Prioritizing "hardening" protected bicycle lanes

May 2024

Executive Summary

Portland's 51 lane miles of protected bicycle lanes include three types that make prominent use of delineator posts. They are:

- Parking protected with delineator posts (10.7 lane miles)
- Delineator post protected (10.3 miles)
- Tuffcurb delineator post protected (1.1 lane miles)

Discounting delineators on the Burnside Bridge, SE Stark, and the 28th and 21st Avenue overcrossings of the Banfield[1], there are a total of 20.5 lane miles of protected bicycle lanes using delineator posts to be replaced with a more permanent material.

Converting delineator posts to concrete (ie., "hardening") is prioritized based on undue maintenance demands and aesthetics. Maintenance considerations are based on reports from MO staff as to which protected lanes require frequent replacement of posts. Aesthetic considerations are based on proximity to commercial districts and anecdotal complaints received by PBOT staff about the appearance of protected lanes. Of the 48 distinct segments with delineator posts, 5 were identified as having both maintenance and aesthetic reasons for replacement.

ES-1. Summary of range of costs and length of projects by prioritization focus

if we focused on:	Distinct segments	Length		Range of Costs	
		linear feet	lane miles	low	high
Maintenance, only	10	28,280	5.4	$2,455,000	$4,012,000
Aesthetics, only	17	44,085	8.3	$3,518,000	$5,374,000
Maintenance and aesthetics	5	23,405	4.4	$2,232,000	$3,621,000
Maintenance or aesthetics	22	48,960	9.3	$3,741,000	$5,765,000
Requiring additional engagement*	*3*	*14,690*	*2.8*	*$1,750,000*	*$2,778,000*
All segments	48	108,305	20.5	$5,187,000	$7,987,000

**includes segments with maintenance and/or aesthetic considerations*

[1] Delineator posts on Burnside Bridge with be replaced as part of the Earthquake Ready Burnside Bridge project. Those on SE Stark will be replaced with the Stark Street project. Tuffcurb delineator posts on the 21st and 28th Avenue overcrossings of the Banfield cannot be replaced with traffic separators because PBOT's practice is to use glue down materials only on structure so as to not puncture the skin and allow water to penetrate to the super structure.

Estimated costs are expressed as a range for each segment, based on typical coverage of protection along a corridor, PBOT's unit costs for materials and a 3.1 multiplier for design and contracting.

Prioritizing just those segments with either a maintenance or aesthetic reason, approximately 14 lane miles of bikeways would be hardened over approximately 10 years at a cost range of $3.7 million - $5.8 million.

The below prioritization tiers suggest an initial five years of projects with each year's average cost hovering near $500,000. The three projects assumed to require additional public process are held out from those first five years.

Prioritization Tiers

	Low cost range	High cost range	linear feet	miles
First year	$391,000	$676,000	11,015	2.1
Second year	$429,000	$751,000	14,000	2.7
Third year	$455,000	$556,000	8,570	1.6
Fourth year	$396,000	$445,000	3,110	0.6
Fifth year	$267,000	$467,000	8,700	1.6
Subtotal	**$1,938,000**	**$2,895,000**	**45,395**	**8.6**
Need more process / separate process	$1,750,000	$2,778,000	25,830	4.9
All other segments	$1,499,000	$2,314,000	37,080	7.0

Figure ES-2. The five priority tiers correspond roughly to years. All projects in the five years are those identified as having maintenance and/or aesthetic issues. There are three larger projects needing additional process or a separate funding source: NW and SW Broadway and NE Glisan. At $500,000 as the annual budget, those projects could require 4-5 years to complete. All other segments will require between $1.5-$2.8 million and another 3-5 years beyond the initial 5 years.

Background

As of May 2024 Portland has 51 lane miles of protected bicycle lanes.[2] These protected lanes are created by 11 different types of treatments, as shown in Figure 1. This document prioritizes the replacement of three of those treatments: delineator posts, tuffcurb delineator posts and parking-protected with delineators. Together, those three types represent 43% of the linear miles of Portland's existing protected bicycle lanes.

Protected Lane Type	Center line miles	Lane miles*
Sidewalk level	2.8	4.3
Half-step to sidewalk	1.1	1.9
Concrete island	0.1	0.1
Traffic Separator	10.9	20.1
Tuffcurb solid curb	0.1	0.1
Planters	0.4	0.9
Parking protected (w/ delineators)	7.1	10.7
Parking protected (w/o delineators)	0.9	0.9
Delineator posts	6.7	10.3
Tuffcurb delineator posts	0.7	1.1
Other**	0.1	0.3
Totals	**31.0**	**50.7**

* figures in this column may be slightly inflated as calculations do not account for different treatments on different sides of roadway
**"Other" here refers to the metal fences used on SW Porter and SE Tilikum Way

Figure 1. Miles of protected bicycle lanes by type*. Bold types are those prioritized for replacement.*

"Hardening" the bike lanes, refers to replacing plastic delineator posts with more permanent material, typically either a traffic separator or, in the case of parking-protected bicycle lanes, a concrete island with a minimum 3' wide surface to step on. There are two principal reasons for replacing the plastic delineator posts with more permanent materials: maintenance burden and aesthetic considerations.

Considerations for prioritization

Maintenance. The frequent need to replace delineator posts places an unnecessary burden on PBOT's maintenance crews. This responsibility takes crews away from addressing the many other needs associated with maintaining a city's (bicycle) transportation system in good working order. Concrete traffic separators require infrequent attention.

Aesthetics. Even when in good conditions, plastic delineator posts have a temporary and low-quality appearance. We borrow much from the Dutch—builders of the world's best bikeways and bikeway networks. They have five considerations for bikeways: *safety, comfort, directness, network cohesion and attractiveness*. We have generally fallen short on attractiveness and have received deserved criticism as a result. While delineator posts are affordable and allow quick implementation, they are criticized as Portland not putting its best foot forward, especially in commercial districts.

All segments of protected lanes that feature delineator posts are shown in Figure 3. Those protected lanes are Delineator post protected ("DP"), Tuffcurb delineator post protected ("TDP") and Parking protected (w/ delineators) ("PP").

[2] Total span is 31 centerline miles. PBOT has a minimum of 16 centerline miles of protected lanes currently funded.

Estimated costs for hardening are based on conservative assumptions and are shown as a range based on expected coverage of the treatment. The cost estimates are based on the following unit costs and are shown in Figure 2.

- The cost of concrete (assumed 16" width traffic separator for non-parking protected installations and on a 3'-wide island for parking-protected installations)
- The use of a surface mounted tubular marker (one every hundred feet)
- Reflective pavement markers (one every twelve feet)
- A 4' gap between each 24'-long traffic separator
- A cost multiplier of 3.1 to account for design, contracting, overhead and project management
- Extent of coverage ranging between 40% to 70% for non-parking protected installations and 80%-90% coverage for parking-protected installations in areas without driveways.

The 40%-70% coverage reflects the presence of driveways, cross-streets, transit stops and other elements that require breaks in protection. The pathway along N Greeley—without driveways, transit stops or cross-streets—is an example of 100% coverage. Most roadways will fall within the 40% to 70% estimate for coverage.

	16" traffic separator	3' step out island
Concrete Cost per linear foot	$24.79	$55.77
Surface Mounted Tubular Marker / lf (1/100lf)	$2.56	$2.56
RPM (12-foot spacing)	$1.51	$1.51
Total Cost/lf	$28.86	$59.84
Fully loaded cost multiplier	3.1	3.1
Gap between separators/island	4	feet
Length of separator/island	24	feet

Figure 2. Linear foot costs used in estimating*. Concrete cost for both 16" separator and 3' step-out island is based on multiplying the PBOT's square foot cost for concrete islands ($18.59) by 16/12 for the separator and 3 for the 3'-wide step out island.*

MO staff identified those segments with the highest maintenance needs. They, and the range of costs associated with their conversion to traffic-separator-protected, are shown in Figure 3.

PBOT planning staff identified those segments needing replacement primarily due to aesthetic considerations. These tended to be protected lanes in or proximate to commercial districts, within the downtown core, and/or those segments about which adjacent residents have complained about their appearance. Segments prioritized for maintenance and/or aesthetic considerations are shown in Figure 4.

Figure 3. All protected bicycle lane segments with delineator posts

					% protection coverage		project cost range	
Protection Type	Location	Maintenance Issue	Aesthetic Issue	Project length (lf)	Low	high	low	high
PP	NE Glisan (123rd to 160th)	Y	Y	18640	40%	70%	$1,186,000	$2,075,000
PP	N Front Ave (NW 9th to 1900 block)			7580	80%	90%	$964,000	$1,085,000
PP	SW Capitol Hwy (SW Stephenson to SW Valona)		Y	8700	40%	70%	$553,000	$968,000
PP	SW Broadway (Burnside to SW Clay)	Y	Y	3550	80%	90%	$452,000	$508,000
PP	NE Weidler (114th to 102nd)		Y	3170	80%	90%	$403,000	$454,000
PP	NE Multnomah (7th to 13th)		Y	3120	80%	90%	$397,000	$446,000
PP	NE Halsey (102nd to 114th)		Y	3110	80%	90%	$396,000	$445,000
DP	SW BH Highway (SW 39th to SW 65th)	Y	Y	14000	40%	70%	$429,000	$751,000
PP	SE Market St (113th to 122nd)			2360	40%	70%	$150,000	$263,000
PP	SE Hawthorne (Grand to 12th)		Y	1820	40%	70%	$116,000	$203,000
PP	SE Morrison (12th to 6th)		Y	1560	50%	80%	$124,000	$198,000
DP	SW Barbur (SW Meade to SW Lane – includes shared pedestrian space)			5720	40%	80%	$175,000	$307,000
DP	NW Front Ave (61st to bend in Front)			4080	40%	70%	$125,000	$219,000
PP	SE 106th (Cherry Blossom to Washington)			1125	40%	70%	$72,000	$125,000
TDP	N Whitaker (N Schmeer Rd to N Victory Rd)			4000	40%	70%	$123,000	$215,000
DP	NW Broadway (NW Hoyt to NW Burnside)	Y	Y	3640	40%	70%	$112,000	$195,000
DP	NW Naito (NW Davis to NW Hoyt)	Y		3300	40%	70%	$101,000	$177,000
DP	N Lombard Ave (N Weyerhaeuser to N Terminal)			2900	40%	70%	$89,000	$156,000
PP	SE Cherry Blossom (103rd to 106th)	Y		690	40%	70%	$44,000	$77,000
PP	SW Alder (18th to 16th)			535	80%	90%	$68,000	$77,000
PP	N Lombard (Reno to Weyerhaeuser)			630	40%	70%	$40,000	$70,000
DP	N/NE Multnomah (NE 2nd to N Interstate)		Y	2000	40%	70%	$61,000	$107,000
DP	SE Stark (99th to 105th)	Y	Y	1715	40%	70%	$53,000	$92,000
DP	NE 102nd (Morris to Fremont)	Y		550	40%	70%	$17,000	$30,000

					% protection coverage		project cost range	
Protection Type	Location	Maintenance Issue	Aesthetic Issue	Project length (lf)	Low	high	low	high
DP	NW/SW 16th (Flander to Everett; Davis to Burnside; Burnside to SW Alder))	Y		1005	40%	70%	$31,000	$54,000
DP	NE Pacific (99th to 102nd)	Y		980	40%	70%	$30,000	$53,000
DP	SE 103rd (Cherry Blossom to Washington)			915	40%	70%	$28,000	$49,000
DP	NE 1st Ave (NE Oregon St to NE Multnomah)			780	40%	70%	$24,000	$42,000
DP	NE Sandy (NE Ash to NE Ankeny)			740	40%	70%	$23,000	$40,000
DP	N Interstate-Larrabee (N Interstate to NE Larrabee-Broadway Bridge)			715	40%	70%	$22,000	$38,000
DP	N Columbia Blvd (N Burgard to Lombard overcrossing)			690	40%	70%	$21,000	$37,000
DP	SW Jefferson (SW 16th to SW 18th)			640	40%	70%	$20,000	$34,000
DP	SE Morrison St (NE 6th to NE MLK)			590	40%	70%	$18,000	$32,000
DP	SW Madison (SW 2nd to SW 4th)		Y	560	40%	70%	$17,000	$30,000
DP	NE Couch (NE 28th to NE 26th)			525	40%	70%	$16,000	$28,000
TDP	NW 16th Ave (NW Hoyt to Flanders)			520	40%	70%	$16,000	$28,000
TDP	SW Multnomah (250’ w of SW 40th to 750’ w of SW 40th)			500	40%	70%	$15,000	$27,000
DP	SE 106th (Washington to Stark)			440	40%	70%	$13,000	$24,000
DP	SE Main St (Clay to Cherry Blossom)			415	40%	70%	$13,000	$22,000
DP	NE Killingsworth (NE 54th to NE 55th)			360	40%	70%	$11,000	$19,000
TDP	SW Main St (SW 3rd to SW 4th)		Y	290	40%	70%	$9,000	$16,000
DP	SW Alder (SW 4th to SW 3rd)		Y	280	40%	70%	$9,000	$15,000
DP	NE Couch (NE 7th to NE 6th)		Y	260	40%	70%	$8,000	$14,000
DP	SE 30th (SE Stark to SE Washington)			270	40%	70%	$8,000	$14,000
TDP	SW 26th Ave (SW Barbur Ct to 50’ s of Barbur Ct)			50	40%	70%	$2,000	$3,000
DP	Burnside Bridge (MLK to NW 2nd)		Y	5440	0%	0%	$0	$0
TDP	NE 21st Ave overcrossing (NE Pacific to Multnomah)			820	0%	0%	$0	$0
TDP	NE 28th Ave overcrossing) (NE Wasco to NE Sullivan)			800	0%	0%	$0	$0
							$5,187,000	**$7,987,000**

Figure 4. All protected bicycle lane segments with maintenance and / or aesthetic concerns

					% protection coverage		project cost range	
Protection Type	Location	Maintenance Issue	Aesthetic Issue	Project length (lf)	Low	high	low	high
PP	*NE Glisan (123rd to 160th)	Y	Y	18640	40%	70%	$1,186,000	$2,075,000
PP	*SW Broadway (Burnside to SW Clay)	Y	Y	3550	80%	90%	$452,000	$508,000
DP	SW BH Highway (SW 39th to SW 65th)	Y	Y	14000	40%	70%	$429,000	$751,000
DP	*NW Broadway (NW Hoyt to NW Burnside)	Y	Y	3640	40%	70%	$112,000	$195,000
DP	*SE Stark (99th to 105th)	Y	Y	1715	40%	70%	$53,000	$92,000
DP	NW Naito (NW Davis to NW Hoyt)	Y		3300	40%	70%	$101,000	$177,000
PP	SE Cherry Blossom (103rd to 106th)	Y		690	40%	70%	$44,000	$77,000
DP	NE 102nd (Morris to Fremont)	Y		550	40%	70%	$17,000	$30,000
DP	NW/SW 16th (Flander to Everett; Davis to Burnside; Burnside to SW Alder))	Y		1005	40%	70%	$31,000	$54,000
DP	NE Pacific (99th to 102nd)	Y		980	40%	70%	$30,000	$53,000
PP	SW Capitol Hwy (SW Stephenson to SW Valona)		Y	8700	40%	70%	$553,000	$968,000
PP	NE Weidler (114th to 102nd)		Y	3170	80%	90%	$403,000	$454,000
PP	NE Multnomah (7th to 13th)		Y	3120	80%	90%	$397,000	$446,000
PP	NE Halsey (102nd to 114th)		Y	3110	80%	90%	$396,000	$445,000
PP	SE Hawthorne (Grand to 12th)		Y	1820	40%	70%	$116,000	$203,000
PP	SE Morrison (12th to 6th)		Y	1560	50%	80%	$124,000	$198,000
DP	N/NE Multnomah (NE 2nd to N Interstate)		Y	2000	40%	70%	$61,000	$107,000
DP	SW Madison (SW 2nd to SW 4th)		Y	560	40%	70%	$17,000	$30,000
TDP	SW Main St (SW 3rd to SW 4th)		Y	290	40%	70%	$9,000	$16,000
DP	SW Alder (SW 4th to SW 3rd)		Y	280	40%	70%	$9,000	$15,000
DP	NE Couch (NE 7th to NE 6th)		Y	260	40%	70%	$8,000	$14,000
DP	*Burnside Bridge (MLK to NW 2nd)		Y	5440	0%	0%	$0	$0
							$3,741,000	**$5,765,000**

*Three of these segments will require additional engagement and/or will be considered as separate, stand-alone projects. Two of them (Stark and Burnside) will be improved as part of larger, funded capital projects.

Recommended prioritization

Figure 5, below, recommends a prioritization that generally fits the expected annual $500,000 expenditure within the high-low cost range. Segments are prioritized to reflect a presumed primary goal to reduce maintenance burden for PBOT staff. Thus, the first two years tackle those segments identified by MO staff as requiring disproportionate effort to maintain and that should not require additional public process. Over the course of five years the program tackles all segments identified as having either a "maintenance issue" or "aesthetic issue" that do not require additional process.

The average annual cost for each of the first 5 years is $480,000, with an average annual cost range of $390,000-$580,000.

Assuming $500,000 remains as a budgeted amount for all other segments, then completing those will require an additional 3-5 years. This estimate does not include those three projects identified as needing more process.

Figure 5. Segments by prioritization

						Cost Range	
Protection Type	Location	Priority	Maintenance Issue	Aesthetic Issue	Total linear feet	Low	High
DP	NE 102nd (Morris to Fremont)	1	Y		550	$17,000	$30,000
DP	NE Couch (NE 7th to NE 6th)	1		Y	260	$17,000	$29,000
DP	NE Pacific (99th to 102nd)	1	Y		980	$30,000	$53,000
DP	NW Naito (NW Davis to NW Hoyt)	1	Y		3300	$101,000	$177,000
DP	NW/SW 16th (Flander to Everett; Davis to Burnside; Burnside to SW Alder))	1	Y		1005	$31,000	$54,000
PP	SE Cherry Blossom (103rd to 106th)	1	Y		690	$44,000	$77,000
PP	SE Hawthorne (Grand to 12th)	1		Y	1820	$56,000	$98,000
PP	SE Morrison (12th to 6th)	1		Y	1560	$60,000	$96,000
DP	SW Madison (SW 2nd to SW 4th)	1		Y	560	$17,000	$30,000
TDP	SW Main St (SW 3rd to SW 4th)	1		Y	290	$18,000	$32,000
	Subtotal Priority 1:				**11,015**	**$391,000**	**$676,000**

						Cost Range	
Protection Type	Location	Priority	Maintenance Issue	Aesthetic Issue	Total linear feet	Low	High
DP	SW BH Highway (SW 39th to SW 65th)	2	Y		14000	$429,000	$751,000
	Subtotal Priority 2:				**14,000**	**$429,000**	**$751,000**
DP	N/NE Multnomah (NE 2nd to N Interstate)	3		Y	2000	$61,000	$107,000
PP	NE Multhomah (7th to 13th)	3		Y	3120	$191,000	$215,000
PP	NE Weidler (114th to 102nd)	3		Y	3170	$194,000	$219,000
DP	SW Alder (SW 4th to SW 3rd)	3		Y	280	$9,000	$15,000
	Subtotal Priority 3:				**8,570**	**$455,000**	**$556,000**
PP	NE Halsey (102nd to 114th)	4		Y	3110	$396,000	$445,000
	Subtotal Priority 4:				**3,110**	**$396,000**	**$445,000**
PP	SW Capitol Hwy (SW Stephenson to SW Valona)			Y	8700	$267,000	$467,000
	Subtotal Priority 5:				**8,700**	**$267,000**	**$467,000**
	5-year total				**45,395**	**$1,938,000**	**$2,895,000**