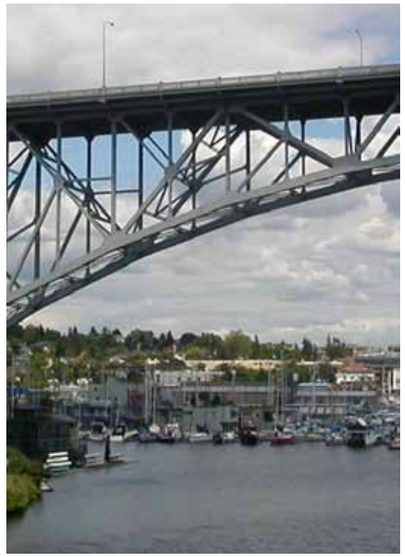
Washington State Department of Transportation

SR 99 AURORA AVENUE BRIDGE FENCE

Design Committee

Work Book



DRAFT
9 2008
PDK

WSDOT Bridge Design Office WSDOT Cultural Resources Office

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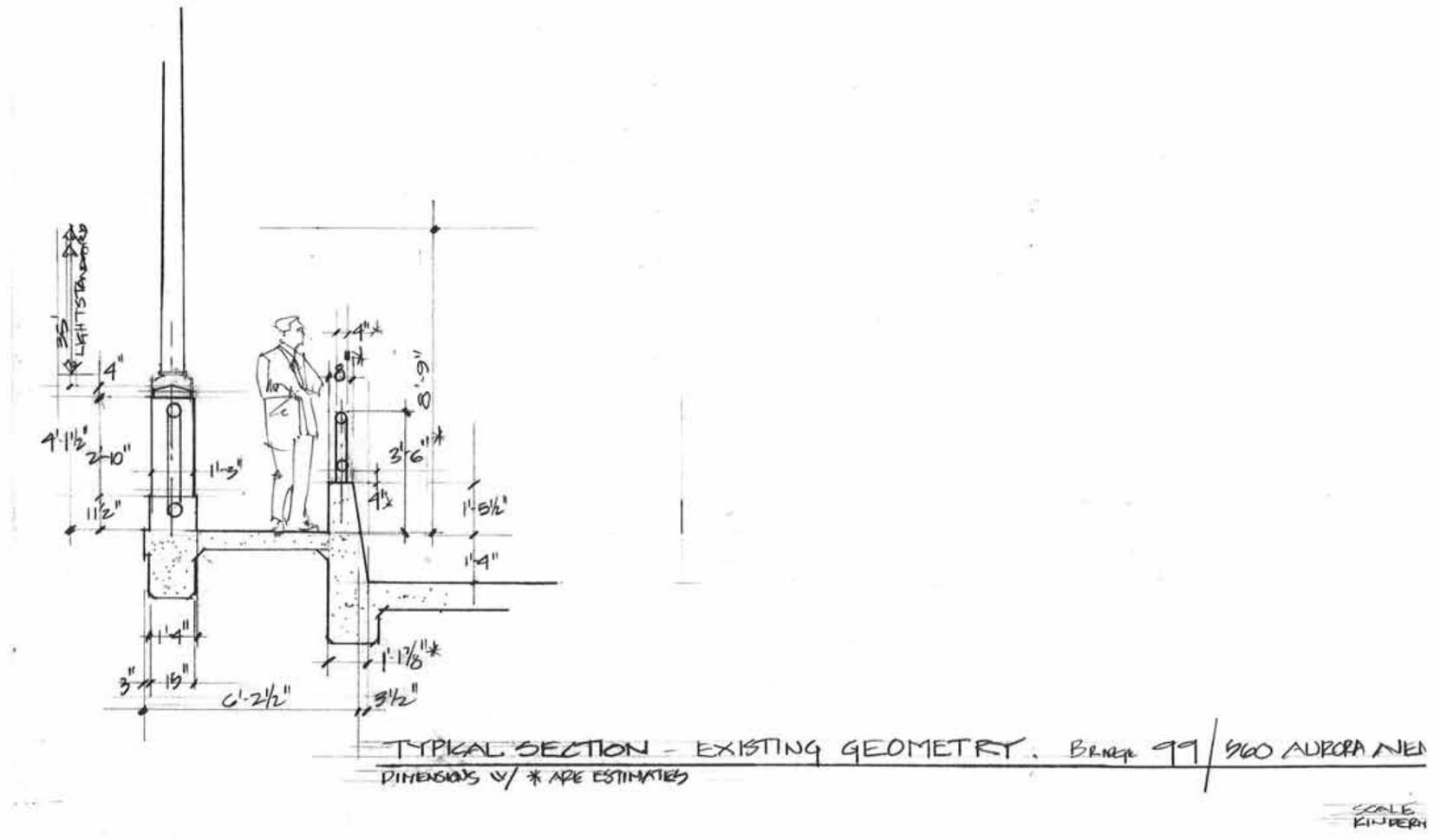
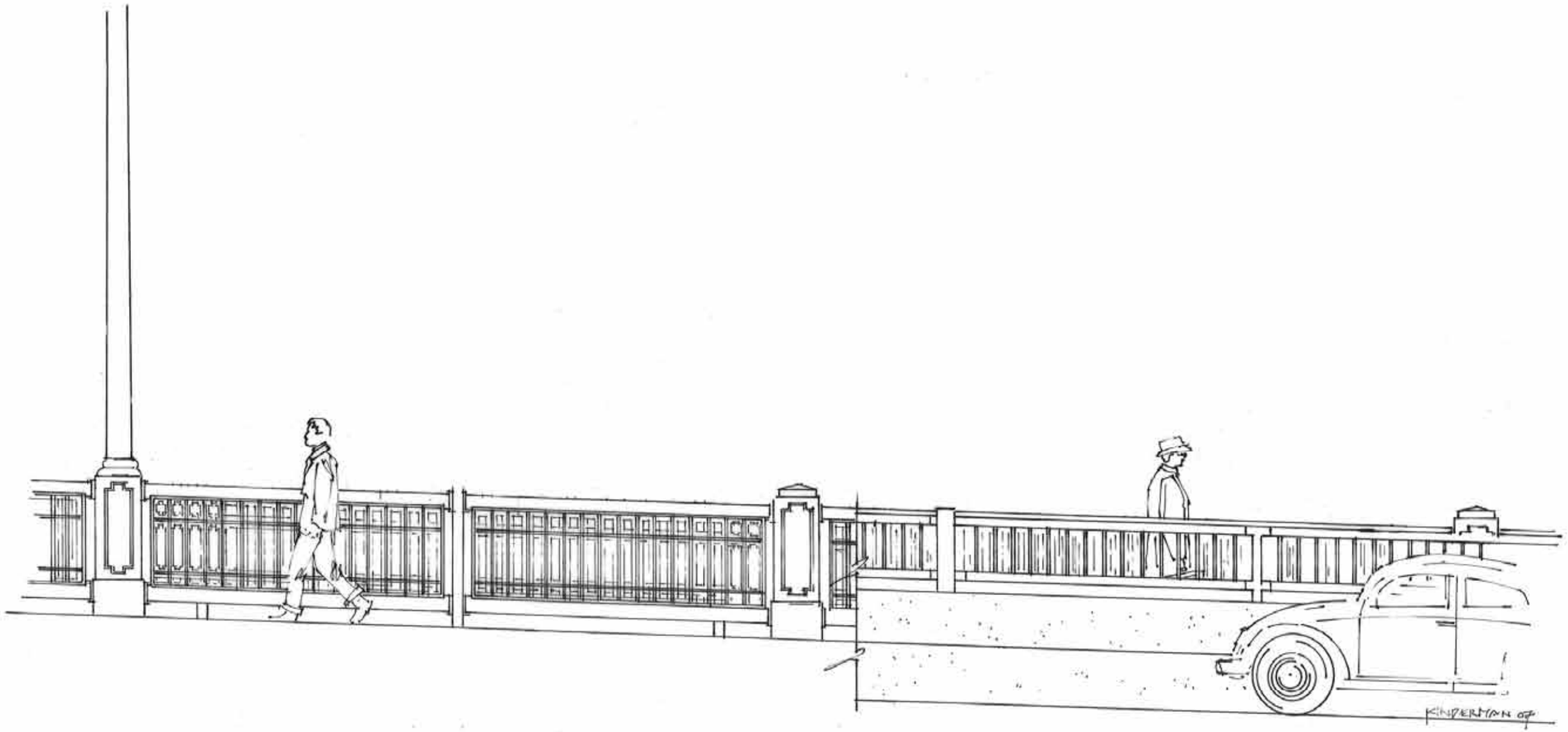
Existing Geometry

- Typical Section of sidewalk
- Elevation View from the Roadway



Existing Typical Section



Existing Elevation

Preliminary Design Concepts

Provided during the early project funding phases

- Design for the Secretary of Transportation
- Design for the Washington State Legislature

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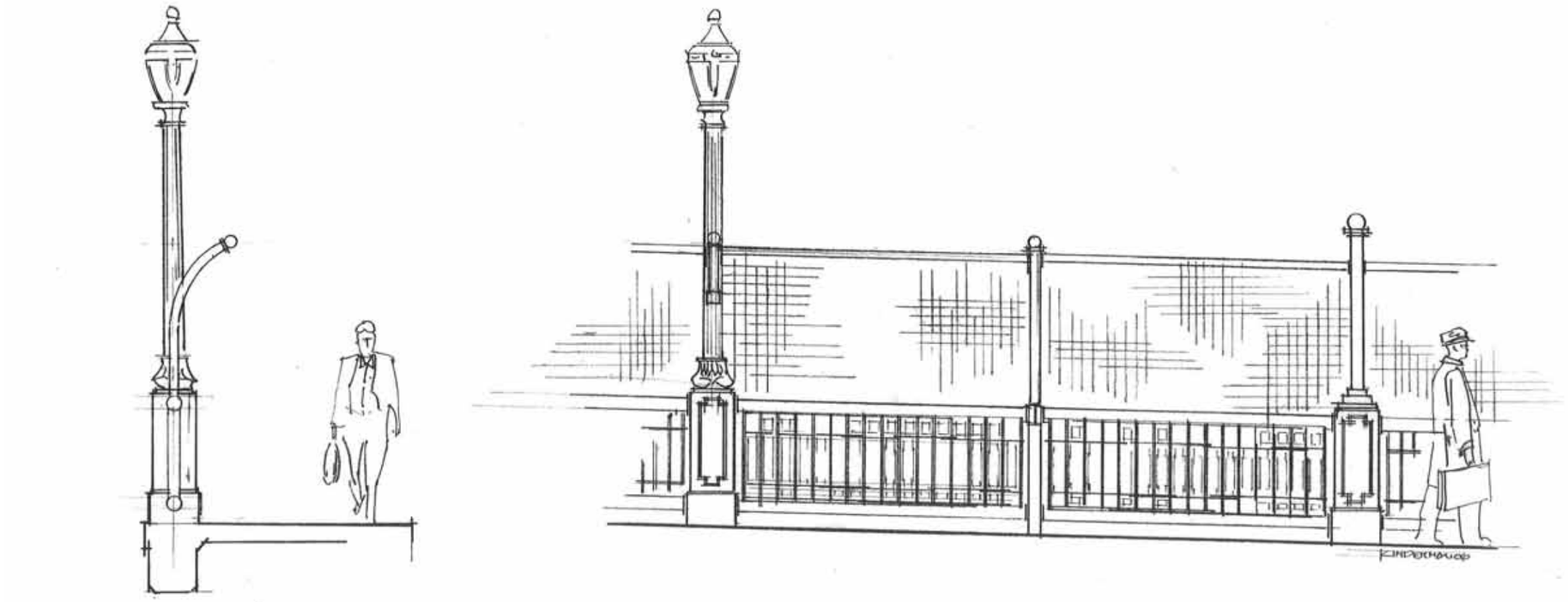
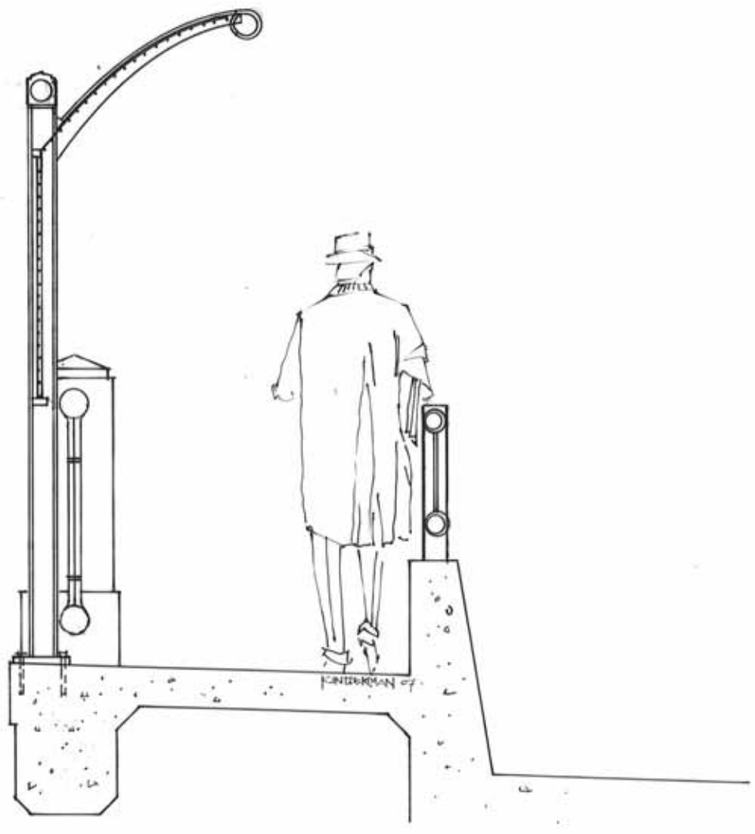


Design for the Secretary of Transportation



Design for the State Legislature

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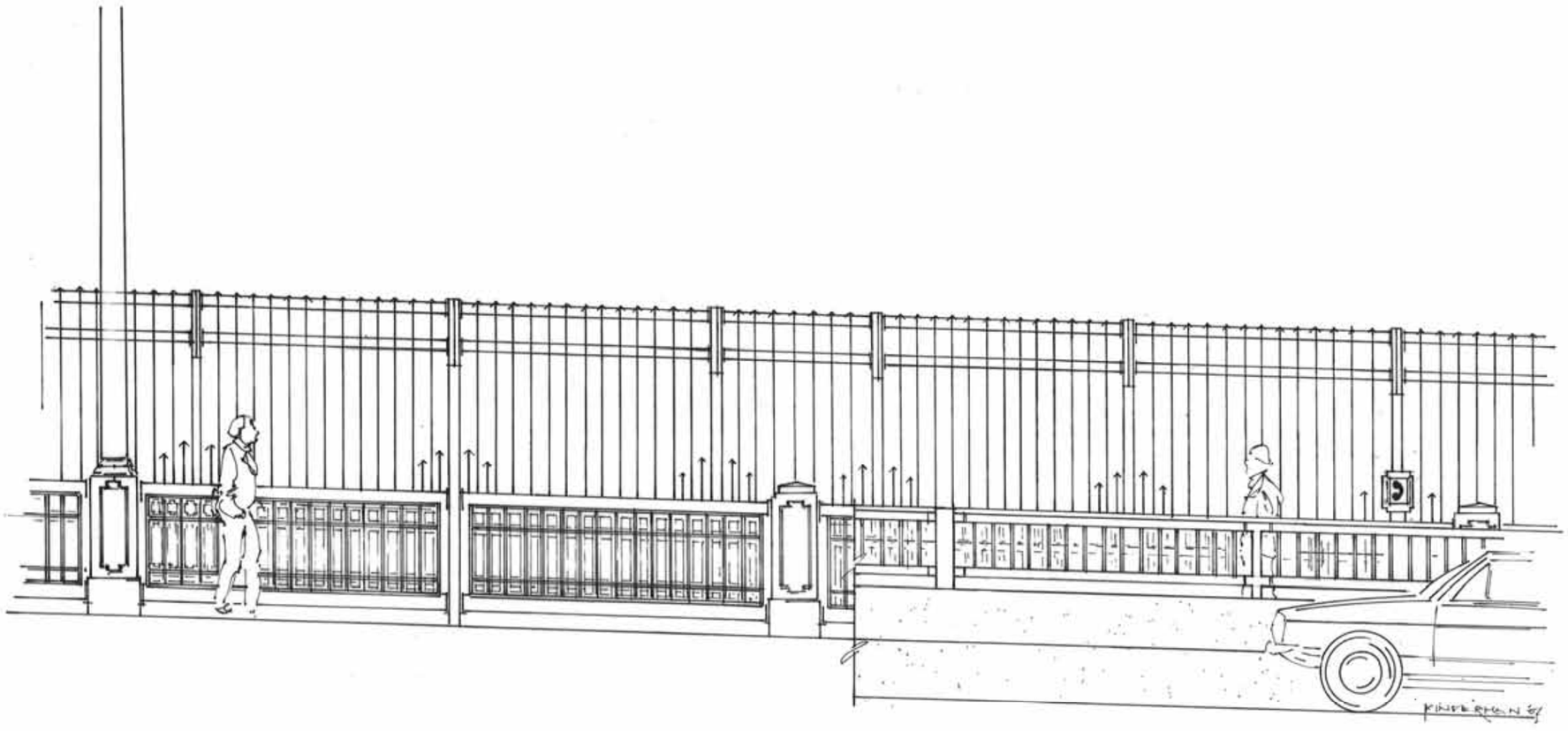
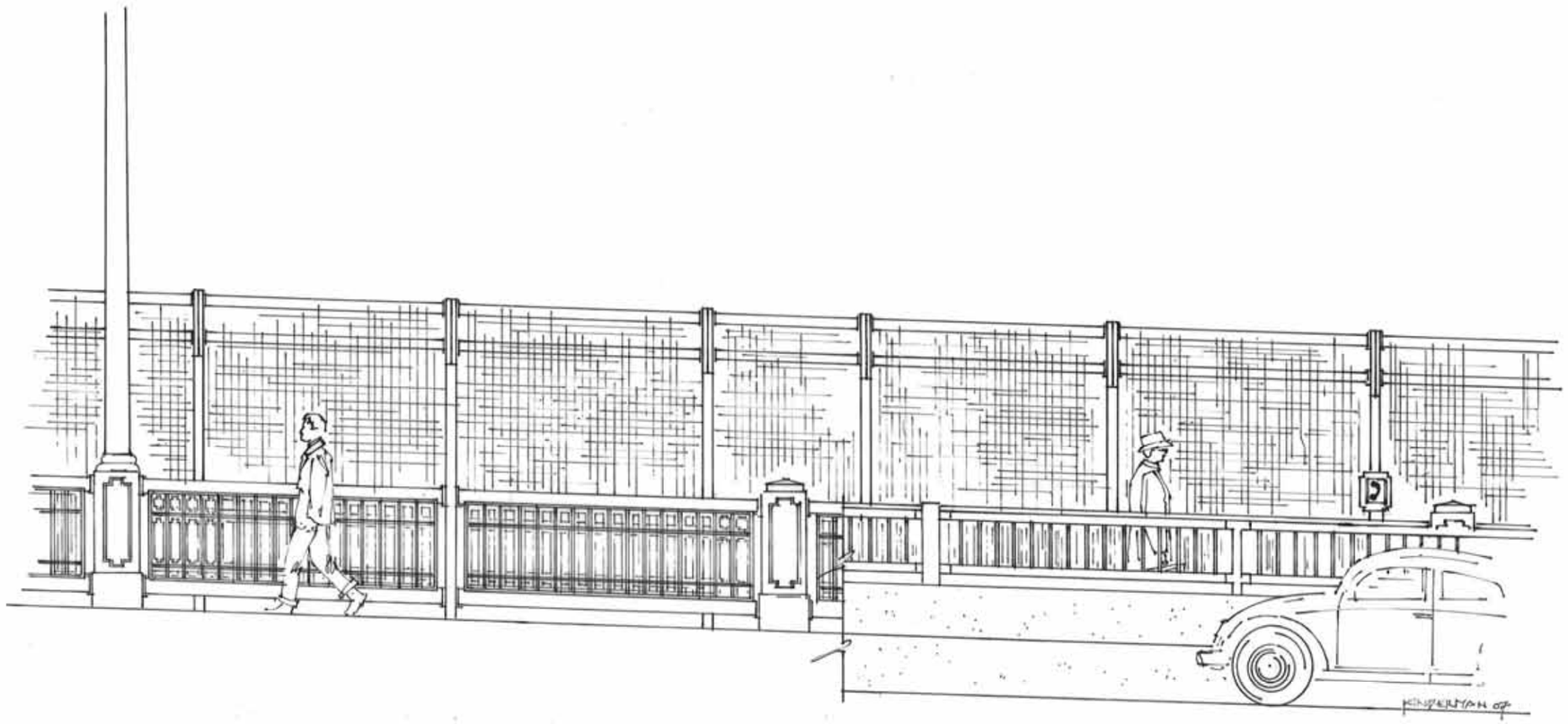


Design with Bars for the State Legislature



Design with screen for the State Legislature

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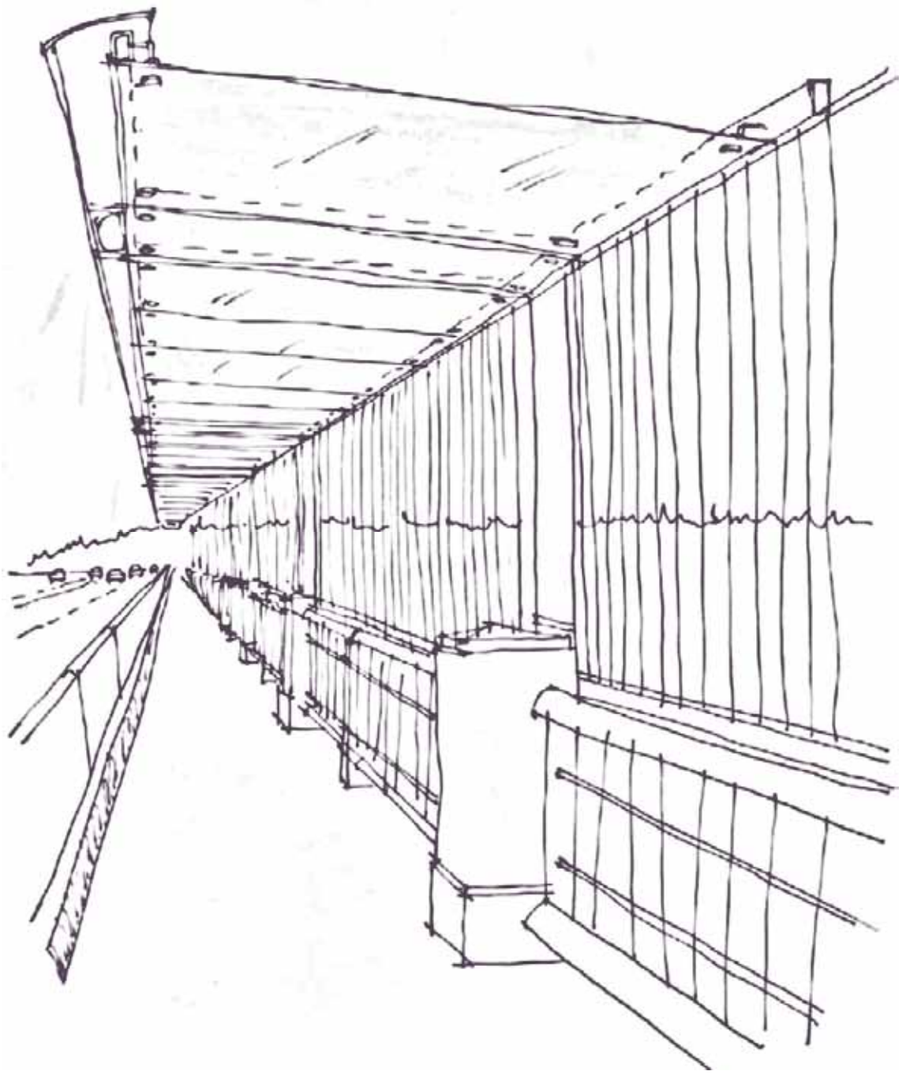
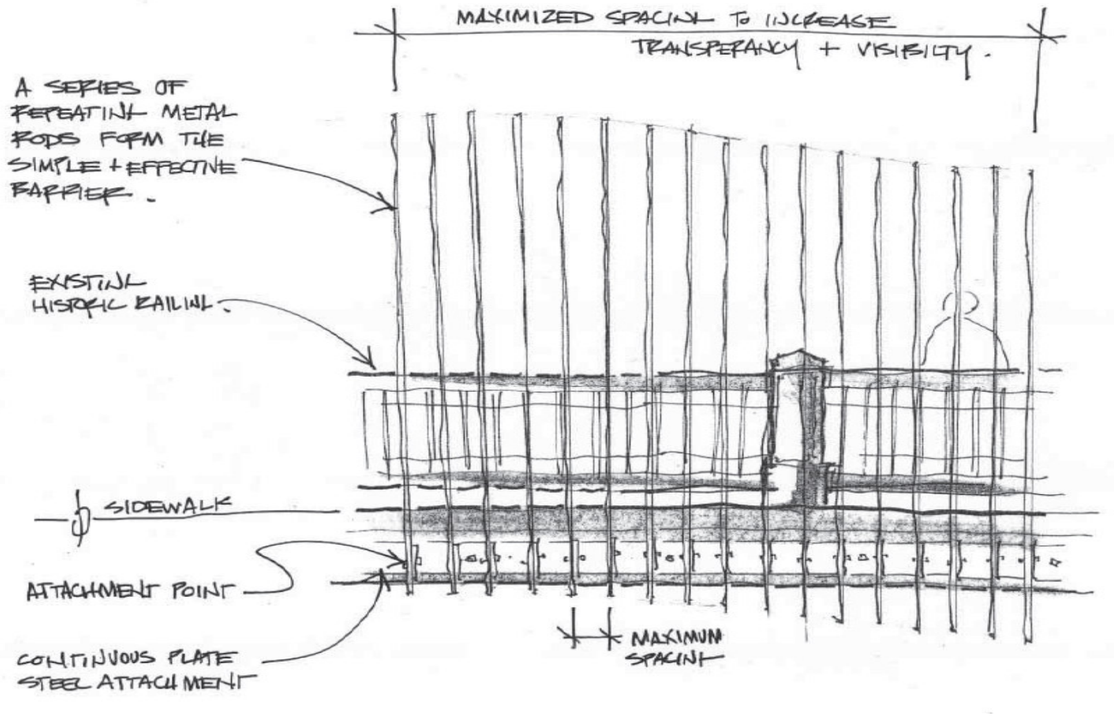
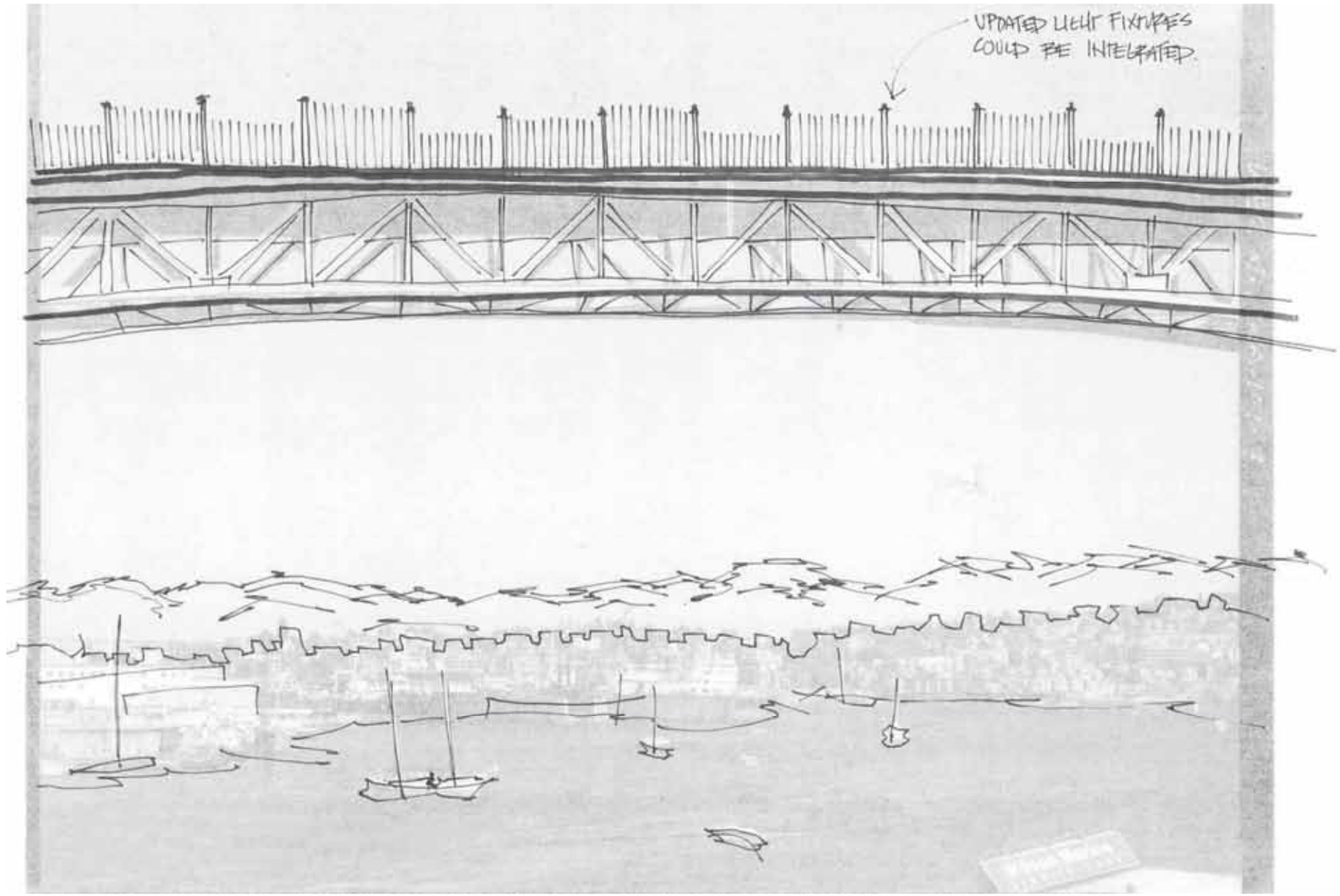
Design Concepts

- Designs concepts from the *Community Conceptual Design Report 2007* to be integrated into the final design

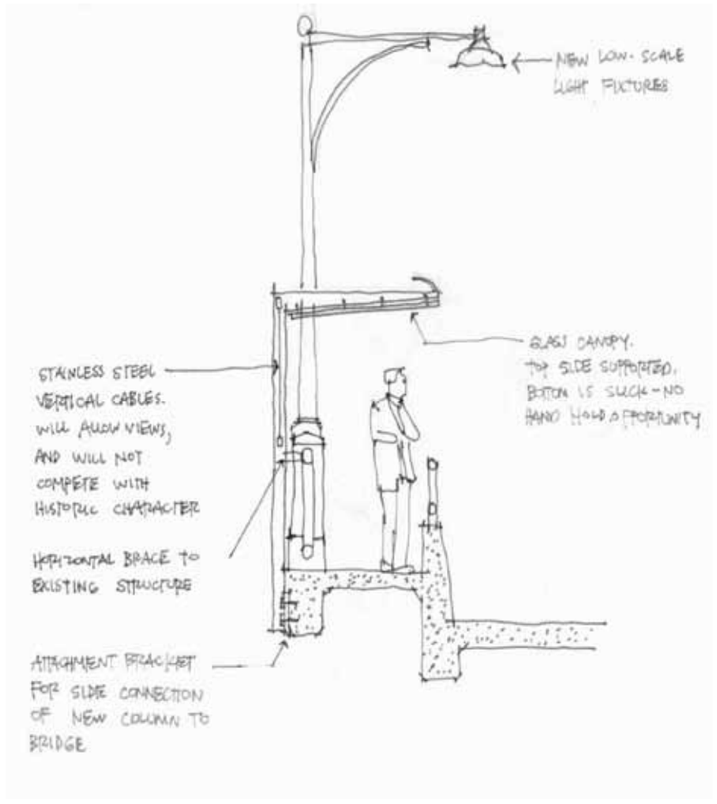
Vertical Elements

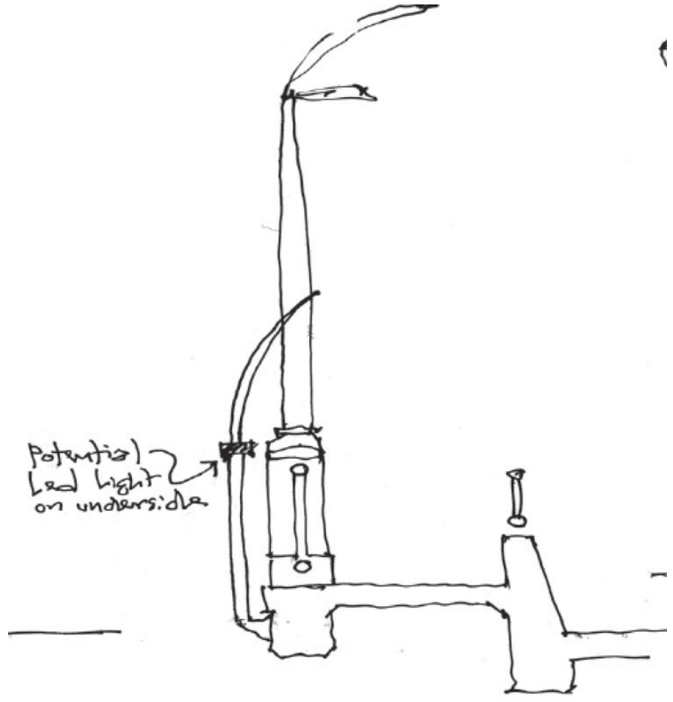






Pedestrian Lighting





Historic Character

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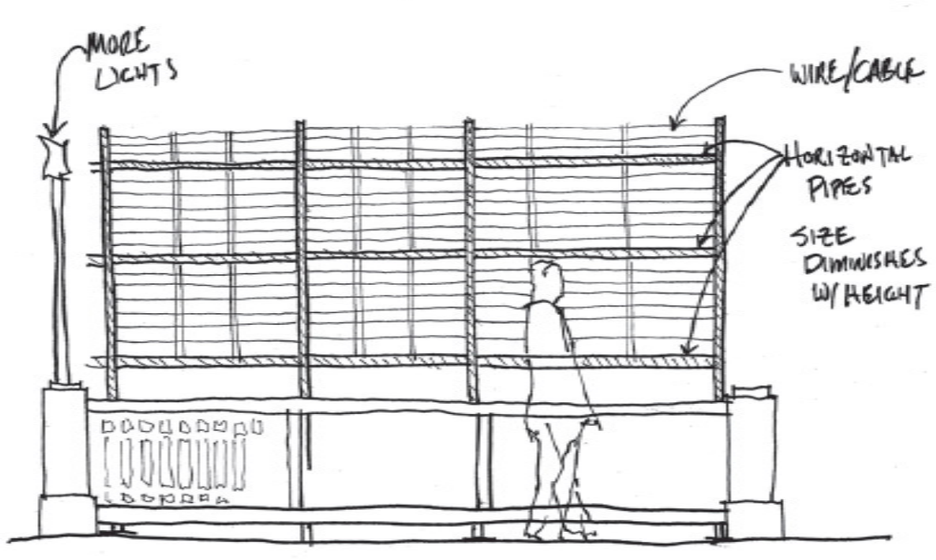
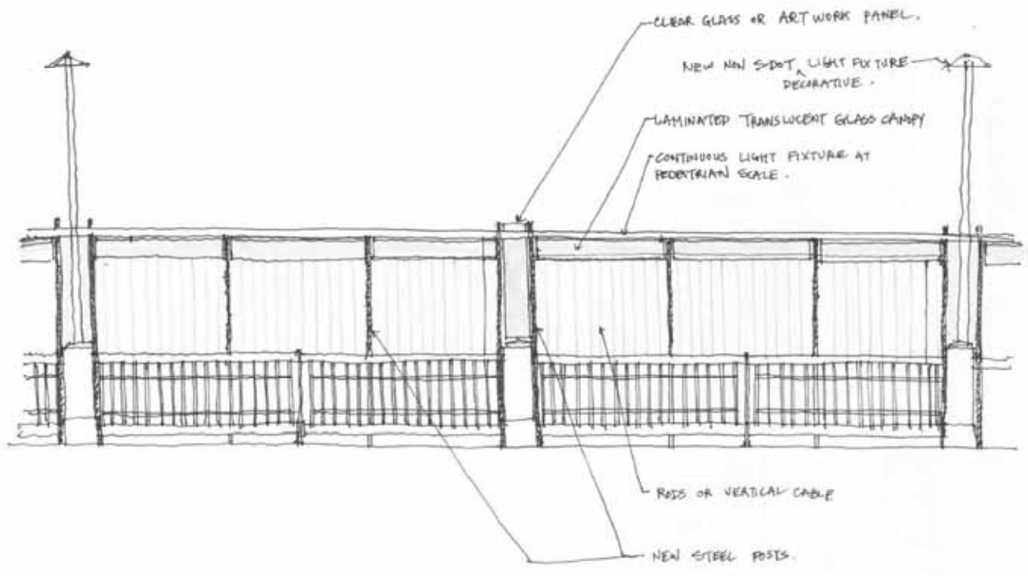
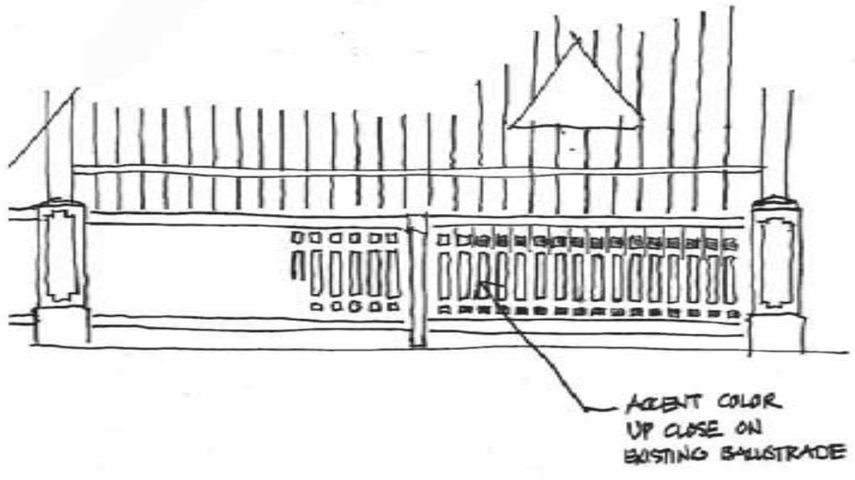


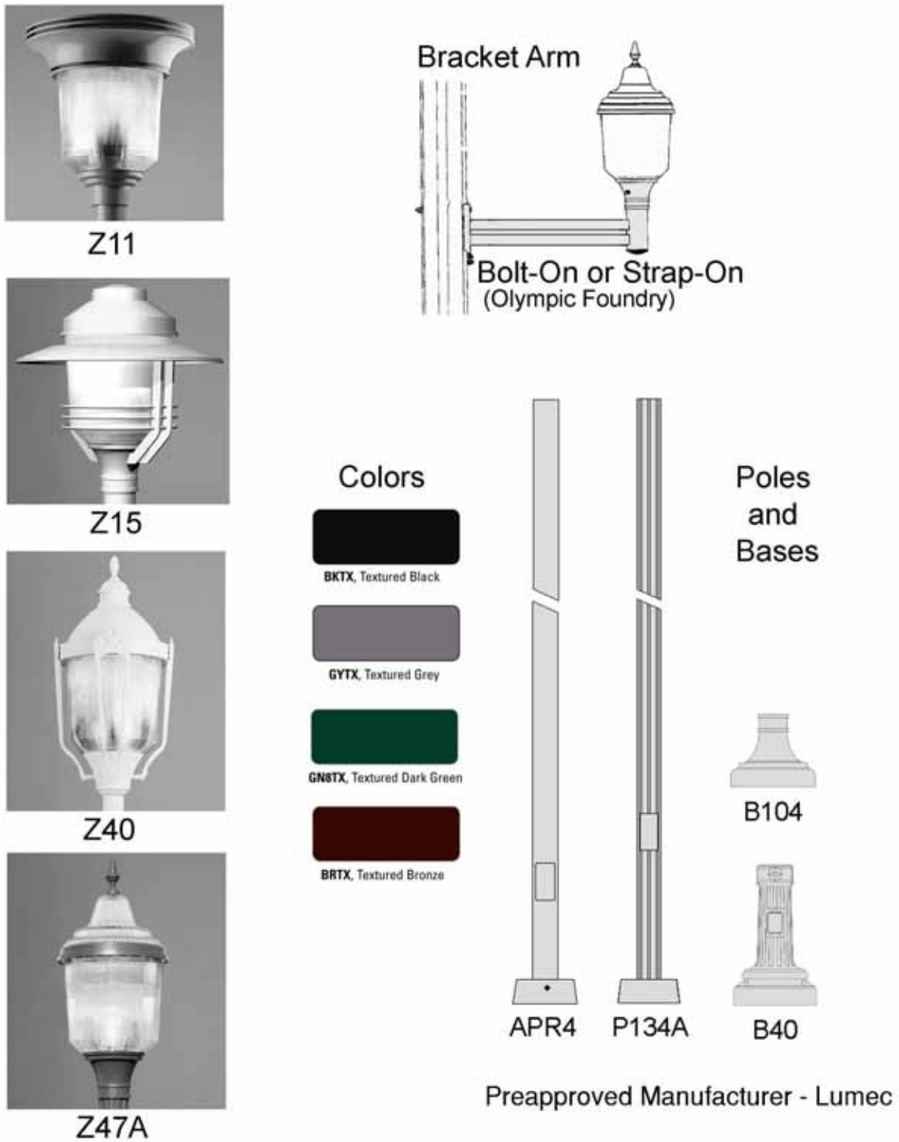
Pedestrian Scale





City of Seattle Lighting Standards

- Standard lights from the City's Right of Way Manual



City of Seattle Pedestrian Lighting Design Standards

- City of Seattle Right of Way Manual figure 4-21

Anthropometric Data

- Human Dimensions

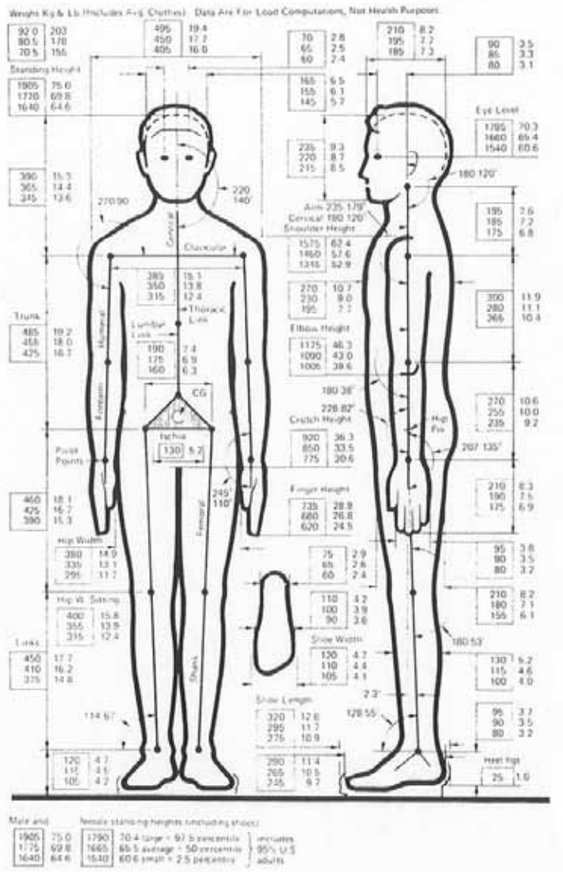
Anthropometric Data

INTRODUCTION TO ANTHROPOMETRIC DATA

The following anthropometric drawings show three values for each measurement: the top figure is for the large person or 97.5 percentile; the middle figure, the average person or 50 percentile; and the lower figure, the small person or 2.5 percentile. The chosen extreme percentiles thus include 95%. The remaining 5% include some who learn to adapt and others, not adequately represented, who are excluded to keep designs for the majority from becoming too complex and expensive. Space and access charts are designed to accept the 97.5 percentile large man and will cover all adults except a few giants. Therefore, use the 97.5 percentile to determine space envelopes, the 2.5 percentile to determine the maximum "kinetospheres" or reach areas by hand or foot, and the 50 percentile to establish control and display heights. To accommodate both men and women, it is useful at times to add a dimension of the large man to the corresponding dimension of the small woman and divide by 2 to obtain data for the average adult. This is the way height standards evolve. Youth data are for combined sex. Although girls and boys do not grow at the same rate, differences are small when compared with size variations.

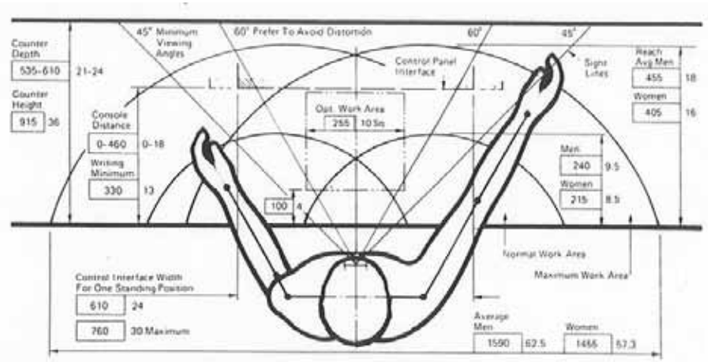
Pivot point and link systems make it easy to construct articulating templates and manikins. Links are simplified bones. The spine is shown as a single link; since it can flex, pivot points may be added. All human joints are not simple pivots, though it is convenient to assume so. Some move in complicated patterns like the roving shoulder. Reaches shown are easy and comfortable; additional reach is possible by bending and rotating the trunk and by extending the shoulder. Stooping to reach low is better than stretching to reach high. The dynamic body may need 10% more space than the static posture allows. Shoes have been included in all measurements; allowance may need to be made for heavy clothing. Sight lines and angles of vision given in one place or another apply to all persons.

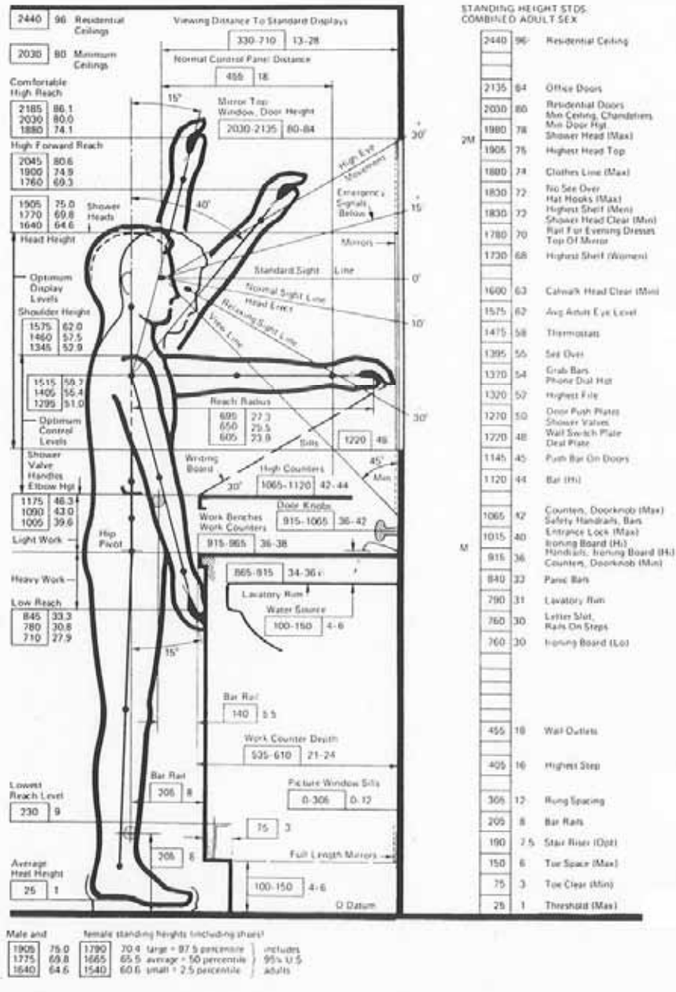
The metric system of measurement has been included, since it is used in scientific work everywhere and is the most practical system of measurement ever devised. Millimeters have been chosen to avoid use of decimals. Rounding to 5 mm aids mental retention while being within the tolerance of most human measurements.



Niels Diffrient, Alvin R. Tilley, Henry Dreyfuss Associates; New York, New York

1 HUMAN DIMENSIONS





STANDING HEIGHT STDS. COMBINED ADULT SEX

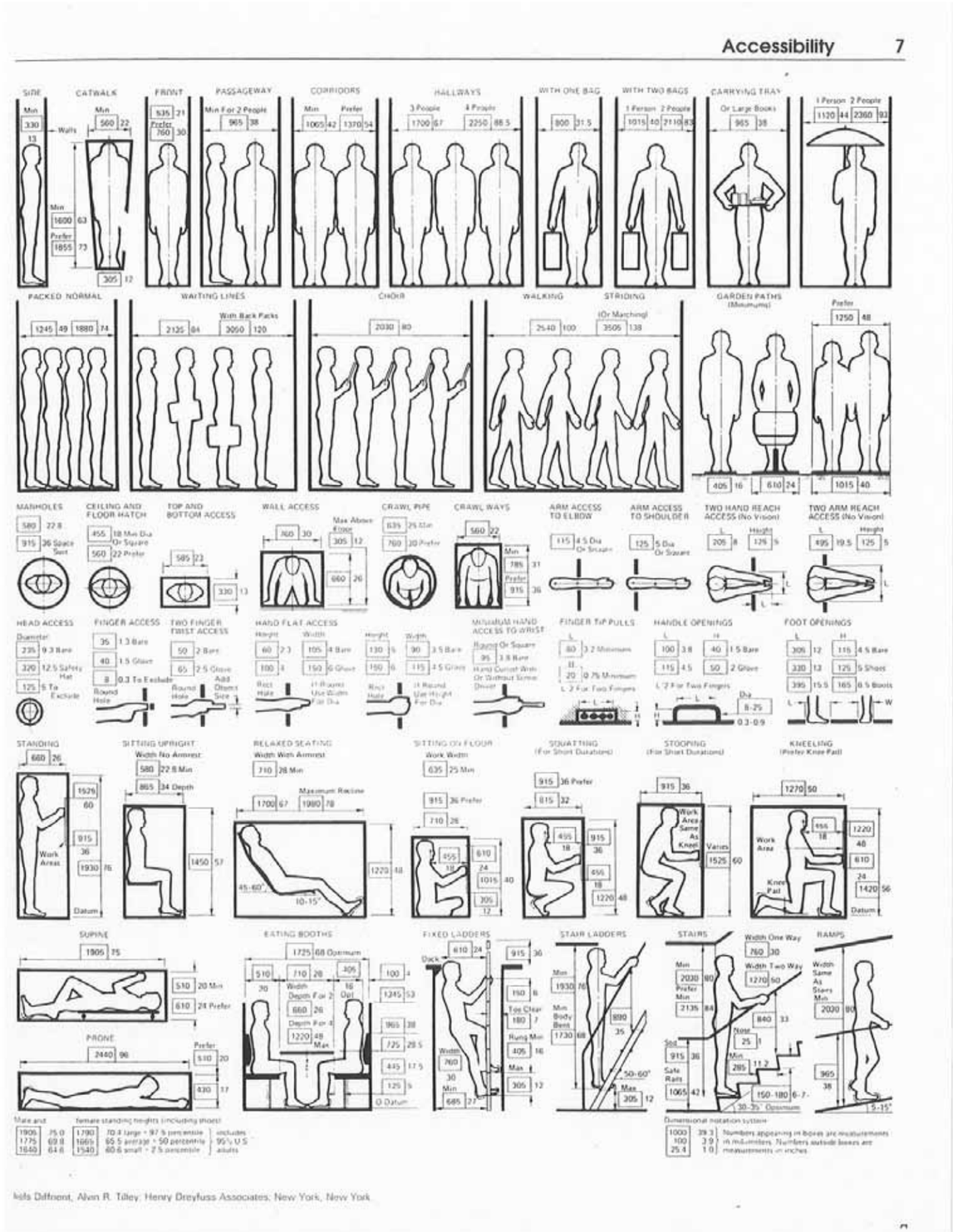
2440	96	Residential Ceiling
2135	84	Office Doors
2030	80	Residential Doors Min Ceiling, Chandeliers
1980	78	Min Door Hgt. Shower Head (Max)
1905	75	Highest Head Top
1880	74	Clothes Line (Max)
1830	72	No See Over Hat Hooks (Max)
1830	72	Highest Shelf (Men) Shower Head Clear (Min)
1780	70	Rail For Evening Dresses Top Of Mirror
1730	68	Highest Shelf (Women)
1600	63	Catwalk Head Clear (Min)
1575	62	Avg Adult Eye Level
1475	58	Thermostats
1395	55	Sill Over
1370	54	Grab Bars Phone Dial Hgt
1320	52	Highest File
1270	50	Door Push Plates Shower Valves
1220	48	Wall Switch Plate Deal Plate
1145	45	Push Bar On Doors
1120	44	Bar (Hi)
1065	42	Counters, Doorknob (Max) Safety Handrails, Bars
1015	40	Entrance Lock (Max) Ironing Board (Hi)
915	36	Handrails, Ironing Board (Hi) Counters, Doorknob (Min)
840	33	Panic Bars
790	31	Lavatory Rim
760	30	Letter Slot, Rails On Steps
760	30	Ironing Board (Lo)
455	18	Wall Outlets
405	16	Highest Step
305	12	Rung Spacing
205	8	Bar Rails
190	7.5	Stair Riser (Opt)
150	6	Toe Space (Max)
75	3	Toe Clear (Min)
25	1	Threshold (Max)

Male and Female standing heights (including shoes) includes 95% U.S. adults

Niels Diffrient, Alvin R. Tilley, Henry Dreyfuss Associates; New York, New York

1 HUMAN DIMENSIONS

Anthropometric Data



Design Concepts

- First designs following the *Community Conceptual Design Report 2007*

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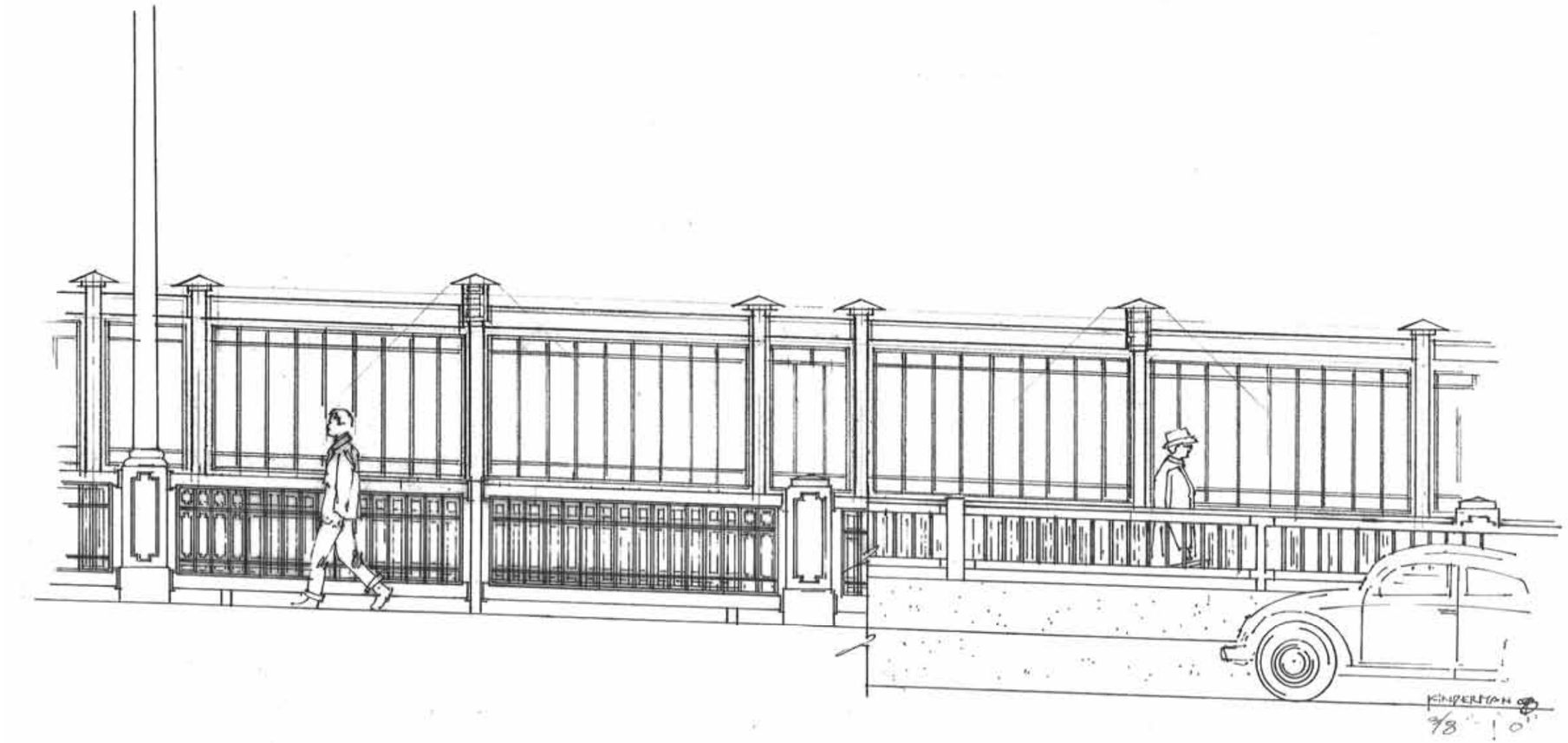
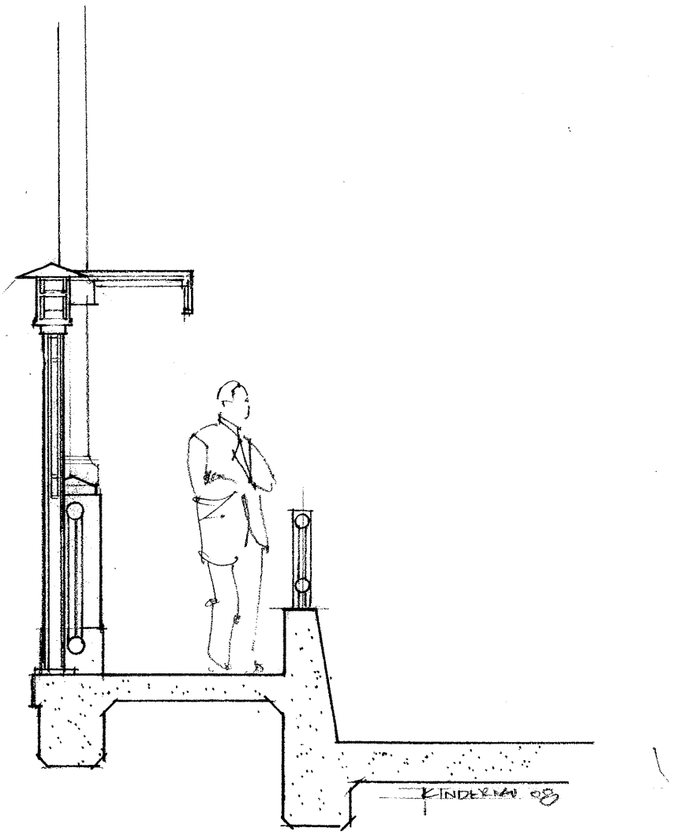
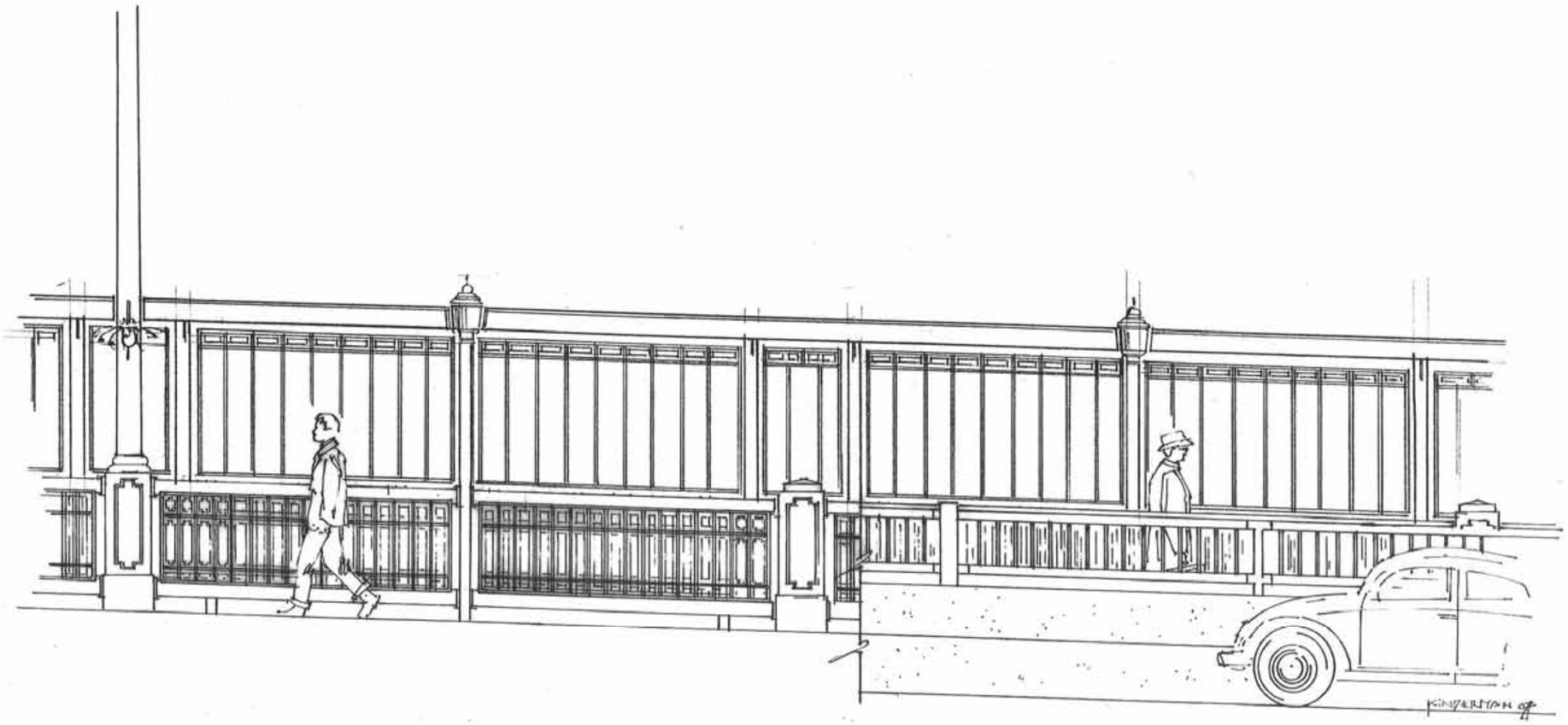


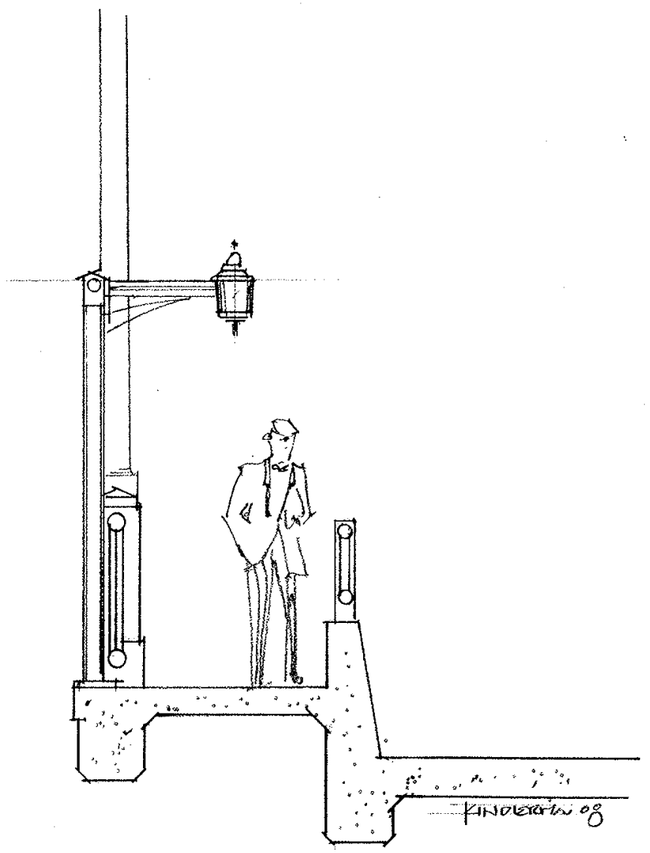
Concept A
Classic Fence with Pedestrian Lights
Niland Aspen Series light standard similar



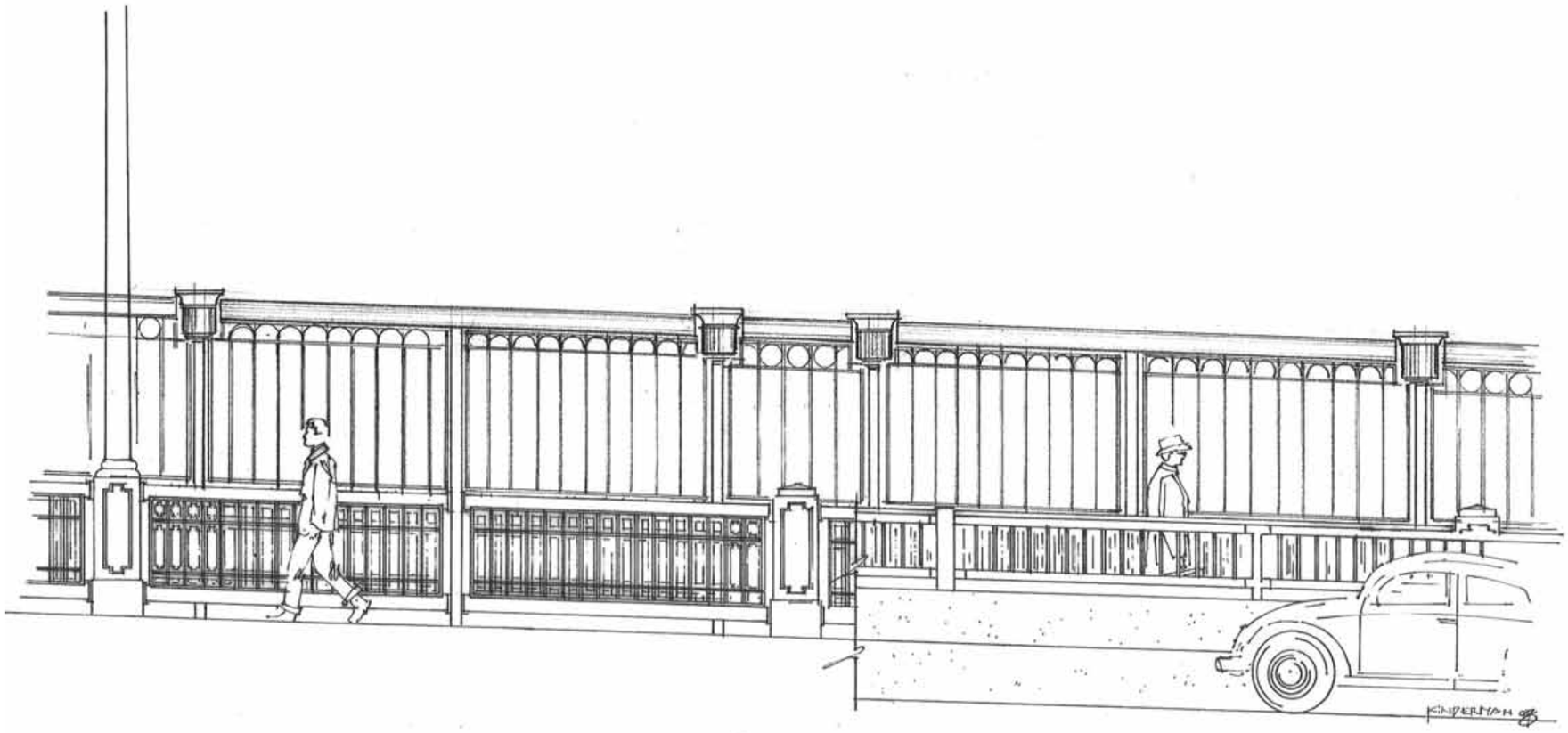
Concept A Typical Section
Classic Fence with Pedestrian Lights
Niland Aspen Series light standard similar



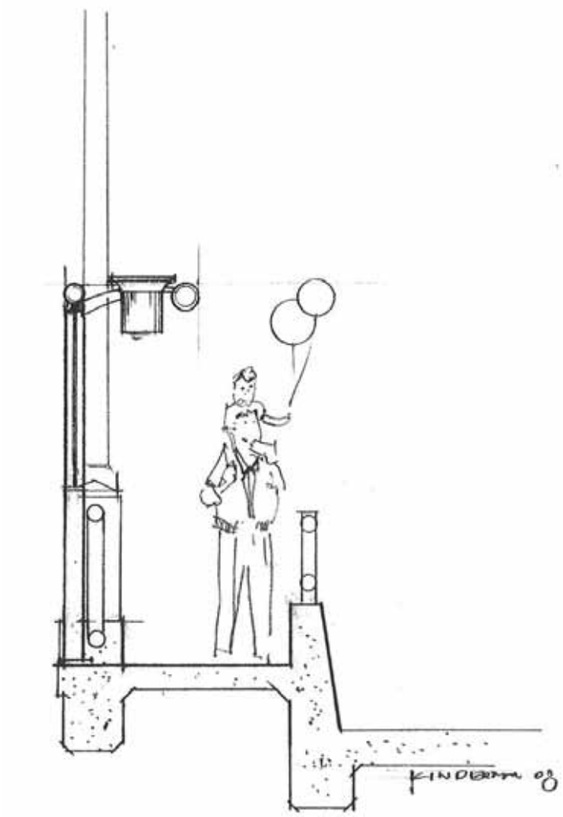
Concept B
Classic Fence with Pedestrian Lights
Lumec Z47A light standard similar



Concept B Typical Section
Classic Fence with Pedestrian Lights
Lumec Z47A light standard similar



Concept C
Classic Fence with Pedestrian Lights
Lumec Z11 light standard similar



Concept C Typical Section
Classic Fence with Pedestrian Lights
Lumec Z11 light standard similar

Post Advisory Committee Meetings 1 & 2

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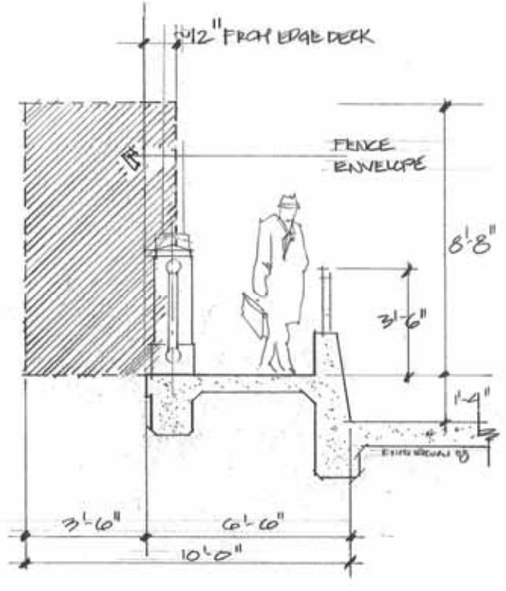
Design Considerations

Qualitative

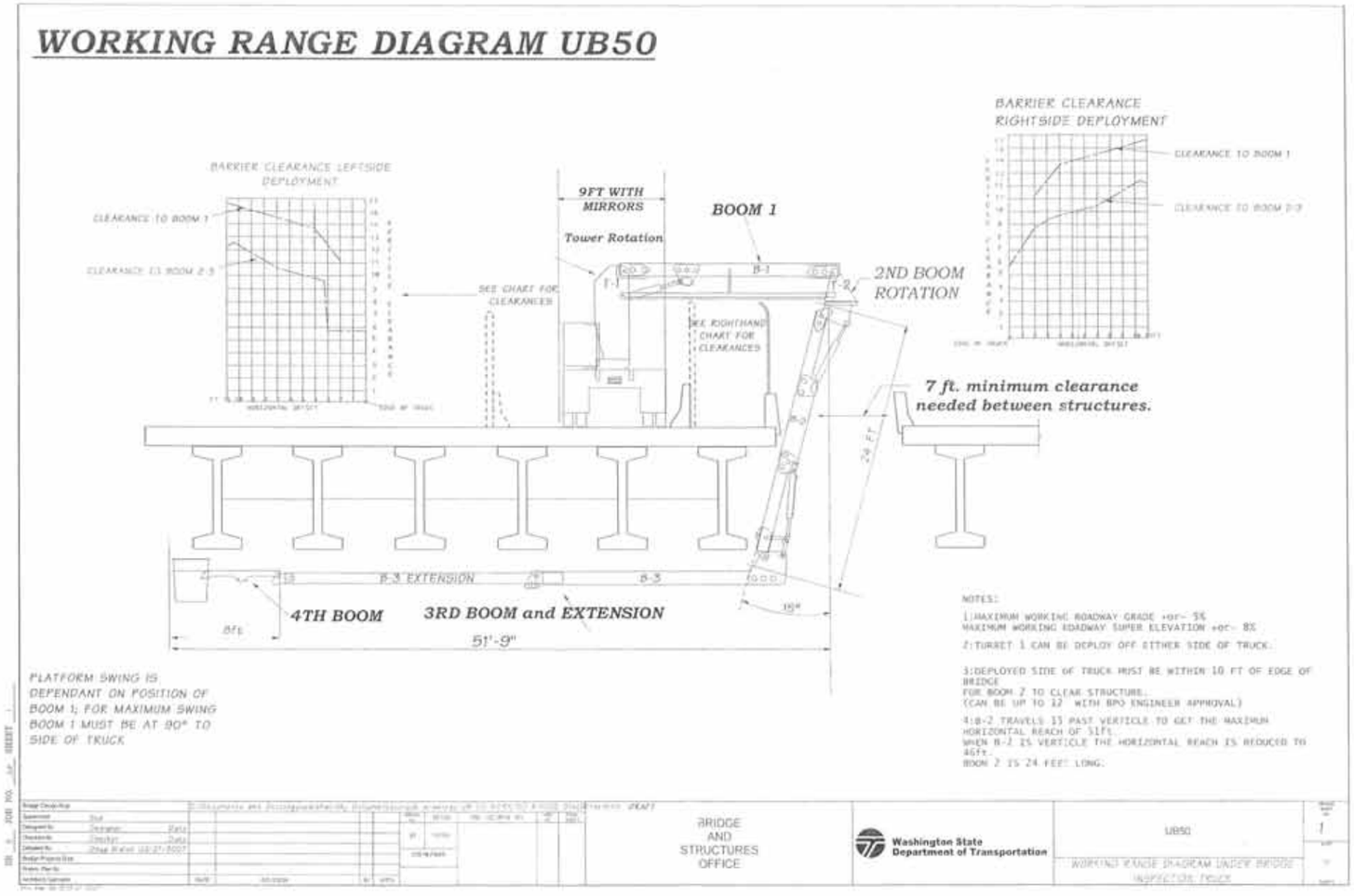
- Use vertical elements as the main fence safety feature.
- Do not use mesh or wire fabric.
- The elements should be stainless steel wire rope or rods. Small diameters contribute to visibility from the bridge.
- The fence may extend only slightly 'outward' toward the water to provide a more 'open' experience for pedestrians. However, not required beyond that of a reasonable structural installation.
- The fence should have an overhang to discourage climbing. Recognize the 'face validity' of such an assembly. Although climbable by some, the overhang may be perceived as difficult to climb.
- The climb ability of the existing rail should be taken into account. Designs should discourage access to the fence top from the top rail or posts.
- Pedestrian lighting, if used, should be low wattage and essentially decorative.

Quantitative

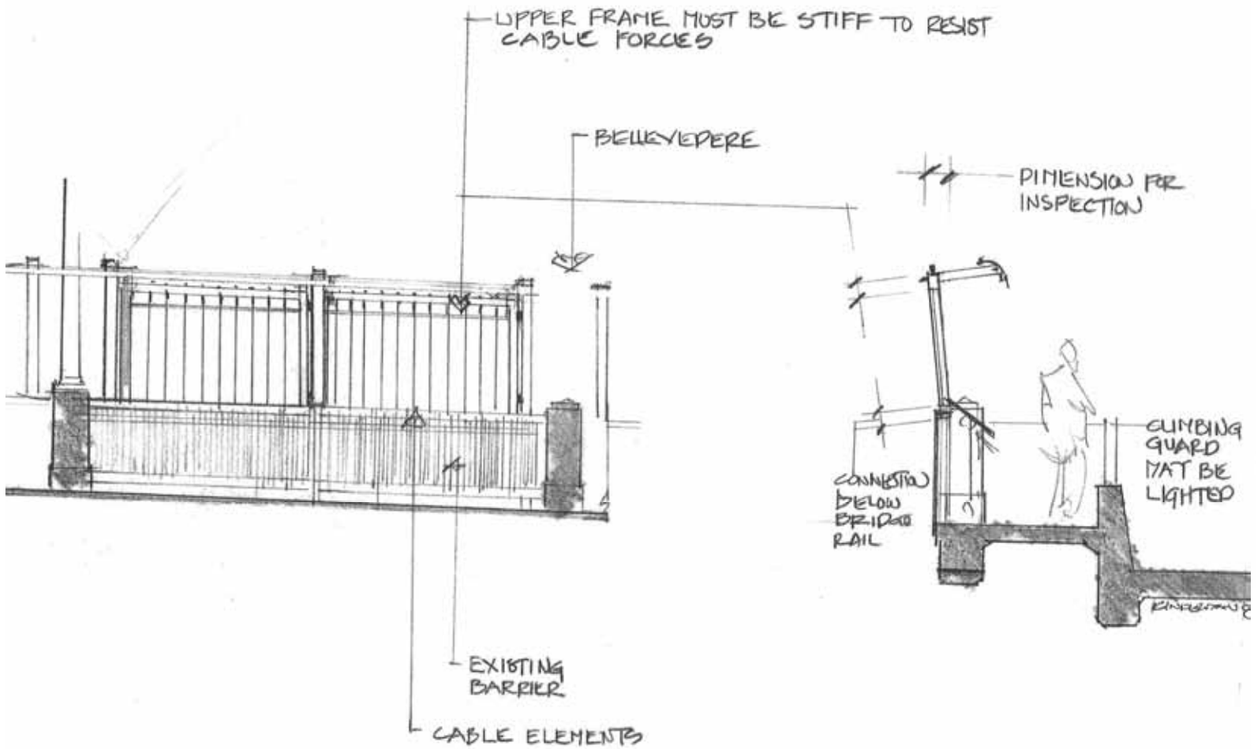
- The elements should be spaced no greater than 6" apart.
- The overhang is limited by inspection truck requirements. The Bridge Office is studying inspection traffic control requirements which may affect the dimension.



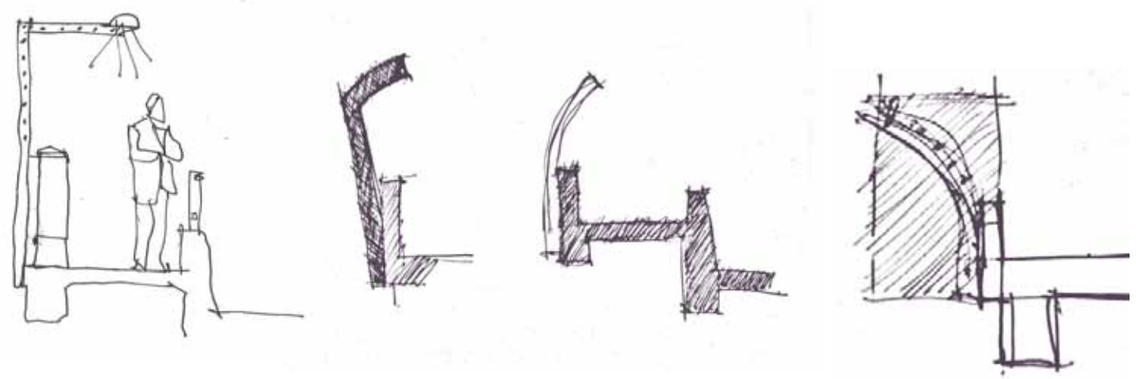
Fence Envelope
The fence must be contained within this space.



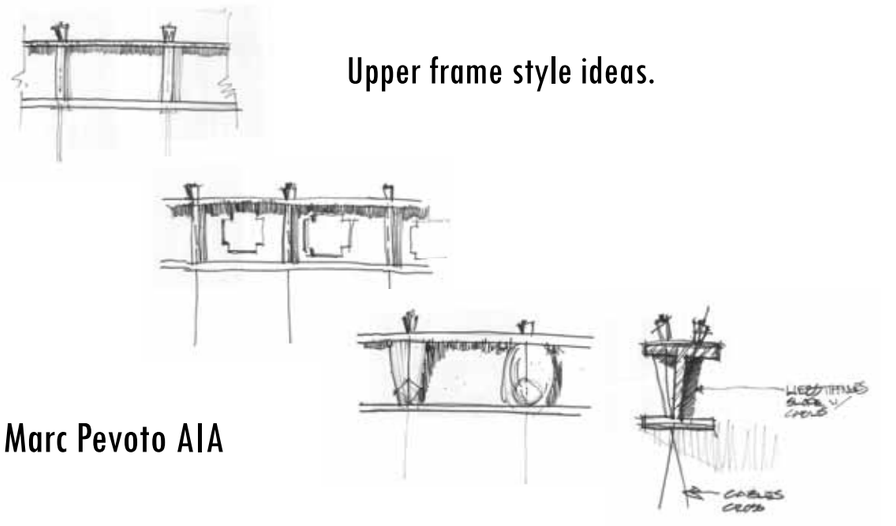
Under Bridge Inspection Truck (UBIT)



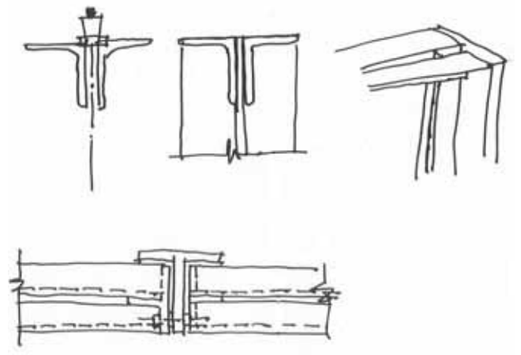
Elevation View
Vertical cables concept.



Section Views
The sidewalk as a ‘room’



Upper frame style ideas.



Frame section shapes should be light in weight and appearance.

Design Committee: Sketch Diary
Conversations with citizen architects David Clinkston AIA and Marc Pevoto AIA

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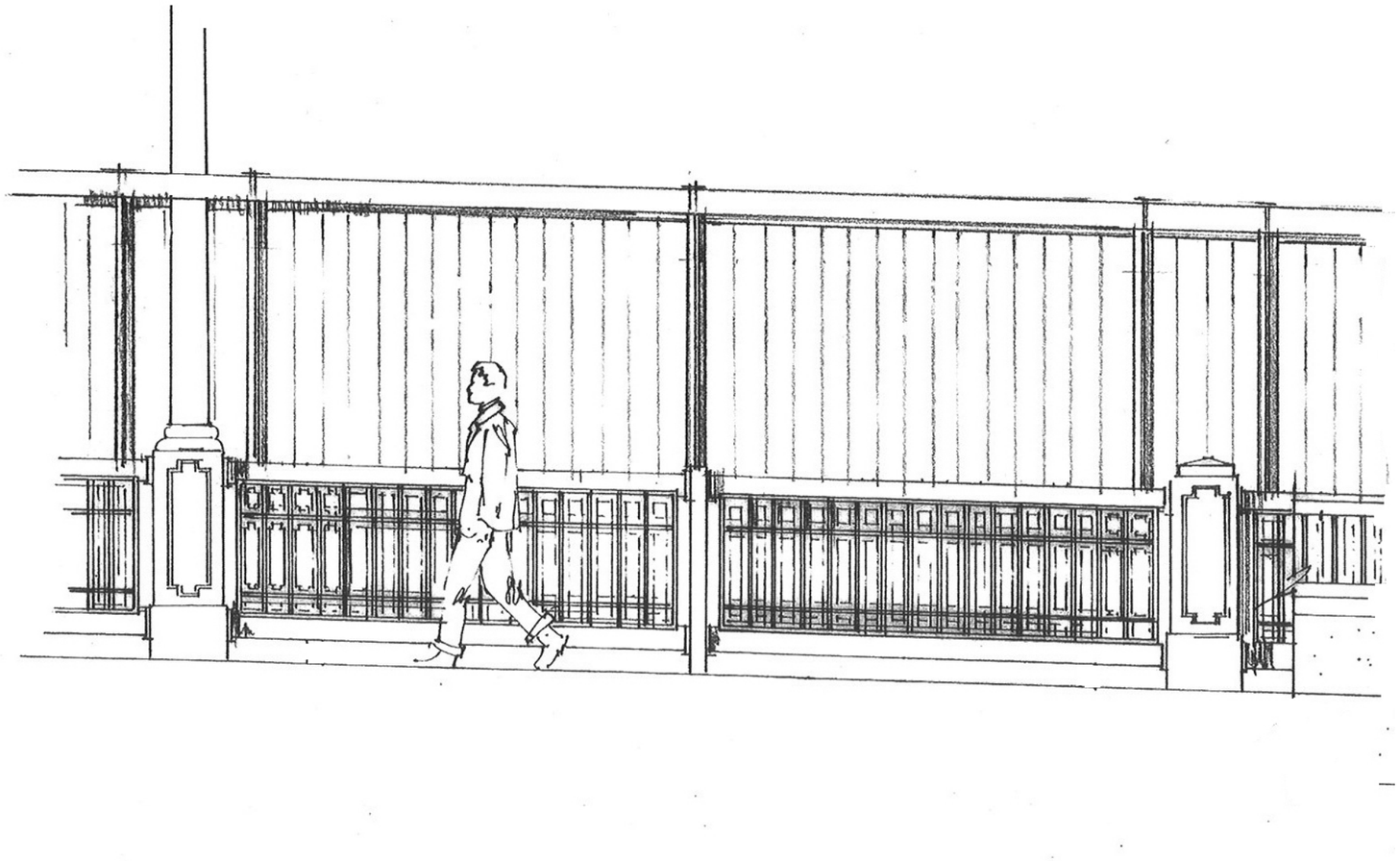


Elevation
Viewed from the traveled way

CURRENT DESIGN DISCUSSION

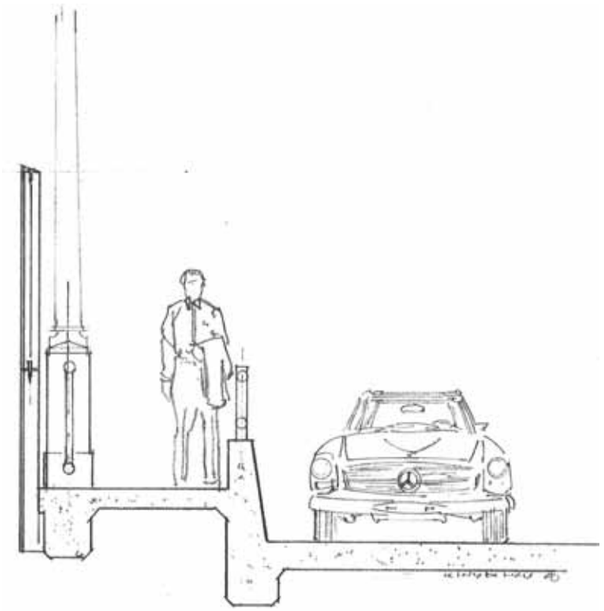
Provide a demountable double T frame system to house 3/16” stainless steel cables. Tension cables to prohibit spreading.

Design an overhang to discourage climbing.

Frame detailing will be visually light to facilitate views.

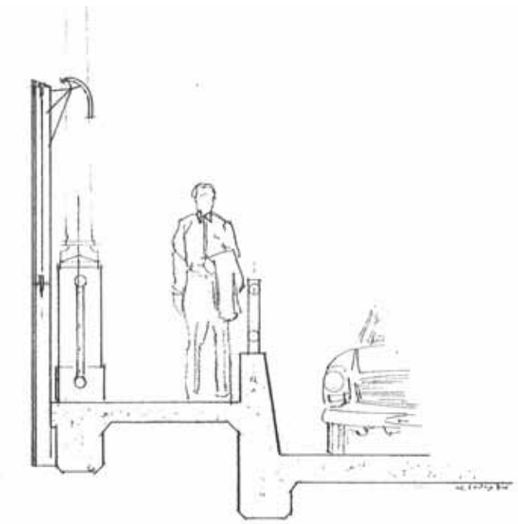
The fence weight is critical to structural bridge preservation issues.

Vertical Cable Design



Straight Fence

Sloping Cap



Curved Cap

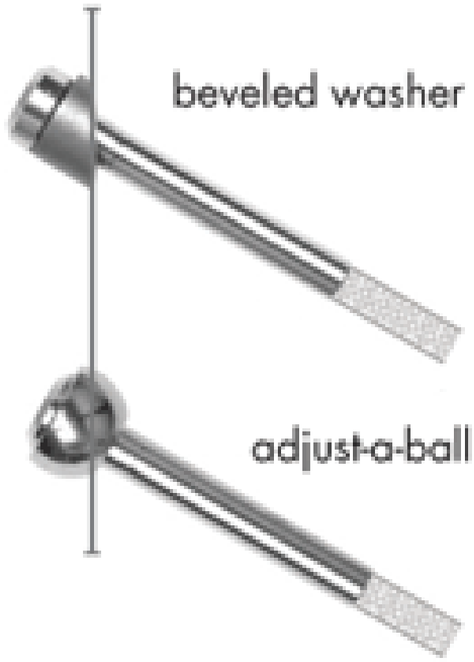
Discussion

The fence should have an overhang. The style will visually dominate the fence.

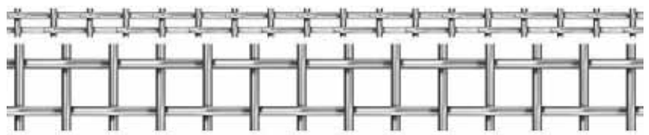
The designs shown are intended to be schematic in nature. The final design style will be developed as the project goes forward.

Typical Section Scenarios Study

Vertical Cable Design



Cable system hardware for vertical elements.



The top of the overhang for the straight cap option.

Materials

Currently under consideration.

Post Advisory Committee Meetings 3

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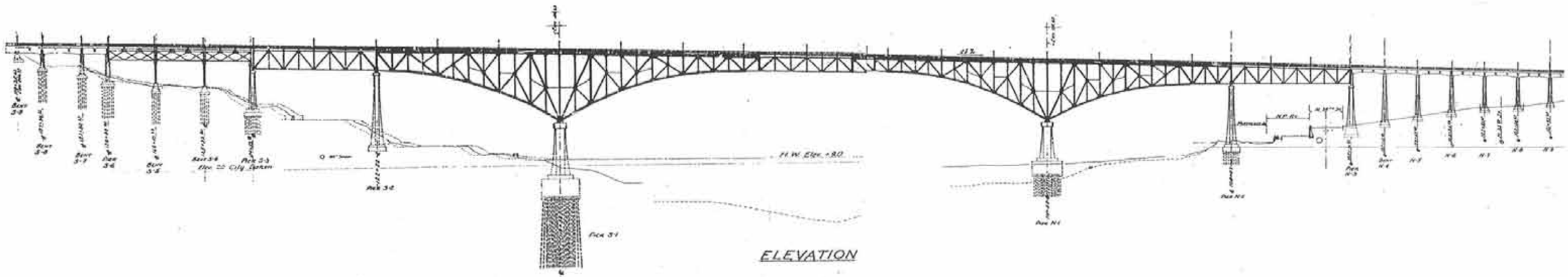
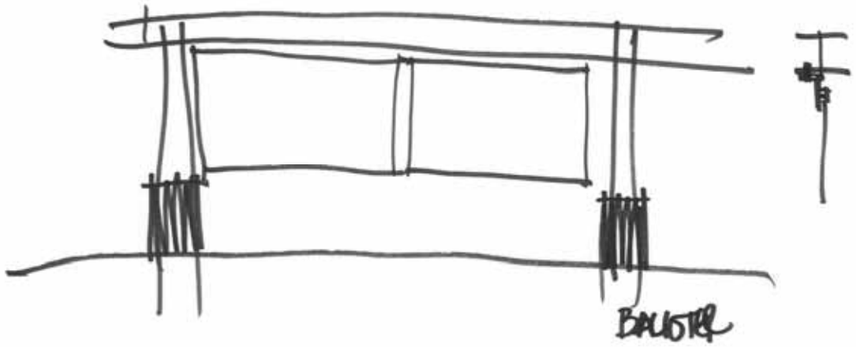
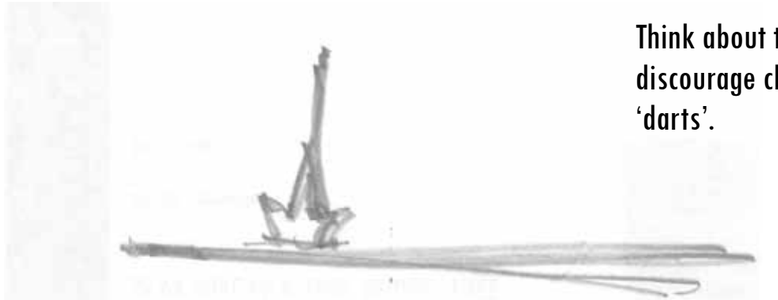


Elevation

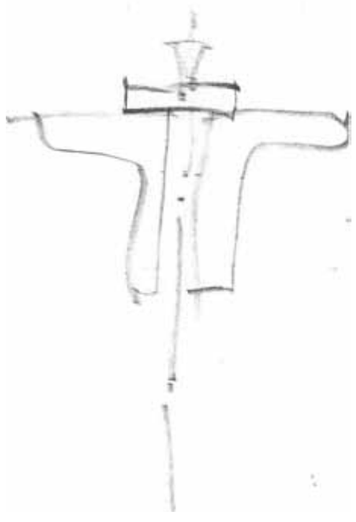
Original 1930 Contract Plans

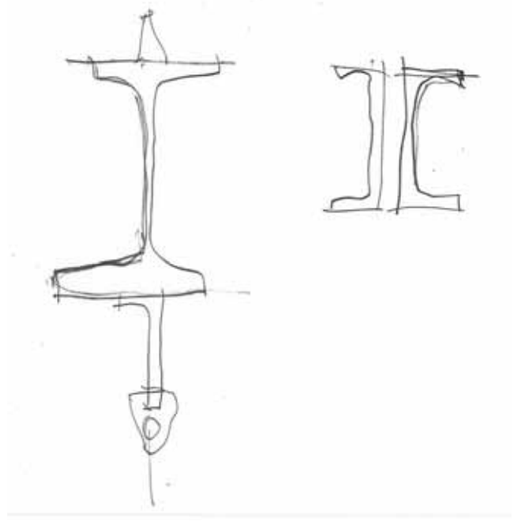


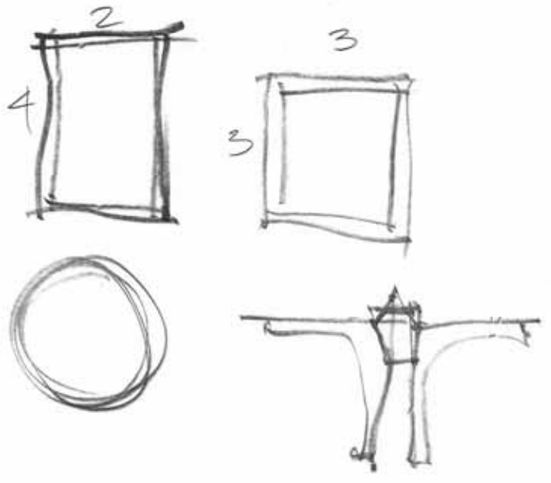
The top frame may span between main rail posts and the cable frame hang from the span.



Think about traditional methods to discourage climbing such as fence 'darts'.





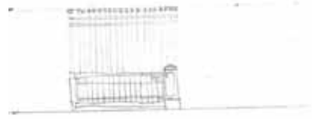


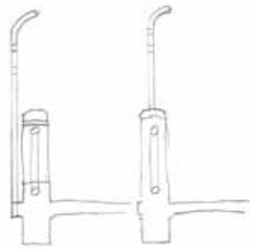
Sections under consideration for the frame. Look for sections that are visually light and produce interesting shadow lines.

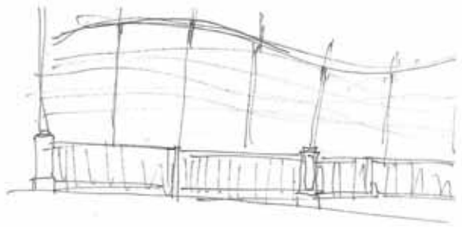
The style of the top frame may be ornamental….however this should be developed as the design progresses.

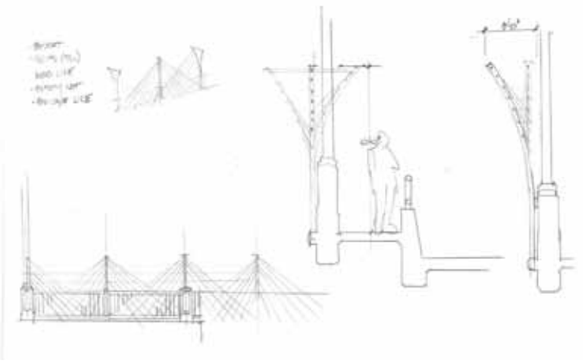
Design Committee: Sketch Diary

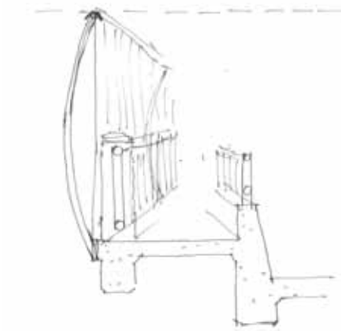
Conversations with citizen architects David Clinkston AIA and Marc Pevoto AIA

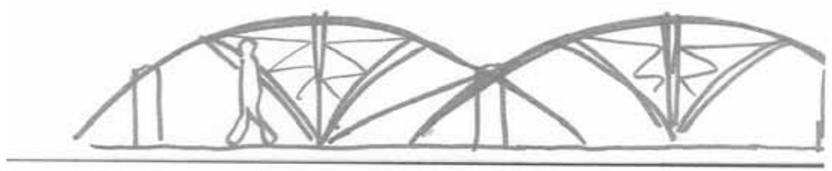


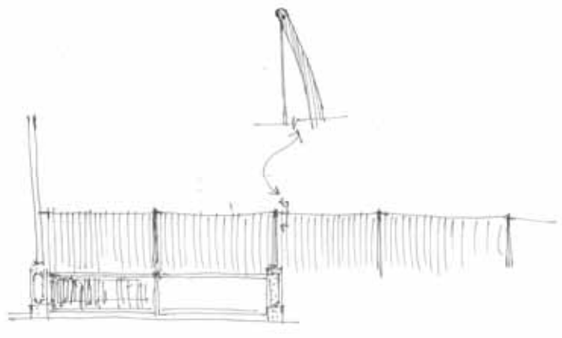


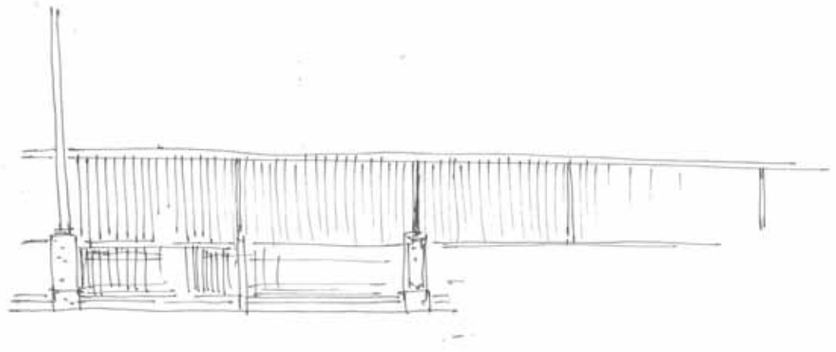


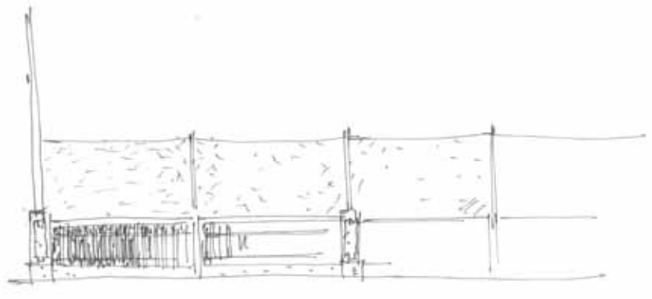












Sketches from Bassetti Architects

Provided following an afternoon in house charette at the Bassetti office.

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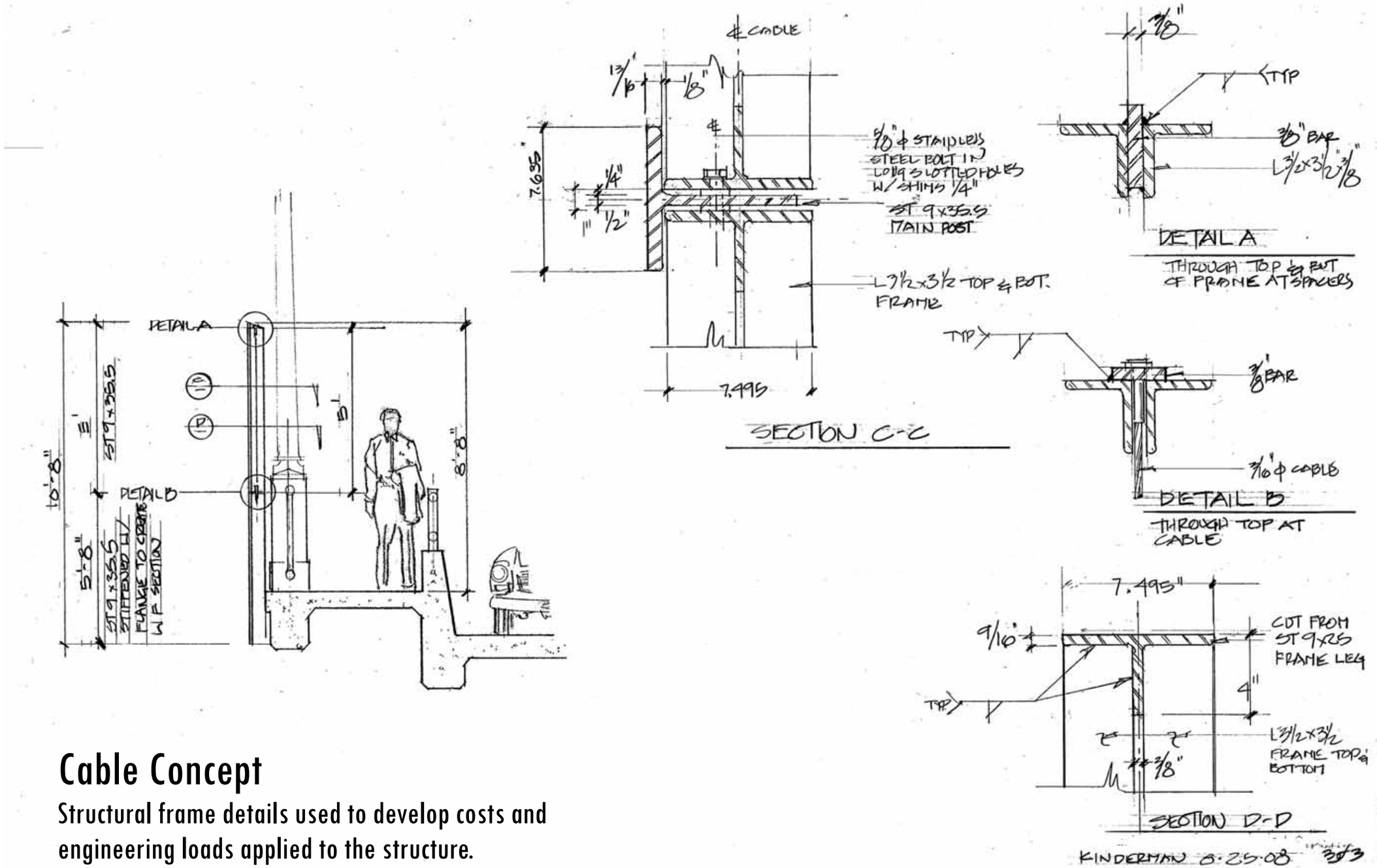
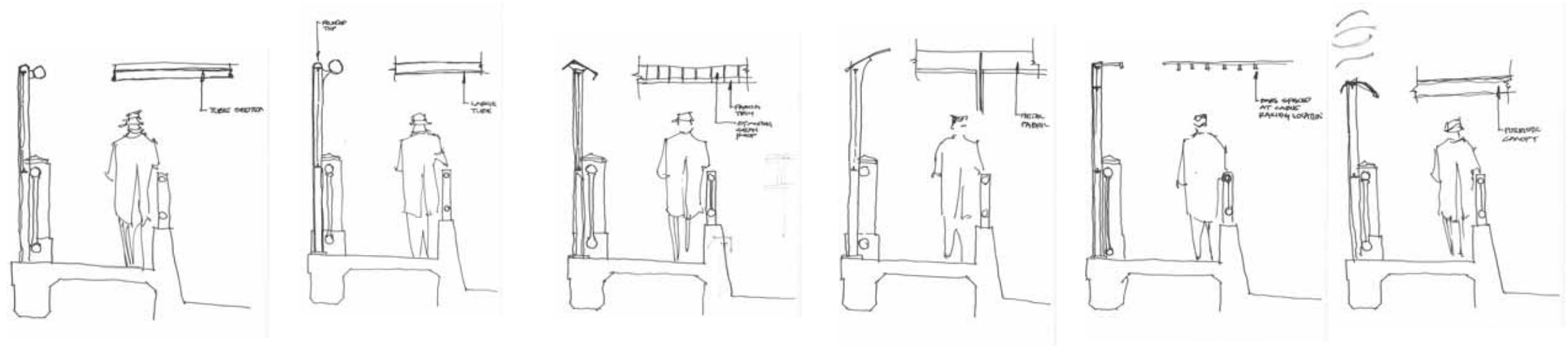


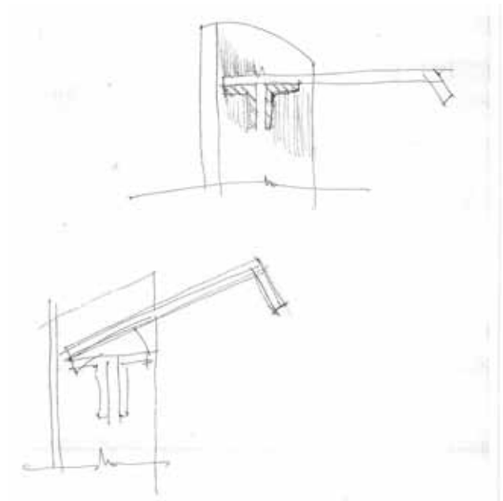
Cable Concept

Structural frame details used to develop costs and engineering loads applied to the structure.

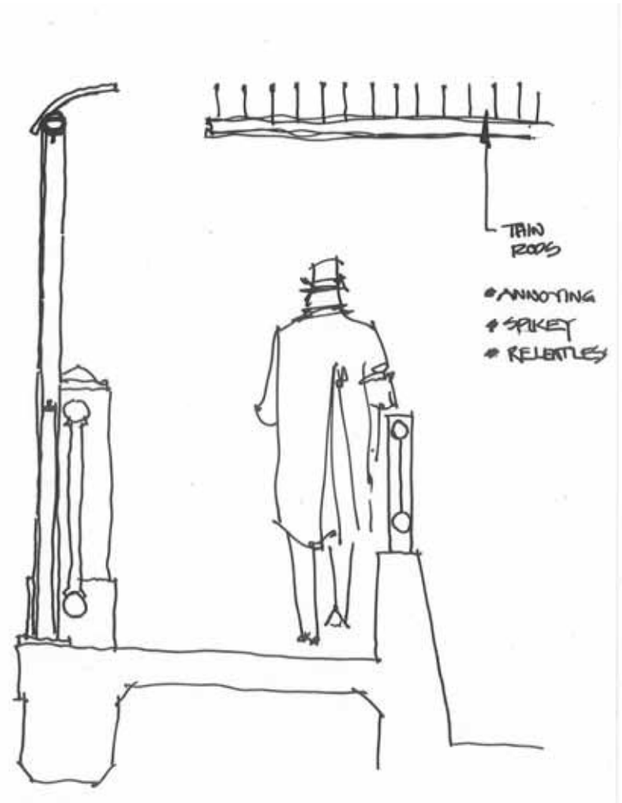


Section Views

Various scenarios.
'Prongs' vs. 'lidded canopy'.



Connection ideas for prong concept.



Recommend 'prongs' in lieu of lidded canopy to discourage climbing.climb.

Design Committee: Sketch Diary

Conversations with citizen architects David Clinkston AIA and Marc Pevoto AIA

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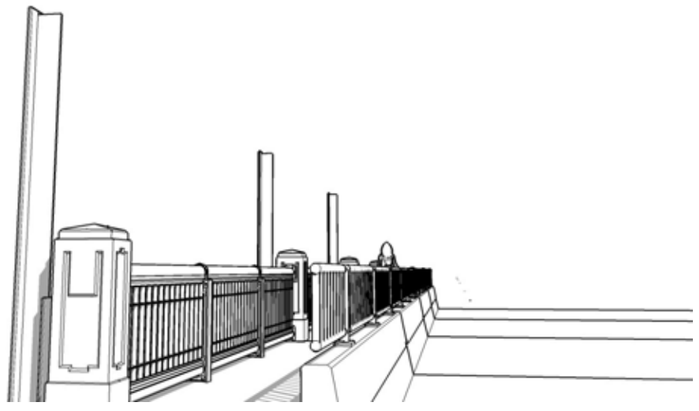
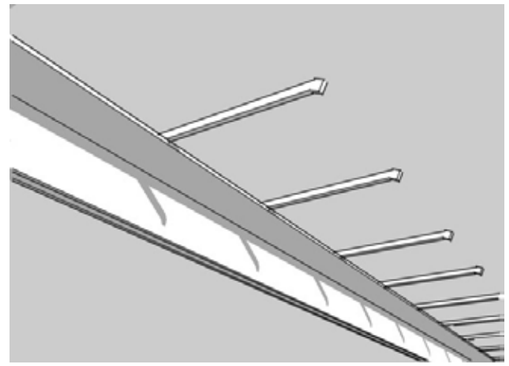
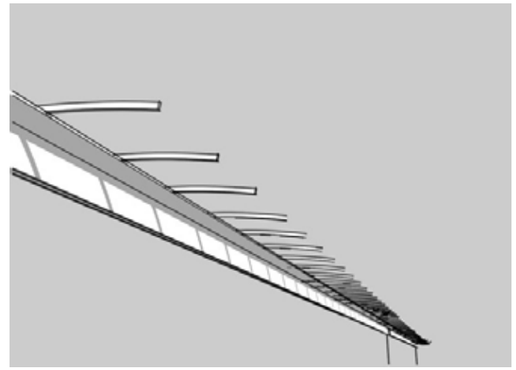
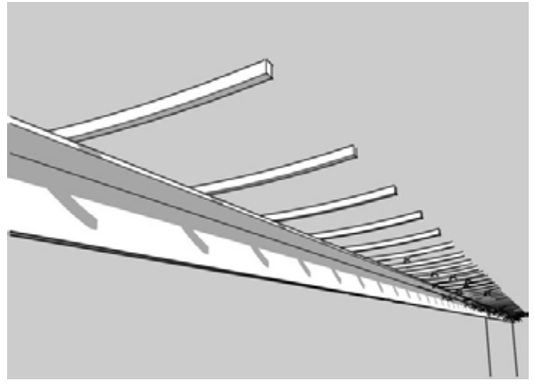


Cable Concept

Three dimensional computer models.
WSDOT is beginning modeling.







Tine designs

Post Advisory Committee Meetings 4

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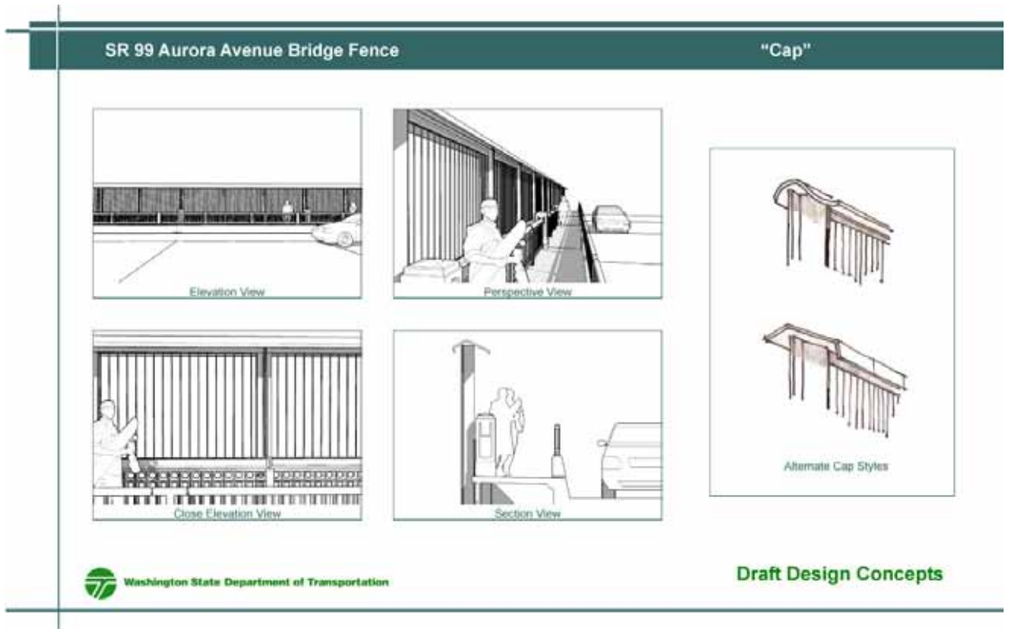

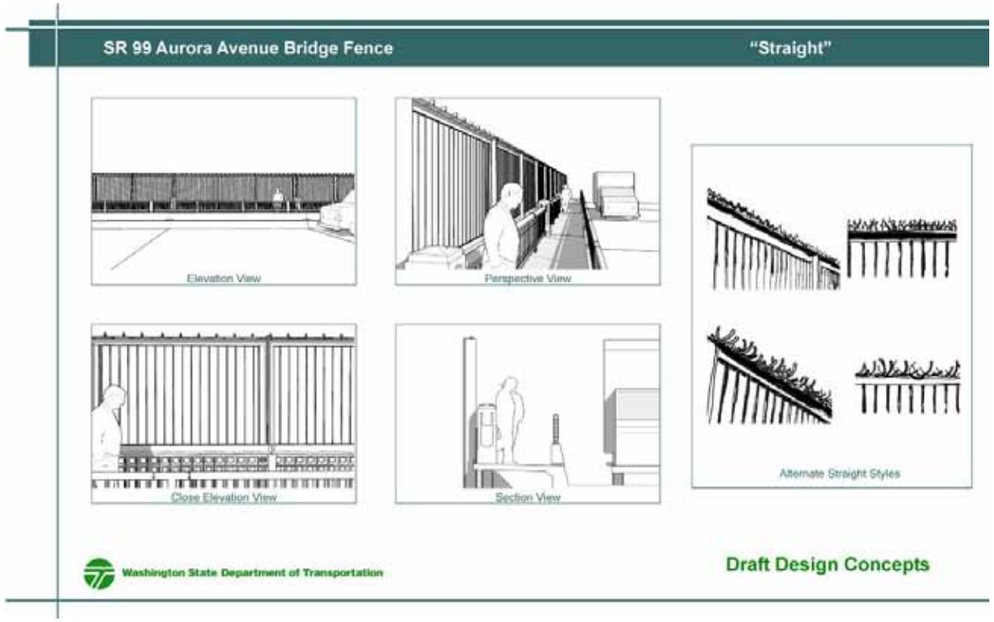

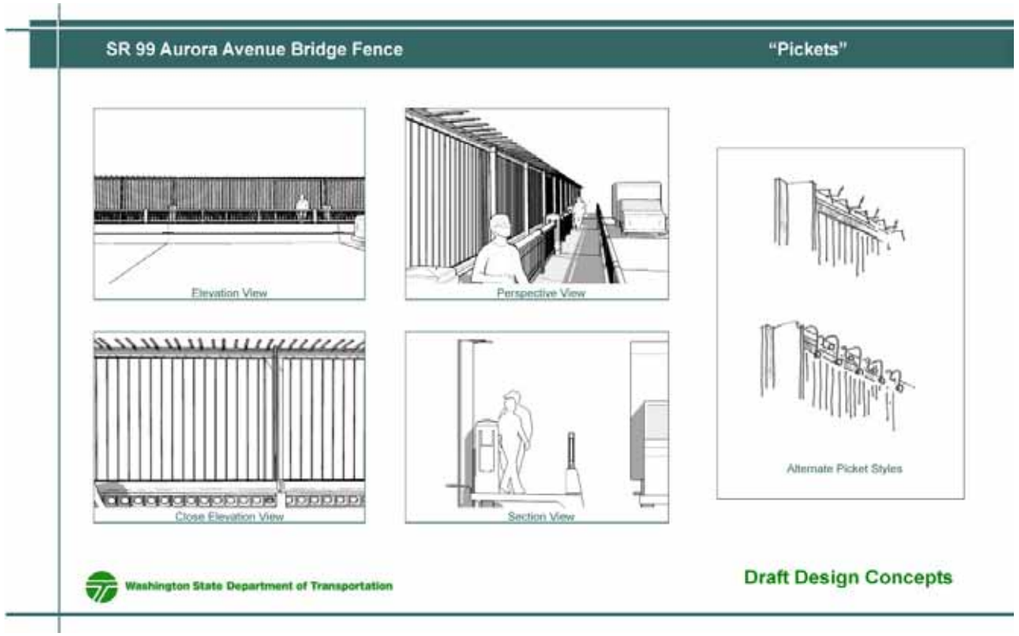

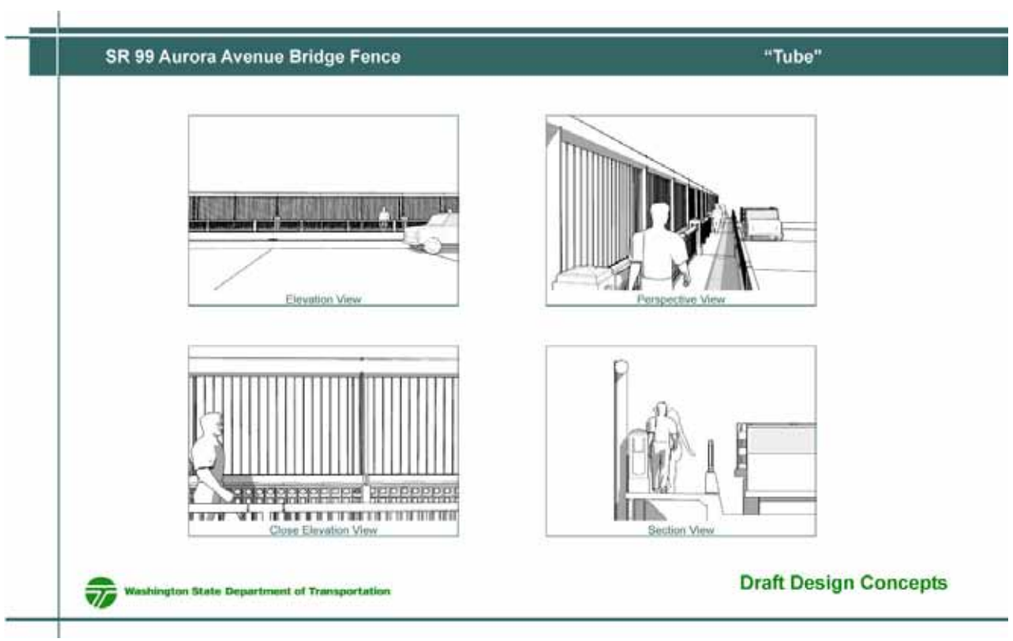

Concepts: The four families of top treatments

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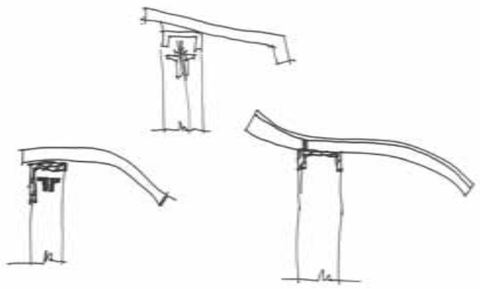
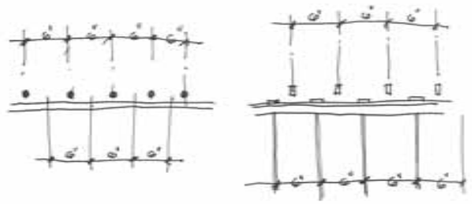
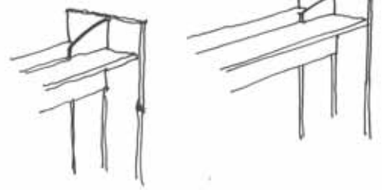


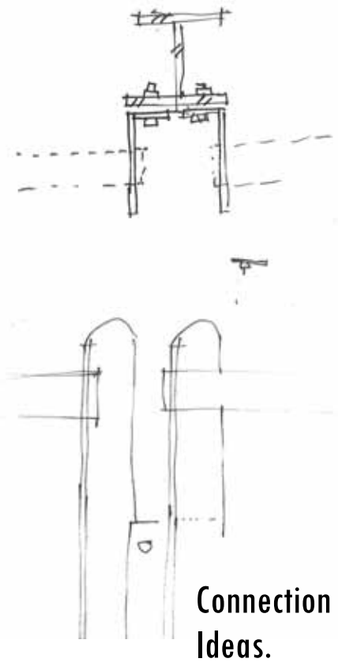


Spacing of top elements.

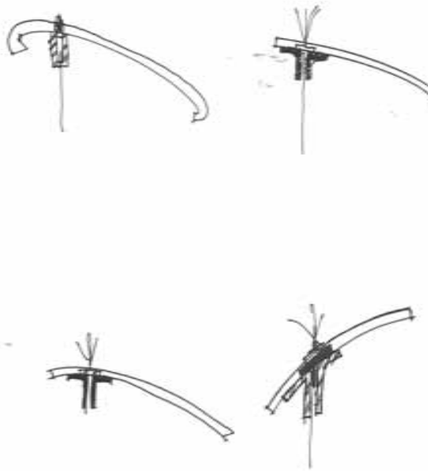
Straight top treatments to discourage climbing.



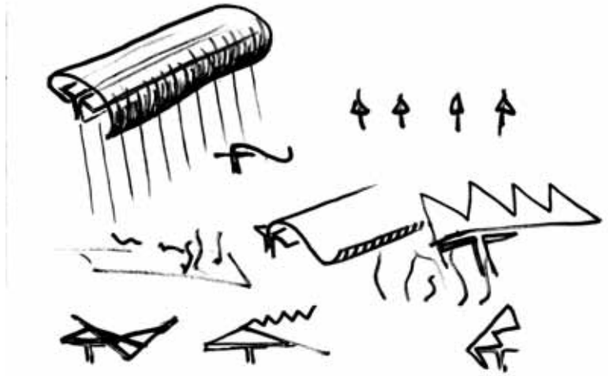
Sculpting the frame by ‘coping’.



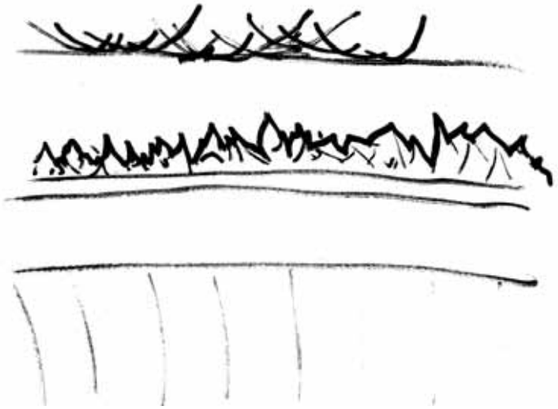
Connection Ideas.



Picket Ideas



Cap Ideas



‘Organic’ straight top concept.

Design Committee: Sketch Diary

Conversations with citizen architects David Clinkston AIA and Marc Pevoto AIA

Brainstorming on various ideas within each of the four top treatment families..

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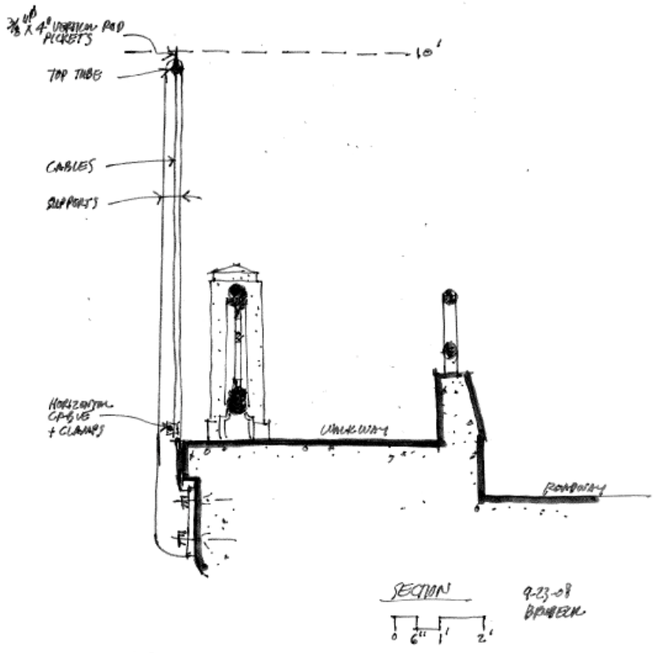
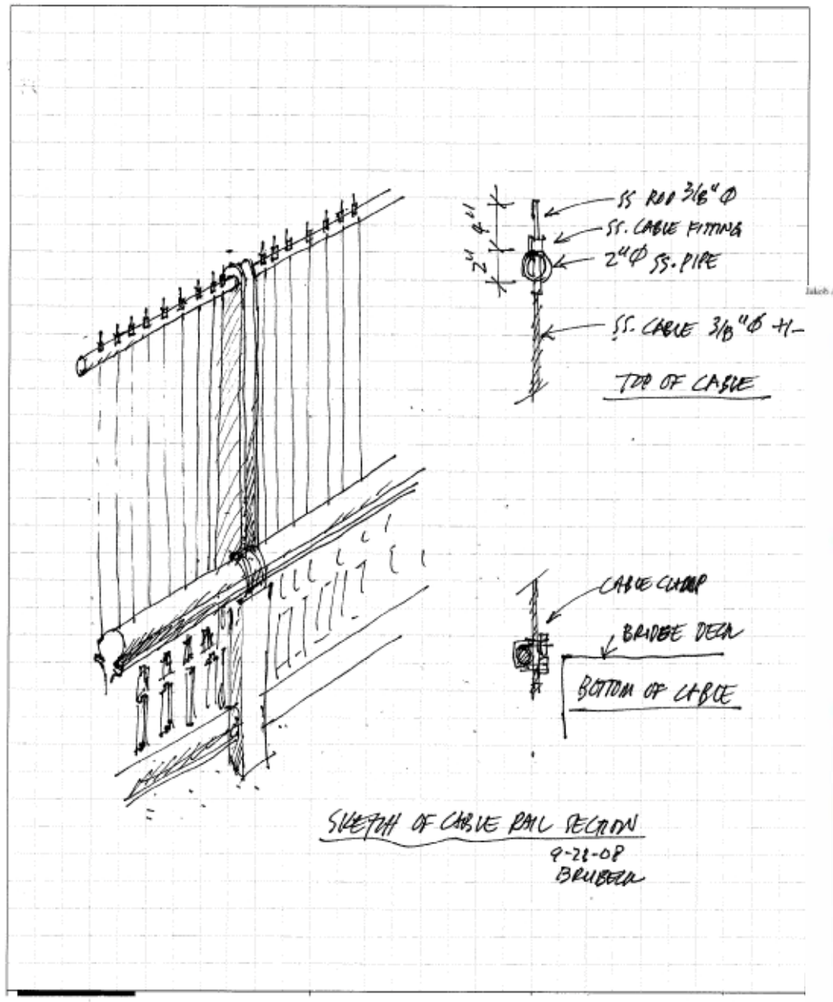
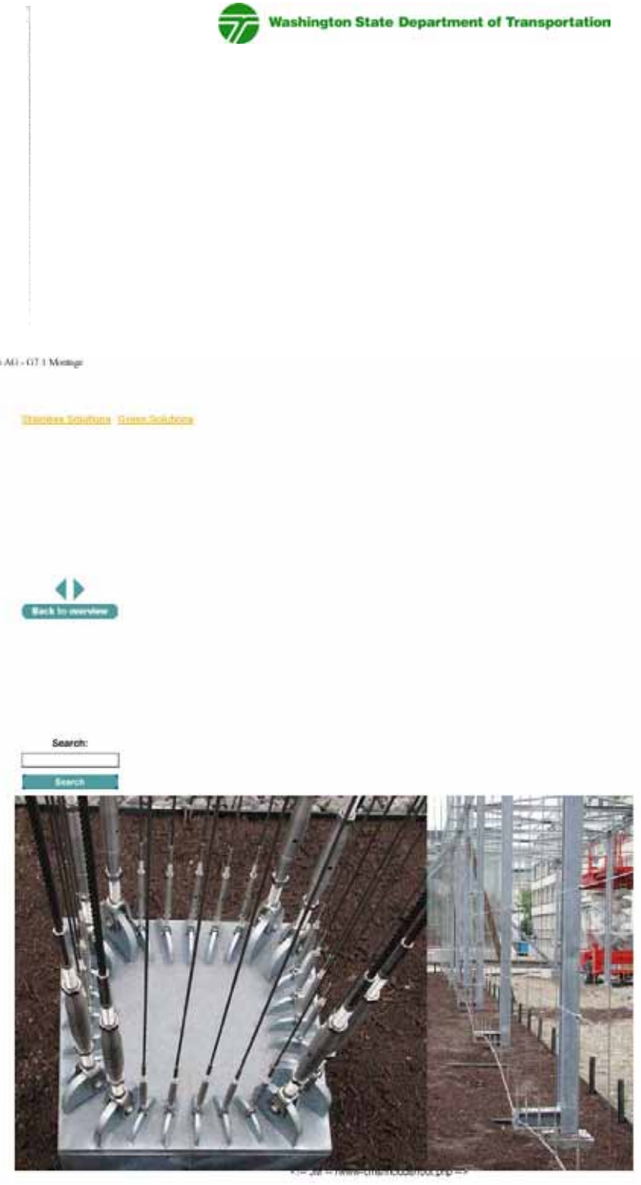


Typical Section



Isometric View showing smaller top tube and integral small pickets at top.



Manufacturer's photo's showing the range of possibilities for cable systems.

Citizen Concept Sketch: Smaller top tube and extended cable length

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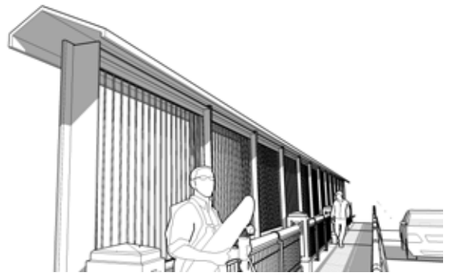
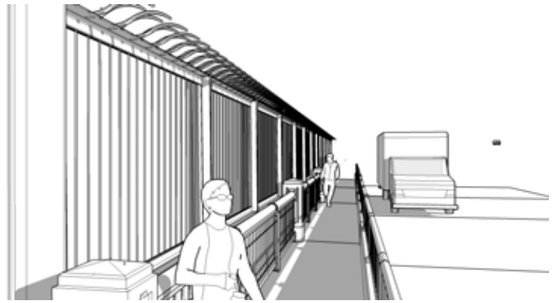
Cap


1

2

Pickets

1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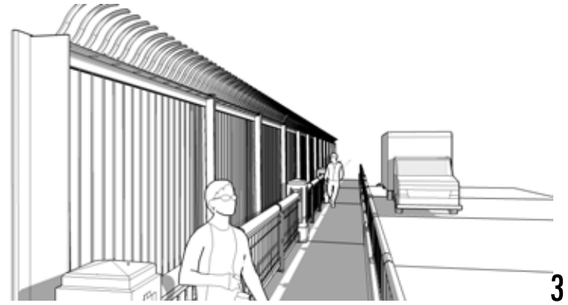
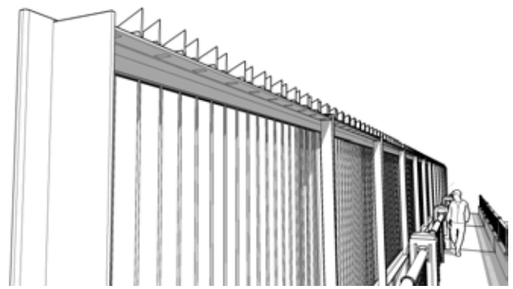

3

Straight

1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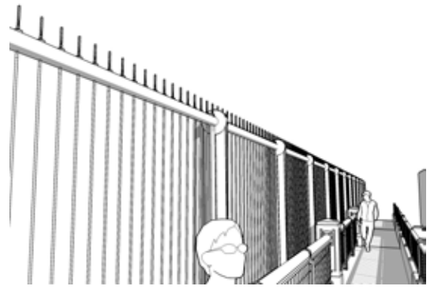
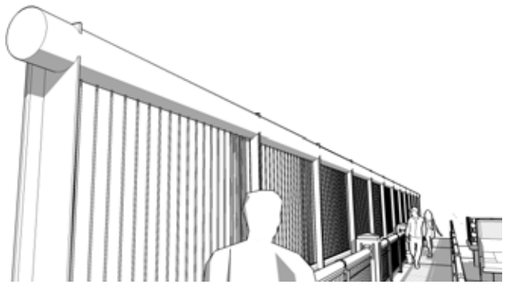
3



Tube



3D Computer Models: Exploring possibilities within the four families of top treatments

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Post Advisory Committee Meetings 5

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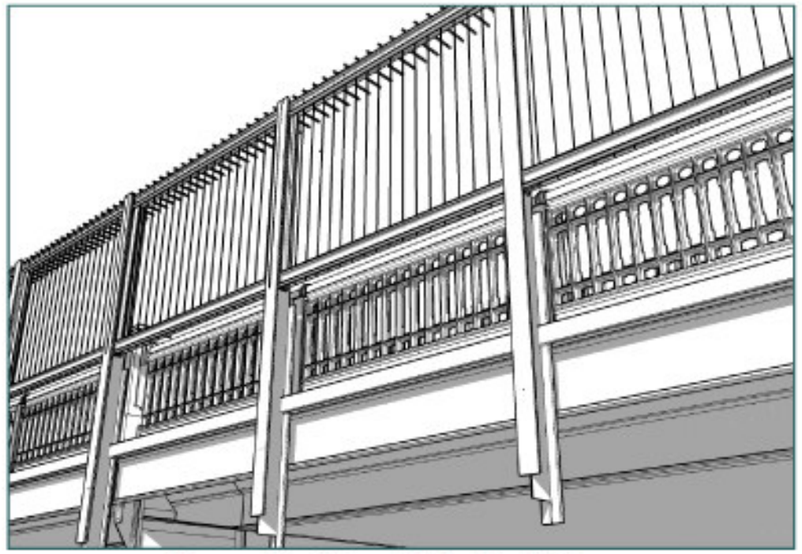
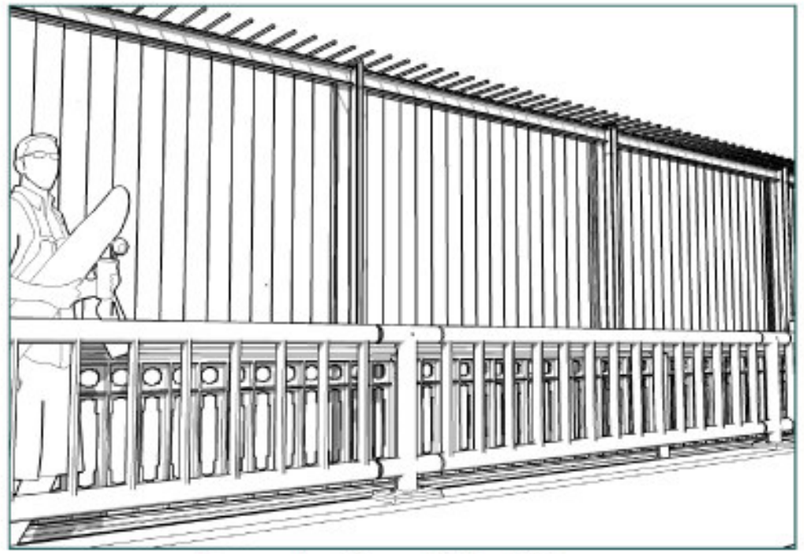
SR 99 Aurora Avenue Bridge Fence

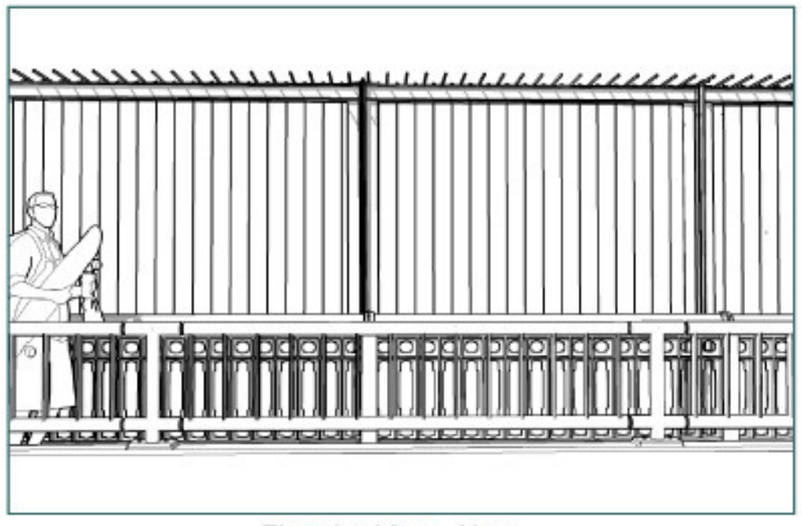
Channel Frame with Horizontal Picket Top



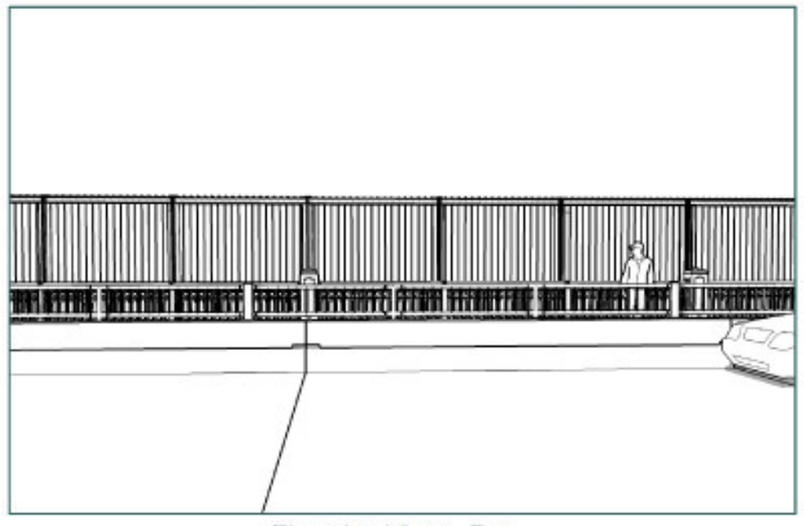
Perspective View—Below the Bridge



Perspective View—On the Bridge



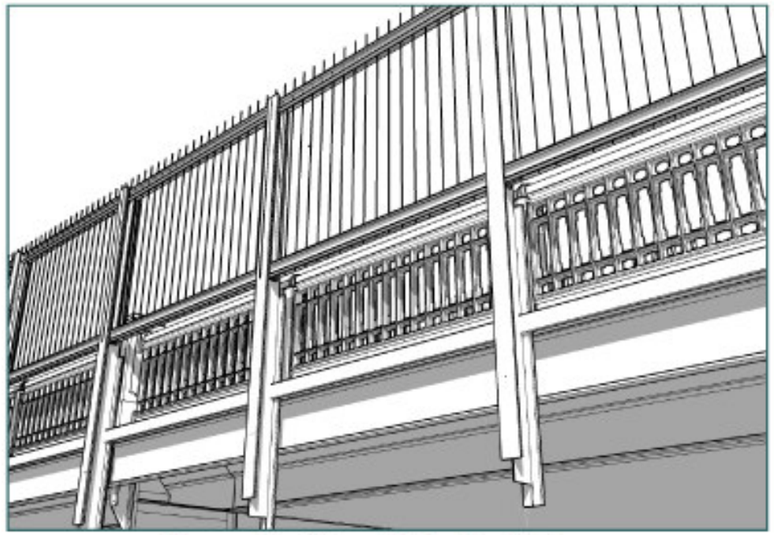
Elevation View—Near



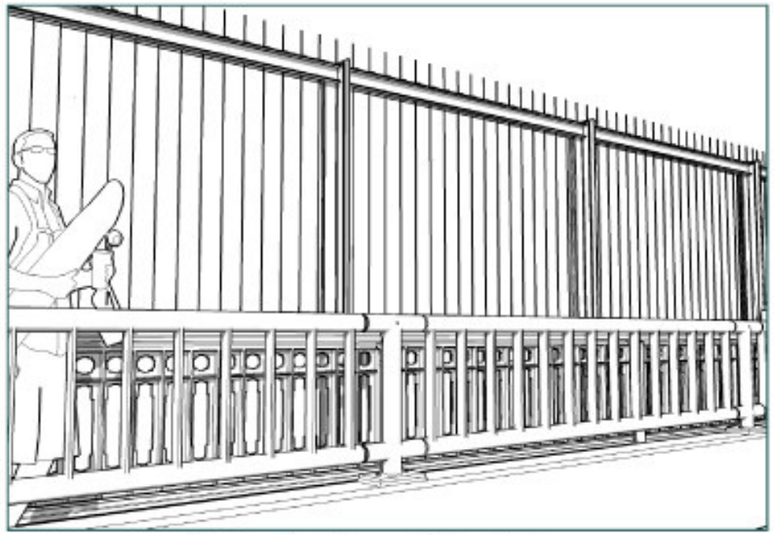
Elevation View—Far

SR 99 Aurora Avenue Bridge Fence

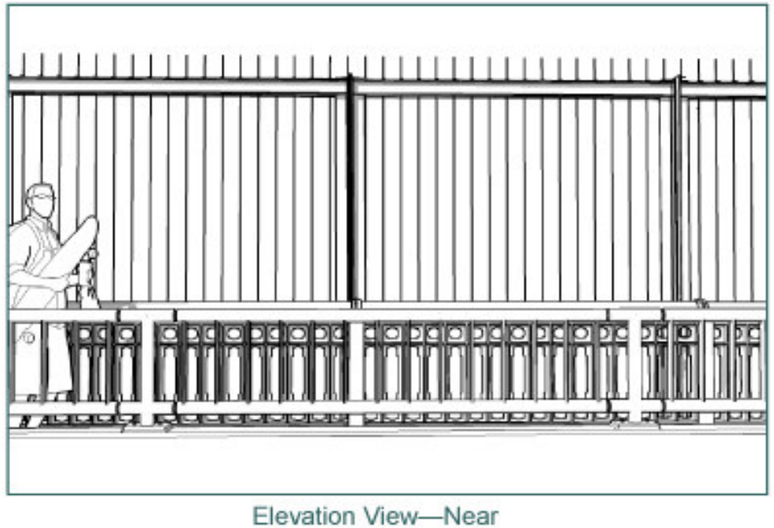
Channel Frame with Vertical Picket Top



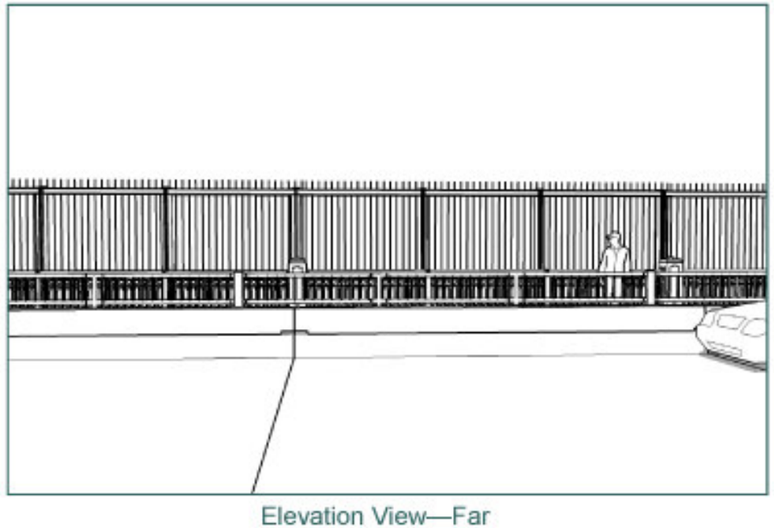
Perspective View—Below the Bridge



Perspective View—On the Bridge



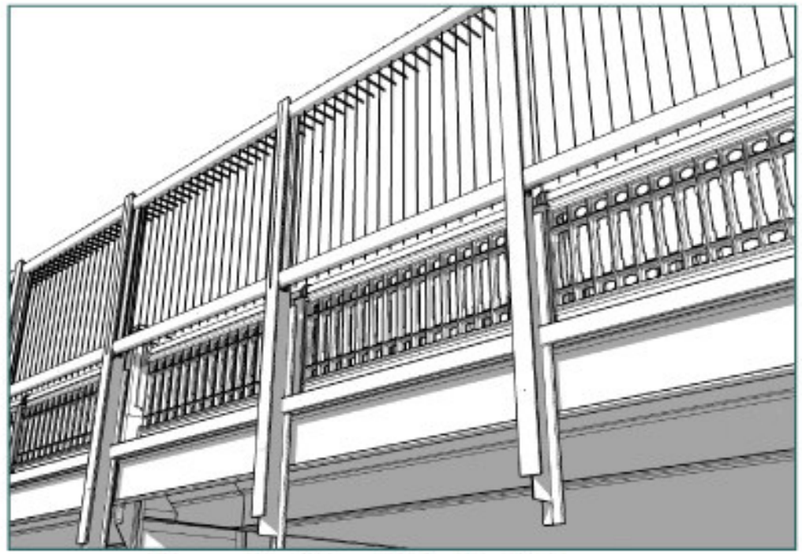
Elevation View—Near



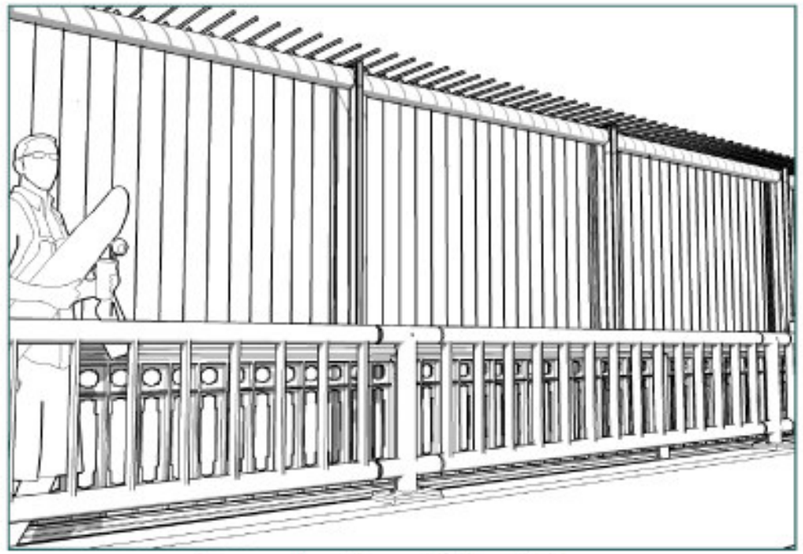
Elevation View—Far

SR 99 Aurora Avenue Bridge Fence

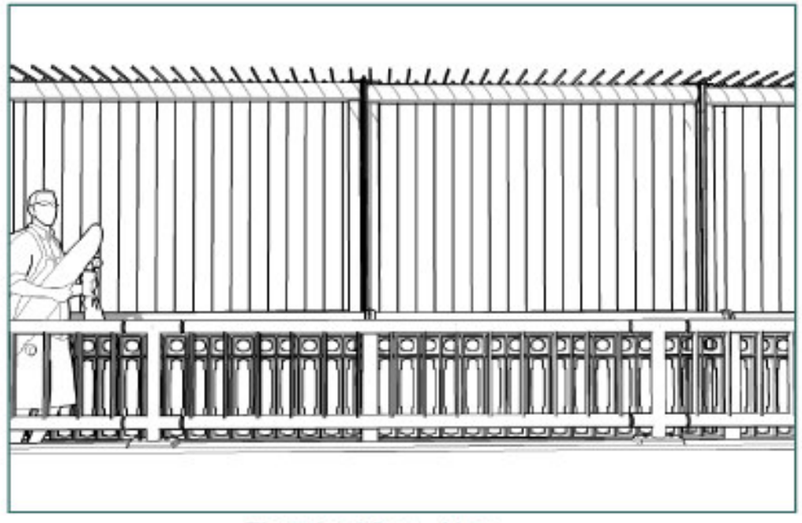
Tube Frame with Horizontal Picket Top



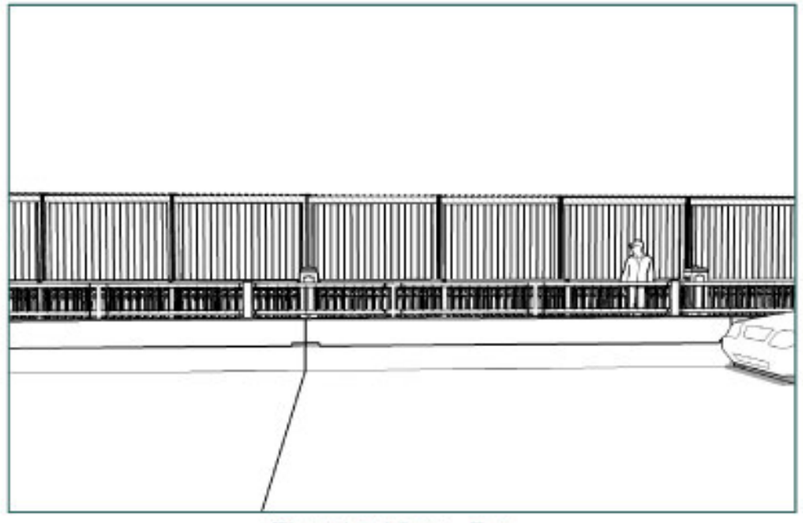
Perspective View—Below the Bridge



Perspective View—On the Bridge



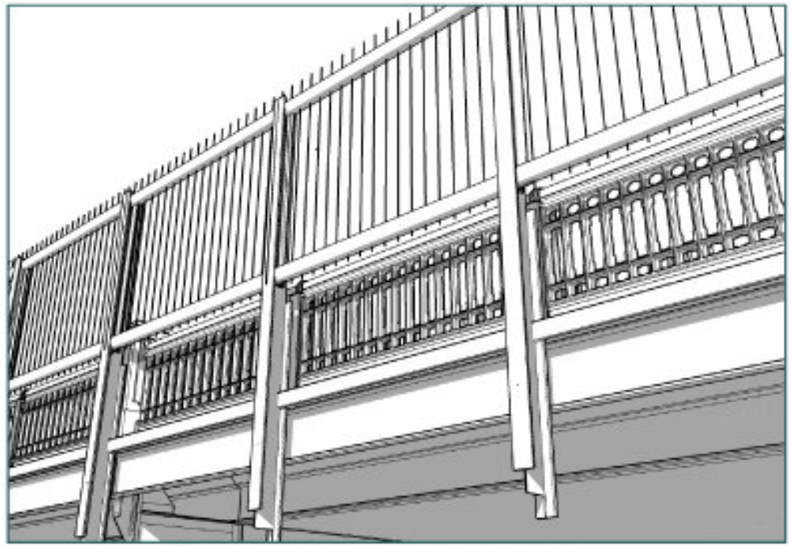
Elevation View—Near



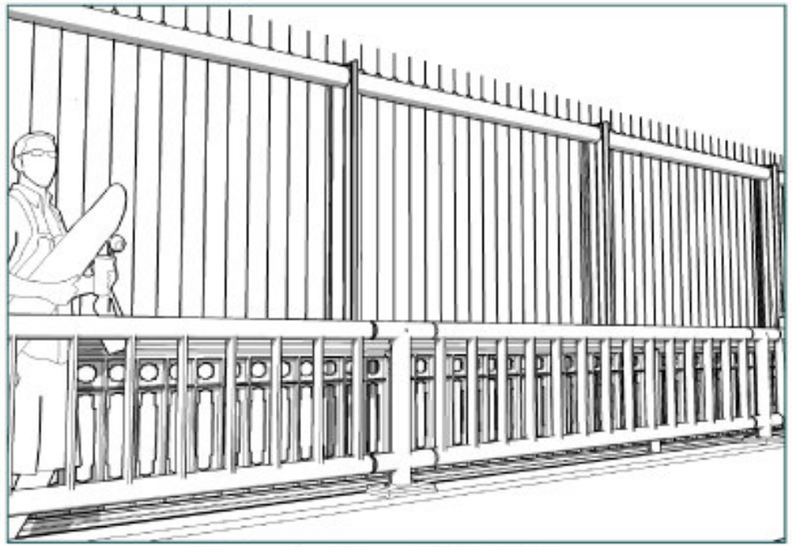
Elevation View—Far

SR 99 Aurora Avenue Bridge Fence

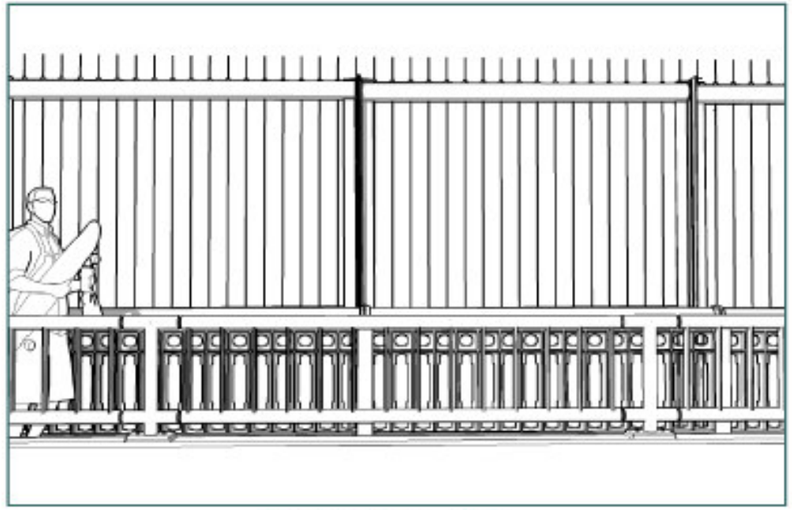
Tube Frame with Vertical Picket Top



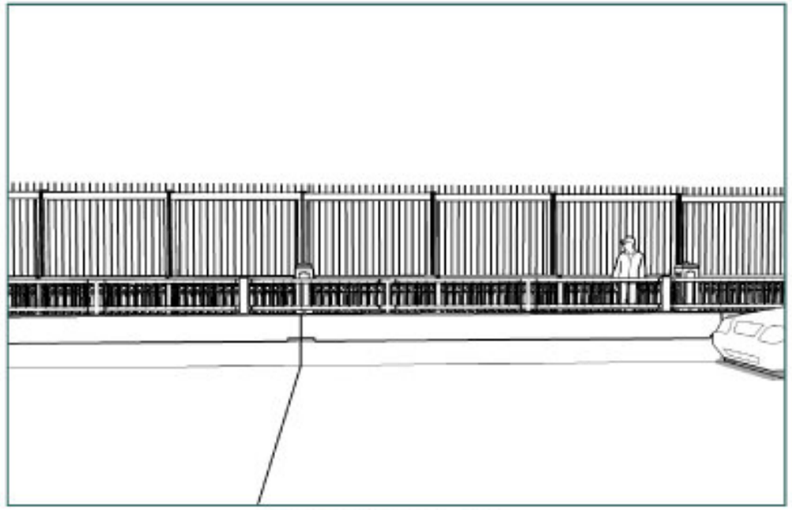
Perspective View—Below the Bridge



Perspective View—On the Bridge



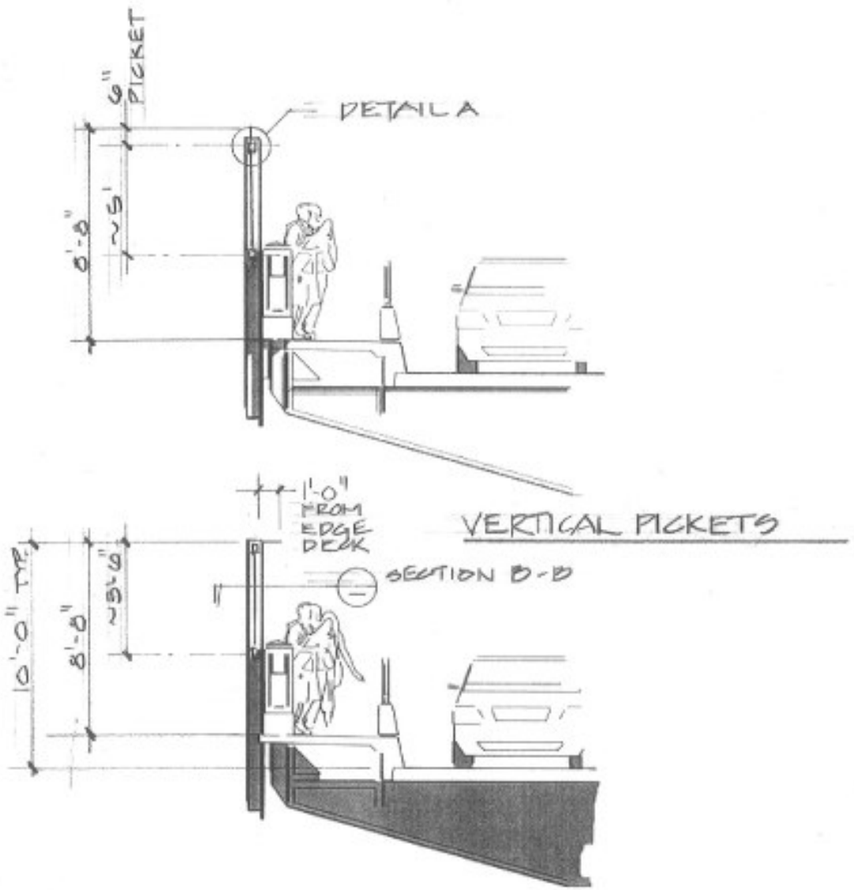
Elevation View—Near

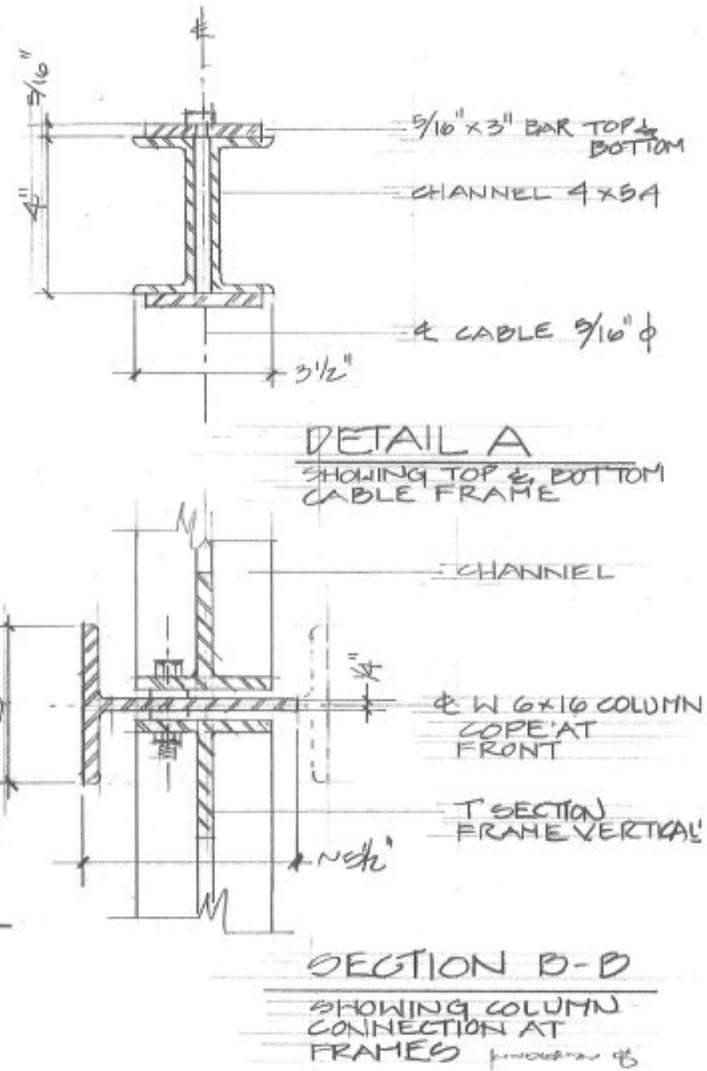


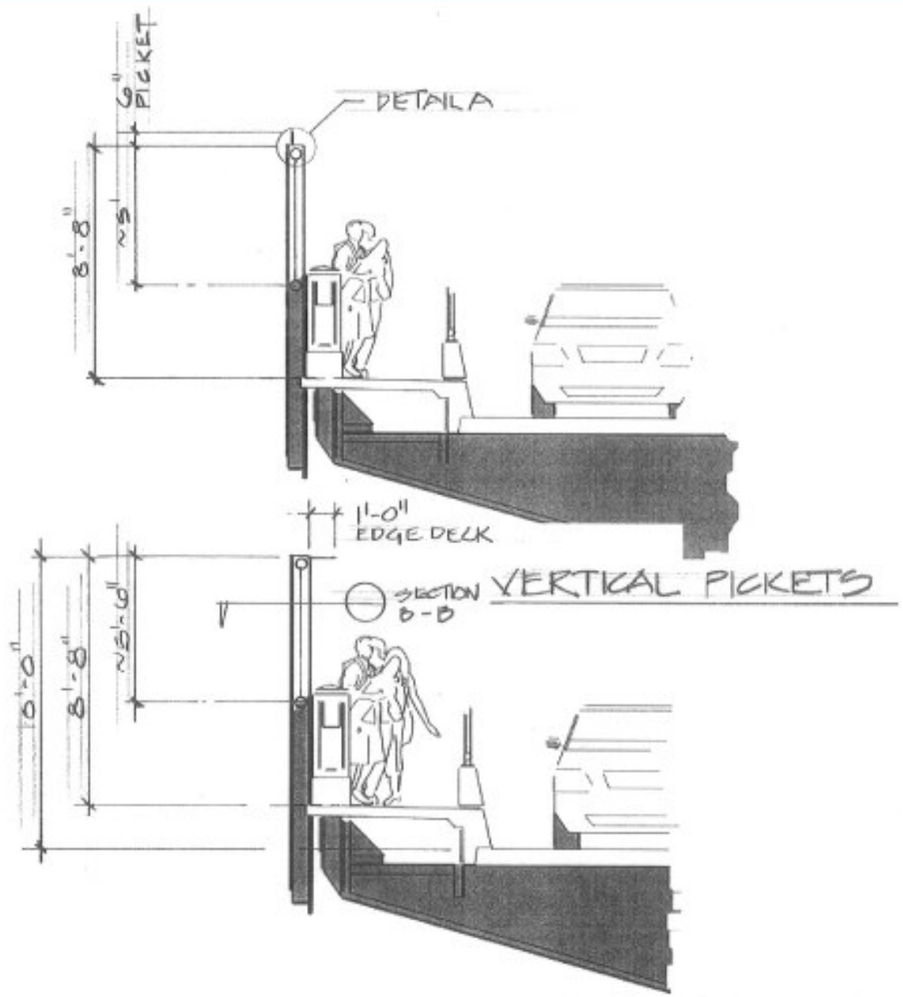
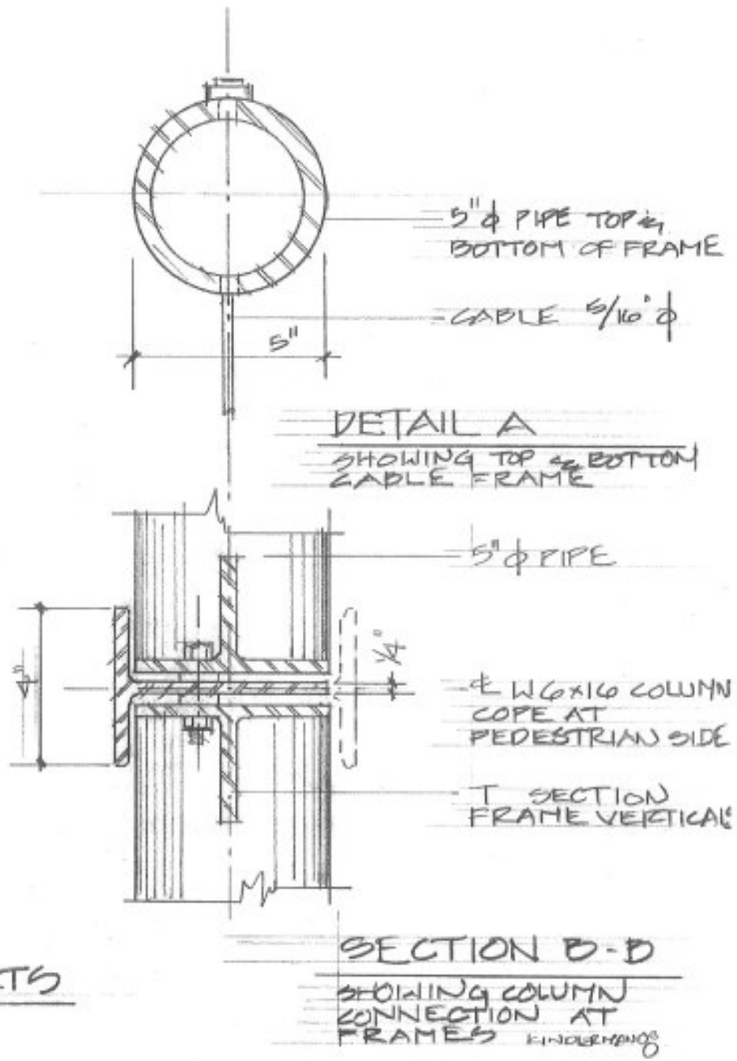
Elevation View—Far

SR 99 Aurora Avenue Bridge Fence

Channel Frame Details





SR 99 Aurora Avenue Bridge Fence

Tube Frame Details