



# **Beautiful Precast Soundwall for State Route 527 City of Mill Creek, Washington**

**A 2035 ft (620 m) long precast concrete soundwall, with artistically designed rural images etched in the concrete surface, provided beauty, serenity and noise control to a major arterial going through the City of Mill Creek, Washington.**

**I**n 2001, the City of Mill Creek in Washington State embarked upon an ambitious program to enlarge and beautify an important section of State Route (SR) 527. To increase highway safety and improve vehicle mobility, the plan called for the widening of more than 2 miles (3.2 km) of highway within Mill Creek (a suburb of Seattle).

The completed highway would comprise two lanes of traffic in both directions (with a center turn lane and landscaped medians), in addition to sidewalks and bicycle lanes. But most important of all, the plan included the installation of a very long soundwall (also called a noise wall and noise barrier) that would not only mitigate increased traffic noise levels but

would also add beauty and excitement to the area.

To execute the plan, the City of Mill Creek negotiated a partnering agreement with the Washington State Department of Transportation (WSDOT), by which the WSDOT would be responsible for the design and implementation of the project while Mill Creek retained the right of final ap-





proval. Recently, the Mill Creek community had built a new city center and made other civic improvements. The city was undergoing a revitalization process and, therefore, wanted to be involved in decisions regarding any future construction.

The design team comprised Cari Hornbein, senior planner for the City of Mill Creek; Jeff Lundstrom, design project engineer for WSDOT; Dawn McIntosh, construction project engineer for WSDOT; Sally Anderson, principal landscape architect for WSDOT; and Alex Young, state bridge and structures architect. Young played a key role in the artistic treatment of the SR-527 project, and especially the intricate design of the soundwall.

Initially, the soundwall was to have been a precast concrete wall with a fractured fin finish. This type of structure has been widely used in urban corridors throughout the State of Washington and also along highways in other regions of the United States. However, this proposal was declined by Cari Hornbein, representing the City of Mill Creek, who wanted something more imaginative and attractive.



After much discussion, the design team decided to use a precast concrete soundwall with artistic wildlife images etched in the concrete surface. Alex Young took the ideas and innovatively incorporated a design featuring maple and alder leaves, cedar branches, dragonflies, ladybugs, and animal tracks – all basic elements representative of

Mill Creek's rural nature and environmental heritage.

Working closely with the formliner manufacturer and precaster, Young developed three clay relief sculptures from which formliners were made. The formliners were then used to fabricate the soundwall. In the final design, the top 3 ft (1 m) of the sound-

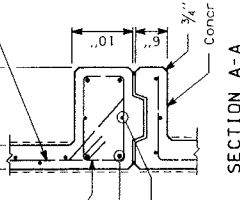
WALL HT H	TYPE 110				TYPE 111C				TYPE 111B				TYPE 111A				WALL HT H		
	DEPTH D1	DEPTH D2	BAR A	BAR B	DEPTH D1	DEPTH D2	BAR A	BAR B	DEPTH D1	DEPTH D2	BAR A	BAR B	DEPTH D1	DEPTH D2	BAR A	BAR B		Y (mm)	PLATE THICK. T
6'-0"	5'-3"	5'-3"	4-#3	4-#5	5'-3"	4'-9"	4-#3	4-#5	5'-3"	4'-9"	4-#3	4-#5	5'-3"	4'-9"	4-#3	4-#5	2'-0"	1/2"	1"
8'-0"	7'-0"	6'-0"	4-#3	4-#5	6'-0"	5'-3"	4-#3	4-#5	6'-0"	5'-3"	4-#3	4-#5	6'-0"	5'-3"	4-#3	4-#5	2'-0"	5/8"	1"
10'-0"	8'-0"	6'-9"	4-#3	4-#5	6'-9"	5'-9"	4-#3	4-#5	6'-9"	5'-9"	4-#3	4-#5	6'-9"	5'-9"	4-#3	4-#5	2'-2"	3/4"	1"
12'-0"	9'-0"	7'-3"	4-#3	4-#5	7'-6"	6'-3"	4-#3	4-#5	7'-6"	6'-3"	4-#3	4-#5	7'-6"	6'-3"	4-#3	4-#5	2'-7"	1"	1"
14'-0"	10'-0"	8'-9"	4-#3	4-#5	8'-0"	6'-9"	4-#3	4-#5	8'-0"	6'-9"	4-#3	4-#5	8'-0"	6'-9"	4-#3	4-#5	2'-7"	1 1/8"	1"
16'-0"	11'-0"	9'-3"	4-#3	4-#5	8'-9"	7'-3"	4-#3	4-#5	8'-9"	7'-3"	4-#3	4-#5	8'-9"	7'-3"	4-#3	4-#5	2'-7"	1 1/8"	1"
18'-0"	12'-0"	10'-3"	4-#3	4-#5	9'-3"	7'-9"	4-#3	4-#5	9'-3"	7'-9"	4-#3	4-#5	9'-3"	7'-9"	4-#3	4-#5	3'-3"	1 3/8"	1 1/8"
20'-0"	13'-0"	11'-0"	4-#3	4-#5	10'-0"	8'-3"	4-#3	4-#5	10'-0"	8'-3"	4-#3	4-#5	10'-0"	8'-3"	4-#3	4-#5	4'-3"	1 3/4"	1 1/2"
22'-0"	14'-0"	12'-6"	4-#3	4-#5	10'-6"	8'-9"	4-#3	4-#5	10'-6"	8'-9"	4-#3	4-#5	10'-6"	8'-9"	4-#3	4-#5	5'-5"	1 3/8"	1 3/8"
24'-0"	15'-0"	13'-3"	4-#3	4-#5	11'-3"	9'-3"	4-#3	4-#5	11'-3"	9'-3"	4-#3	4-#5	11'-3"	9'-3"	4-#3	4-#5	6'-10"	1 1/2"	1 1/2"

NOTES

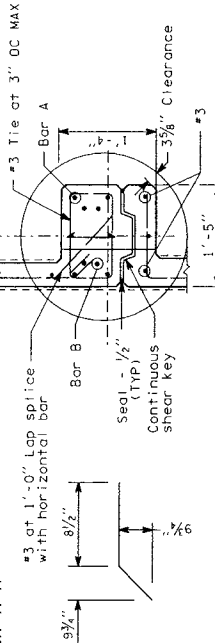
1. Wall to be designated Noise Barrier Type IIA, IIB, IIC or IID. The Contract specifies actual wall dimensions.
2. For intermediate wall heights, use the next higher H.
3. Panels shall have at least 3 feet of level ground on each side.
4. The Contract specifies actual foundation requirements D1 or D2.

Wall reinforcement #3 at 12" both directions or 6 x 6 W5.5 x W5.5 or 12 x 12 W9.5 x W9.5 or W9.5 (D10) vertical at 12" OC with #6 (D6) center horizontal bar on wall face. Alternate vertical bars as shown.

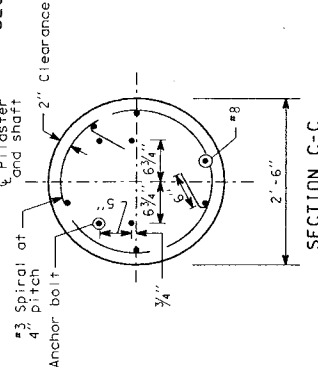
SECTION A-A



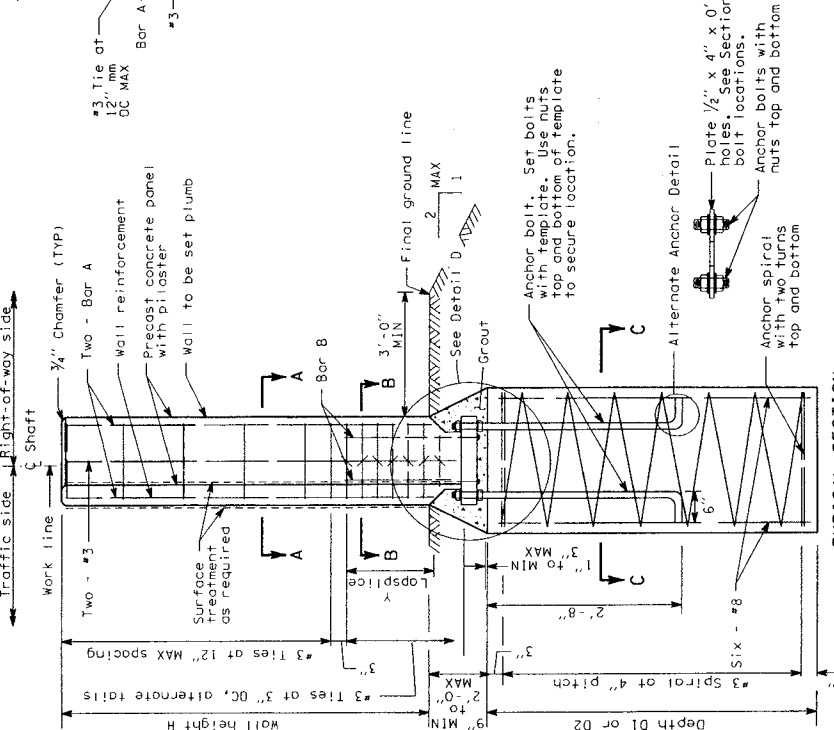
SECTION A-A



SECTION B-B



SECTION C-C



TYPICAL SECTION

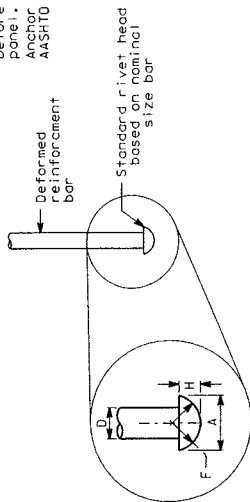
NOISE BARRIER - TYPE 11  
PRECAST CONCRETE WALL  
ON SHAFT FOUNDATION



Fig. 1. Cross-sectional dimensions and reinforcing details of wall panels.

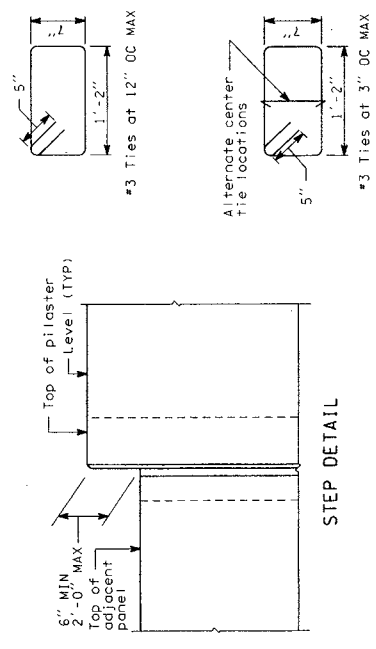
D	#5	#6	#7	#8	#9	#10	#11
A	1 1/8"	1 1/4"	1 1/2"	1 5/8"	1 3/4"	2"	2 1/8"
H	3/8"	1/2"	5/8"	3/4"	7/8"	1"	1 1/8"
F	1/8"	1/4"	3/8"	1/2"	5/8"	3/4"	7/8"

BOLT DIA	SOLE	SLOT C
5/8"	3/4"	
3/4"	7/8"	
7/8"	1"	
1"	1 1/8"	1/8" x 1 1/2"
1 1/8"	1 1/4"	1/4" x 1 3/8"
1 1/4"	1 5/8"	1 3/8" x 1 3/4"
1 3/8"	1/2"	

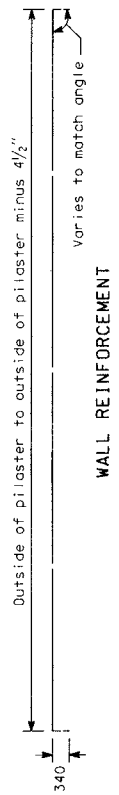


Butt on head shall bear firmly and uniform against base plate. Bar B shall be held secure during concrete placement to prevent gaps between butt on head and base plate.

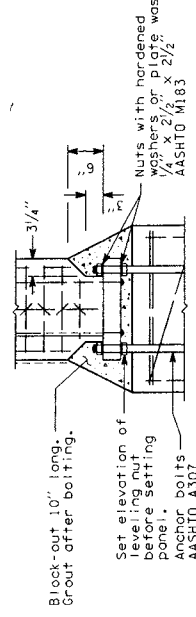
BAR B



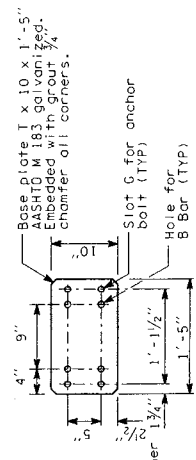
STEP DETAIL



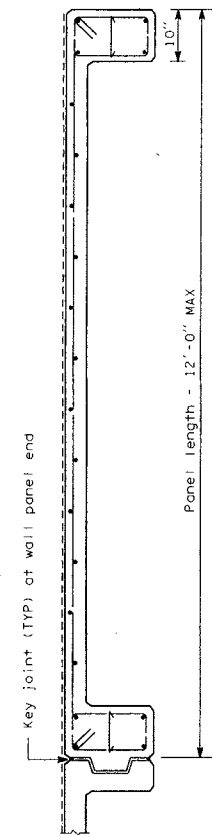
WALL REINFORCEMENT



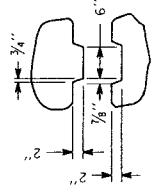
DETAIL D



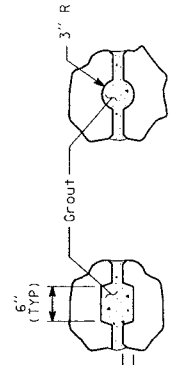
BASE PLATE DETAIL



END PANEL



SHEAR-KEY



OPTIONAL SHEAR-KEY

**NOISE BARRIER - TYPE 11  
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Fig. 1 (cont.). Cross-sectional dimensions and reinforcing details of wall panels.





wall consisted of alternating leaf patterns running the entire length of the wall, while the bottom portion featured a fractured-granite treatment that resembles tree bark. Both the custom foliage relief and the bark texture complemented each other perfectly.

The precast concrete wall panels were fabricated by Precast Concrete Products of Western WA, LLC in Puyallup, about 50 miles (80 km) south of Seattle. The panels were manufactured in the fall of 2001.

In all, 185 precast panels were produced. The average width and height of a panel is 11 and 14 ft (3.4 and 4.3 m), respectively. The total length of the soundwall is about 2035 ft (620 m). For cross-sectional dimensions and reinforcing details of the wall panels, see Fig. 1.

The wall panels were transported to the project site by truck-trailer, a distance of about 50 miles (80 km) in February 2002. Panel erection took about two months. The project was completed at the end of May 2002.

The total cost of the soundwall was \$738,400. The cost of the precast wall panels was \$557,000.

In planning the project, the precast concrete soundwall was chosen over the cast-in-place concrete option for three major reasons:

- The precast option decreased soundwall construction time. Since the soundwall is located on the property line of the adjacent residences, it was critical that a speedy construction be done to minimize the noise, heavy machinery operations, and safety issues near the residences.

- It was desirable to minimize the disturbance to the surrounding landscape. The precast soundwall design allowed the use of shaft supports to reduce the foundation footprint as compared with a conventional spread footing. As a result, a large quantity of existing vegetation could be preserved.

- Most importantly, the precast concrete option was able to capture all the fine details of the sculpture. The original clay molds depicted in great detail patterns such as ladybugs, dragonflies, animal tracks, and leaf veins. Precast concrete was able to capture every small detail of the original sculpture. Indeed, the finished precast concrete

## SAMPLE COSTS FOR AESTHETIC TREATMENT OF SOUNDWALLS

According to Alex Young, the state bridge and structures architect for the Washington State Department of Transportation, the construction cost for installing a concrete soundwall using a rubber formliner custom-designed for an aesthetic treatment is about the same as the cost of using a commercially available rubber formliner.

In Washington State, an off-the-shelf rubber liner, which can be used repeatedly, costs about \$30 per sq ft (\$323 per m<sup>2</sup>). The only cost difference for applying an aesthetic treatment comes from developing the master mold for the formliner. This costs about \$50 per sq ft (\$538 per m<sup>2</sup>). Once the master mold is created, the custom-designed formliner costs the same as a commercially available liner.

Given a 100,000 sq ft (9290 m<sup>2</sup>) precast concrete soundwall composed of 12 x 12 ft (3.7 x 3.7 m) panels, the costs would be as follows:

Option 1: Precast concrete soundwall using commercially available rubber formliners, installed cost at \$16 per sq ft (\$172 per m<sup>2</sup>) equals \$1.6 million.

Option 2: Precast concrete soundwall using custom-designed rubber formliner, installed cost (base cost of \$1.6 million from Option 1 plus \$7000 for the master mold) equals \$1.607 million.

For more information on the cost of concrete soundwalls in specific areas, contact your local precaster.

For general information on concrete soundwalls, see the following publications:

1. PCI Soundwall Committee, "Guide Specification for Reflective Precast Concrete Soundwalls," *PCI JOURNAL*, V. 48, No. 2, March-April 2003, pp. 14-17.

2. Sullivan IV, John J., "Walls of Fame," *Public Roads*, May-June 2003, pp. 10-17.

3. FHWA, *Highway Noise Barrier Design Handbook*, Federal Highway Administration, Washington, DC, 1976.

4. AASHTO, "Guide Specifications for Structural Design of Sound Barriers," American Association of State Highway and Transportation Officials, Washington, DC.

panels exceeded WSDOT's expectations and convinced the designers that it would be impossible to achieve such great detail with the cast-in-place concrete option.

In conclusion, the soundwall project proved to be an overwhelming success. The City of Mill Creek, the neighboring residents, the WSDOT, and the precaster are extremely pleased with the outcome of the project. In addition, motorists, cyclists, hikers and the general public are now enjoying the new facility.

The design itself was such a great

success that it is now considered an aesthetic standard by WSDOT. Currently, similar designs are being planned for the City of Redmond, and a bridge project in Vancouver County. With this experience, we are confident this success story will spread to other parts of the United States.

For further information on this project, contact Alex Young, Washington State Department of Transportation, P.O. Box 47340, Olympia, WA 98504-7340.

## CREDITS

Owner: Washington State Department of Transportation, Olympia, Washington

Engineer of Record: J. A. Weigel, Washington State Department of Transportation, Olympia, Washington

Contractor: Mowat Construction, Woodinville, Washington

Precast Concrete Manufacturer: Precast Concrete Products of Western WA, LLC, Puyallup, Washington

[GDN]