80	15.70	9.41	**70.30**
Total Crashes Per Mile	***14.71***	***24.83***	***2.91***	***9.76***	***5.83***	***27.22***	***16.05***	***24.92***	***26.41***	***47.31***	***25.21***	***225.14***

- SE Division Street has the highest number of crashes per mile in total and for pedestrian and motor vehicle crashes
- NE/SE 122nd Avenue, the longest of the EPASS corridors, has the highest number of bike crashes per mile

Light conditions







- Pedestrian crashes occur more frequently at night (45%) than other modes: bike (24%) and motor vehicle (43%)
- Sandy, Glisan, Stark, and Division have the highest occurrence of pedestrian crashes at night
- SE 122nd and Halsey have the highest frequency of bike crashes at night: 36 percent for each street
- Vehicle crashes during dark conditions occur on 102nd, 122nd, Airport Way, and Foster more frequently than on the other EPASS corridors (>50% of total).

02 Optional Countermeasures

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Background and Approach

- Reviewed city safety analysis
- Identified trends
- Identified treatments to address concerns
- Provide CMFs where possible
  - Crash Modification Factor (CMF)
    - Multiplicative factor to estimate the number of crashes after implementing a countermeasure
    - CMF = 0.75, means a 25% reduction in crashes

CMF Resources

- HSM Predictive Method for Urban and Suburban Arterials
  - Highway Safety Manual, American Association of State Highway Transportation Officials. 2010.
- Crash Modification Factors Clearinghouse
  - Federal Highway Administration. 2019.
- NCHRP Report 500: Guidance for Implementation of the AASHTO Strategic Highway Safety Plan
  - National Cooperative Highway Research Program. 2004.
- Urban Street Design Guide
  - National Association of City Transportation Officials. 2013.
- PBOT Vision Zero Action Plan
  - City of Portland. 2016
- PedPDX: Portland's Citywide Pedestrian Plan
  - Portland Bureau of Transportation. 2019.
- Safe Systems Synthesis: An International Scan for Domestic Application
  - University of North Carolina Highway Safety Research Center. 2018

CMF Resources

- ODOT's HSIP Countermeasures and Crash Reduction Factors
  - Highway Safety Manual, American Association of State Highway Transportation Officials. 2010.
- PBOT Analysis Road Reconfigurations Reduce Crashes and Speeding in Portland
  - Portland Bureau of Transportation. 2014

Crash Conditions

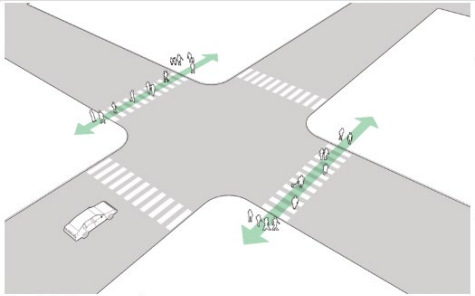
- Pedestrian crashes
  - Signalized (38%)
  - Un-signalized intersections (22%) and mid-block (35%) locations
  - Mostly turning vehicles not yielding right-of-way
  - Nearly half during dark lighting conditions
- Bicyclist crashes
  - Signalized and un-signalized intersections
    - Some bicyclists (25%) disregarding signal
  - Mostly turning vehicles not yielding right-of-way
  - One-quarter during dark lighting conditions
  - One-quarter crashes at driveways

Crash Conditions and Contributing Factors

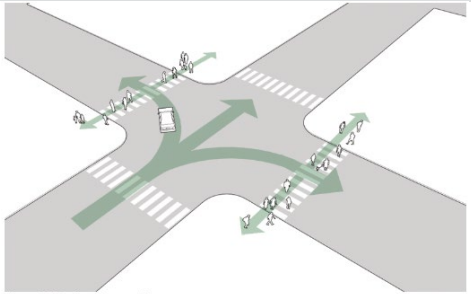
- Vehicle Crashes
  - Rear-end (30%), turning movement (30%), angle (17%), and fixed object (16%)
  - Nearly half occurred during dark lighting conditions
- 85th percentile speeds higher than posted speed limit on all corridors
- 29-96% of drivers traveling above 30 mph, varying by corridor

Countermeasures for Pedestrian and Bicyclist Crashes

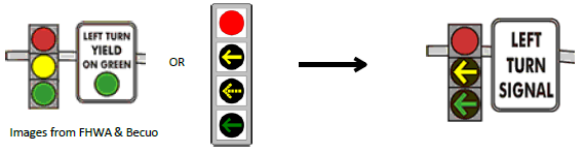
- Issue: Vehicles turning into peds/bikes at intersections
- Countermeasures
  - Leading pedestrian intervals (CMF=0.87)
    - Give peds 3-7 second head start when entering intersections
  - Restrict right-turn-on-red movements (CMF=0.92)
  - High visibility/raised crosswalks (CMF=0.60)
  - Replace permissive or protected/permissive left turn to protected only (CMF=0.01)



Phase 1: Pedestrians only
Pedestrians are given a minimum 3–7 second head start entering the intersection.



Phase 2: Pedestrians and cars
Through and turning traffic are given the green light. Turning traffic yields to pedestrians already in the crosswalk.



Images from FHWA & Becuo

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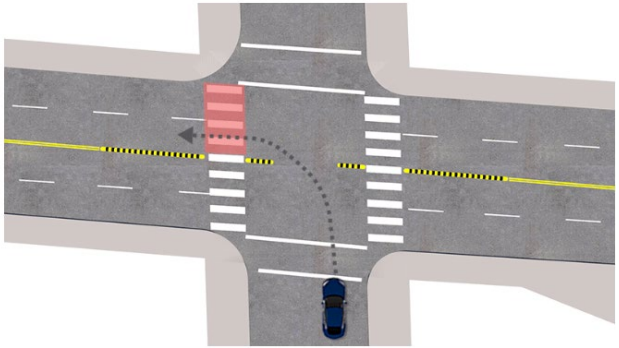
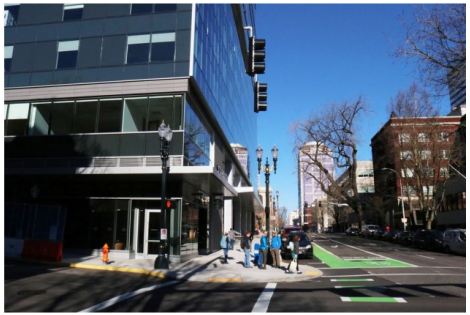
Countermeasures for Pedestrian and Bicyclist Crashes

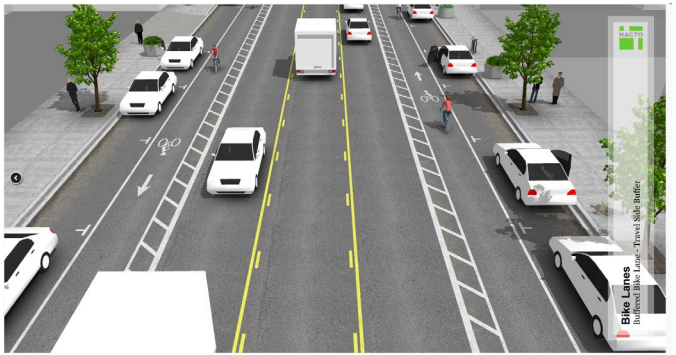
- Countermeasures (continued)
  - Install left turn calming (PBOT Pilot Project) (No CMF available)
    - Rubber speed bumps force drivers to slow down on turns, not cut corners, and increase driver view of crossing pedestrians
  - Install curb extensions at intersections (No CMF available)
    - Reduce crossing width for pedestrians and reduce vehicle speeds
  - Install mid-block marked crossings (CMF=0.74). Install rectangular rapid flashing beacons (RRFB) at midblock crossings (CMF=0.53)





Countermeasures for Speeding Related Crashes

- Issue: Majority of drivers traveling above speed limit
- Countermeasures
  - Road diet (CMF=0.63)
    - Convert 5-lane sections to 3 lane sections
  - Install buffered bicycle lanes (No CMF available)
    - Separate modes that travel at different speeds
    - Additional space within right-of-way after road diet reduces number of lanes
  - Install raised median (CMF=0.78)
  - Reduce driveway density (CMF=0.71)



Countermeasures for Speeding Related Crashes

- Countermeasures (continued)
  - Install automated speed enforcement cameras (CMF=0.83)
    - Photo taken of driver's license plates if threshold speed surpassed, citation mailed to driver
  - Speed reader board (CMF=0.54)
    - Remind driver's of vehicle speed and speed limits
  - Lower posted speed from 30 mph to 25 mph (CMF=0.74)
  - Reduce cycle lengths and use slower signal progressions (No CMF available)
    - Force drivers to accelerate more slowly after signal change

Countermeasures for Crashes in Dark Conditions and Fixed Object Crashes

- Issues
  - Large percentage of pedestrian, bicyclist, and motor vehicle crashes during dark conditions
  - Road departure crashes with light poles and utility poles
- Countermeasures
  - Increase average illuminance (CMF=0.96)
    - Install lighting on both sides of road segments and/or install light fixtures with higher lumen output
  - Reduce fixed object density, increase offset to fixed objects (CMF=0.78)

Countermeasures Summary

Crash Type	Safety Issue/Concern	Treatment	Effectiveness
Pedestrian and bicyclist crashes	Vehicles turning into pedestrians/bicyclists at intersections	Install leading pedestrian intervals (LPI) (ODOT, 2018)	0.63 (all severities, pedestrian and bicyclist crashes, ODOT ID=BP3)
		Restrict right-turn-on-red movements at intersections (HSM, 2010)	0.92 (all severities, all crash types, Clearinghouse ID=5194)
		Replace permissive or protected/permissive left turn with protected only (ODOT, 2018)	0.01 (all severities, left turn crashes, ODOT ID=I4)
		Provide high visibility/raised crosswalks at intersections (PedPDX, 2019)	0.60 (all severities, pedestrian crashes, Clearinghouse ID=4123, 2 Stars)
		Install left turn calming (PBOT Pilot Program, 2019)	Unknown
		Install curb extensions, marked crosswalks according to PedPDX crossing spacing guidelines and pedestrian warning signs (e.g. rectangular rapid flashing beacon). (ODOT, 2018)	0.63 (all severities, pedestrian crashes, ODOT ID=BP12)
Speeding related crashes	Motor vehicles traveling at unsafe speeds	• Road diet: Change 5 lane section to 3 lane section with buffered bike lanes (PBOT, 2014) • Install buffered bicycle lanes (NACTO, 2013)	• 0.63 (all severities, all crash types, no ID available) • Unknown
		• Install raised median (ODOT, 2018) • Reduce driveway density (ODOT, 2018)	• 0.78 (all injury, all crash types, ODOT ID=H34) • 0.71 (all injury, all crash types, ODOT ID=H30)
		• Install automated speed enforcement (Vision Zero Action Plan, 2016) • Install individual changeable speed warning signs (ODOT, 2018)	• 0.83 (fatal and injury, all crash types, Clearinghouse ID=4583) • 0.59 (all severities, all crash types, ODOT ID=H47)
		Lower posted speed limit from 30 miles per hour to 25 miles per hour (CMF Clearinghouse, 2019)	0.74 (all severities, all crash types, Clearinghouse ID=8076)
		Reduce cycle lengths and use slower signal progressions (NACTO, 2013)	Unknown
Crashes in dark conditions	All mode crashes in dark light conditions along segments	Increase average illuminance on roadway segments and sidewalks (CMF Clearinghouse, 2019)	0.96 (all severities, crashes during dark lighting conditions, Clearinghouse ID=8798, 3 Stars)
Fixed object crashes	Road departure crashes with utility poles and light poles	Reduce fixed object density, increase offset to fixed objects (HSM, 2010)	0.78 (all severities, fixed object crashes, Clearinghouse ID=35)

Discussion Questions

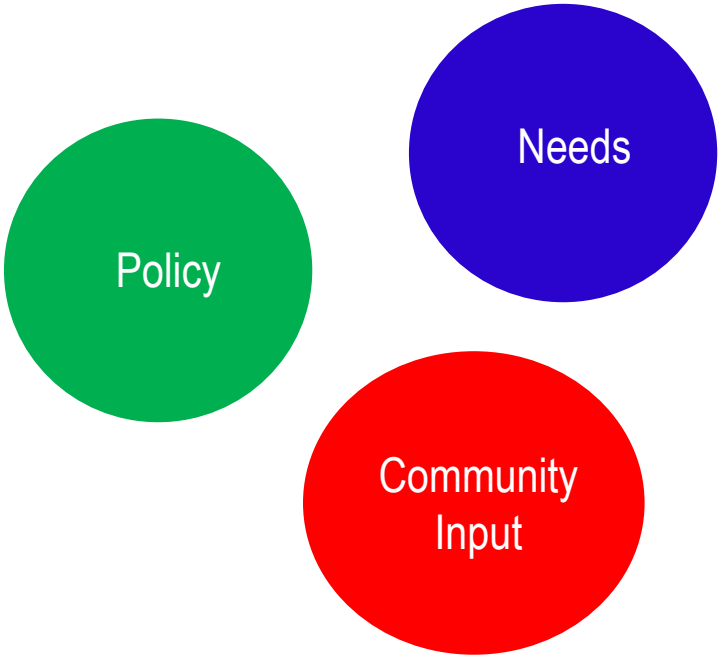
- Which countermeasures should be prioritized for which corridors?
- Should we prioritize cross-section modifications or traffic improvements that do not require changes in geometry?
- How do the optional countermeasures work *towards* or *against* the intended function of the corridors?
- Are there additional ideas/considerations for countermeasures?

03

Evaluation Criteria

Evaluation Criteria

- Planning projects criteria to drive decision making on where or how to invest
- Evaluation and prioritization criteria typically driven by:
  - Needs based on data
    - Safety
    - State of repair
    - Infrastructure gaps
  - Policy
    - Equity, safety, climate, modal share, and mobility goals
  - Community input and desire
    - Priorities identified in previous plans
    - Survey and outreach feedback



Common Plan Criteria

Plan	Transportation System Plan	Growing Transit Communities	Ped PDX	Southwest In Motion	Safe Routes to Schools
Access	X	X	X	X	X
Equity	X	X	X		X
Safety	X	X	X	X	X
Stakeholder Input/ Support	X	X		X	
Demand			X	X	
Cost effectiveness	X	X		X	
Opportunities				X	

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Sample criteria measures

Plan	Transportation System Plan	Growing Transit Communities	Ped PDX	Southwest In Motion	Safe Routes to Schools
Access	Relative to other projects, how many people will benefit from improved walk/bike/transit access to essential neighborhood destinations due to this project	Improved access to transit: Proximity to transit stop, average daily ridership, bus ramp deployment	"Demand" via street classification and district overlays	Access to buses, particularly high frequency, rail, streetcar	Access to schools
Equity	Relative to other projects, how much will this project improve safety, access (opportunity and neighborhood), and/or health for underserved populations (low-income, people of color, seniors and youth?	Serves Transportation Disadvantaged	Location-based race and income data		Title 1 school

Sample criteria measures, cont.

Plan	Transportation System Plan	Growing Transit Communities	Ped PDX	Southwest In Motion	Safe Routes to Schools
Safety	Relative to other projects, how much will this project reduce fatalities and serious injuries?	Transportation Safety: Crash history, High Crash Network, High Crash Intersections, Crash Risk Factors	Pedestrian High Crash Network, high numbers of pedestrian collisions, risk factors based on # of lanes, and speed		On vision Zero High Crash Network, High Crash Intersections, Speed data; vehicle volumes
Stakeholder Input	What is the extent of support or opposition to the project?	Stakeholder Input		Community Support: supported by neighborhood, district coalition, in recent area plan	

Criteria Considerations

- Most existing criteria uses spatial or location-based differentiators to prioritize amongst projects

- EPASS needs criteria to prioritize or choose amongst cross sections, design decisions, and safety countermeasures

EPASS Guiding Policy framework: Vision Zero/ Safety

Does the roadway design or intervention on this corridor:

- address or mitigate leading crash factors for vulnerable users (peds/ bikes)?
- address or mitigate leading crash factors for vehicle operators?

Will the intervention or design significantly contribute to more people driving at safe speeds?

EPASS Guiding Policy framework: Climate Justice

- Does the roadway design or countermeasure design support a modal shift away from single occupant vehicle trips?

- Does the roadway design improve access to essential neighborhood destinations by foot, bicycle, scooter or transit?

EPASS Guiding Policy framework: Equity

- Does the change create faster and/or more reliable transit service?
- Does the road design improve safe access to transit stops and stations?
- Does the road design or countermeasure improve the comfort or personal safety of those walking, rolling, or riding a bicycle in the corridor?

EPASS Guiding Policy framework: Mobility

- Do the corridor intersections still meet level of service standards under roadway redesigns?
- Does the change add more than X% travel time for vehicles on the corridor?
- Does the change create unacceptable levels of diversion onto greenways?

Evaluation Discussion

- Are there measures we missed?
- Will these measures differentiate enough between countermeasures or roadway designs?

Summary:

- Address leading crash factors?
- Contribute to driving at safe speeds?
- Support modal shifts?
- Create better access for peds, bikes, transit users?
- Aid in faster/ more reliable transit?
- Improve access to transit stops/stations?
- Improve safety/comfort for peds, bikes, transit users?
- Maintain level of service?
- Keep people moving with reliable travel times?
- Maintain acceptable vehicle volumes on greenways?

04 Modeling Update and Next Steps

Performance Measures

- PM Peak Conditions:
  - VMT/VHT = average speed for network
  - Vehicle Hours of Delay
  - Travel Time
  - Travel Distance
  - Total Delay Time
  - Latent vehicles
  - % of congested roadway miles (V/C ratios)