Council Meeting Date: July 12, 2004 **Agenda Item:** 9(c)

CITY COUNCIL AGENDA ITEM

CITY OF SHORELINE, WASHINGTON

AGENDA TITLE:	Interurban Trail – Pedestrian & Bicycle Crossing 30% Design Alternatives and Cost Estimates
DEPARTMENT:	Public Works
PRESENTED BY:	Kirk McKinley, Interurban Trail Project Manager Kris Overleese, Capital Projects Manager KO

PROBLEM/ISSUE STATEMENT:

Policy T-39 of the Comprehensive Plan states: "Aggressively pursue construction of the Interurban Trail." Council Goal #1 states: "Work toward completing the Aurora Corridor & Interurban Trail Projects." In pursuit of these goals and policies, Council has included six segments of the Interurban Trail for construction within the next several years. Currently, the South Segment (N 145th Street to N 155th Street) and North Segment Schedule A (N 192nd Street to N 200th Street) are complete. The South Central Segment (N 160th Street to Top Foods at N 175th Street) and the North Segment Schedule B (N 200th Street to N 205th Street) are to be constructed beginning late summer 2004. The Interurban Trail Pedestrian & Bicycle Crossing project (N 155th Street to N 160th Street) is slated for construction in 2005.

PROJECT BACKGROUND:

In 2003, the City performed an alternatives analysis for the Interurban Pedestrian & Bicycle Crossing between N 155th Street and approximately N 158th Street. The project team identified over 25 alternatives and Council authorized staff to pursue the "Loop Ramp Alternative" on October 20, 2003 (See Attachment A). Council awarded the design contract to CH2M Hill on February 23, 2004. At the time, staff committed to returning to Council at 30% design to discuss the cost estimate, design options, and 1% for Public Art process.

The design team reviewed three structure types: steel truss, steel arch, and concrete girder. A concrete girder structure was evaluated as the cost of steel has significantly increased in the last year and concrete structures are typically less expensive than steel structures. However, because of the greater depth of the concrete structure, the ramps must be taller and longer as the structure sits higher.

Through the 1% for Public Art process, the Art Jury and Parks, Recreation and Cultural Services (PRCS) Board recommend: a bridge over Aurora Avenue N that has an arch, a sky garden in the west loop ramp of the Aurora bridge, artistic missile barriers on both bridges that are non-linear and made of mesh and glass, and the use of form liners to pattern the project's concrete walls. The Art Jury and PRCS Board had no preference as to whether the bridges are steel or concrete.

As the alternative bridge structures were being discussed, unsuitable soils were discovered (via deep soil borings) behind the Pershing abutment at the southwest corner of N 155th Street and Aurora Avenue and adjacent to Denny's on N 155th Street (west of Aurora Avenue N). These soils negatively impact the ability to construct the N 155th Street bridge and ramping structures in a cost effective manner. The north approach to the N 155th Street bridge was re-engineered to avoid the unsuitable soils. The soils in the vicinity of the Aurora Bridge are competent and simple spread footings may be utilized for this bridge and ramping structures as planned.

ALTERNATIVES ANALYZED:
The budget for this project is $3.6 million dollars. Below are three alternatives evaluated by staff and the merits of each.

Alternative 1: $3.6 Million Dollars
This alternative consists of:

- 16 foot wide concrete deck bulb tee girder bridge over N 155th Street
- North approach to the N 155th Street bridge is stairs with an elevator/lift
- 18 foot wide concrete tub girder bridge over Aurora Avenue N
- Chain link missile barrier
- Asphalt trail and "orchard" (tree plantings) between the two bridges

This alternative is within the project budget. It does not include the sky garden, form liners for concrete patterning, or aesthetically pleasing missile barriers. The deck bulb tee concrete girder bridge (Attachment B) over N 155th Street will not be as visually pleasing as the concrete tub girder Aurora Avenue N bridge (Attachment C). Construction of stairs and an elevator/lift mechanism as the north approach to the N 155th Street bridge is not desirable as users may circumvent the bridge and cross N 155th street at grade. This alternative provides the best visibility of businesses on the Joshua Green property from Aurora Avenue N. This alternative meets the funding agency criteria.

Alternative 2: $4.0 Million Dollars
This alternative consists of:

- 16 foot wide concrete deck bulb tee girder bridge over N 155th Street
- North approach to the N 155th Street bridge is a ramp that lowers to grade parallel to Aurora Avenue N
- 18 foot wide concrete tub girder bridge over Aurora Avenue N
- Upgraded missile barrier to inexpensive metal mesh
- Sky garden
- Form liners
- Asphalt trail between bridges

This alternative adds the sky garden (Attachment D) which is not feasible to add at a later date, form liners for concrete patterning (see example in Attachment E), and upgrades the missile barrier. This alternative could construct a ramp for the north approach of the N 155th Street bridge which is more desirable than stairs from the user

standpoint. However, this alternative would impact the visibility of Joshua Green businesses from Aurora Avenue N more than Alternative 1. This alternative would also impact the ability to have an "orchard" between Aurora and Joshua Green property between the two bridges. This alternative meets the funding agency criteria.

Alternative 3: $4.8 Million Dollars
This alternative consists of:

- 18 foot concrete tub girder bridge over N 155th Street
- North approach to the N 155th Street bridge is a ramp that lowers to grade parallel to Aurora Avenue N
- 18 foot concrete tub girder bridge over Aurora Avenue N with anon-structural arch
- Missile barrier of mesh and glass
- Sky garden
- Form liners
- Lighting
- Asphalt trail between bridges

This alternative is recommended by the Art Jury and PRCS Board. This alternative would be aesthetically pleasing and would provide additional opportunities for the project's Art Jury to be involved with the form liner and missile barrier creation. The Art Jury and PRCS Board recommend an arch on the Aurora Avenue N bridge to add height and visibility. The N 155th Street bridge would not have an arch and it would have a simplified (yet similar) missile barrier to tie the bridges together.

This alternative would impact the visibility of businesses within the Joshua Green triangle from Aurora Avenue N more than the stairs option would. This alternative would also impact the ability to have an "orchard" between Aurora and Joshua Green property between the two bridges. This alternative meets the funding agency criteria.

Attachment F shows the costs for all three alternatives by category: administration & design, bridge structures, ramp & stair structures, missile barrier and trail connection.

FINANCIAL IMPACT:
The adopted 2004-2009 Capital Improvement Program (CIP) includes an estimate of $3,634,292 for the Pedestrian & Bicycle Crossing Project. The funding currently available for the project is from four grant sources and the Roads Capital Fund and is $3,690,448. The grants cover $3,117,117 and the Roads Capital Fund provides $573,331.

Washington State Dept of Transportation – Target Zero	$ 534,292	Design
Federal STP	$ 334,992	Construction
CMAQ	$ 666,060	Construction
IAC	$1,581,773	Construction
Roads Capital Fund	$ 573,331	Predesign (2003) and Construction
Total:	$3,690,448	

The Aurora Corridor project will pay for the trail and vegetation between the two bridge ramps.

The City continues to pursue additional funds for the Pedestrian & Bicycle Crossing project and staff believes up to $412,000 may become available from Intermodal Surface Transportation Efficiency Act's (ISTEA) non-motorized enhancement program early in 2005. The City has applied for these funds and preliminary competition for the funds has been positive. This would bring the total funds available for the project to just over $4 million dollars.

If Council selects Alternative 3, staff recommends utilizing $800,000 from the Aurora Corridor Phase II project for the Pedestrian & Bicycle crossing project. Staff is comfortable with this recommendation because the Interurban Bridges are a key visual and pedestrian safety element of the Aurora Corridor and as such, having the Aurora Project contribute to these elements would not be contrary to the established goals. The second phase of the Aurora project currently estimates a City roads capital fund contribution of $11 million. A reduction of this amount of $0.8 million to support Alternative 3 will still give us adequate budgeting leeway as we refine our Phase 2 estimates to meet a 13% match equal to the funding level we are committed to on Phase 1.
If Council selects Alternative 3, staff will reflect this change as part of the 2005 proposed budget. The City's project share of a $4.8 million improvement would be approximately 28% depending on our success with the ISTEA grant.

RECOMMENDATION:

Unforeseen increases in concrete and steel prices, together with unsuitable soils, have combined to increase the projected costs above the estimates used to originally program this project. Given the preferences expressed by the Art Jury, PRCS Board, and public, staff recommends moving forward with Interurban Trail Pedestrian & Bicycle Crossing Alternative 3. This we believe is the affordable balance between community expressed aesthetic interest and a practical and durable set of structures for both pedestrian and bicycle users.

Approved By: City Manager City Attorney ___

INTRODUCTION

Policy T-39 of the Comprehensive Plan states: "Aggressively pursue construction of the Interurban Trail." Council Goal #1 states: "Work toward completing the Aurora Corridor & Interurban Trail Projects." In pursuit of these goals and policies, Council has included six segments of the Interurban Trail for construction within the next several years. Currently, the South Segment (N 145th Street to N 155th Street) and North Segment Schedule A (N 192nd Street to N 200th Street) are complete. The South Central Segment (N 160th Street to Top Foods at N 175th Street) and the North Segment Schedule B (N 200th Street to N 205th Street) are to be constructed beginning late summer 2004. The Interurban Trail Pedestrian & Bicycle Crossing project (N 155th Street to N 160th Street) is slated for construction in 2005.

BACKGROUND

The Pre-Design Report prepared by Otak in 2001 recommended a bridge alternative design that was a post tension elevated structure. The cost of this bridge is beyond the budget allocated in the CIP. The Council allocated $50,000 in 2003 for the bridge alternatives analysis. In the summer of 2003, the City hired CH2M Hill to perform an alternatives analysis for the Interurban Trail Pedestrian & Bicycle Crossing between approximately N 155th Street to N 158th Street. Staff and consultants evaluated alternatives for the crossing and a public open house was held September 17, 2003. In general, there was significant support for the bridge. The most favored alternative was the original elevated option, followed closely by the Loop Ramp Option and Westminster Options.

Council authorized staff on October 20, 2003 to move forward with design of the Loop Ramp Option and the City again hired CH2M Hill in February 2004 to perform the design work. Council indicated they were interested in truss style bridges and remaining within the $3.6 million dollar budget for the project.

This is the first project that has utilized the City's 1% for Public Art process. CH2M Hill's contract also included an urban design component and they brought Vicki Scuri, Siteworks Design, to the project as its artist and architect David Clinkston from Otak. The Parks, Recreation and Cultural Services (PRCS) Board created an Art Jury chaired by Bill Clements to work with staff and the project's artist and architect. The Art Jury also included a member from the Shoreline-Lake Forest Park Art Council, the Shoreline Historical Museum, Joshua Green Corporation, Shoreline Central Market, Safeway, and PRCS Board members.

The Art Jury met several times and worked with the architect and artist. The focus was mostly on missile barrier design, vegetation, concrete patterning for ramp walls and bridge abutments, and the sky garden. The Sky Garden is a raised sitting area/garden in the center of the west ramping structure for the Aurora bridge.

A community open house was held Wednesday May 19 for both the Aurora Corridor first phase and the 1% for Public Art concepts for the bridges. The bridge open house was hosted by the Art Jury. There was mixed interest for the different missile barrier and bridge structure options (steel vs. concrete). Attendees liked the sky garden and

were interested in seeing structures that were "timeless". Many attendees were concerned about the City's resources and wanted to stay within the project budget.

STAKEHOLDERS

Joshua Green Corporation (JGC) has worked with City staff throughout the alternatives evaluation process. They desire minimum impact to their visibility and signage and request continued access from Aurora Avenue N. Staff has worked with JGC staff to evaluate parking requirements on their property, existing sign conformance, and access from Aurora. Staff believes it is feasible to avoid impacts to the Sherwin Williams and old Dairy Queen signs. The Pizza Hut sign will be removed by west Aurora ramp construction if the Aurora Corridor project doesn't require its removal first. These issues are to be handled during the right of way phase of the project.

SITE CONDITIONS AND CONSTRAINTS

Unsuitable Soils

After the May open house, three soil borings were taken as part of the pre-design work for the project. The boring behind the Pershing abutment on the southwest corner of N 155th Street and Aurora Avenue N shows unsuitable soils for a spread footing. Unsuitable soils were also experienced adjacent to Denny's on N 155th Street west of Aurora Avenue N. The unsuitable soils in this area will require a more expensive and deep foundation for the N 155th Street Bridge and a significantly more expensive loop ramp on the north side of the Bridge. Staff intends to take another boring closer to Aurora Avenue near Denny's.

Stable soils were experienced at the soil boring on the east side of Aurora where the east bridge ramping structure will be. Economical spread footings can be utilized for the Aurora bridge supports.

Existing Abutment

The above mentioned Pershing abutment is approximately 2 feet thick and is estimated to extend below the existing ground 8 feet. The thickness and extent of the footing structure below are unknown. The overall condition of the abutment is also unknown. The abutment is currently retaining the existing embankment approximately 10 feet above finished grade.

The structure would not have the capacity to transfer loads from the bridge to its foundation. Nor is the abutment expected to be able to handle the pressure that will result from the new fill embankment that would have to be built on top of it to make the bridge high enough to meet clearances over N 155th Street.

Right of Way

The corridor for the proposed trail is located in City of Shoreline and Seattle City Light (SCL) right of way. Within the Westminster Triangle, the SCL right of way is between private property owned by Joshua Green Corporation. There are two locations in which the Joshua Green property will potentially be impacted: the north ramp for the N 155th Street bridge is adjacent to Denny's restaurant and the Aurora Avenue bridge west ramp structure next to Pizza Hut).

The layout and configuration of the approach structures has been developed to minimize impact to these two parcels. At the Denny's restaurant location, realigning the approach ramp to the north parallel to Aurora Avenue would avoid impacting this property.

Sight Distance at N 155th Street

The span length of the N 155th Street bridge is dictated by turning sight distance for left and right hand turns to and from N 155th Street. The bridge abutments and MSE retaining walls have been located behind sight lines.

Existing Utilities

Both bridge locations contain existing utilities such as overhead power, telecommunications, sanitary sewer, storm sewer, and drainage features. Overhead power and telecommunications lines cross the proposed bridge alignments at the east abutment for the Aurora Bridge and nearly the entire alignment for the N 155th Street Bridge.

There are two types of power lines within the project area. High level transmission lines pass through the SCL corridor and span across Aurora Avenue between steel transmission poles. There are a total of 6 to 8 transmission wires and the lowest wires are approximately 60 feet above existing grade at the Aurora bridge and 60 feet above grade at the N 155th Street bridge. These lines are to remain in place during and after construction. There are also lower level distribution lines that span between the steel transmission poles and shorter timber distribution poles. These power lines will be removed and replaced with an underground power distribution system prior to construction of the bridges as part of the Aurora Corridor project.

The transmission power lines will restrict equipment movements and size during construction. As a result, foundation types such as driven piles may not be feasible and drilled shafts or shallow foundations will be more economical. Additionally, clearances to the power lines will restrict crane movements and crane size for setting of superstructure elements.

An existing sanitary sewer line crosses the face of the existing abutment wall at North 155th and runs across the street between the N 155th Street bridge and the existing businesses. The sewer is approximately 15 feet deep and is located above a thick layer of soft soil deposit. A sewer manhole structure north adjacent to N 155th Street will need to be either moved or supported for any work done above the line. There are also several drainage features and storm sewer lines that cross in the same area that will require modification.

There are two sanitary sewer lines located at the Aurora Avenue bridge, one located below the west approach structure and the other located perpendicular to the bridge on the east side of Aurora. The west sewer line contains an access manhole that will need to be relocated along with the point of attachment for the neighboring business. The east sewer line runs parallel to the Aurora alignment and can remain provided that the bridge substructure is located to the east of the pipe.

STRUCTURAL ALTERNATIVES

Three bridge types were considered in the preliminary design. These included a prestressed concrete tub girder structure, a steel truss, and a steel tied arch bridge. This section includes a brief description of the structural system, construction issues, and aesthetic considerations of each bridge type.

The span length and number of spans were also evaluated for the two bridge locations. The span length of the N 155th Street bridge is approximately 130 feet and is dictated by turning sight distance for left and right hand turns to and from N 155th Street. At the Aurora Avenue bridge, the 150 foot span length is governed by the configuration of the west loop ramp approach structure

A two span bridge option was considered for the Aurora Avenue bridge. The center pier could be located in the proposed traffic island that is being constructed for the Aurora Corridor Improvements project. The benefit of a two span bridge would be the reduced superstructure depth for a prestressed concrete bridge; however, this would be offset by the higher overall cost of the structure, as the cost of constructing a center pier and footing would offset savings in the superstructure.

Prestressed Concrete Tub Girder

Prestressed concrete girder structures offer the least cost option for the bridge crossings. Prestressed girders are fabricated offsite at a precast plant and shipped to the site for erection. There are several types of prestressed girders available in this range of span length, including prestressed I-girder, tub girder, and deck bulb tee girder. Of these, the deck bulb tee is the least expensive, as the girder is fabricated with a top flange that becomes the walkway surface of the bridge, so that onsite forming and placement of the deck slab is not required.

From an aesthetic standpoint, the tub girder is most desirable, as the sides of the girder are flat and sloped outward slightly to provide a simple, uncluttered appearance. In addition, casting the deck slab onsite affords an aesthetic opportunity that is not possible with the deck bulb tee. The prestressed tub girder was evaluated as the preferred girder type for these bridges.

The tub girder bridge is constructed using a pair of standard WSDOT tub type girders. The girders are shipped to the site as a "U" shape with sloped sides and a bottom slab. The girders are lifted into place with crane and then a cast in place concrete deck is placed on top of the girder webs.

For the Interurban pedestrian bridges it is anticipated that the girders can be fabricated and shipped in a single piece, precluding the need to post-tension the girders onsite.

Missile barriers are required at each side of the bridge. The missile barriers are constructed to protect traffic and pedestrians from debris and personal injury. The barriers are required to be a minimum of 8 ft tall and are shaped to inhibit climbing or throwing objects over the edge of the structure. They can be constructed of various materials and configurations, and provide numerous opportunities for aesthetic appeal.

Several missile barrier alternatives were developed by the artist and bridge architect. The three main concepts that emerged were a truss-shaped "mountain and sky" theme

(Attachment G), an arch-shaped barrier, and a trolley barrier concept (Attachment H). Each of these alternatives consists of a combination of glass and steel mesh in various forms to produce different visual appeal. These missile barrier concepts are presented in the Art Opportunities Booklet that was published in May 2004. In addition to these alternatives, a low cost chain link fence barrier was considered as an affordable, yet undesirable, solution.

Steel Truss

Another bridge type explored was a steel truss structure. This structure type is more expensive than the concrete girder bridge due to the higher material and fabrication costs of the steel superstructure. With the recent volatility in the steel market, in which both the price and availability of structural steel have been dramatically affected, the risk associated with steel bridge alternatives has elevated.

The truss bridge would consist of two trusses, one on each side of the bridge, with a depth of approximately 14 feet. The truss configuration shown is a simple Warren truss similar to those of early rail bridges. In this configuration, the outer diagonal is in compression and forms an inverted "V" with the next diagonal. The diagonals are symmetric with respect to the midspan of the structure.

The steel truss members would be standard hollow tube or pipe steel sections that are bolted or welded together. The use of standard sections helps to mitigate the effects of the current fluctuating steel market. The individual trusses would be constructed in the field or in the shop and shipped to the site for fabrication, depending on contractor preference.

For this bridge type, two missile barrier options were considered. The first option is a steel mesh infill between the truss elements. The second option is the "mountain and sky" glass and mesh infill configuration, which would be more expensive. In each case, the entire space between the top and bottom chord members of the bridge would be infilled. The truss members compose the structural support for the missile barrier, and therefore the cost of the missile barrier is less than that for the tub girder system, which requires additional framing elements to support the missile barrier.

Steel Arch

A steel tied arch system was also explored and the configuration proposed consists of two arches, one on each side of the walkway, that are tied together with chord members located at the deck level and which also support the deck structure. Cross bracing is located at the top chord of the arches.

This structure is similar to the truss configuration in that the structural elements can be used to support the missile barriers, and the members are standard steel shapes except for the main arch sections, which can be fabricated from structural steel plate. The arches proposed are 18 feet high at the center of the span and at grade near the supporting ends. Due to the complexity of construction, the cost for this bridge type is more than that of a truss bridge.

Two missile barriers options are proposed for the tied arch structure. The first is a glass barrier and the second is a mesh and glass system. The height of the barrier would be 8

feet, shorter than that used for the truss bridge. The barrier would be supported by the vertical chord members of the arch structure.

The steel arch is the most expensive of all bridge types.

LOOP RAMP OPTION - FINANCIAL COMPARISON BY BRIDGE TYPE

The following table shows the alternatives evaluated by staff and the Art Jury utilizing concrete girder, steel truss and steel arch bridges to build the Loop Ramp Option. All alternatives exceed the project budget of $3.6 million dollars because of the unsuitable soils.

Table 1. Summary of Cost Estimates for "Loop Ramp Option" Bridge Alternatives

Alternative	Description	Estimated Cost (in millions)
1	**Concrete Tub Girder Bridge**	
1A	Chain link fence missile barrier	$4.8
1B	Mesh & small window missile barrier	$5.3
1C	Truss-shaped missile barrier with mesh and glass	$5.5
1D	Arch-shaped missile barrier with mesh and glass	$5.5
2	**Steel Truss Bridge**	
2A	Truss-mesh only (12' high)	$5.4
2B	Truss-mesh/glass (12' high)	$5.6
3	**Steel Arch Bridge**	
3A	Arch-mesh only (8' high)	$5.5
3B	Arch-mesh/glass (8' high)	$5.8

Assumptions:

1. Costs shown include bridge and ramp supports to handle unsuitable soils with the Loop Ramp Option
2. Costs shown include structure costs of the bridges, approaches and the trail north of the Aurora Bridge to N 160th Street
3. Costs shown are total project costs and include design, right of way, construction, and construction administration
4. Construction cost includes mobilization (10%) and a contingency of 25%.
5. Both bridges are concrete tub girder and 18 feet wide
6. The west Aurora Bridge ramp structure is a loop ramp with the "sky garden".

VALUE ENGINEERING - COST SAVINGS OPTIONS

On June 11, 2004, a value engineering (VE) workshop was conducted that included staff from the City of Shoreline, WSDOT, and CH2M HILL. The purpose of the workshop was to consider ways to reduce the project costs in Table 1 to meet the project budget.

The following project elements were considered: bridge superstructure, bridge substructure, missile barriers, and bridge approaches (ramping) within the Westminster Triangle.

Bridge Superstructure

A deck bulb tee girder is a less expensive system than a tub girder system, depending on the overall width of the bridge and number of girders needed. The flange width of the deck bulb tee ranges from 4 to 8 feet, so for an 18 foot wide bridge, three 6 feet wide girders would be needed. This would not be much more economical than providing two precast tub sections. A $100,000 savings on the N 155th Street bridge would be realized if two deck bulb tee girders were used. This would narrow the N 155th Street bridge to 16 feet.

Bridge Substructure

Bridge substructure alternatives were discussed for the N 155th Street bridge. The foundation types include spread footings founded on stone column soil improvement or deep foundations using either drilled shafts or driven piling. Of these, spread footings on stone column appear to be the least expensive option and offer advantages over deep foundations.

Alternatively, the 130 foot long N 155th Street bridge could be lengthened to found the structure on more competent soils. It might be feasible to move the north abutment farther north; however, the savings in substructure cost would likely be offset by higher superstructure cost. In addition, spans longer than 150 feet would not be feasible for single span prestressed girder structures.

Missile Barriers

The glass and mesh missile barriers add significantly to the cost of the structures. In order to achieve the $3.6 million budget, it is assumed that a chain link fence or inexpensive mesh barrier will be used at the Aurora Avenue bridge. At the N 155th Street bridge, the use of a 4'-6" high bicycle guardrail was considered as a possibility instead of an 8 ft high missile barrier. However, this does not provide cost savings.

North Approach to N 155th Street Bridge

Alternatives were considered for the north loop ramp near Denny's, parallel to N 155th Street. Due to the unsuitable soils at this location, this ramp structure will require extensive soil improvement measures consisting of either complete removal of approximately 22 feet of soft, compressible soils or ground improvement with the use of stone columns. The removal of this much soil or the use of stone columns to support the entire ramping structure is expensive. Staff evaluated other alternatives to this ramping structure layout and location.

The alternatives included the following:

1. A ramp on MSE (mechanically stabilized earth) fill structure that flows north of the N 155th Street bridge and is parallel to Aurora Avenue N.
2. A steel ramp structure aligned parallel to Aurora Avenue.
3. A stairway with no ramp.
4. A stairway with an elevator/lift
5. Delete the N 155th Street Bridge

Option 1 would move the MSE fill structure to the north side of the bridge aligned parallel to Aurora Avenue where competent soils are expected. This alignment would reduce the costs associated with soil improvement and protecting existing utilities. The disadvantage is that the fill structure would obstruct the view of existing businesses with frontage to Aurora Avenue. The fill structure could be constructed with a partial sloped fill to about 12 feet above grade with MSE fill placed up to the bridge deck elevation.

In Option 2, the MSE fill structure would be replaced with a steel ramp structure aligned parallel to Aurora Avenue where competent soils are expected. One possibility is a loop ramp that slopes down at 8% grade with 180 degree landings to meet the trail at grade. Another possibility is a straight ramp at 8% grade that parallels Aurora Avenue. The steel structure options mitigate the effects of both the soil conditions expected to the west of the site and provides a broken frontage view for the existing businesses.

In Option 3, the ramp would be deleted and replaced with a stairway. This would limit use of the N 155th Street bridge to pedestrians only. Bicyclists, skaters, strollers, and wheelchair users would cross North 155th St at grade and connect to the trail using the recently completed ramp south of N 155th Street. IAC funding could not be used for this option as it is not ADA accessible.

In Option 4, the ramp would be deleted and replaced with a stairway and elevator or lift device. This approach was recently used on a bridge in Seattle. The bridge would be ADA accessible, but may be circumvented by roller bladers, bikers and families with strollers. This option also requires higher than normal maintenance costs.

In Option 5, there would be no N 155th Street bridge and trail users would cross N 155th Street at grade. IAC funding could not be used for this option as the funding scope was awarded based on elevated crossings of N 155th Street and Aurora Avenue N.

West Approach Aurora Avenue Loop Ramp

The cost of the west approach ramp could be reduced by eliminating the "sky garden" that is located inside the loop ramp and replacing it with a 2:1 sloped fill area that could be landscaped. This would eliminate the interior wall of the ramp and reduce the amount of fill material to lower the cost of the structure. Removal of the "sky garden" would provide a $200,000 cost savings

Table 2 below summarizes the cost reduction measures that were considered in the staff value engineering workshop. The most effective means of reducing costs is to reduce the cost of the approach structures on the north side of the N 155th Street bridge and the west of the Aurora Avenue bridge. To achieve a project within budget, staff

started with the 1A concrete tub girder bridge ($4.8 million dollars) with missile barrier and removed/altered project components from Table 2 to reach $3.6 million dollars.

Table 2 – Summary of Cost Reduction Measures

Item	Location	Reduction Measure	Cost Reduction (in Thousands)	Pros	Cons
1	N 155th Street North Ramp Structure	Option 1 - Relocate ramp to north side parallel to Aurora Ave (slope fill to 12 feet or all MSE wall)	$690	Avoids need for ground improvement along 155th St	Obstructs view of Denny's restaurant, not conducive to future expansion
2	N 15th Street North Ramp Structure	Option 2 - Steel ramp structure north of the bridge (straight or switch back)	$370	Open structure that minimizes blockage to Denny's restaurant	More difficult for bicyclists to use
3	155th Street North Ramp Structure	Option 3 - Stairway only with no ramp	$1050	Least expensive, conducive to future expansion	Does not facilitate bicycles and other users, return IAC funding
4	155th Street – North Ramp Structure	Option 4 – Stairway with elevator or lift	$850	Less expensive than ramp structure, accommodates, wheelchairs, bikes/strollers	Safety and security issues, maintenance, vandalism costs
5	N 155th Street Bridge	Delete bridge	$2,000 for concrete tub girder option	Reduce design costs, improved business visibility and reduced business impact	Return IAC funds, no elevated crossing over N 155th St., reduced safety
6	N 155th Street Bridge	Use of Bulb T Girders instead of Tub Girders	$100	Less expensive	Bridge would narrow to 16 feet, Not aesthetically pleasing
7	Aurora Avenue West Approach Structure	Eliminate "sky garden" and provide sloped fill inside loop ramp	$200	Less expensive	Elimination of garden
8	Aurora Avenue Bridge	Use of Bulb T Girders instead of Tub Girders	$20	Less expensive	Not aesthetically pleasing
9	Aurora Avenue Bridge	Use of Bulb T Girders instead of Tub Girders – reduce bridge width	$50	Less expensive	Bridge would become narrower (16'). Not aesthetically pleasing
10	MSE walls	Eliminate form liners on all MSE walls	$60	Less expensive	Not aesthetically pleasing and this was a potential 1% for Public Art item

ALTERNATIVES

Utilizing the Loop Ramp project costs in Table 1, the value engineering cost saving options, and the recommendations from the Art Jury and PRCS Board, staff presents three alternatives of varying cost for Council consideration.

Alternative 1: $3.6 Million Dollars
This alternative consists of:

- 16 foot wide concrete deck bulb tee girder bridge over N 155th Street
- North approach to the N 155th Street bridge is stairs with an elevator/lift
- 18 foot wide concrete tub girder bridge over Aurora Avenue N
- Chain link missile barrier
- Asphalt trail and "orchard" (tree plantings) between the two bridges

This alternative is within the project budget. It does not include the sky garden, form liners for concrete patterning, or aesthetically pleasing missile barriers. The deck bulb tee concrete girder bridge over N 155th Street will not be as visually pleasing as the concrete tub girder Aurora Avenue N bridge. Construction of stairs and an elevator/lift mechanism as the north approach to the N 155th Street bridge is not desirable as users may circumvent the bridge and cross N 155th street at grade. Elevators and lifts also have higher long term maintenance costs than a mechanically stabilized earth (MSE) ramp. This alternative provides the best visibility of businesses on the Joshua Green property from Aurora Avenue N. This alternative meets the funding agency criteria.

Alternative 2: $4.0 Million Dollars
This alternative consists of:

- 16 foot wide concrete deck bulb tee girder bridge over N 155th Street
- North approach to the N 155th Street bridge is a ramp that lowers to grade parallel to Aurora Avenue N
- 18 foot wide concrete tub girder bridge over Aurora Avenue N
- Upgraded missile barrier to inexpensive metal mesh
- Sky garden
- Form liners
- Asphalt trail between bridges

This alternative adds the sky garden (which is not feasible to add at a later date), form liners for concrete patterning, and nicer mesh missile barrier to Alternative 1. This alternative would construct a ramp for the north approach of the N 155th Street bridge which is more desirable than stairs from the user standpoint. However, this alternative would impact the visibility of Joshua Green businesses from Aurora Avenue N more than Alternative 1. This alternative would also impact the ability to have an "orchard" between Aurora and Joshua Green property between the two bridges. This alternative meets the funding agency criteria.

Alternative 3: $4.8 Million Dollars
This alternative consists of:

- 18 foot wide concrete tub girder bridge over N 155th Street
- North approach to the N 155th Street bridge is a ramp that lowers to grade parallel to Aurora Avenue N
- 18 foot wide concrete tub girder bridge over Aurora Avenue N with a non-structural arch
- Missile barrier of mesh and glass
- Sky garden
- Form liners
- Lighting
- Asphalt trail between bridges

This alternative is the recommendation from the Art Jury and PRCS Board. This alternative would be aesthetically pleasing and would provide additional opportunities for the project's Art Jury to be involved with the form liner and missile barrier creation. The Art Jury and PRCS Board recommend an arch on the Aurora Avenue N bridge to add height and visibility. The N 155th Street bridge would not have an arch and it would have a simplified (yet similar) missile barrier to tie the bridges together.

This alternative would impact the visibility of businesses within the Joshua Green triangle from Aurora Avenue N more than the stairs option would. This alternative would also impact the ability to have an "orchard" between Aurora and Joshua Green property between the two bridges. This alternative meets the funding agency criteria.

FINANCIAL IMPACT:

The adopted 2004-2009 Capital Improvement Program (CIP) includes a project estimate of $3,634,292 for the Pedestrian & Bicycle Crossing Project. The funding currently available for the project is from four grant sources and the Roads Capital Fund in the amount of $3,690,448. The grants cover $3,117,117 and the Roads Capital Fund provides $573,331.

Washington State Dept of Transportation – Target Zero	$ 534,292	Design
Federal STP	$ 334,992	Construction
CMAQ	$ 666,060	Construction
IAC	$1,581,773	Construction
Roads Capital Fund	$ 573,331	Predesign (2003) and Construction
Total:	$3,690,448	

The Aurora Corridor project will pay for the trail and vegetation between the two bridge ramps.

The City continues to pursue additional funds for the Pedestrian & Bicycle Crossing project and staff believes up to $412,000 may become available from Intermodal Surface Transportation Efficiency Act's (ISTEA) non-motorized enhancement program early in 2005. The City has applied for these funds and preliminary competition for the funds has been positive. This would bring the total funds available for the project to just over $4 million dollars.

If Council selects Alternative 3, staff recommends utilizing $800,000 from the Aurora Corridor Phase II project for the Pedestrian & Bicycle crossing project. Staff is comfortable with this recommendation because the Interurban Bridges are a key visual and pedestrian safety element of the Aurora Corridor and as such, having the Aurora Project contribute to these elements would not be contrary to the established goals. The second phase of the Aurora project currently estimates a City roads capital fund contribution of $11 million. A reduction of this amount of $0.8 million to support Alternative 3 will still give us adequate budgeting leeway as we refine our Phase 2 estimates to meet a 13% match equal to the funding level we are committed to on Phase 1.

As Council is aware, the second phase of Aurora is dependent on obtaining additional grants or funding sources in order to have the required level of funding. This means that we will continue to seek out grant sources that can contribute to the completion of the project. The second phase of the Aurora improvements are scheduled to occur over the next six years with construction estimated to begin in 2008. There are a number of things that can change during this time period and therefore we will have a more concrete understanding of the costs of the project and the grant or alternative funding sources that will be available to complete the Aurora Corridor project in the next few years.

If Council selects Alternative 3, staff will reflect this change as part of the 2005 proposed budget. The City's project share of a $4.8 million improvement would be approximately 28% depending on our success with the ISTEA grant.

SCHEDULE

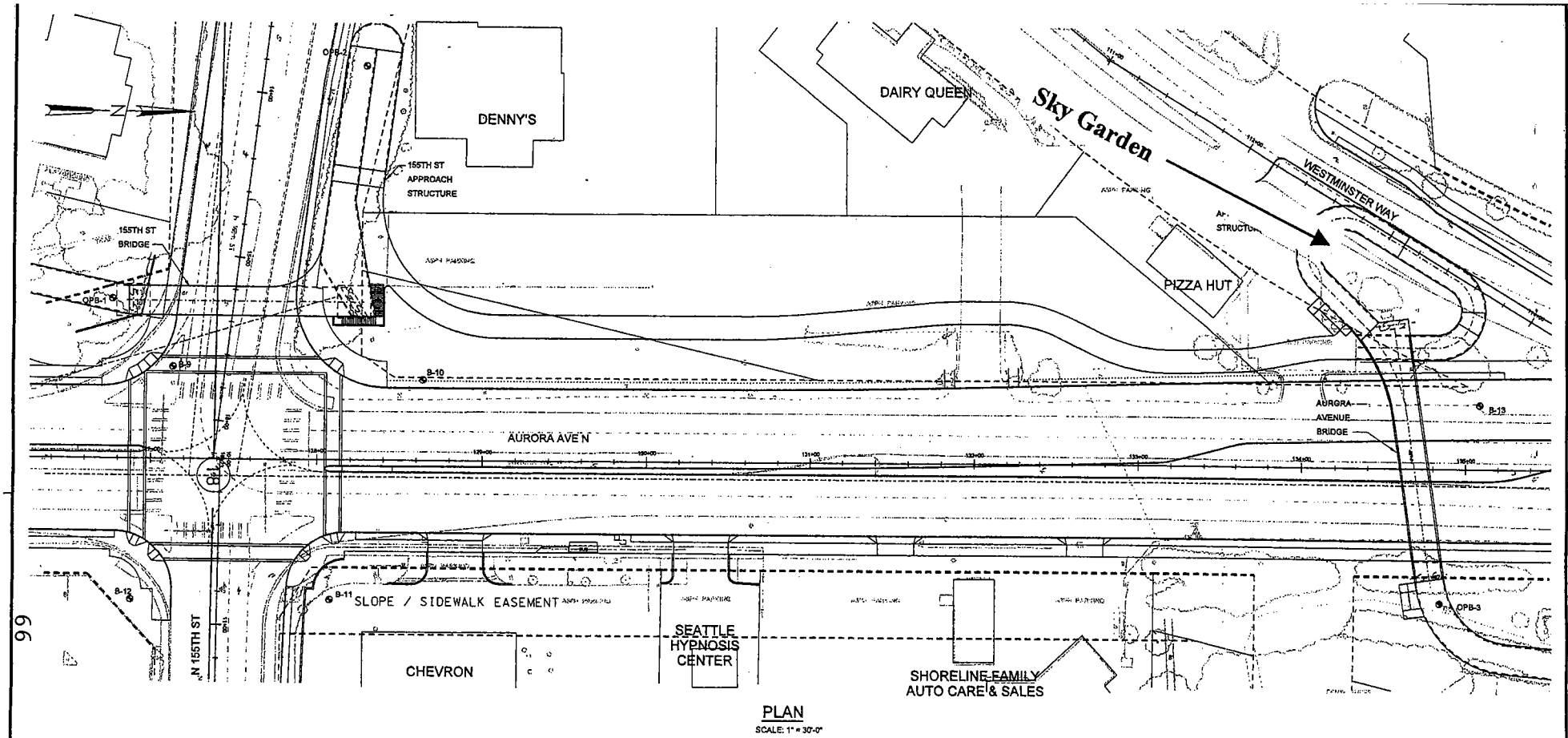
Design of this project is to be complete in 2004. Construction of the Interurban Trail Pedestrian & Bicycle Crossing project is to be joined with construction of the first Phase of the Aurora Corridor project. Advertisement for a contractor is anticipated for late spring of 2005.

RECOMMENDATION

Unforeseen increases in concrete and steel prices, together with unsuitable soils, have combined to increase the projected costs above the estimates used to originally program this project. Given the preferences expressed by the Art Jury, PRCS Board, and public, staff recommends moving forward with Interurban Trail Pedestrian & Bicycle Crossing Alternative 3. This we believe is the affordable balance between community expressed aesthetic interest and a practical and durable set of structures for both pedestrian and bicycle users.

ATTACHMENTS

Attachment A: Loop Ramp Option Alternative
Attachment B: Concrete Deck Bulb Tee Girder Bridge
Attachment C: Concrete Tub Girder Bridge
Attachment D: Sky Garden
Attachment E: Form Liner/Concrete Patterning
Attachment F: Alternatives Cost Comparison
Attachment G: "Mountain Sky" Missile Barrier
Attachment H: "Trolley Wave" Missile Barrier



PLAN

SCALE: 1" = 30'-0"

99

PRELIMINARY

NOT FOR CONSTRUCTION

DSGN	DSGN
DR	DRAWN
CHK	CHECKED
APVD	APPROVED

NO.	DATE	REVISION	BY	APVD

VERIFY SCALE

BAR IS ONE INCH ON ORIGINAL DRAWING. IF NOT ONE INCH ON THIS SHEET, ADJUST SCALES ACCORDINGLY.

CH2MHILL

CITY OF SHORELINE

CITY OF SHORELINE
INTERURBAN TRAIL
PEDESTRIAN BRIDGE PROJECT

AURORA AVENUE NORTH MULTIMODAL CORRIDOR PROJECT
N 145TH STREET - N 185TH STREET

FIGURE 1
SITE PLAN

SHEET	SHEET NO.
DWG	DWG NO.
DATE	
PROJ	

32fsh03gn.dlv 18-JUN-2004 12:44:05

Attachment A: Loop Ramp Option

PCANY MONTHLY NEWSLETTER

PRECAST CONCRETE ASSOCIATION OF NEW YORK, INC. May 2003 Volume 14, No 5

DOT design of bulb-tees at ABCD seminar

A seminar entitled "Design and Construction of Bridge Superstructures with Prestressed Concrete Bulb-tees," will be presented by ABCD on Tuesday, May 6th, at the Hilton Garden Inn at the Albany Airport, 800 Shaker Road in Albany. ABCD is the Eastern NY Chapter of the Association for Bridge Construction and Design.

The presentation will be made by Matthew Royce and Harry White, both with the NYSDOT Structures Division in Albany, and will include the following topics:

- **History of prestressed concrete bridges in New York State.**
- **Design issues of bulb-tee girders, including spliced girders.**
- **NYSDOT detailing standards.**
- **Installation issues, including post-tensioning procedures.**

Registration is scheduled for 8:00 AM with the last presentation ending at 12:00 noon. Reservations may be made with ABCD c/o Mark Olstad at Clough Harbour Associates at 518-453-3957. The cost is $15 per person including break. ❑

Bulb-tee girder is lifted from special erection slider beams after being pulled across span to second crane. photo by Schuylkill Products

First bulb-tee girder is installed on Black Meadow Creek Bridge. Note that girder bears directly on top of pile and will be fixed in the abutment. See details below. photo by Schuylkill Products

Orange County bulb-tee bridge, latest in integral bridge design

The new bridge currently under construction over Black Meadow Creek in Orange County, NY is a single span, HPC, bulb-tee bridge using the latest in integral bridge design. The bridge is being constructed on a relocated section of Route 94 in the Village of Chester near Goshen, NY.

The bulb-tee girders span 28.18 m (92.45') from c/c of bearings. They are spaced 1.96 m (6.45') on center with an 8.5" composite deck. The overall width of the bridge is 15.68 m (51.44'). The girders bear directly on the top of HP 310 x 110 steel bearing piles which extend thru the abutment pile cap. The piles are oriented with the weak axis parallel with the center of roadway above. Integral bridge design eliminates expansion joints in a bridge, and relies on piling to flex with movement in the superstructure, that are created by creep, shrinkage and temperature. Note the photo above and story on page 3.

The girders were cast with 10 ksi high performance concrete (HPC) and pretensioned with 34 each 0.5" dia strand. They were cast at the Schuylkill Products plant in Cresonna, PA. The first cast was made on February 13th and the last on February 26th. All eight girders were delivered and erected in one day on March 19th. The girders were installed using erection slider beams (see photo) used for rolling one end of a girder across with cranes at each end of the bridge.

The owner and engineer on the bridge is the New York State Department of Transportation. B. Anthony Construction Co. is the contractor and performed the erection. ❑

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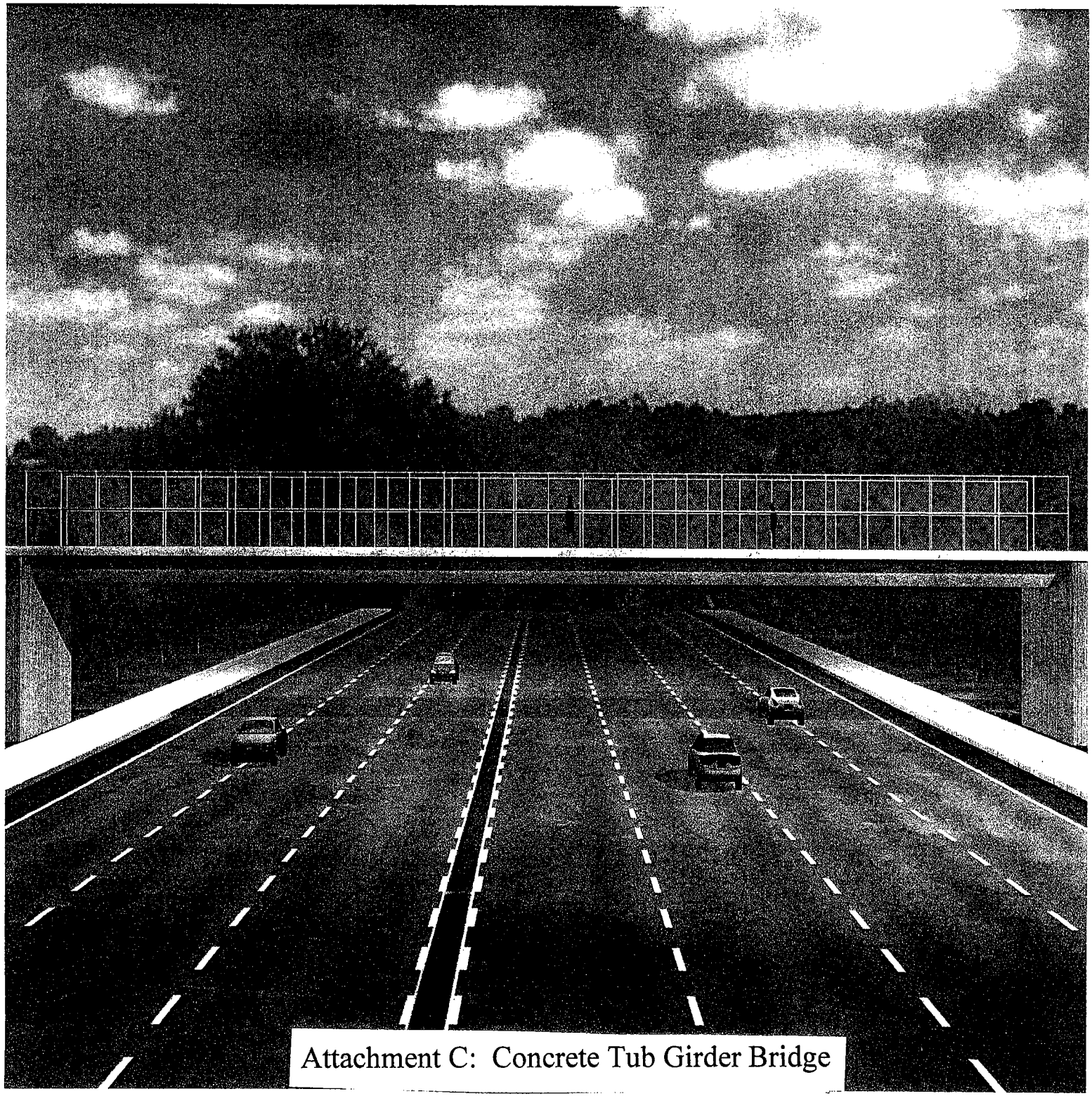
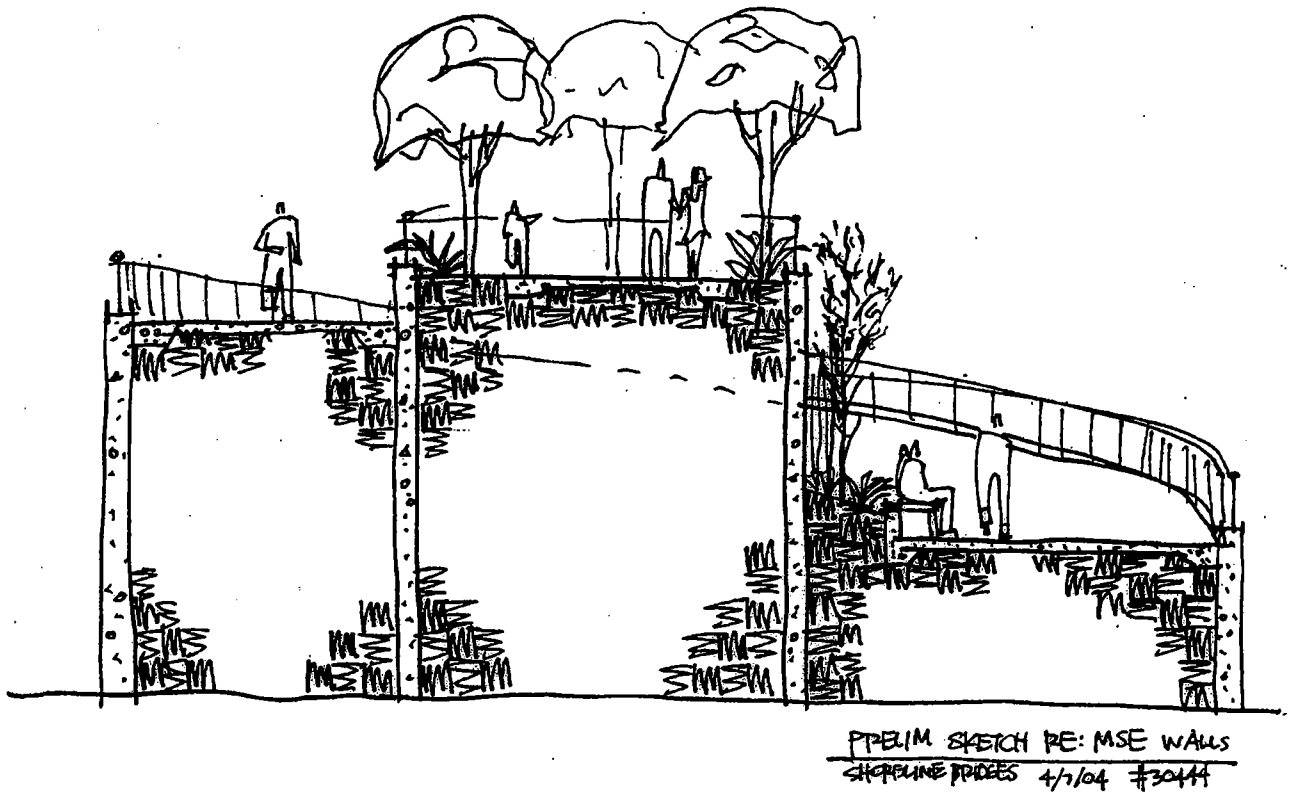
Mary Ellen Yankosky: Admin Director
Edward Hourigan, PE: Tech Director
Harold Nelson, PE: News Editor

Attachment B: Concrete Deck Bulb Tee Girder Bridge

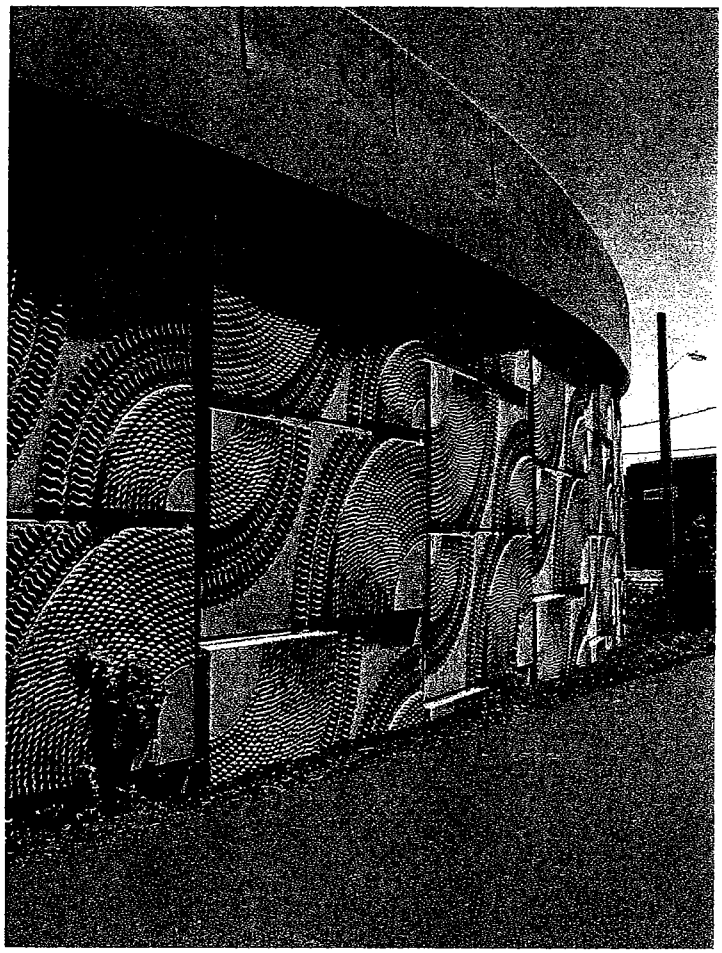


Attachment C: Concrete Tub Girder Bridge

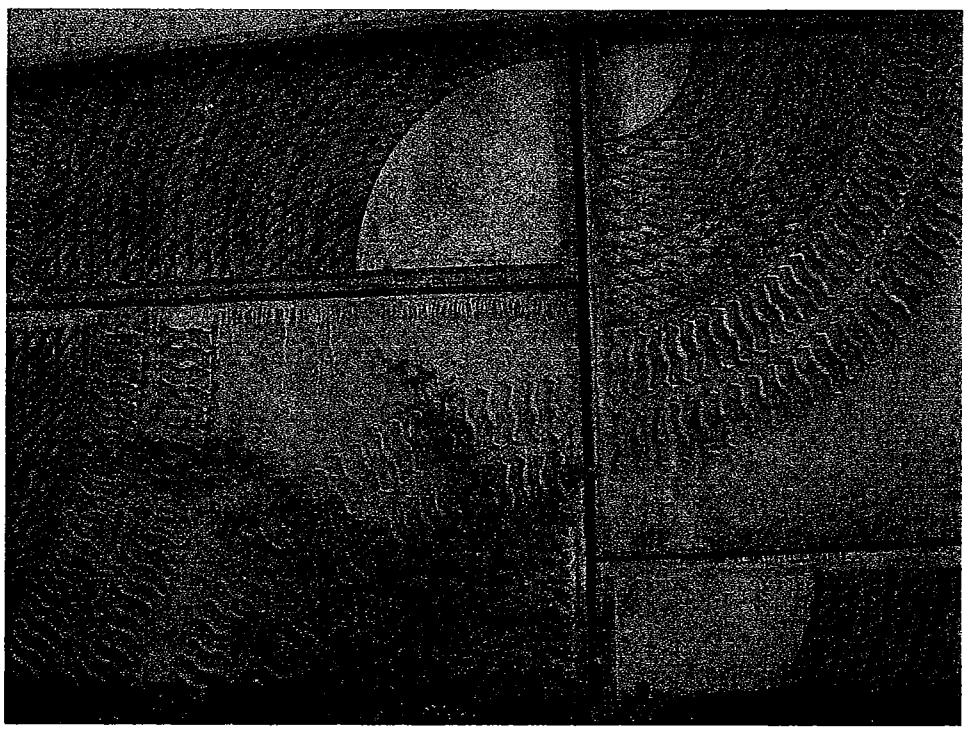


Left, the architect's sketch of the proposed ramp. This ramp creates an elegant ground form, with a slow curve rising in a ratio of 1:20, to provide a slow steady uninterrupted climb to the top. It features a plateau landscape, with up-lights on the trees, providing safety and a nighttime beacon. Also, this plateau landscape provides the opportunity to exit the bridge, and rest, overlook the grounds below, and then resume the journey.

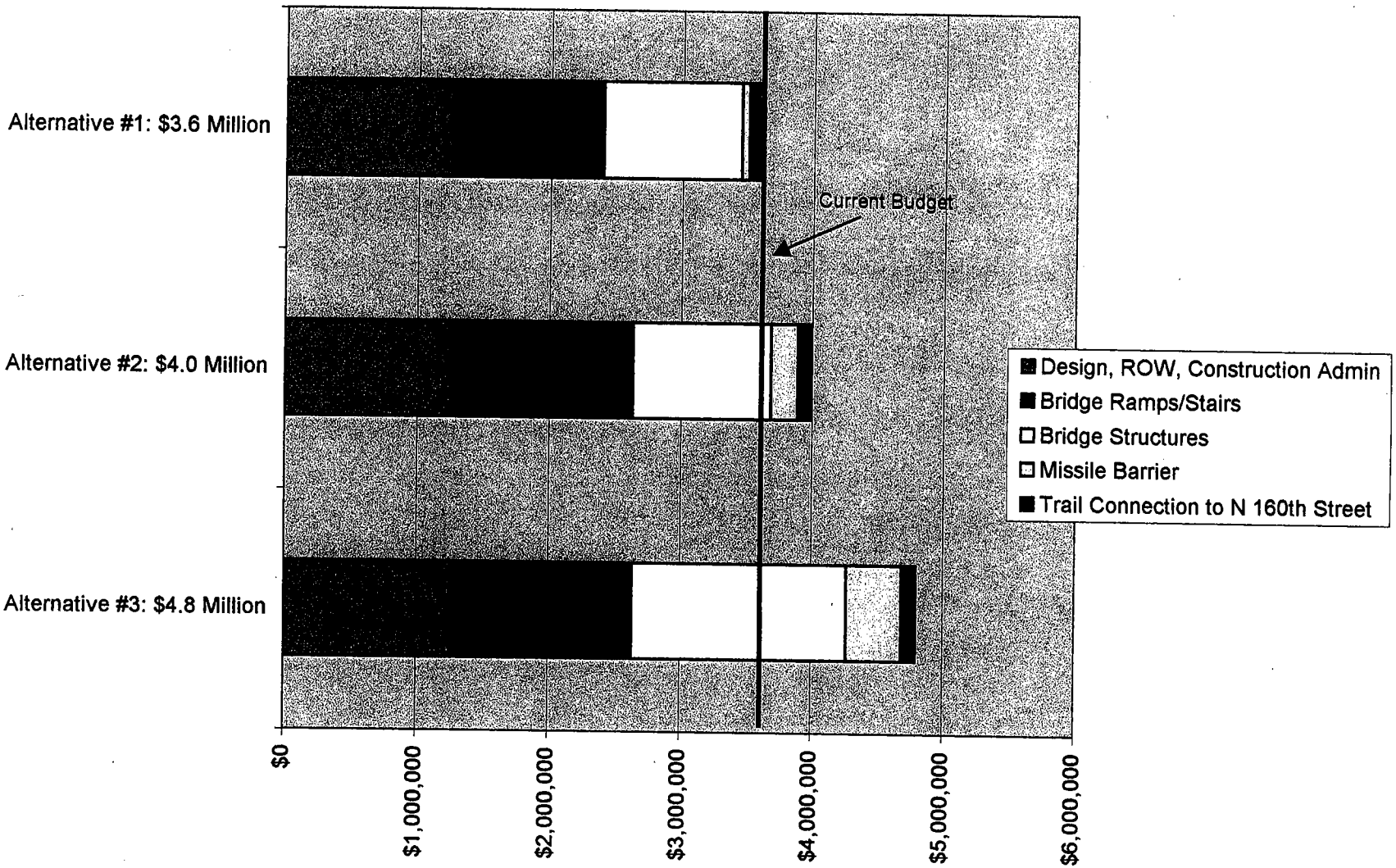
Attachment D: Sky Garden



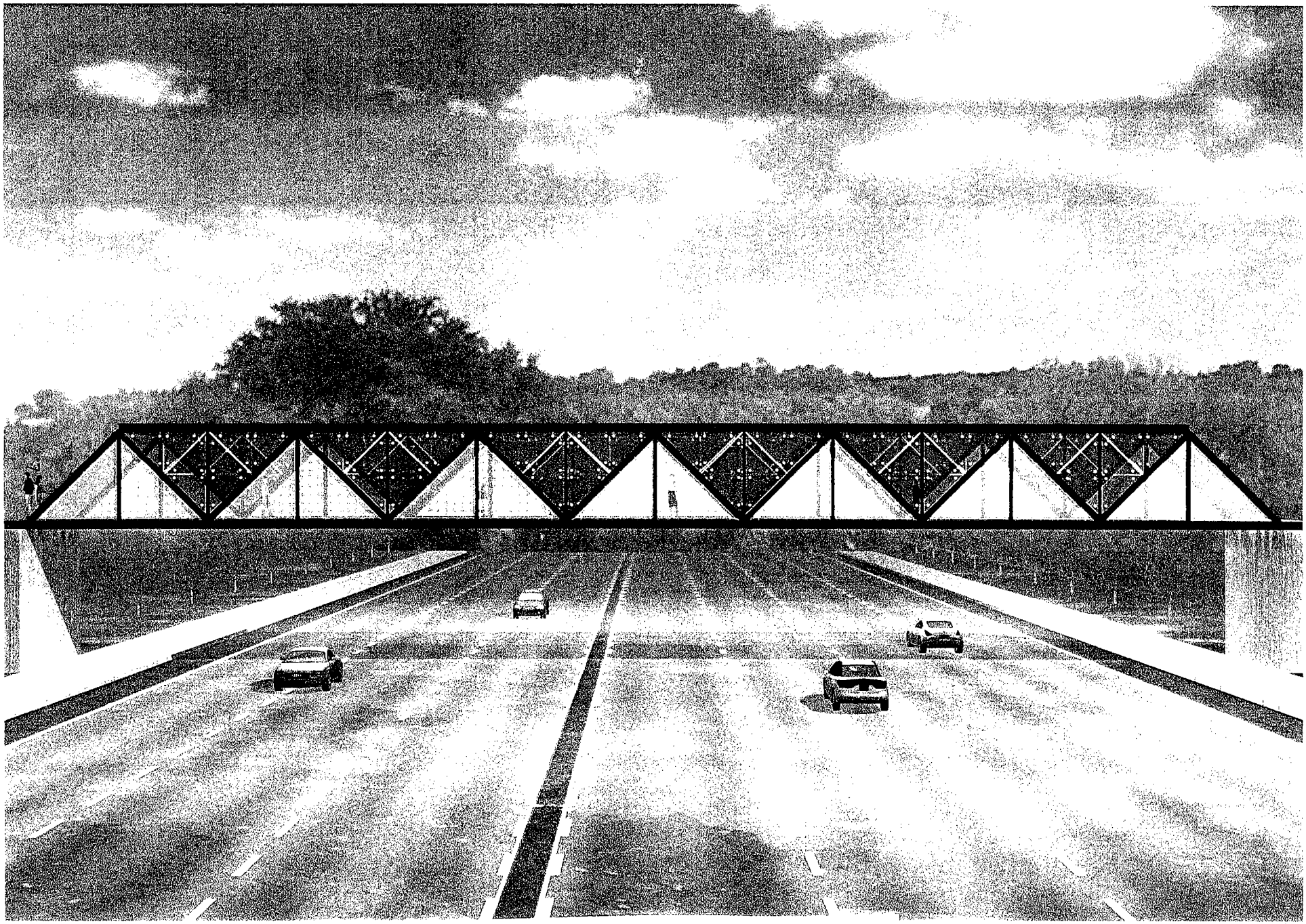
- **Concrete Pattern**
  (Use of form liner)
- **West Galer Street Flyover**
- **Seattle, WA**



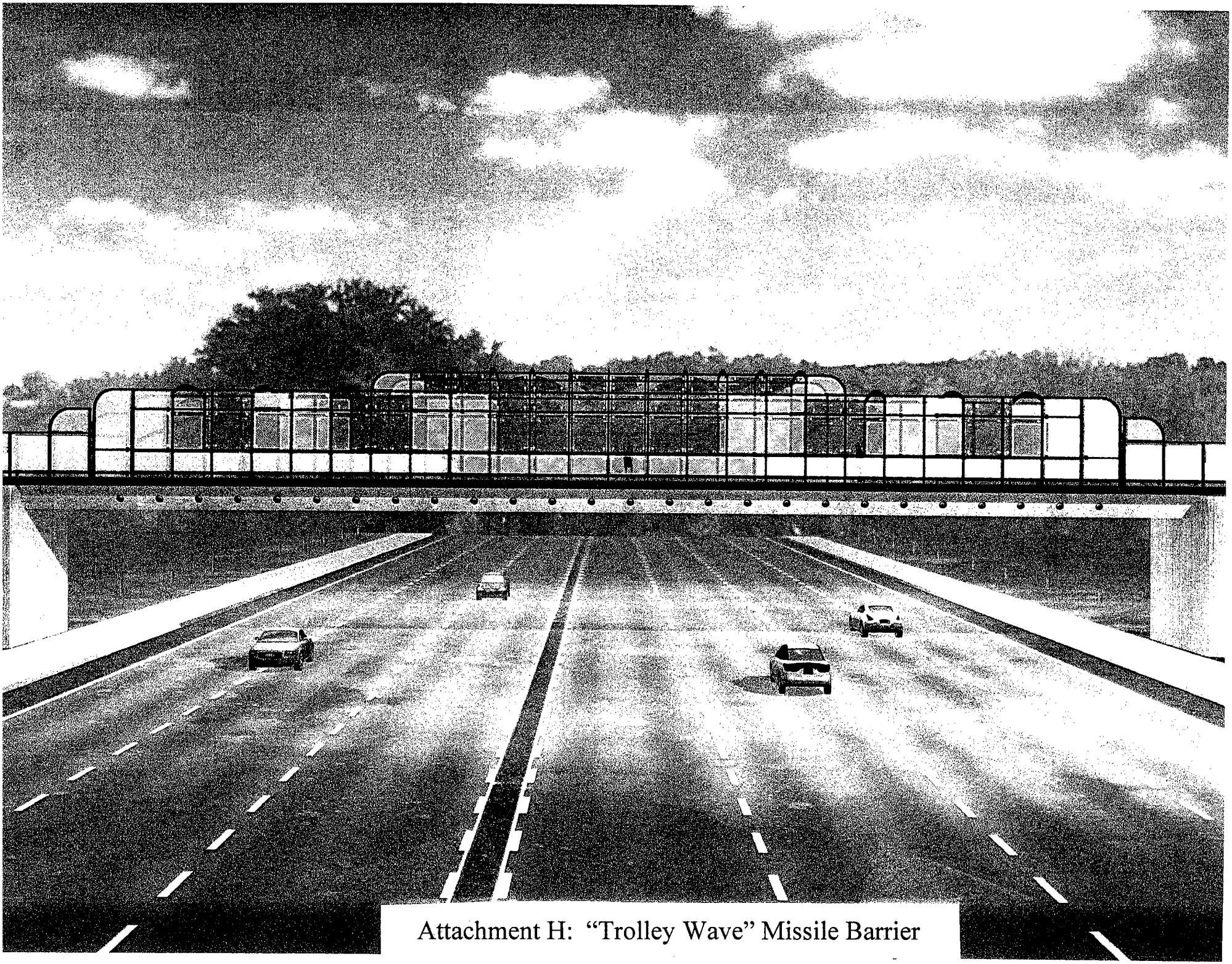
Attachment E: Concrete Patterning Example



Attachment F: Pedestrian & Bicycle Crossing Alternatives



Attachment G: "Mountain Sky" Missile Barrier



Attachment H: "Trolley Wave" Missile Barrier