



# Alternative Evaluation Results

Presentation to Community Task Force

July 9, 2007

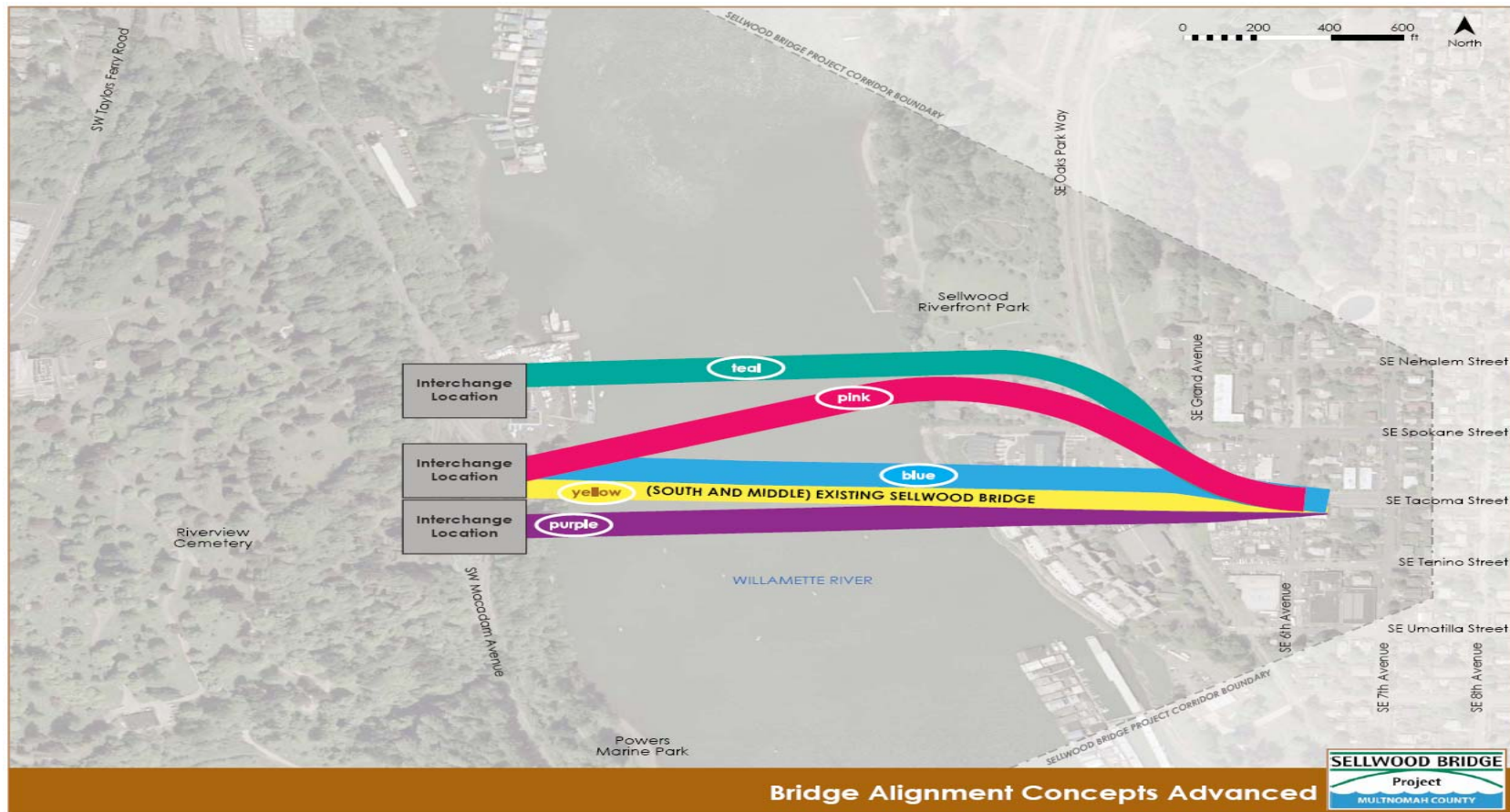
# Outline of Presentation

- Overview of alternative evaluation
- Alternative evaluation methodology
  - Process and assumptions
  - General findings
- Alternative evaluation results
  - Preliminary scores
  - Key findings
- Discussion

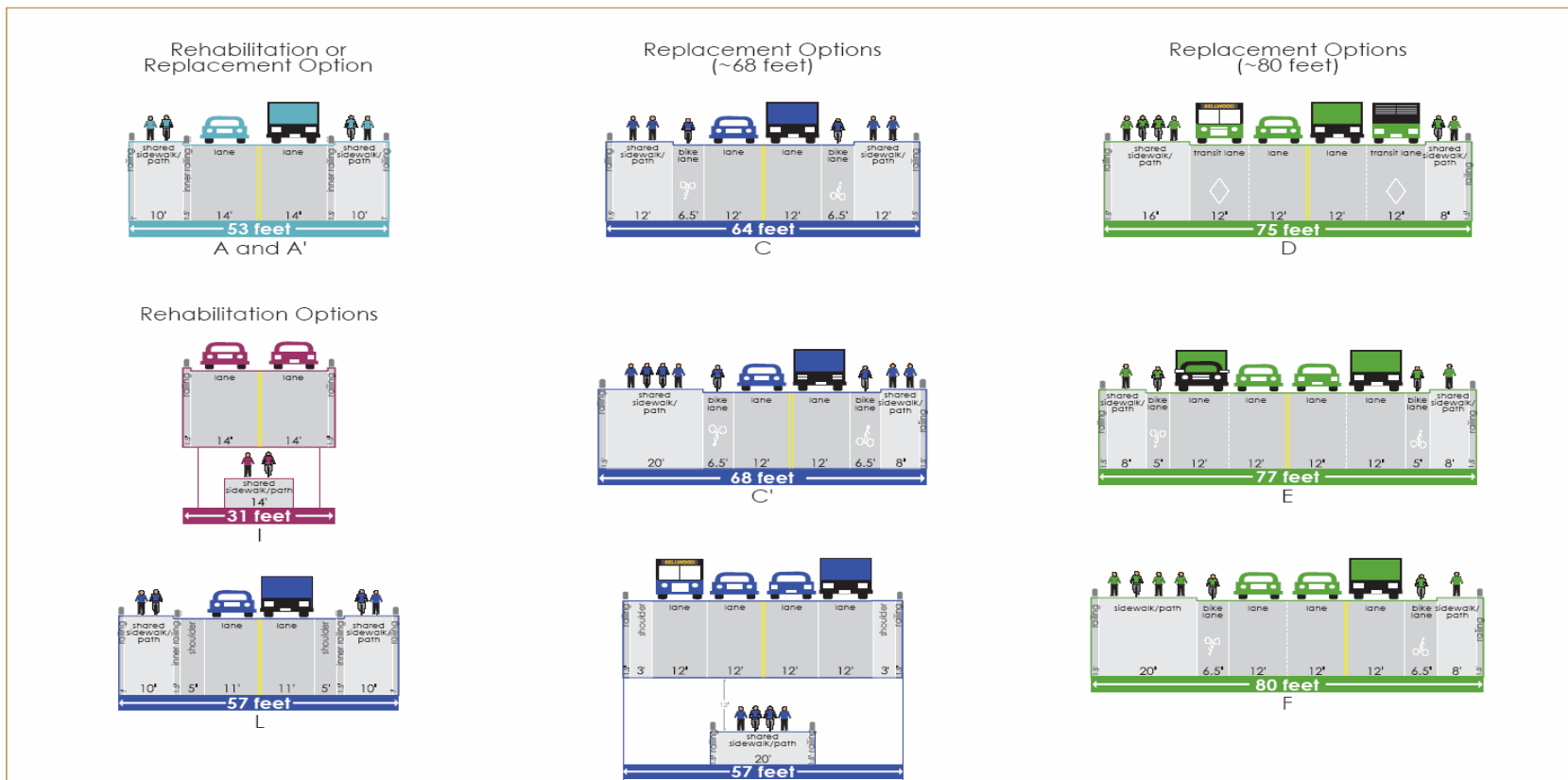


# Alternatives Evaluated

# Bridge Alignments Evaluated



# Bridge Cross Sections Evaluated



Note: These width colors are not related to the alignment colors.

Figure 5a — Representative Cross Sections to Advance



# Bridge Cross Sections Evaluated, Cont.

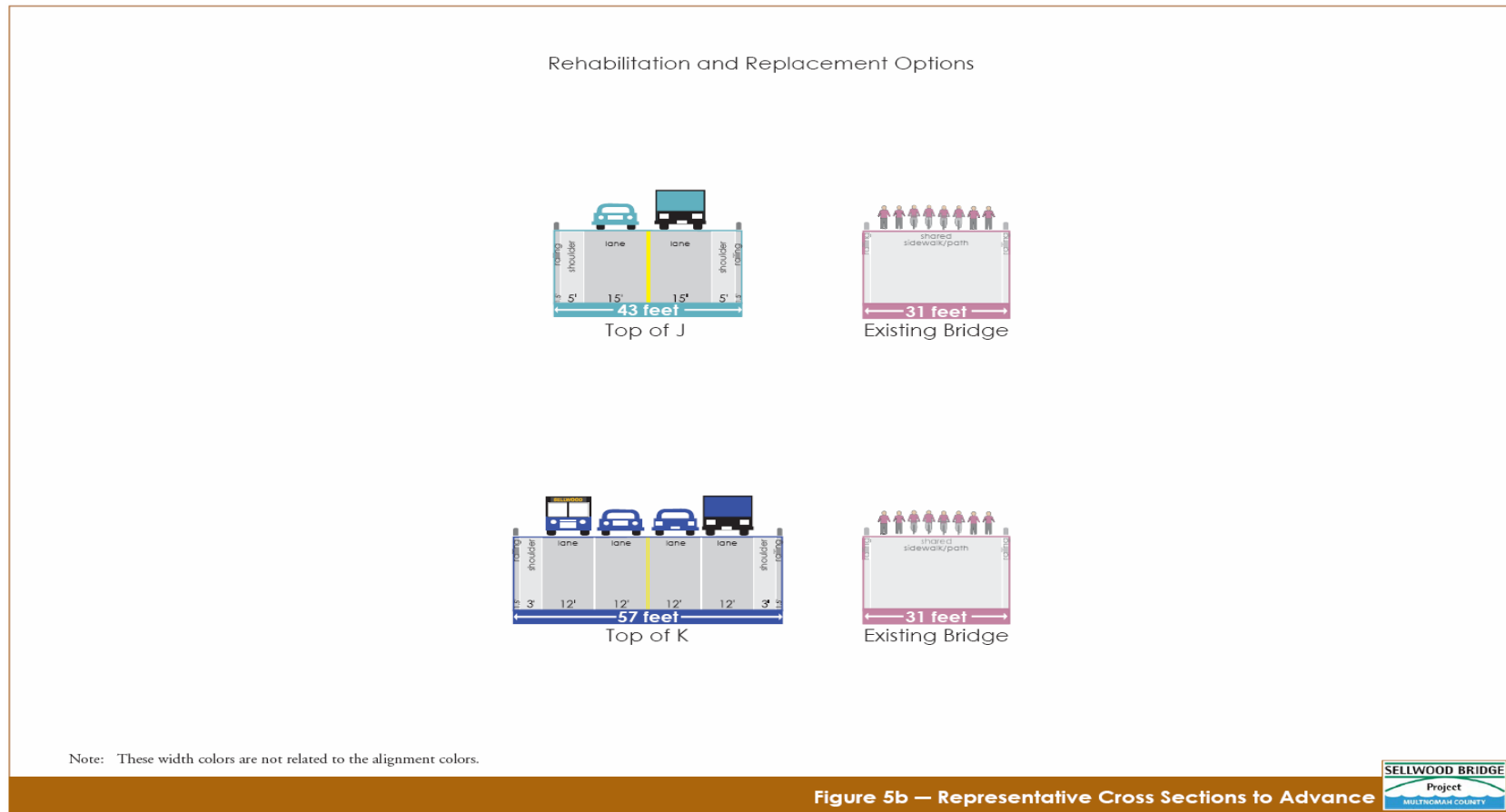
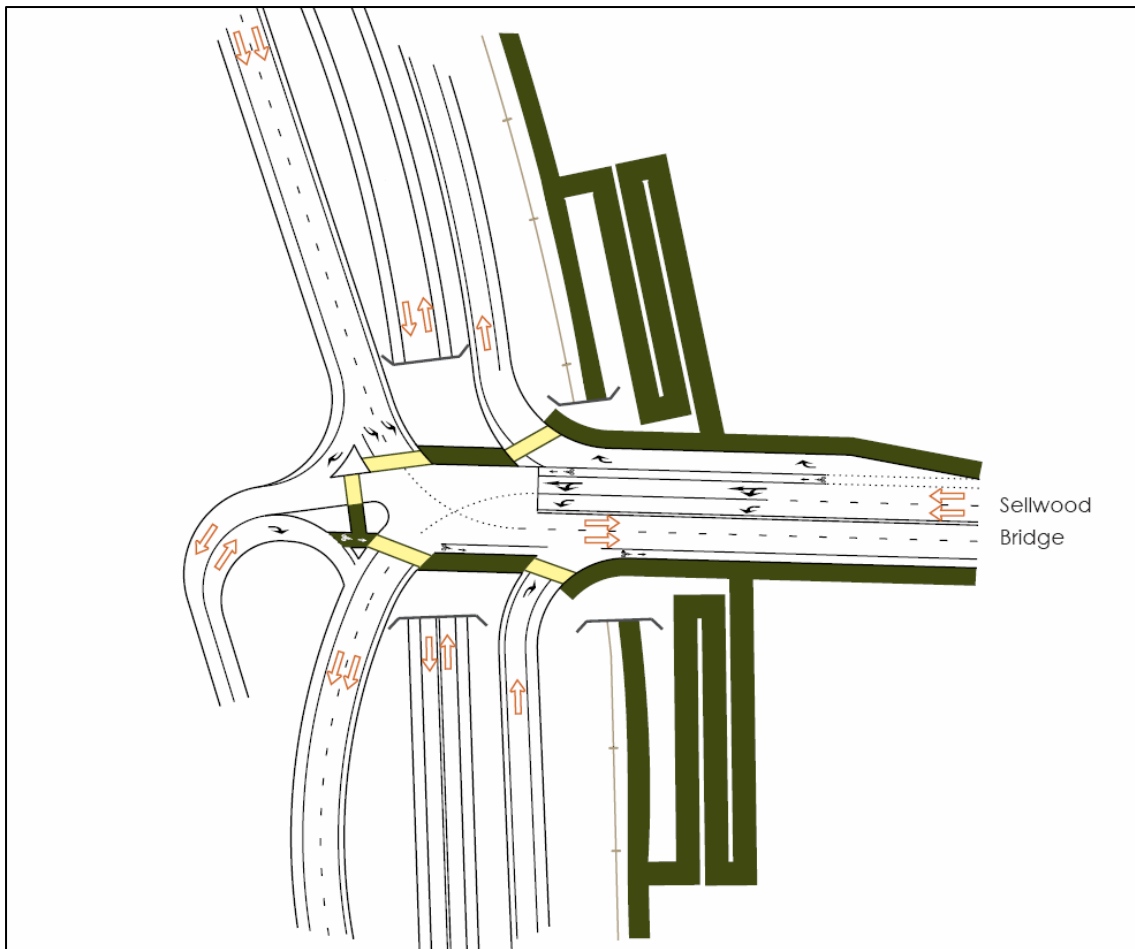


Figure 5b — Representative Cross Sections to Advance

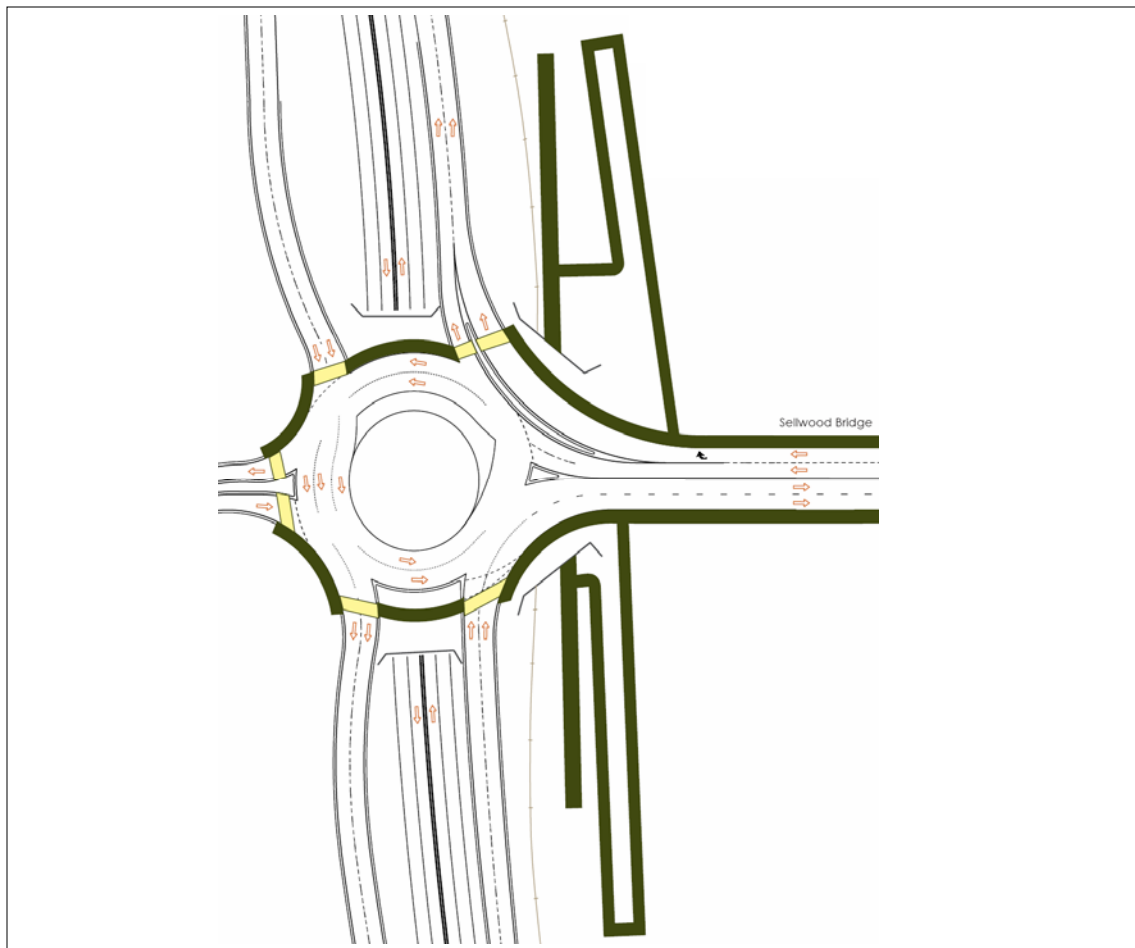
# Bridge Interchange Types Evaluated - Signalized



## LEGEND

- Proposed streetcar/trail
  - Proposed road/streets
  - Proposed bike/pedestrian path
  - Direction of traffic
  - Pedestrian crosswalk
  - Grade-separated crossing
- 0 50 100 150 ft
- North

# Bridge Interchange Types Evaluated - Roundabout



## LEGEND

- Proposed streetcar/trail
  - Proposed road/streets
  - Proposed bike/pedestrian path
  - Direction of traffic
  - Pedestrian crosswalk
  - Grade-separated crossing
- 0 50 100 150 ft
- North

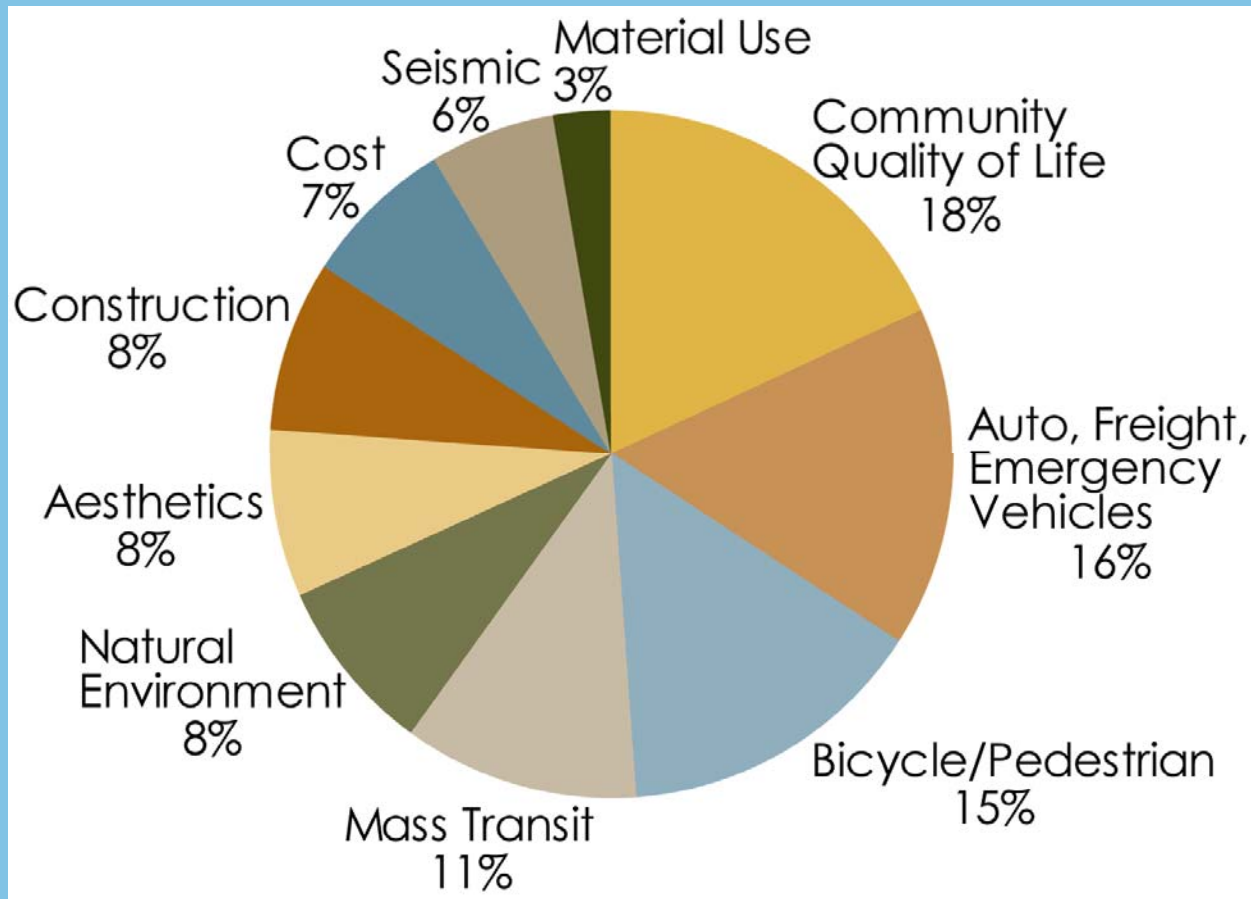
# Evaluation Criteria

- A total of 37 evaluation criteria
- Criteria were organized into 10 categories:
  - Aesthetics
  - Bicycle and Pedestrian
  - Community Quality of Life
  - Automobile, Freight, and Emergency Vehicles
  - Construction
  - Cost and Economic Impacts
  - Natural Environment
  - Material Use
  - Mass Transit
  - Seismic

# Alternative Evaluation - Overview of Process

- A total of 124 alternatives were analyzed against every evaluation criteria
- Ratings were quantitative or qualitative
- Total of over 4,500 scores!
- Criteria weights were established by CTF
- Decision science model tabulated scores and ranked alternatives

# Weighting of Criteria Categories





# Evaluation Methodology

## A. Aesthetics - Criteria

- Total weight of 8 points
- Three evaluation criteria
  - Flexibility in bridge design
  - Views from bridge
  - Views from community
- Additional aesthetics criteria will be considered when information about bridge type is available

## A. Aesthetics - General Findings

- Alignment mattered for views from the bridge and flexibility in design type (reverse curve has less flexibility)
- Cross section mattered for views from the bridge (four lane bridges have less of a view from inner lanes)
- Interchange type mattered for views from the community - greater landscaping options associated with a roundabout

## B. Bicycle/Pedestrian - Criteria

- Total weight of 14.6 points
- Examined two primary criteria
  - Maximize bike/ped safety
  - Maximize convenient/direct bike/ped connections
- Each criterion made up of several sub-criteria
- Evaluated using a numeric scoring system

## B. Bicycle/Pedestrian - Criteria "Maximize Bike/Ped Safety"

- Sub-criteria
  - Number of direct conflict points with vehicles in westside interchange area
  - Sidewalk/shared use path width
  - Bicycle lane width
  - Number & type of vehicle travel lanes
  - Separation between differing users (such as between pedestrians and bicyclists)
  - Physical separation from vehicle traffic
  - Visibility of bikes/peds from other bridge users

## B. Bike/Ped Safety - General Findings

- Wider path + bike lanes, physical separation, visibility (C' as example)
- Signalized intersection at westside interchange
- Yellow alignment and alignments close to existing bridge

## B. Bicycle/Pedestrian - Criteria

### "Maximize Convenient/Direct Connections"

- Sub-criteria
  - Westside interchange
    - Access ramps to Willamette Greenway Trail (provided on north and/or south side of bridge)
    - Number of tight turns on Greenway Trail access ramps
    - Presence of bike/ped facilities on one or both sides of interchange area (north side, south side, both)
    - Directness of route through interchange area
  - Bridge length
  - One-way vs. two-way bicycle facilities on bridge

## B. Bike/Ped Connections - General Findings

- Highest scoring cross-sections: those with full 2-way access and good connections (C, K, C', D, I).
- Signalized interchange
- Purple alignment (direct route across river, fewest number of tight turns on access ramps); other alignments close to existing bridge

## C. Community Quality of Life

- Total weight of 18.1 points
- Nine criteria
  - Noise
  - Neighborhood traffic intrusion
  - Recreational facilities
  - Historic and cultural resources
  - Residential relocations
  - Residential impacts
  - Business relocations
  - Business impacts
  - Plan consistency

## C. Community Quality of Life - General Findings

Element	Criteria that Provided Differentiation
Alignment	<ul style="list-style-type: none"><li>• Mattered, but findings differed</li><li>• <i>Example:</i> Pink and teal - high score for noise and residential impacts, but low for cultural impacts. Pink has highest number of business relocations.</li></ul>
Cross Section	<ul style="list-style-type: none"><li>• Mattered for intrusion of through traffic, business impacts, and plan consistency - two lane sections rated better with both.</li><li>• <i>Not</i> a differentiator for residential and business relocations.</li></ul>
Interchange Type	<ul style="list-style-type: none"><li>• Not a clear differentiator.</li></ul>

## D. Automobile, Freight, and Emergency Vehicles - Criteria

- Total weight of 16.1 points
- Six evaluation criteria
  - Congestion delay
  - Accessibility
  - Incident impact
  - Accommodate trucks
  - Future needs
  - Open during maintenance

## D. Automobile, Freight, and Emergency Vehicles - General Findings

- Cross section mattered
  - Wider cross sections performed better for impacts from crashes, accommodating trucks, retaining flexibility for future needs, and ability to remain open during maintenance
- Congestion delay criteria was not a differentiator

## E. Construction - Criteria

- Total weight of 8 points
- Minimize closure time
  - What mattered - overlap between new and existing
- Minimize construction time
  - What mattered - proximity to existing
- Minimize travel impacts during construction
  - What mattered - proximity to existing/detours

## F. Cost and Economic Impacts - Criteria

- Total weight of 7.1 points
- Factors considered
  - Unit costs
  - Right of way
  - Engineering
  - Maintenance costs
  - Escalation from 2007 to 2012
- Rehabilitation (2012 \$) - \$260 M to \$416 M
- Replacement (2012 \$) - \$278 M to \$449 M

## G. Natural Environment - Criteria

- Total weight of 8.1 points
- Seven evaluation criteria
  - Floodplain impacts
  - Fish species and habitat
  - Terrestrial species
  - Wildlife habitat
  - Riparian and trees
  - Air quality
  - Recreational fishing

## G. Natural Environment - General Findings

- Alignment was most important - alignments closest to existing alignment less of an impact on floodplain, terrestrial species, and wildlife habitat
- Wider footprint (impervious surfaces) on land scored lower for terrestrial species
- Three criteria (riparian areas, air quality, and recreational fishing) were not clear differentiators

## H. Material Use - Criteria

- Total weight of 2.7 points
- One evaluation criteria
  - Maximize use of existing materials
- What mattered - all rehabilitation alternatives scored higher than replacement alternatives

# I. Mass Transit - Criteria

- Total weight of 11.3 points
- Four evaluation criteria
  - Mass transit reliability
  - Accommodate future transit
  - Cohabitation of modes
  - Transit connectivity

# I. Mass Transit - General Findings

- Cross section D performed best (dedicated transit lanes), but did not receive maximum points due to short length
- Wider cross-sections performed well
- Signalized interchange performed better than roundabout interchange due to ability to accommodate future streetcar and ability for transit signal priority
- Alignment was not a differentiator

## J. Seismic - Criteria

- Total weight of 6 points
- One evaluation criteria
  - Minimize loss of life/property

## J. Seismic - General Findings

- Minimize loss of life/property
  - What mattered:
    - Replacement alternatives scored highest
    - Phase II rehabilitation alternatives next highest
    - Phase I rehabilitation alternatives scored lowest



# Evaluation Results

# Preliminary Evaluation - Scores

	Cross Section	Alignment	Interchange Type	2,3,4 lane	1. Aesthetics	2. Bike and Ped	3. Community Qual of Life	4. Auto, Freight, Emergency Veh.	5. Construction	7. Natural Env.	8. Material Use	9. Mass Transit	10. Seismic	6. Cost	Total Decision Score	Decision Score Rank
					8	14.6	18.1	16.1	8	8.1	2.7	11.3	6	7.1	100.00	
1	D	Purple	Signal	Transit	4.59	11.67	13.76	11.16	4.69	5.05	0.00	11.35	6.04	5.77	74.06	1
2	D	Yellow South	Signal	Transit	4.59	11.30	11.38	11.16	5.29	5.76	0.00	11.35	6.04	5.38	72.25	2
3	C'	Purple	Signal	2	5.99	13.86	15.43	7.09	5.79	5.56	0.00	5.47	6.04	5.63	70.86	3
4	D	Blue	Signal	Transit	4.59	10.57	11.84	11.16	4.69	5.76	0.00	11.35	6.04	4.81	70.80	4
5	F	Purple	Signal	3	4.59	13.86	10.96	12.81	4.69	4.85	0.00	6.77	6.04	5.07	69.63	5
6	C	Purple	Signal	2	5.99	13.13	15.43	6.22	5.79	5.56	0.00	5.47	6.04	5.91	69.54	6
7	D	Purple	Roundabout	Transit	5.30	9.48	13.76	11.16	4.69	5.05	0.00	8.03	6.04	5.06	68.57	7
8	E	Purple	Signal	4	4.59	7.66	10.96	15.20	4.69	5.05	0.00	8.33	6.04	5.57	68.09	8
9	C'	Yellow South	Signal	2	5.99	13.49	13.06	7.09	5.79	5.76	0.00	5.47	6.04	5.21	67.90	9
10	C	Yellow South	Signal	2	5.99	13.86	13.06	6.22	5.79	5.76	0.00	5.47	6.04	5.49	67.67	10
11	D	Pink	Signal	Transit	4.49	6.20	11.74	11.16	6.39	4.35	0.00	11.35	6.04	5.77	67.48	11
12	F	Yellow South	Signal	3	4.59	12.76	8.58	12.81	5.29	5.76	0.00	6.77	6.04	4.67	67.28	12
13	C'	Blue	Signal	2	5.99	12.76	13.56	7.09	5.79	5.76	0.00	5.47	6.04	4.64	67.10	13
14	C	Blue	Signal	2	5.99	13.13	13.56	6.22	5.79	5.76	0.00	5.47	6.04	4.90	66.85	14
15	D	Teal	Signal	Transit	4.49	5.10	8.66	11.16	6.39	4.35	0.00	11.35	6.04	5.47	66.49	15
16	F	Blue	Signal	3	4.59	12.76	10.96	12.81	4.69	4.85	0.00	6.77	6.04	4.13	66.38	16
17	D	Yellow South	Signal	Transit	3.20	11.30	11.38	11.16	5.29	5.76	0.00	11.35	3.02	2.05	65.86	17
18	C'	Purple	Roundabout	2	5.71	10.57	15.43	7.09	5.79	5.56	0.00	2.41	6.04	5.14	65.83	18
19	A'	Purple	Signal	2	5.99	13.86	13.06	6.22	5.79	5.76	0.00	5.47	6.04	6.84	65.65	19
20	K	Purple	Signal	4	2.61	8.39	11.39	14.24	6.39	3.54	0.00	6.42	6.04	5.41	65.64	20
21	C	Purple	Roundabout	2	5.71	10.03	15.43	6.22	5.79	5.56	0.00	2.41	6.04	5.40	65.58	21
22	E	Yellow South	Signal	3	4.59	6.56	8.58	15.20	5.29	5.76	0.00	8.33	6.04	5.18	65.54	22
23	D	Blue	Roundabout	Transit	5.30	8.39	11.84	11.16	4.69	5.76	0.00	8.03	6.04	4.07	65.27	23
24	D	Pink	Roundabout	Transit	5.20	6.93	11.74	11.16	6.39	4.35	0.00	8.03	6.04	5.10	64.94	24
25	F	Blue	Signal	4	4.59	6.56	9.04	15.20	4.69	5.76	0.00	8.33	6.04	4.62	64.83	25
26	F	Purple	Roundabout	3	5.30	11.67	10.96	12.81	4.69	5.05	0.00	3.46	6.04	4.62	64.60	26
27	K	Teal	Signal	4	2.61	8.39	11.39	14.24	6.39	3.54	0.00	6.42	6.04	5.10	64.13	27
28	K	Yellow South	Signal	4	2.71	9.12	9.14	14.24	5.29	5.76	0.00	6.42	6.04	5.04	63.76	28
29	F	Pink	Signal	3	4.49	8.39	8.95	12.81	6.39	4.35	0.00	6.77	6.04	5.10	63.29	29
30	K	Blue	Signal	4	2.71	8.39	10.03	14.24	4.69	5.96	0.00	6.42	6.04	4.47	62.96	30
31	D	Yellow South	Roundabout	Transit	3.92	8.39	11.55	11.16	5.29	4.24	2.69	8.03	3.02	4.62	62.90	31
32	E	Purple	Roundabout	4	5.30	5.47	10.96	15.20	4.69	5.05	0.00	5.02	6.04	4.89	62.63	32
33	D	Yellow South	Roundabout	Transit	5.30	8.39	11.38	11.16	5.29	5.76	0.00	8.03	6.04	1.26	62.61	33
34	F	Teal	Signal	3	4.49	7.29	10.87	12.81	6.39	2.83	0.00	6.77	6.04	4.82	62.31	34
35	C'	Blue	Roundabout	2	6.71	10.57	13.56	7.09	5.79	5.76	0.00	2.41	6.04	4.20	62.12	35
36	C'	Pink	Signal	2	5.89	8.39	11.74	7.09	6.89	4.86	0.00	5.47	6.04	5.71	62.08	36
37	C	Pink	Signal	2	5.89	8.75	11.74	6.22	6.89	4.86	0.00	5.47	6.04	5.99	61.85	37
38	C	Blue	Roundabout	2	6.71	10.94	13.56	6.22	5.79	5.76	0.00	2.41	6.04	4.43	61.85	38
39	A'	Blue	Signal	2	6.68	8.75	13.59	3.18	6.39	5.76	0.00	5.47	6.04	5.79	61.65	39

See Handout

## Top 25 Rated Alternatives (Top Quintile)

- Perform very well on three of the highest weighted criteria:
  - Bicycle/Pedestrian
  - Community Quality of Life
  - Mass Transit
- Not a strong correlation with Auto, Freight, and Emergency Vehicle criterion (2<sup>nd</sup> highest weight)
- Performed well on other criteria\*, even if not at the highest level

\* Material Use was an exception – highest ranked alternatives did not perform well on this criterion

## Lowest 25 Rated Alternatives (Lowest Quintile)

- Perform poorly for several categories
  - Bicycle/Pedestrian
  - Mass Transit
  - Aesthetics
  - Seismic
  - Auto, Freight, and Emergency Vehicles

## Lowest 25 Rated Alternatives (Lowest Quintile)

- “Middle of the road” performance in two categories
  - Community Quality of Life
  - Natural Environment
- Perform well in only two categories (both of which do not carry high weights)
  - Construction
  - Material Use

# Assumptions Regarding Weights and Costs

- Rankings remain largely unchanged when weights are removed and when Cost is considered differently

Change in Structure	# of Top Performers Remaining in Top 25
All Criteria Given Equal Weight	20
Criteria Categories Given Equal Weight	22
Cost Removed	23
Cost Re-Added as Cost/Benefit	21

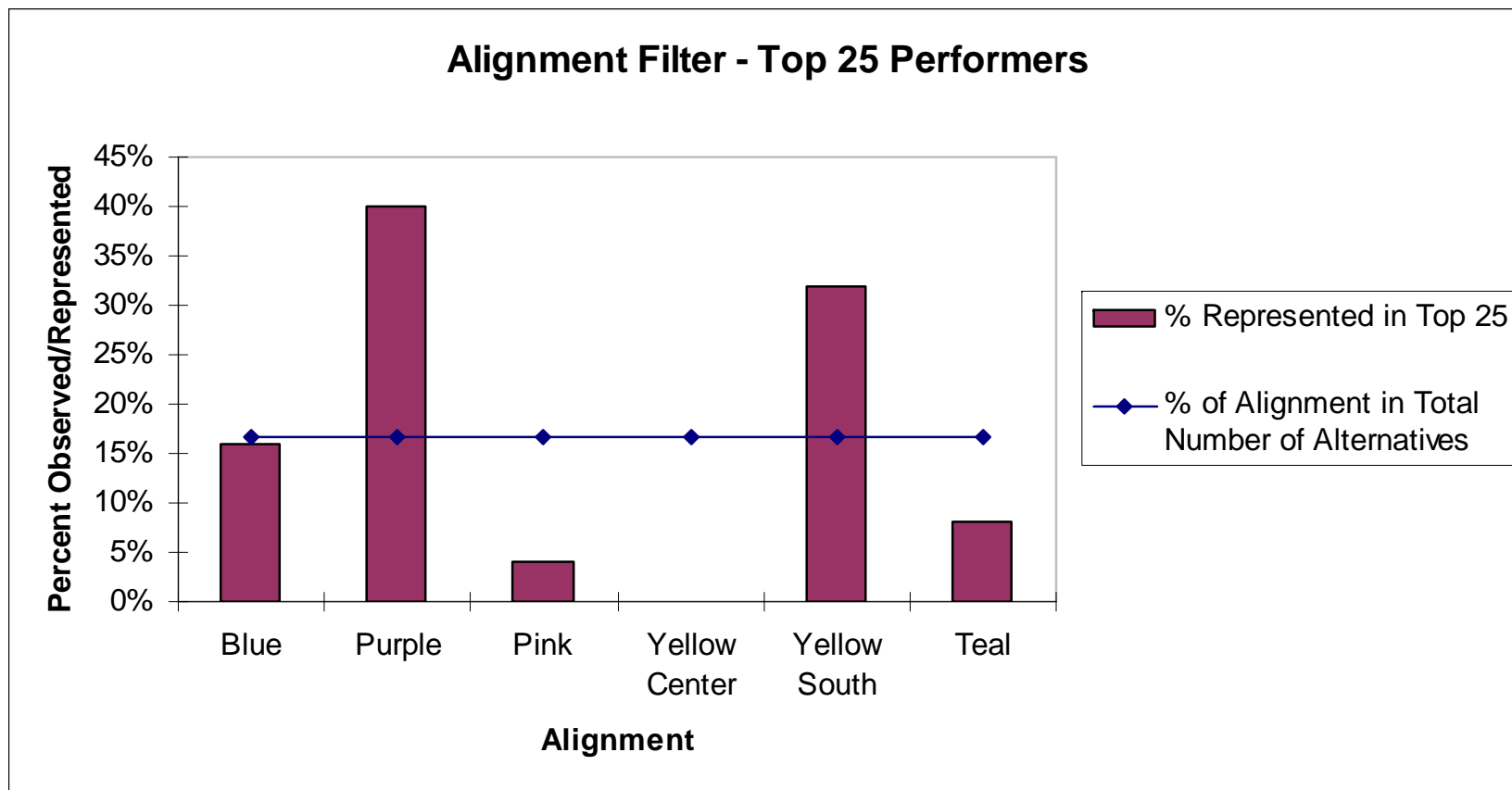


# Key Findings

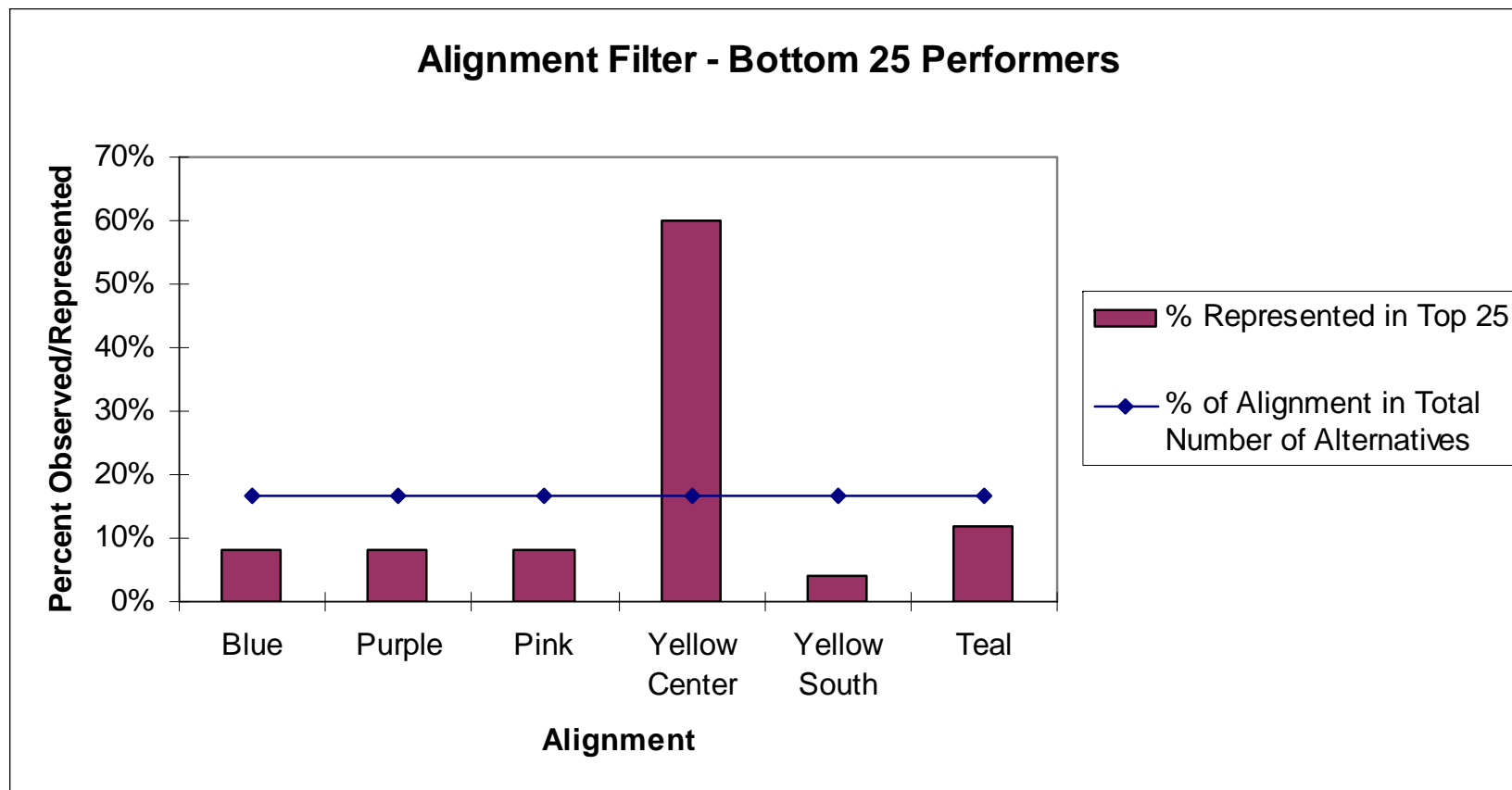
# Key Findings

- Considered upper and lower quintiles in relation to seven elements
  1. Alignment
  2. Cross section
  3. Interchange type
  4. Number of lanes
  5. Rehabilitation vs. replacement
  6. Bicycle/pedestrian facilities at same level vs. below
  7. Existing bridge used for bicycle/pedestrian use only

# Alignment Element



# Alignment Element

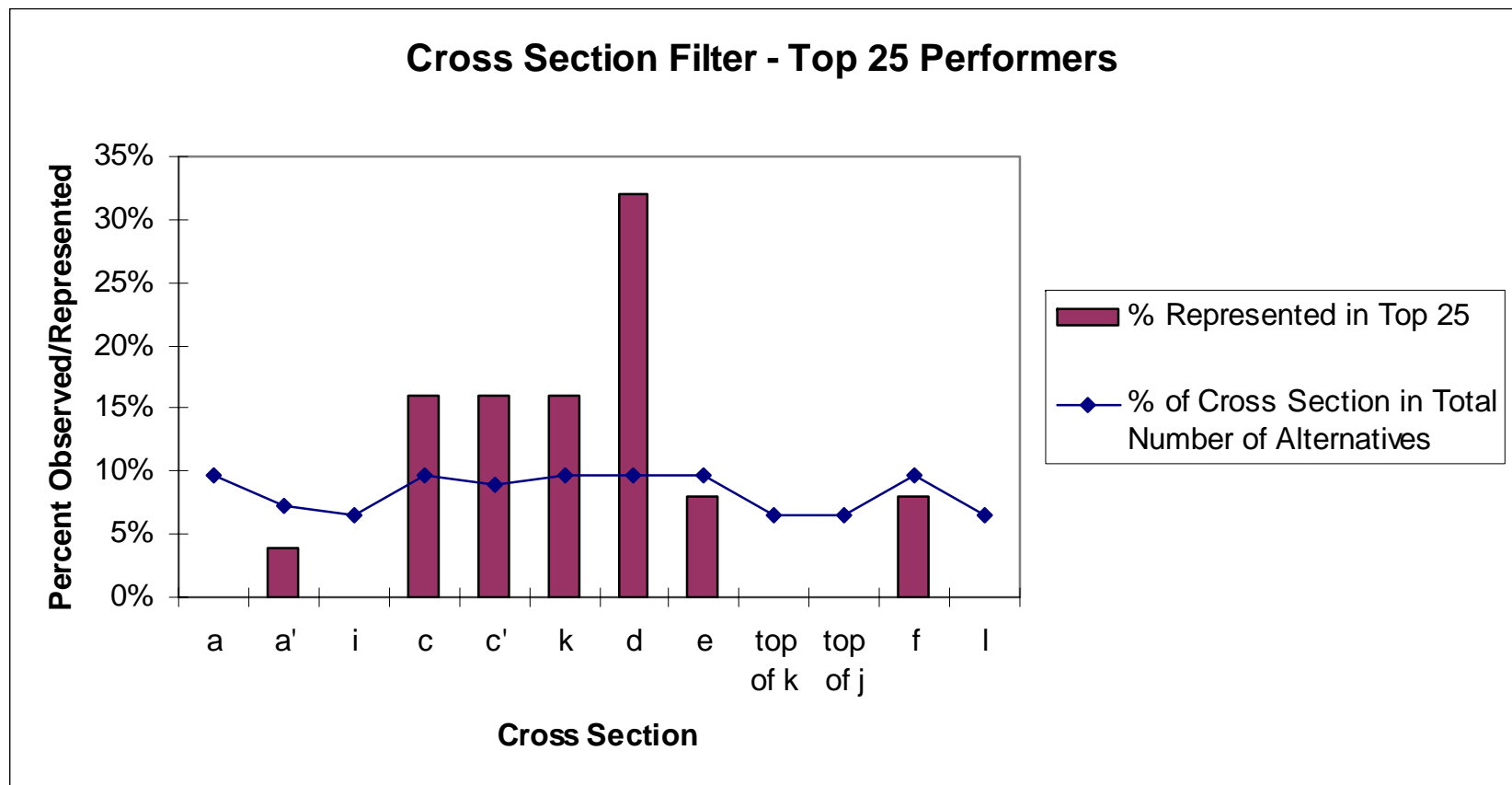


# Key Findings - Alignment

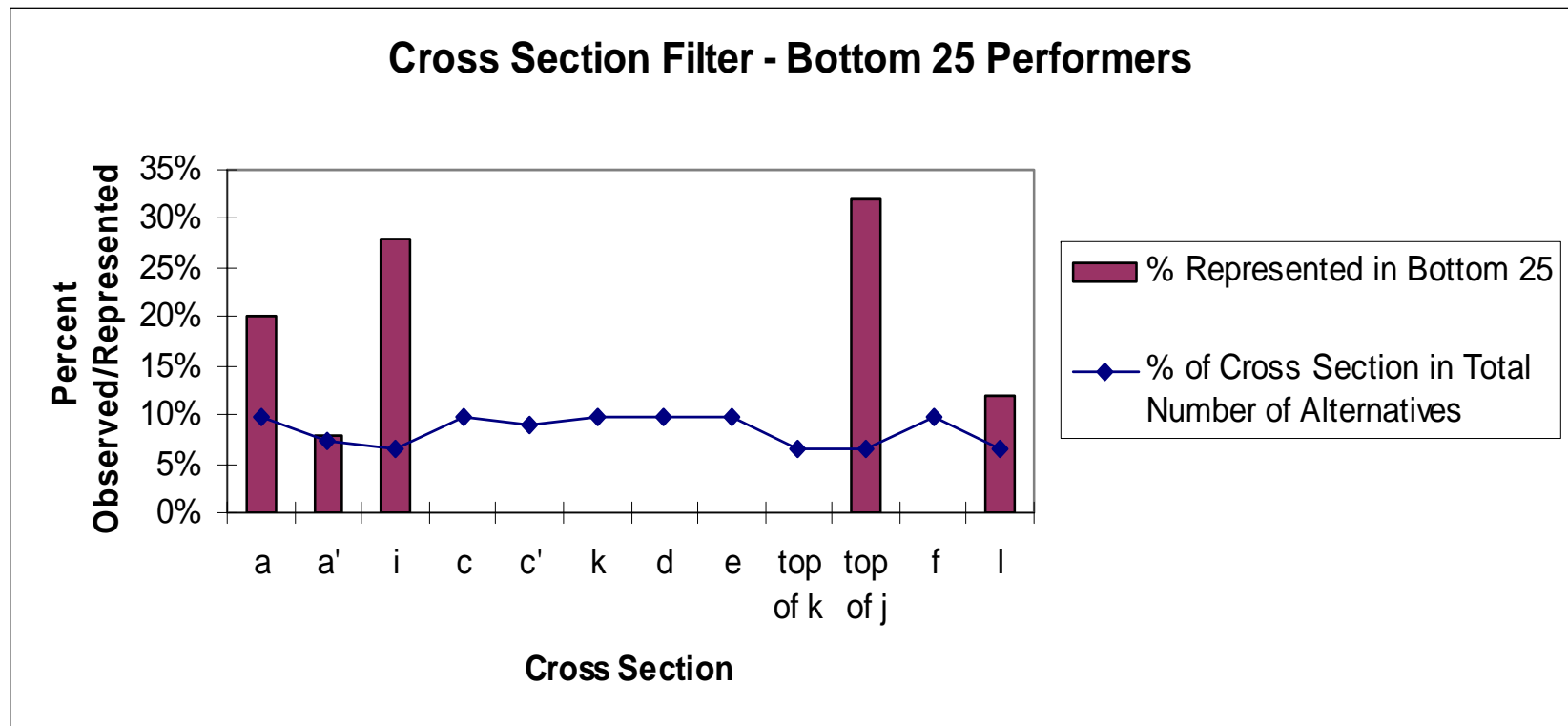
Evaluation Criteria	Alignment	Explanation
Bicycles/Pedestrians	Yellow South (Highest) Purple and Blue (High)	Designated Bicycle/ Pedestrian Facilities, near Existing Alignment
Residential Relocations	Yellow Center	Existing Alignment, One Residential Relocation
Business Relocations	Teal	Avoids Business Relocations
Construction	Pink and Teal	Farthest Away from Existing Bridge
Natural Environment	Purple, Yellow, Blue	Closest to Existing Bridge

(Element 1 of 7)

# Cross-Section Element



# Cross-Section Element



## Key Findings - Cross Section

- Two lane cross sections rated high for Aesthetics, Community Quality of Life, Construction, and Natural Environment
  - Compatible with regional and community plans
  - Fewer impacts to local businesses\*
  - Shorter construction schedules
  - Less impervious surface

\* Not fewer relocations. Relocations depended mainly on alignment.

(Element 2 of 7)

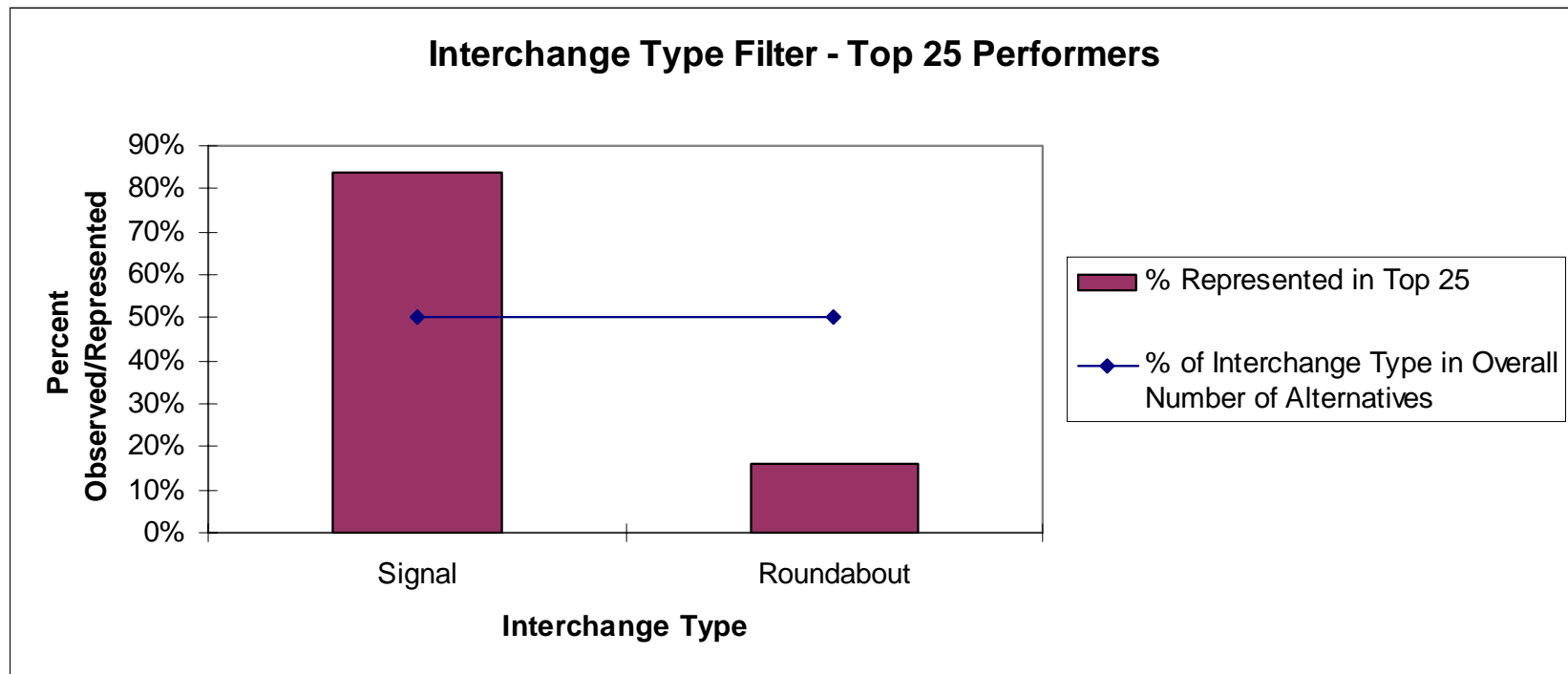
## Key Findings - Cross Section

- Wider cross sections rated high for Automobile, Freight, and Emergency Vehicles
  - Additional capacity for automobiles and freight
  - More space for emergency vehicles to navigate through traffic, and for traffic to move around disabled vehicles
  - Additional lanes provide flexibility to respond to future transportation needs
  - Creates greatest opportunity to keep bridge open to traffic during periods of maintenance

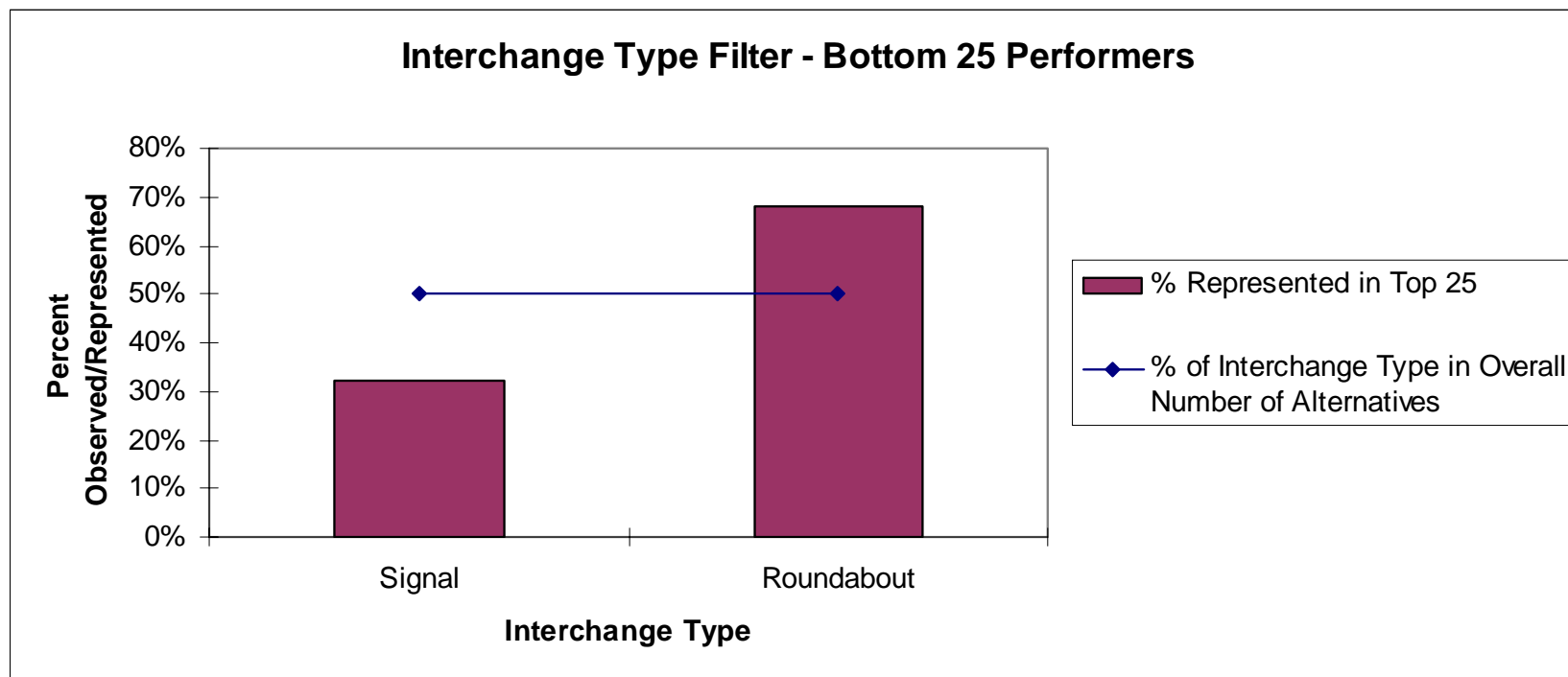
## Key Findings - Cross-Section

- Top performers were C' and D
  - Bicycle/Pedestrian
  - Mass Transit
- Poor performers were A, I, Top of J, and L
  - Three of four cross sections are rehab alternatives (more later)
  - Poor performance across the board, but especially
    - Auto, Freight, Emergency Vehicles
    - Mass Transit

# Interchange Type Element



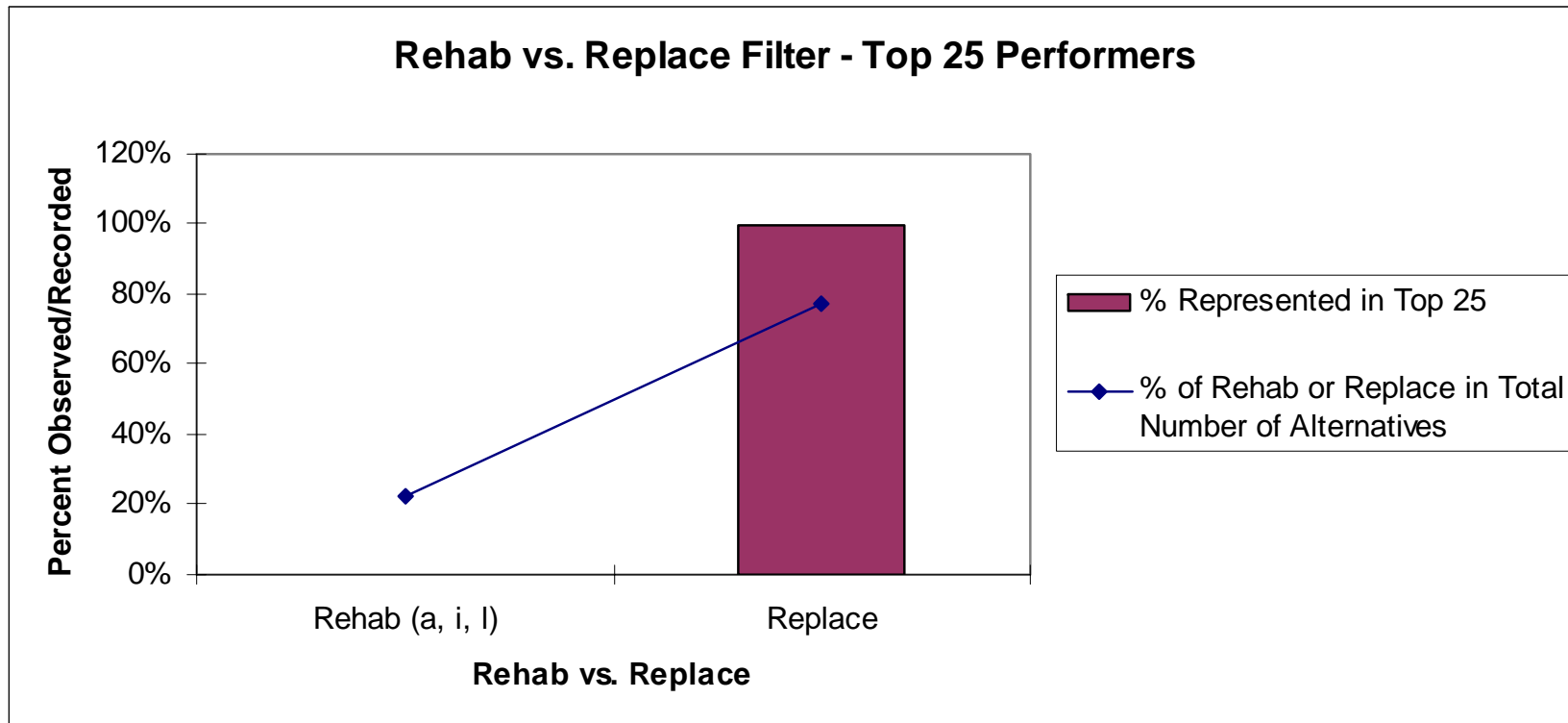
# Interchange Type Element



## Key Findings - Interchange Type

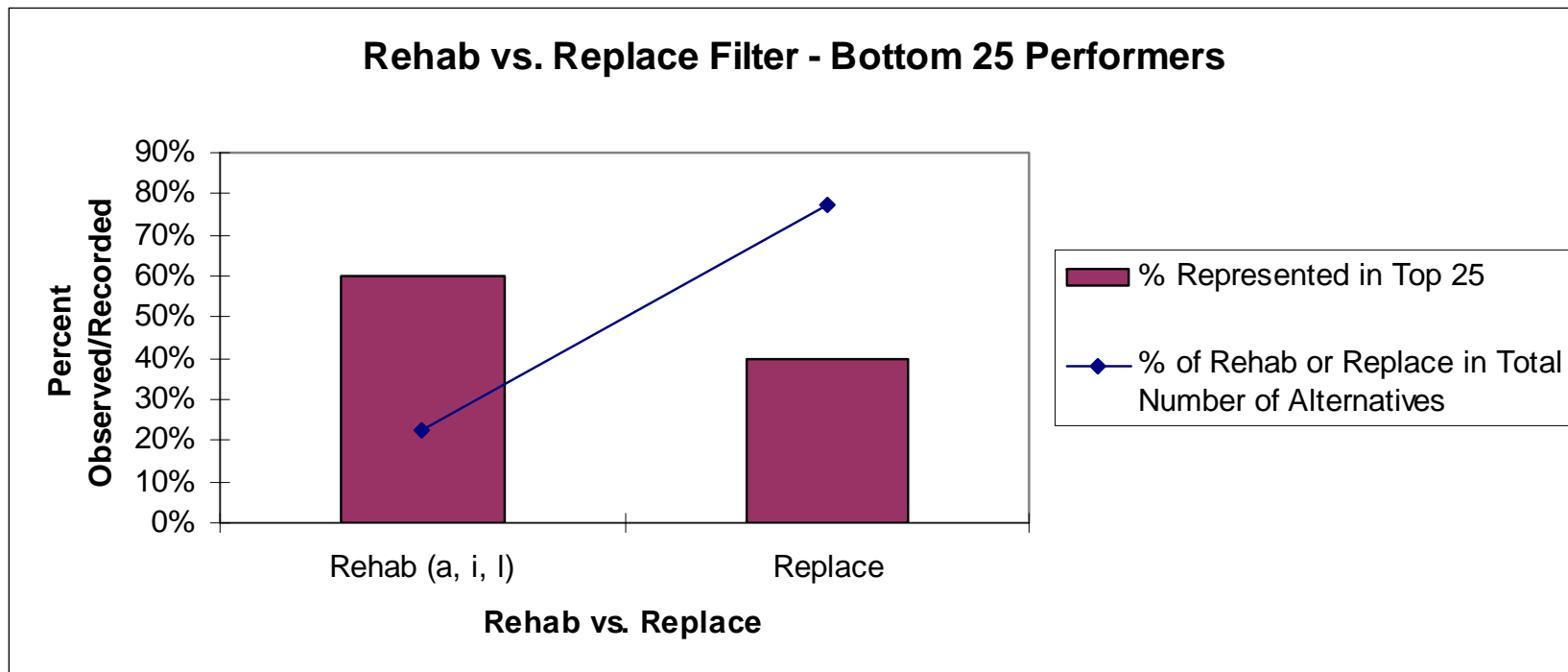
- Signal performs better for Bicycle/Pedestrian and Mass Transit
  - Dedicated time for bicyclists/pedestrians to cross the roadway (safety)
  - More easily accommodates future streetcar
  - Greater opportunities for bus pullouts and transit signal priority
- Roundabout performs well for Aesthetics
  - Potential for landscaping in center (lid)
  - Potential gateway feature for community
- Interchange type was not a differentiator for several evaluation criteria

# Rehabilitation vs. Replacement Element



(Element 4 of 7)

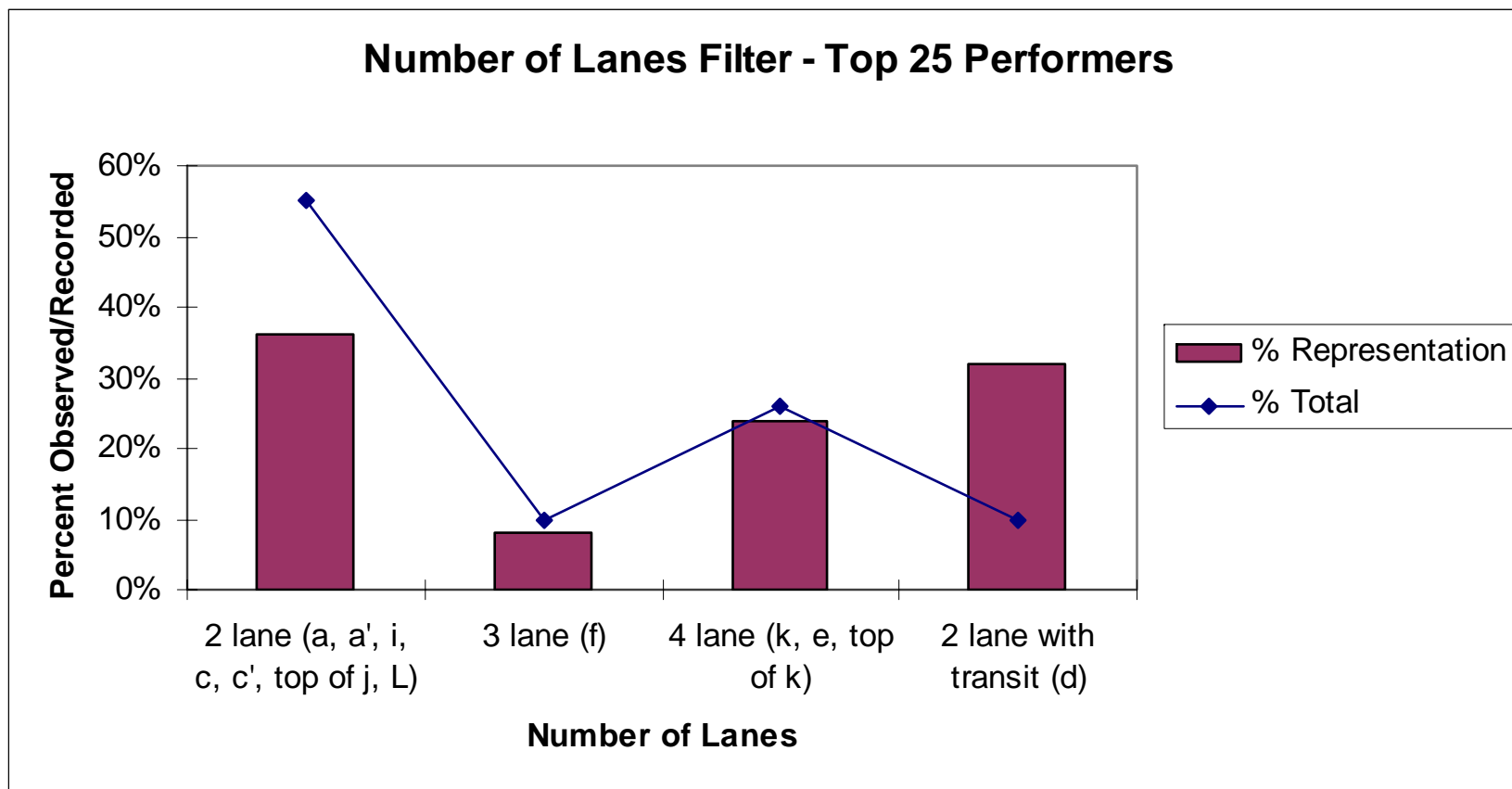
# Rehabilitation vs. Replacement Element



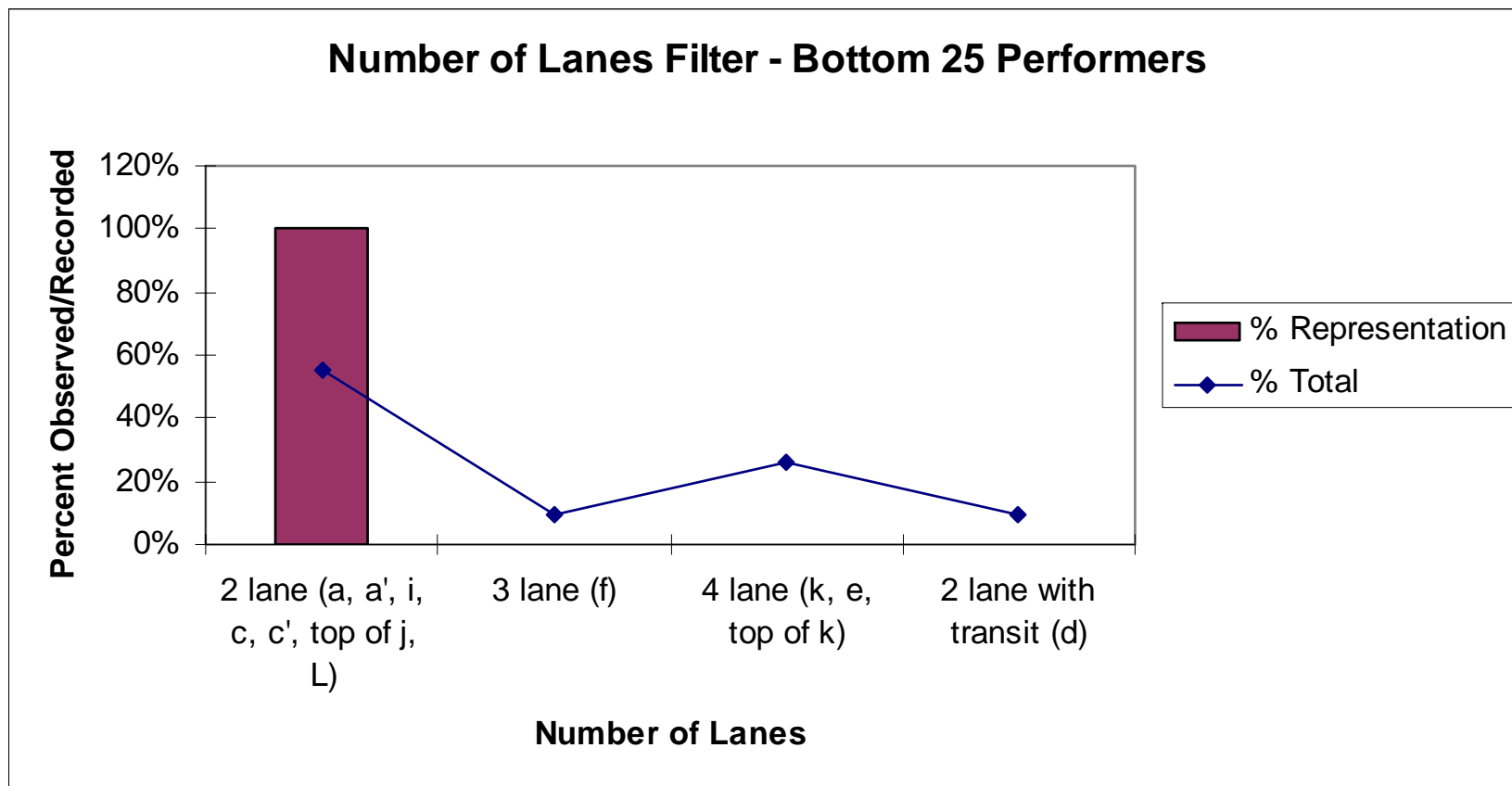
## Key Findings - Rehabilitation vs. Replacement

- Rehabilitation alternatives perform poorly
  - Bicycle/Pedestrian
  - Auto, Freight, Emergency Vehicles
  - Aesthetics
  - Construction
  - Seismic

# Number of Lanes Element



# Number of Lanes Element

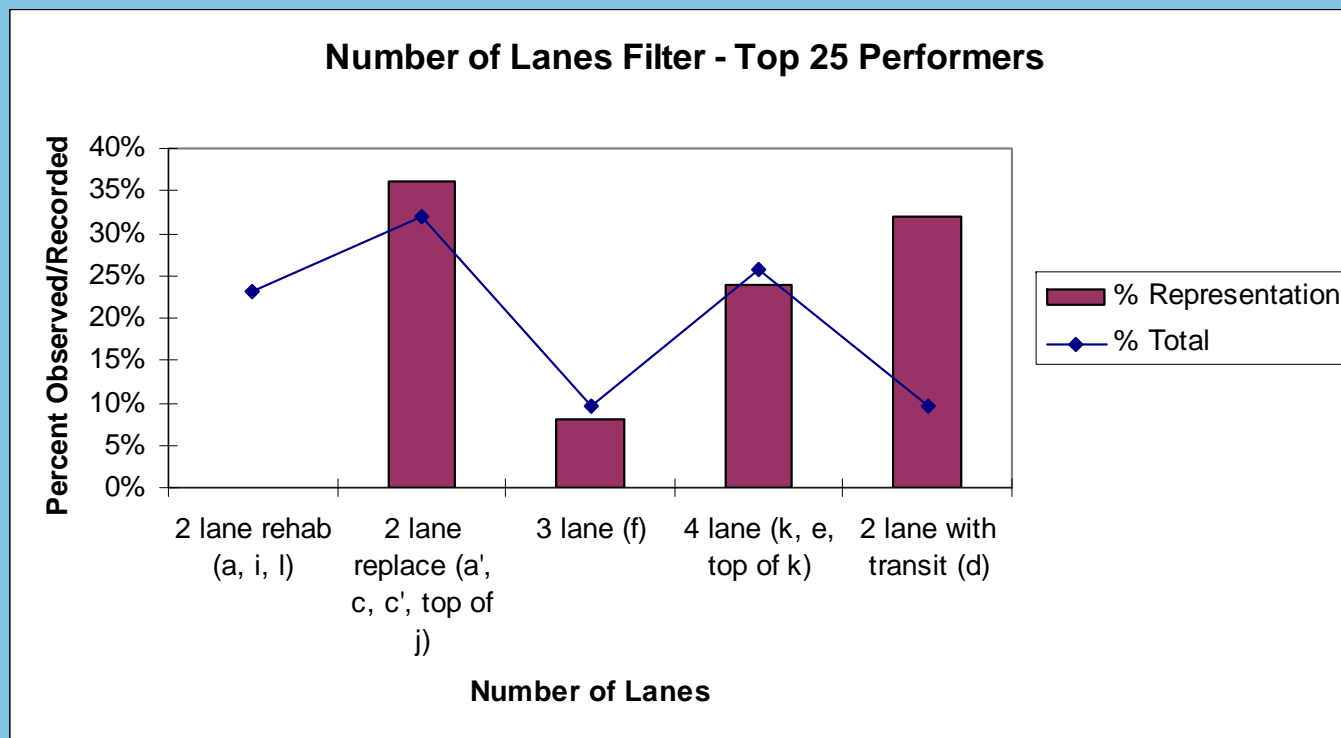


## Key Findings - Number of Lanes

- Two lanes with dedicated transit (D) performs well
  - Mass Transit (dedicated transit lane) is key
  - Moderate performance for
    - Bicycle/Pedestrian
    - Automobile, Freight, and Emergency Vehicles

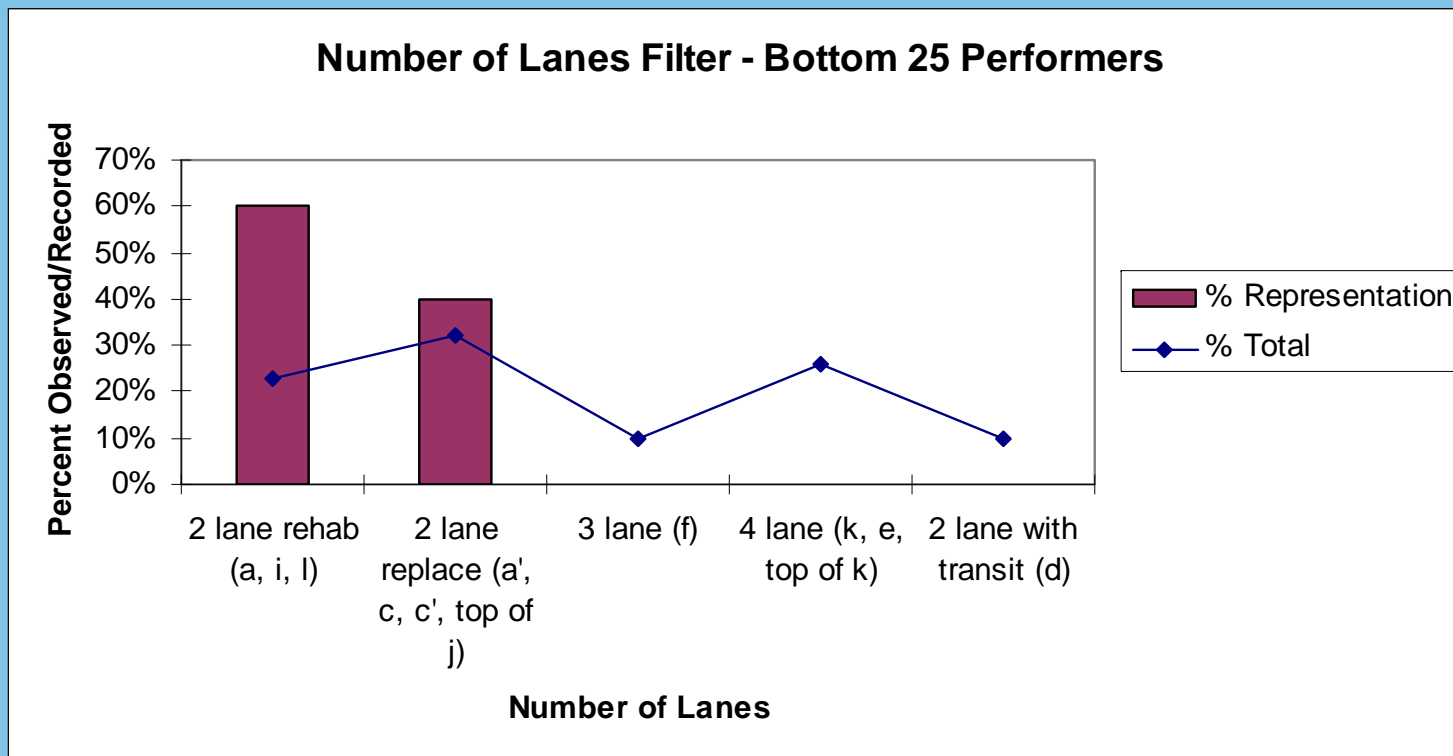
# Key Findings - Number of Lanes

- *When split out two-lane rehab (a, i, l) from replacement (a', c, c'), replacements perform well*

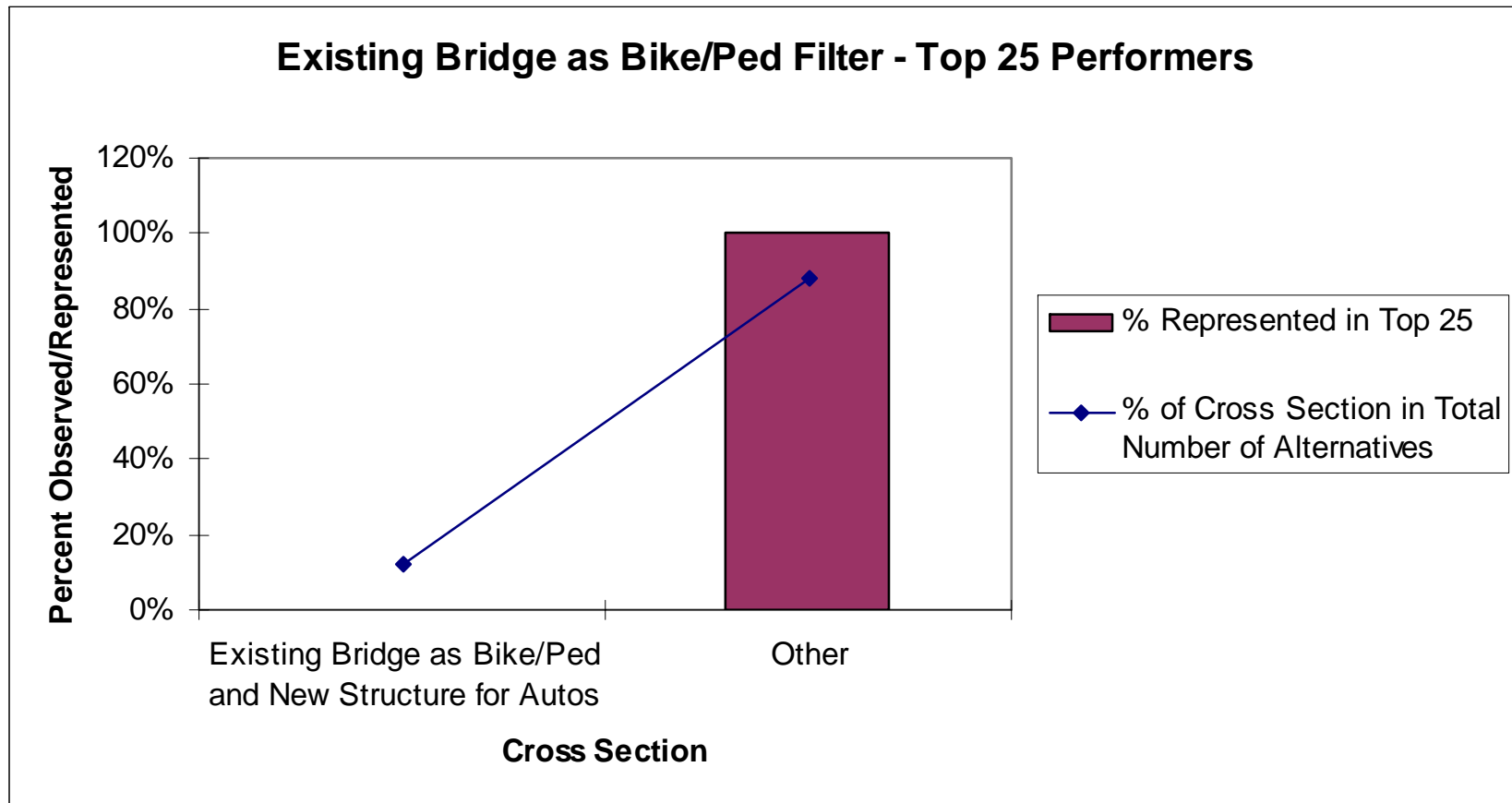


# Key Findings - Number of Lanes

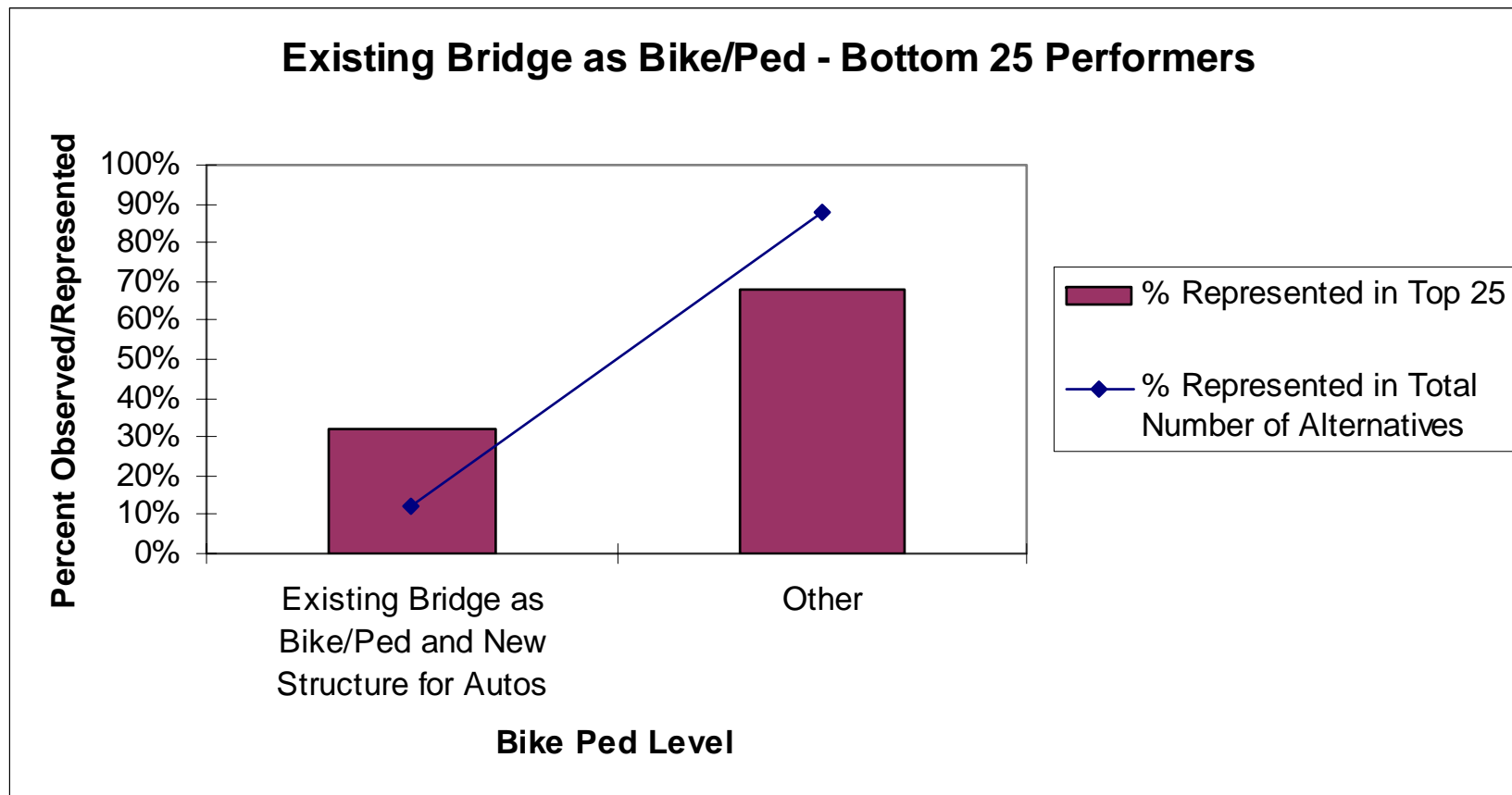
- *Two lane replacement with existing bridge for bicycle/pedestrian use perform poorly*



# Existing Bridge Used for Bike/Ped Element



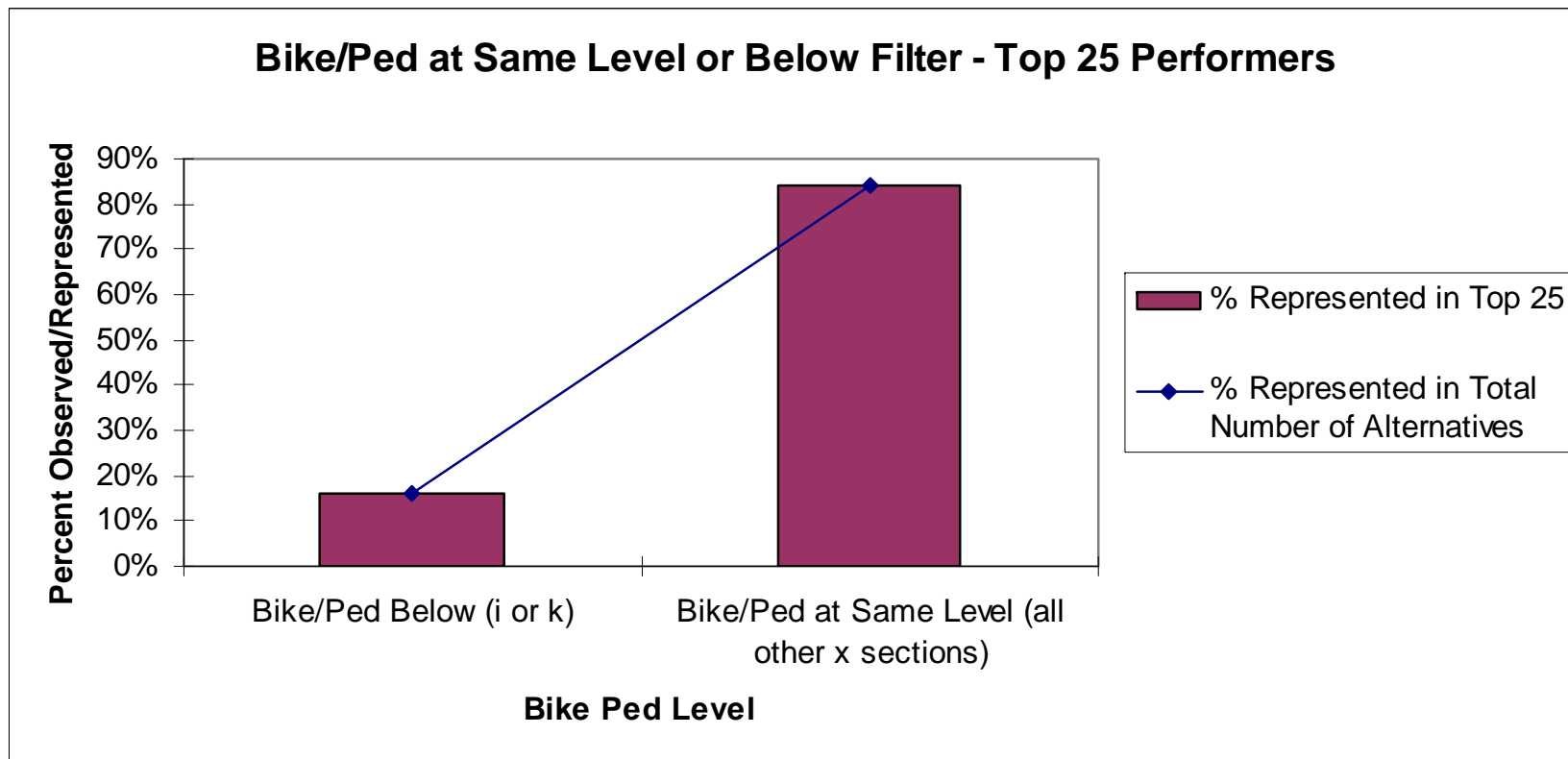
# Existing Bridge Used for Bike/Ped Element



## Key Findings - Existing Bridge as Bicycle/Pedestrian, New Bridge for Automobiles

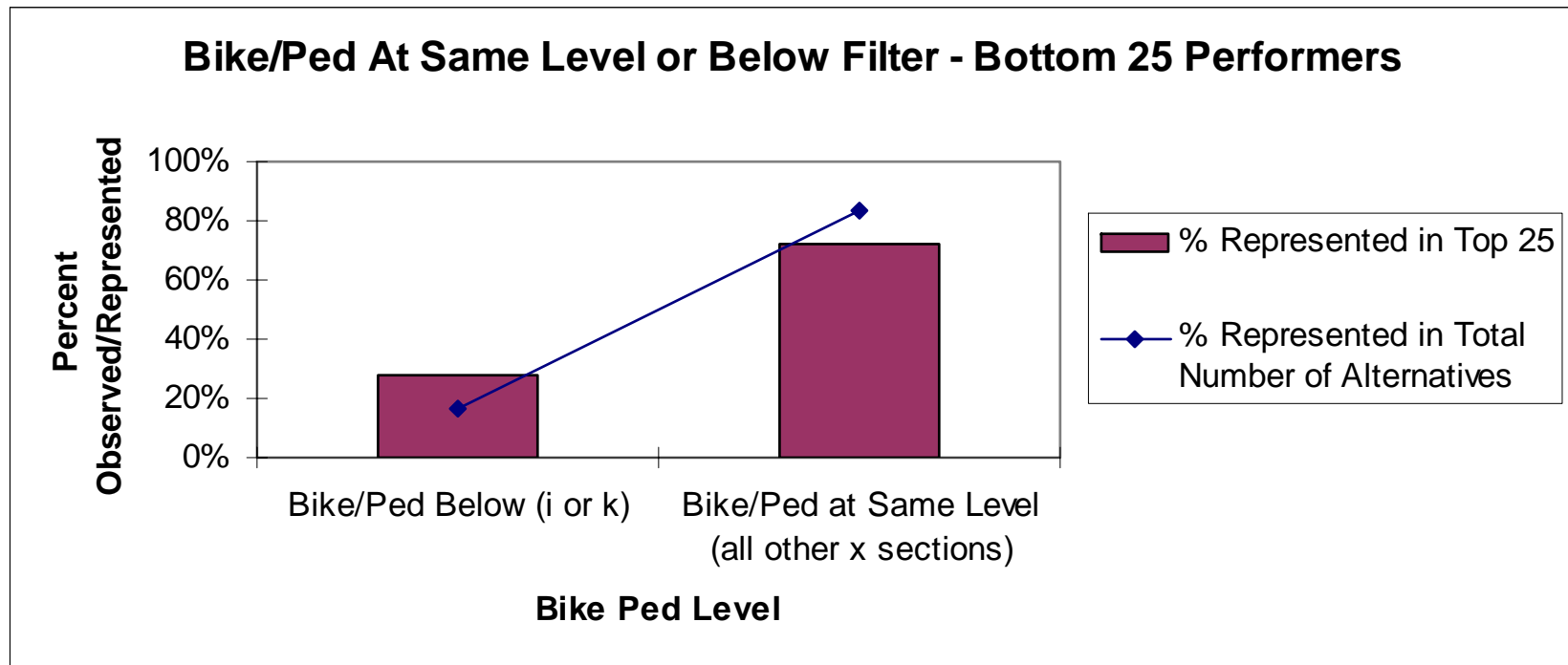
- Performs poorly against several criteria
  - Aesthetics
  - Mass Transit
  - Recreational Impacts
  - Cost

# “Double Decker” Element



(Element 7 of 7)

# “Double Decker” Element



## Key Findings - "Double Decker"

- Double deck (with bicycle/pedestrian facilities below) performs about average overall, though overrepresented in lower quintile
- Four lane double deck performs better than two lane
  - Auto, Freight, and Emergency Vehicles
  - Mass Transit



# Discussion