As the precast concrete industry continues to evolve, the diversity of product lines continues to grow. The National Precast Concrete Association’s Plant Certification Program is part of this dynamic industry evolution and continues to adapt to meet member needs.

To address the growth in the architectural precast sector, NPCA has added new content to its Quality Control Manual for Precast and Prestressed Concrete. Most of the architectural content will be found in Chapter 4 – Production Practices; however additional information related to architectural precast has been added throughout the manual. The process of furnishing fabrication drawings and mock-ups can be found in Chapter 1 – General, for example.

Chapter 2 – Materials contains additional requirements related to architectural finishes such as: using the same type and brand of cement from the same mill and lot to avoid color variations; and avoiding mix water with iron oxides to prevent staining when using white cement.

Chapter 3 – Concrete contains requirements for producing a piece with different mix designs for face and back-up concrete.

Requirements and recommendations for all different types of surface finishes such as exposed aggregate, acid-etched, stone or clay veneers are contained in Chapter 4. The application of surface retarders, the use of tools in finishing architectural concrete and the use of bond breakers when producing products with stone veneers are examples of additions to this chapter.

The NPCA Building Committee and its subcommittees are already hard at work developing additional architectural precast content for the next edition of the manual. Members and staff will continue to add and refine content so that it continually serves the evolving needs of our membership as well as the needs of industry specifiers.

The 8th edition of the NPCA Quality Control Manual can be found on NPCA’s website at www.precast.org/manual.

Claude Goguen, P.E., LEED AP, is NPCA’s director of Technical Services.
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The Creative Use of Precast Awards recognize projects that promote the innovative and cost-saving advantages of precast concrete over other materials.
Welcome to the second annual architectural issue of Precast Solutions. Architectural precast concrete is one of the most versatile, dynamic building materials in 21st century construction. Computer-generated molds, increasingly sophisticated mix designs and precise manufacturing techniques have enabled designers to create stunning precast concrete structures. For this issue, we have selected a handful of projects that illustrate the wide range of possibilities that can be achieved with precast. We start in East Los Angeles at the Mariachi Station where custom precast veneers beautifully mimic natural stone. Then we move north to Redmond, Wash., to show how bridge abutment panels combine form and function for a sweeping, layered look. While we’re in Redmond, we look at how precast concrete helped achieve LEED Gold status at an office building. Then it’s on to Springville, Utah, to view an incredible home that features more than 1,000 pieces of precast concrete.

Back in Washington, we’ll look at how large block precast concrete combined with a father’s vision to create a lasting memorial to his son whose life was tragically cut short.

We hope you enjoy this issue and agree that when it comes to incredible architectural design, precast concrete makes it possible. For additional examples of the wide range of precast, please visit our website at www.solutions.precast.org.

**Mariachi Station**

*Arto Brick, Gardena, Calif.*

In East Los Angeles stands an historic plaza with a beautiful stone gazebo at the center. Donated by Guadalajara, Mexico, it honors the mariachi bands that congregate in the bustling plaza and offer their music to locals and visitors. When the city was ready to expand its Metro line, Mariachi Plaza became the natural selection for a new Metro Station Gold Line extension from Pasadena to East LA.

Because of the historic nature of the neighborhood, the Mariachi Station was constructed underground with above-ground entrances that complement the natural stone architecture. Specially designed form liners were used to create precast concrete veneers that...
complement the historic stone gazebo. The 12 in. x 24 in. (305 mm x 610 mm) veneers were given irregularly colored aggregate to further enhance the cantera stone look for a more natural appearance.

The custom veneers simplified construction with a quicker lead time, while also providing the city with a lower-cost project. Not only was the precast concrete veneer less expensive than natural stone, it is also thinner and much lighter than stone, so a smaller and more economical foundation could be used. The Metro Gold Line extension proved to be a home run with the local residents and commuters, while paying homage to the existing architecture of the neighborhood.
New Art Medium Features
Form and Function

Olympian Precast, Redmond, Wash.

These days it seems that state Departments of Transportation are looking for projects beyond the traditional – something more inspiring for local motorists. Bridges and sound walls are currently the canvas of choice for architects and designers across North America. Washington State DOT recognized this trend and recently hired an architect to design bridge abutment walls. The architect’s final design consisted of seven layers that form a smooth, sweeping pattern in the center with an adjacent ashlar stone pattern. This level of detail sets a new standard for local transportation projects.

The precaster had several challenges on this project. The girders for the elevated freeway had already been installed, and the headroom above varied from 2 to 4 ft (0.6 to 1.2 m). The overhead girders eliminated a crane installation, so the contractor built a special eight-pronged front-end loader installation device. At Olympian, the project management and drafting team worked closely with the contractor’s engineering staff to specify the precise location of the lifting device holes to establish a center of gravity on each unique panel. The panels, placed on their sides for shipping, were removed from the truck and rotated 90 degrees for transport to their installation points. The holes were later patched and the panels were painted.

Olympian produced a total of 40 panels for the project: 16 of the central design and 24 ashlar stone panels. The total panel area was 6,600 ft² (613 m²).
LEEDing with Precast

Olympian Precast, Redmond, Wash.

Located in Redmond, Wash., this LEED Gold-certified building serves as office space along a very prominent corridor of travel. Precast concrete contributed to earning one point toward the recycled content (Materials and Resources credit 4) and two points for the regional materials credit (Materials and Resources credit 5). The precaster was located less than five miles (8 km) from the project site and utilized more than 80% local component materials by weight, making the 500-mile (805 km) limitation of the Regional Materials credit easily attainable.

The biggest project challenges were based on obtaining consistency in color and finish. The project’s details were made possible with 100% Self Consolidating Concrete (SCC). The precast at the base of the building featured 12-in. (305 mm) pilasters at the west elevation and returned on the north and south elevations. An 18-in. (460 mm) half-round bull nose accented both dark- and light-colored precast. The upper office partition of the project, the lighter color, featured crushed marble aggregate with white cement and finished with a light acid etch. The parking level, the darker color, features standard aggregates with a gray cement and mineral oxide pigment, finished with a light sandblast. The precast concrete reveals enhance the natural beauty by adding some interest to the simple form of the building facade while also reducing the look of variations in color and texture.

Olympian Precast, as evidenced by the smooth, color-matched precast panels, takes great pride in its architectural precast, which added to the success of this LEED Gold-certified building – proving that precast is an excellent choice for a sustainable project.
NATURAL BEAUTY

Photos courtesy Olympian Precast (www.olyprecast.com)
Nestled in the Rocky Mountains of Springville, Utah, this residence merges rustic mountain lodge stability with Mediterranean elegance. The inviting entry bridge is entirely encased with custom precast concrete bridge skirts, paneling, newel posts and balustrades. As you proceed up the path from the bridge, you are greeted by the impressive home itself. Despite its grand size, the 60,000-ft² (5,574-m²) residence embodies the rich, comforting feel of its surroundings. This massive residential project took nearly three years to complete, with more than $500,000 worth of precast material.
More than 1,000 pieces of precast concrete are integrated throughout the home’s exterior, blending seamlessly with the natural stone and timber finishes. This residence demonstrates the remarkable smoothness of standard mold-finished precast; however, a variety of textures, stains, mold materials, and flexible anchoring systems enable nearly limitless possibilities with architectural precast concrete. For example, the structural walls of the residence are composed of insulated concrete forms, which presented a unique production challenge in establishing an anchoring system that would work with a non-typical application process.
A Lasting Memorial

Wilbert Precast, Spokane, Wash.

When the life of 16-year-old Andrew S. Rosell was cut tragically short in a traffic accident, his father, Ed, spent a lot of time grieving and dwelling on the past. After the worst of his grief subsided, he funneled his emotions into the organization that had meant so much to his son: the Boy Scouts of America.

Andrew and his father spent many hours together in scouting activities, and Andrew had been working to become an Eagle Scout prior to his untimely death. As a result, Ed felt it was fitting to donate not only his time but also the money he received in a settlement from the accident to Camp Cowell, a Boy Scout Camp located on 400 acres (162 hectares) on Diamond Lake in Washington State.

Looking to revamp a fire pit built of logs and rocks nearly 90 years ago, Ed turned to Wilbert Precast to see if precast concrete could be used to complete the renovation of pit. Although it was not the intended use of plant’s retaining wall product, Wilbert was able to adapt the wall system perfectly to the project.

What resulted is a stunning amphitheater with seating for more than 300 facing the pristine lake, with two fire pits, and a grand entrance bearing the name Andrew S. Rosell Memorial Fire Bowl. The project used 224 wall blocks and 160 wall caps for seating, 27 pavers, two flag pole bases and two manhole riser sections.

Looking to meet a tight timeline of just 45 days, SCC was used to pour forms
multiple times a day. The precast pieces proved easy to move around the site and needed less backfill and compaction than traditional landscaping, saving the customer soil and labor costs. But most importantly, it provided the Boy Scouts with a dramatic gathering place and gave Ed Rosell a lasting legacy for his son. 

Kyle Kerstiens, Assoc. AIA, LEED AP, is NPCA’s director of sustainability.
When commercial real estate company Parker Properties decided to add a Class A office structure to its portfolio in the planned community of Valencia Gateway in Santa Clarita, Calif., the developers knew the project was both an excellent opportunity and a challenge. “We knew there was a need for more office space in the community – Class A in particular” says Matt Jepsen, vice president of design and construction for Parker, “and the site we selected was on a cul de sac next to two hotels right on the freeway.” It made for an excellent location, but also a prominent one. There could be no skimping on the details if the building was going to attract a high-end tenant and also complement the surrounding landscape of Southern California. When construction began in 2007, building material prices were on the rise and the real estate market beginning to waver, so time was of the essence. Architectural precast concrete provided a key part of the solution.

**WHY PRECAST?**

Summit Oaks, as the building was christened (in honor of the native oaks of Southern California), was to be a 144,000-ft² (13,380-m²) office space, designed for the ultimate in sustainability. From the start, the developers and builders were aiming for a Leadership in Energy and Environmental Design (LEED) Silver rating from the U.S. Green Building Council. Precast concrete would help fulfill the locally manufactured product points for the designation.

“The architecture we were going for was an old gentleman’s club feel,” says Jepsen. The building is

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1“Class A” is the top designation for the highest quality office building in a given market, reflecting high-quality design and materials, good location, state-of-the-art technology and on-site services. Class A classified buildings earn high rents and attract high-profile tenants.
trimmed in anodized bronze accents and dark glazing, all of it complementing the curtain-wall system of architectural precast that forms the structure’s earthy-looking facade.

The building’s structure makes use of recycled structural steel in a steel moment frame, which Jeff Crosier, principal with Miyamoto International, the project’s structural engineering firm, says was a critical element since Summit Oaks is located about a mile (nearly 2 km) from the San Andreas Fault.

Jepsen says Parker Properties considered other options besides precast concrete for Summit Oaks’ facade, including cast-in-place concrete tilt-up panels as well as plaster construction. “Since it was a Class A, we ruled out the concrete tilt right away,” he says. As for plaster, the developers didn’t want the building to be entirely homogenous and also wanted to take advantage of the way in which they could reuse identical building members with precast concrete.

“Parker Properties really didn’t feel that plaster was Class A,” says Lon Stephenson, the project architect and director of operations for Ware Malcomb, “and stone was too expensive.”

**Enhancing real estate value in a tough market**

Richard Cavecche, group vice president for Snyder Langston, the project builder, whose company has built more than three dozen structures using precast concrete says, “Precast really sets this building apart. It has good aesthetics, and it’s easy to build with. It allows for ambience and detailing in the architectural design.” He feels architectural precast concrete also enhances a property’s resale value because of its durability and looks.

“Precast is a much higher-quality product, too,” adds Crosier. “It properly positioned the client in the marketplace. This is a highly visible property.” Precast concrete not only provided durability and low maintenance, but it provided Parker Properties the edge it needed to draw a high-profile tenant. “Architectural precast is a Cadillac material,” says Crosier. Precast was durable as well and, in Stephenson’s view, provided the acoustical value necessary for the building given its close proximity to the Interstate 5 freeway.

Precast concrete architectural panels were also better suited to the developer’s schedule. “We felt under
the gun because of the crisis in the real estate market and the fact that we were competing with another project across the freeway,” Jepsen explains.

And precast concrete also suited the local climate’s dramatic temperature variations. Santa Clarita’s temperatures can hover in the mid-30s (0 C) in winter and go as high as 95 F (35 C) in summer. The Parker Properties design team felt precast would withstand the temperature differences best and that it would also have better UV sensitivity and watertightness. Being in a high-wind area, the building’s facade would need to be able to provide a barrier against water infiltration in a wind event.

**Manipulating forms for faux-stone finish**

The project’s biggest challenge was determining the look and texture of the building’s precast panels. “We went through a couple of samples in terms of what we were trying to capture,” Jepsen explains. Coreslab Structures, the project precaster, brought mock-ups to the site so Parker Properties and the design-build team could see how the precast’s colors melded with the surrounding environment. “We wanted a warm, rich look,” Jepsen adds, something that would mirror the look of the indigenous oaks for which the building was named.

Phil Felton, sales manager for Coreslab Structures, says showing different options for color, finish and texture on site is essential. The first level of precast incorporates a natural stone pattern, while the top four stories feature a sleek beige design. “Generally the two colors were differentiated at ground level,” explains Jon Clausen, Coreslab’s plant manager. The lower level features a chocolate faux stone facade, and Clausen says the process for selecting it was very involved. Coreslab considered making a form liner of real stones but decided that was too costly and instead purchased a manufactured liner. But that presented a problem, because the client wanted a real stone look, and a manufactured liner shows a noticeable pattern repetition. Coreslab devised a work-around.

“We were trying to make it look like real stone,” Felton explains. “We used a purchased form liner from a local manufacturer and then tried to not make it repetitive.” To do that, they altered the form pattern elements that were used in different panels and also changed the orientation of the form. The color variation was achieved through a sandblasting process, where the precaster blasted the concrete at different angles to achieve variation in the product’s texture.

**Two finishes in one panel and seamless corners**

Interestingly enough, the panels that feature the faux stone are actually part of one large section that features both elements – the masonry look of the first-level facade and then the smooth beige-toned panels of the upper half of the first floor. “We achieved this by pouring the stone facade to a breakpoint, letting it get to that initial set, and then pouring the rest of the panel,” explains Clausen.

During the manufacturing process, Coreslab
also mixed an integral sealer into the concrete. This represented a substantial cost savings over the traditional approach of spray-waterproofing the structure's post-construction with an external sealer.

"There was quite a bit of repetition," Clausen explains, "but some panels were oddballs and had returns." That meant they had to have a vertical side for turning corners. Stephenson says that it was important to everyone that the faux stone continued to look like real stonework even while turning corners on the sides of the building and at entryways. They studied a variety of colored sealants to find the best one for blending into the stone so the casual observer doesn't notice corner seams.

The lighter-colored precast concrete panels were much easier to develop, as the building’s punched-window template held pretty much all the way around the structure. "The window modulation is very consistent," Stephenson points out, "so there are not a lot of panel differences."

In all, Coreslab cast 104 wall panels and 84 column covers. The largest was 20 by 13 ft. (6 x 4 m). The precast architectural panels make up Summit Oaks’ facade up to the fourth floor. The fifth floor to the roof is made up of steel aluminum cladding. Creating the architectural precast panels in the plant took about seven to eight weeks, and then the on-site installation consumed another nine to 10 weeks.

Crosier says the installation of the precast panels involved typical lateral installation. They were installed using a connection system designed in-house at Coreslab and fastened column-to-column.

**Sustainability and collaboration**

Upon completion of Summit Oaks in 2008, total construction costs came in at $45 million, including an adjacent poured-in-place concrete parking structure and 4.29 acres (1.74 hectares) of carefully landscaped grounds and parking area. Featuring a light-filled, two-story atrium, certified cool roofing system, on-site stormwater drainage filtration system, recycled structural steel, drought-tolerant landscape, and extensive use of locally acquired and manufactured building materials including its architectural precast panels, the building obtained LEED Silver certification shortly after project completion. It also acquired a prominent client who leased the entire building, Advanced Bionics, a manufacturer of cochlear implant systems, which has office, lab and manufacturing all under the Summit Oaks roof.

Stephenson says it’s essential to have the precaster and builder involved early in the process. “Discuss not only the aesthetic but the structural criteria,” he advises. “Make sure everyone understands attachment locations and where the joints are going to be.”

Jepsen says one thing he really appreciates about the building’s precast structure is how quiet it makes the interior spaces. “It’s so close to the freeway, but the precast concrete along with the acoustical glazing shuts out the noise from those 10 lanes of traffic,” he says.

“The project came together very quickly,” adds Jepsen. “I cannot emphasize enough the importance of those mock-ups – getting that control up on the site and considering the surroundings and the colors.”

Cavecche says collaboration is also important, because it increases project economy and reduces the likelihood of errors. He says it’s important to make sure, for example, that the steel frame can bear the load of the architectural precast concrete and then to make sure all the building’s different components (in this case, steel, glazing and precast) can be integrated for both seismic movement and aesthetics. For Summit Oaks, for example, the team needed to be sure that caulking products were compatible with glass, steel and precast. “You have to make sure everything functions together as a unit,” Cavecche says.

Precast concrete definitely functions well in this project – especially since cost, speed of construction, sustainability and aesthetics were major factors.

Deborah Huso is a freelance writer who covers home design and restoration, sustainable building and design, and home construction.
In 1972, the United States passed the Noise Control Act authorizing the Environmental Protection Agency (EPA) to regulate major sources of noise to protect public health and the environment. In addition, the EPA issues noise emission standards for motor vehicles used in interstate commerce. The Federal Motor Carrier Safety Administration enforces these standards.

**EPA Maximum Noise Emission Levels: Newly Manufactured Trucks**

<table>
<thead>
<tr>
<th>Effective date</th>
<th>Maximum noise level 50 ft (15 m) from centerline of travel**</th>
</tr>
</thead>
<tbody>
<tr>
<td>January 1988</td>
<td>80 dB(A)***</td>
</tr>
</tbody>
</table>

*Trucks with Gross Vehicle Weight Rating (GVWR) over 10,000 lb (4,540 kg)

**Society of Automotive Engineers Inc. (SAE) test procedure for acceleration under 35 mph (56 km/h).

***dB: noise intensity is measured in decibel units (dB); “dB” is the most common type of scale for measuring sound.

High traffic creates unwanted noise

Numerous studies indicate that the most pervasive sources of noise today are those associated with transportation. Major sources of unwanted and destructive noise emissions originate from:

1. Transportation equipment and facilities;
2. Electrical machinery;
3. Construction equipment; and

Sound-sensitive receivers (typically places with people and/or animals who may be adversely impacted by loud noise) include residential homes or apartments, hospitals, schools, office buildings and nature areas.

When transmitted noise adversely affects the receivers, precast concrete sound barriers may be an ideal solution for noise abatement.

PreCast concrete sound walls, whether reflective or absorptive, are the best choice for noise abatement.

By Evan Gurley
Sound walls are the most effective method of mitigating noise from major sources other than sound cessation or volume control at the source. In North America, concrete sound walls account for nearly half of all noise-abatement walls – and with good reason.

Besides being considered one of the strongest, most durable and versatile materials used in construction, precast concrete sound walls also:

1. Provide the highest noise transmission-loss value compared with other common sound wall materials (concrete's greater mass reduces sound penetrating through a wall by more than 80% compared with wood or steel frame construction)
2. Require a considerably smaller footprint compared with earth berms or other noise-reduction methods
3. Can be designed to blend with urban architecture and natural topography (see “Plants and Precast are a Natural Solution” in Summer 2010 Precast Solutions)
4. Can provide absorptive or reflective qualities on both sides of the wall panel system
5. Provide a lower life-cycle cost and high durability compared with other materials

**Sound wall geometry determines noise reduction**

Noise intensity is measured in decibel units (dB), and the scale in which decibel units are measured is logarithmic. To the human ear, this means that each increase of 10 dB will essentially result in a doubling of the noise intensity. For example, 50 dB is 10 times more intense than 40 dB, and 60 dB is 100 times more intense than 40 dB and sounds four times as loud to the human ear.

<table>
<thead>
<tr>
<th>Typical Sound Levels (in decibels, dB)</th>
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</thead>
<tbody>
<tr>
<td>Threshold of audibility</td>
</tr>
<tr>
<td>Rustle of leaves in gentle breeze</td>
</tr>
<tr>
<td>Average whisper 4 ft. (1.2 m) away</td>
</tr>
<tr>
<td>Restaurant</td>
</tr>
<tr>
<td>Busy street</td>
</tr>
<tr>
<td>Automobile horn 23 ft. (7 m) away</td>
</tr>
<tr>
<td>High-speed express train</td>
</tr>
<tr>
<td>Threshold of painful sounds; limit of ear's endurance</td>
</tr>
<tr>
<td>Jet engine</td>
</tr>
</tbody>
</table>

Precast concrete sound walls are designed to drastically reduce noise emissions generated by major sources from affecting sound-sensitive receivers in one of two ways: absorbing the sound energy or reflecting the sound energy back across the source (away from the receiver) and into the atmosphere.

Breaking the line-of-site from the noise source to the receiver can account for a 5 dB noise-level reduction. After this reduction, sound barriers can achieve approximately 1.5 dB of noise reduction for each additional 3 ft. (1 m) of barrier height. Because sound levels are measured logarithmically, a reduction of 9 dB is equivalent to eliminating about 80% of unwanted sound. A properly designed sound wall can effectively eliminate the majority of unwanted noise emitted from the noise source.
How Sound Walls Work

Both types of sound walls (absorptive and reflective) help to force sound waves take a longer path (over and around the barriers) thereby reducing the amount of sound reaching the receiver; this is called diffraction. Diffraction occurs when sound waves pass an edge, such as wall edges and at the apex of the wall. Sound walls are more efficient at eliminating higher frequencies (shorter wavelengths) from reaching the receiver, since higher frequencies are diffracted at a smaller degree (angle) as compared with diffraction of lower frequencies (longer wavelengths).
In general, a rule of thumb for sound barriers is that noise reduction falls into one of the following categories:

- **ABSORPTIVE WALLS ACT AS SOUND SPONGES**

  Absorptive sound walls allow for sound waves generated by the source to enter the wall structure. As the sound waves travel through the acoustical material or textured surface, they are forced to follow a longer path to the end source (forcing directional changes in the sound waves). Every directional change in the sound waves will decrease the waves’ energy. After passing through a sound-absorbing wall, very low amounts of sound energy remain to re-enter the environment; in this way, less noise reaches the receiver’s ears.

  Materials and finishes that are commonly used for manufacturing precast concrete absorptive sound wall panels and posts include:
  - Textured/stamped concrete surface (double raked, popcorn or fuzzy finish); porous finish; or stamped brick
  - Sound-absorptive aggregates (perlite or vermiculite)
  - Lightweight cellular material
  - Acoustic facing tile
  - Composite materials
  - Fibrous materials (fiberglass; mineral wool; recycled tire rubber; or recycled wood fibers or shavings)

  Big players in sound absorption are the size and the shape of the path of the voids between the aggregate particles or admixtures added to the concrete mix. Fibrous materials produce some of the best results for sound absorption, as they are densely packed and randomly arranged in such a manner that makes a difficult path for the pressure wave in the air to be dissipated.

  The precast concrete absorptive wall manufacturer essentially strives to design an absorptive wall with...
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Reflective sound wall systems can be used to help redirect noise emitted from highway transport to areas that will not negatively affect the welfare of the public. The Florida DOT has identified 21 communities that would benefit from the construction of sound walls along the I-959 and the Florida Turnpike corridors. As part of the I-595 Express Corridor Improvements Projects, a total of 13 sound walls will be built. Two types of precast concrete sound barrier walls will be constructed: nine ground-mounted and four shoulder-mounted walls.

**How sound-absorbing effectiveness is measured**

Sound absorptive walls have been tested and proven to be effective sound-reduction barriers, although there may be an increased cost associated with some absorptive finishes. A challenge for sound wall manufacturers is developing a highly sound absorptive, porous material that will be durable in harsh environments alongside highways in cold climates.

*The Noise Reduction Coefficient (NRC)* determines the amount of energy reflected back toward the noise source and the amount of energy absorbed by the wall material. NRC ratings will have a range between 0 (100% reflective) to 1 (100% absorptive). A precast concrete sound wall with a rating of 0.7 means that the wall absorbs 70% of the noise and deflects 30% of the noise back toward the source. A typical NRC for an absorptive sound wall ranges from 0.6 to 0.9.

*The Sound Transmission Class (STC)* determines the amount of noise energy that is ultimately transmitted through the wall material and the noise energy that reaches the receiver. Sound walls that have a STC rating of 30 or more represent walls in which less than 0.1% of the noise energy is transmitted through the barrier material. Many state DOT specifications require a minimum STC rating of 24.

Absorptive sound wall surfaces avoid the negative effects that may occur with reflective sound wall surfaces. Reflected sound waves may pose a problem, as it is difficult to precisely predict the path of the reflected sound waves. Once a sound wave is reflected...
from a flat surface, numerous variables can affect the direction of the diffracted sound wave. Therefore, sound absorptive walls are less likely to produce uncontrollable and unexpected results.

**Reflective sound walls repel sound waves**

Reflective noise walls are not designed with an absorptive material or surface finish. Consequently, sound reflects off the surface and back toward the noise source or into the atmosphere. The decreased noise level reflected back to the source or into the atmosphere is less than the original noise emission, because some of the noise is absorbed into the wall (natural materials in concrete will absorb some sound) and because noise dissipates over distance. Flat, hard concrete surfaces with no surface textures will reflect noise back to the source or into the atmosphere.

Noise emissions that are reflected back to the source or into the atmosphere may not reflect in a straight-line fashion due to various conditions that affect noise wave diffraction, including: atmospheric variations (temperature, wind gradients); divergence; shielding; the ground effect; and higher and lower frequencies.

Therefore, when designing reflective noise walls, these various conditions must be considered or the reflected sound may actually increase and create more unwanted noise.

Although reflective noise walls do, by definition, redirect noise emissions from a source back at the source or into the atmosphere, if a reflective precast concrete sound wall is properly designed only limited or inaudible (< 3 dB) noise will be experienced at the receiving location.

**Field studies on sound walls**

According to the Retaining Wall Noise Reflection Analysis on I-70/I-71 South in Ohio, potential traffic noise reflections associated with large retaining walls were tested to see if absorptive treatments on segments of the highway would be needed if elevated levels of noise were experienced.

The testing showed that while there was a minimal detectable increase in noise due to deflections, the application of sound-absorptive materials would provide only marginal improvement; that is, the reduction in noise would not be perceptible to the human ear. So in this case, a reflective barrier was sufficient for the project.
Research has been conducted on precast concrete sound walls on both sides of a noise source as well as on only one side. The results were interesting: For properly designed and constructed precast concrete sound walls located on one side of the noise source, residents located on the opposite side of the noise wall perceived that the noise levels had actually increased due to the reflective sound-barrier construction. Field studies have debunked this perception.

Research states that even if all the noise striking the barrier on one side of the road were reflected back to the other side of the highway, the increase in sound would be only about 3 dB. In reality, not all of the acoustical energy is reflected back to the other side; rather, some sound is absorbed by the barrier itself, some sound travels through the barrier and some sound is redirected to other locations.

For properly designed and constructed precast concrete sound walls located on both sides of a highway or noise source, studies show that problems associated with this type of reflective noise are similar to results from studies of one wall. If elevated noise levels are perceived by resident receivers, sound absorptive treatments can be used to eliminate the additional perceived noise.

Attractive precast concrete sound walls are becoming more popular in applications from highways to hospitals. Depending on the particular challenges of the site and the sound source, absorptive or reflective precast concrete wall systems are the most effective engineering solutions for reducing adverse sound impacts on humans and animals.

Evan Gurley is NPCA’s technical services engineer.
The words “floating” and “precast” are not typically used synonymously, but that was exactly the task Jefferson Concrete Corp. faced when the Port of Oswego Authority in New York decided to build a 630-foot dock for Lake Ontario.

The harbor faces the winds and fury of storms that push across the lake unabated for 193 miles. The Port Authority wanted a solid docking system that could not only provide a stable platform for boaters, but serve as a breakwater for the inner harbor.

The Port Authority looked at many options before settling on Marinetek, a Finland-based company that specializes in precast solutions for docking needs, but the company did not have a plant close enough to the harbor to efficiently serve the project. After a careful search, Marinetek chose Jefferson Concrete because it had the expertise to cast the project to its exacting specifications.

The size and extremely tight tolerances made it crucial to execute each step of the process with absolute precision. Eight of the pieces were 65 ½ ft.
long, 11 ft. 9 in. wide and 4 ft. 3 in. tall, weighing in at 103,588 lbs. The two remaining pieces were 52 ½ ft. long, 11 ft. 9 in. wide and 4 ft. 3 in. tall, weighing 81,548 lbs. each.

To cast the pieces, Marinetek shipped a mold from Florida, and throughout the casting process an expert from Marinetek monitored each step meticulously. A deviation of even a ¼ in. on the large Styrofoam flotation voids would cause the dock to list in the water and be unstable.

In order to bear the Marinetek name, Jefferson Concrete needed to provide an exact finish that would be consistent with other Marinetek products worldwide. The Styrofoam floats underneath were coated to keep out marine organisms and every piece of metal used was galvanized to inhibit corrosion.

Handling each piece required devising a cabling system that could lift the massive pieces at no more than 3 degrees from vertical, with only two acceptable blocking areas for storage and shipping.

Despite all the challenges, the dock pieces performed exactly as desired once in place on the lake, with each floating above the minimum 21 in. of clearance required and perfectly level. The result is a beautiful, low-maintenance surface that is so stable it does not even appear to be floating.

**Company Profile**

**Jefferson Concrete Corp.**
22850 Murrock Circle
Watertown, NY 13601
(315) 788-4171
www.jeffconcrete.com

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**ABOVE GROUND**

**SECOND PLACE**

**Virginia Tech Hahn Hurst Basketball Facility**

**Location:** Blacksburg, Va.

Virginia Tech University officials knew one thing for sure when they decided to build a new practice facility for their basketball teams: They wanted it to stand out as one of the best practice facilities in the country.

To achieve that lofty goal, the university’s project manager specified a top-of-the-line interior, but also turned to Cannon Design to create an exterior that blended with existing buildings on campus but also created a “wow” factor.

Architect Tae Jung created a design that included incorporating “Hokey Stone,” a natural stone facade that can be found on buildings throughout the campus, with precast concrete panels that matched the stone. To make the building truly unique, Jung developed a series of shapes and figures that were to be cast directly into the panels to give it a signature look. The design called for Virginia Tech logos, basketballs, the school crest and shapes that resemble the keys of a piano to be cast directly into the panels.

Smith-Midland Corp. hand-built the custom wooden forms that would give the panels the desired look. The forms were created in a couple of weeks, and a mock-up was provided for the school to review.

Over the next eight weeks, the plant painstakingly cast each of the panels, ensuring the finish was of the highest quality and 100% consistent, and that each cast shape was crisp. When the project was completed, it exceeded expectations. “We had a really good reaction,” Jung said.

**Company Profile**

**Smith-Midland Corp.**
5119 Catlett Road
P.O. Box 300
Midland, VA 22728
(540) 439-3266
www.smithmidland.com
ABOVE GROUND
THIRD PLACE

THE NAVAL FACILITIES ENGINEERING COMMAND SOUTHWEST BRIG

Location: San Diego, Calif.

In 2010, the Naval Facilities Engineering Command Southwest set out to add 100,000 sq. ft. to its 200,000 sq. ft. prison facility. The No. 1 priority was to significantly decrease construction time while increasing the quality control, maintaining structural integrity and aesthetic appearance, as well as provide a more durable and low-maintenance facility.

The request was a tall order, but entirely possible to achieve with precast concrete. The housing facility, which was specially designed as a total precast concrete building, added 120 beds for men, a separate 80-bed unit for women, a new galley, two mess decks to feed 200 prisoners, two medical examination rooms and additional offices for correctional staff.

Among the pieces cast for the project by Oldcastle Precast Modular were 200 five-sided precast concrete cells, monolithic balconies and 49 wall panels to create the parapets to support the roof structure, which wrapped the perimeter of the secured building envelope.

The cell modules and other precast building components were produced in highly innovative precision forms, using 5,000 psi concrete and steel reinforcing. They were then shipped to the site fully fitted with pre-installed furniture, plumbing, lighting fixtures, special anti-graffiti epoxy interior wall paint and exterior side wall insulation. This allowed the project to finish one week ahead of schedule despite the short timeline.

The project was designed to achieve LEED Silver certification and to meet the military’s Anti-Terrorism/Force Protection standards. The state-of-the-art facility incorporates precast cells that contain recycled content and regionally harvested materials, and a parking lot made from recycled asphalt and concrete.

The precast-based process reduced labor costs, on-site construction costs, and erection and finish work time by at least one-third. It also overcame shortages of construction workers and provided the Navy with a durable, low-maintenance and highly secure facility.

Company Profile

Oldcastle Precast Modular
200 Keystone Drive
Telford, PA 18969
(215) 257-2255
www.oldcastleprecast.com

UNDERGROUND FIRST PLACE

FLXX FIRE-FOE

Location: Eagle, Colo.

The goal of underground-tank precasters has always been to create a 100% watertight structure, but Front Range Precast turned that concept on its head when it created an innovative new product for fire departments in its region.

In urban settings, firefighters are able to simply hook up to a hydrant that draws from a municipal water supply. But the task of fighting a blaze in a rural setting makes the task much more difficult. With no access to municipal water, trucks must make costly trips to and from the nearest water supply, and the results can be devastating.

To combat this common problem, the precaster developed a precast concrete tank that
did the exact opposite of most tanks. Cast with 100 uniform, tapered holes distributed evenly around the 2,800-gallon tank, the new structure allows ingress of water from a natural source such as a creek or river. The tank can be poured and stripped, and the perforations cleared in just two days.

A tank was installed in rural Eagle, Colo., outfitted with a dry hydrant and set next to the water source so that the groundwater flows over, and surrounds, the tank. The excavation was lined with a filter fabric and backfilled with large, clean rock aggregate that acts as an additional filter. The installation also has manhole access to the tank, as well as an air vent with an insect screen.

After installation, it was time for testing. With their hoses connected to the tank, the firefighters began pumping with 500-gallon and 1,000-gallon nozzles. The water level did not drop in the tank. The combination of automatic recharge and storage make the tank perfect for fighting fires such as the devastating Four Mile Canyon fire that occurred early in 2010 in Boulder, Colo.

Company Profile
Front Range Precast
5439 North Foothills Highway
Boulder, CO 80302
(303) 442-3207
www.flxx.com

UNDERGROUND SECOND PLACE

Rancho Cucamonga Pedestrian Undercrossing

Location: Rancho Cucamonga, Calif.

When the San Bernardino Associated Governments (SANBAG) decided to add a second rail line to the Southern California Regional Rail Authority’s Rancho Cucamonga Station, it provided a much-needed boost to daily travelers and helped greatly increase productivity and revenue.

However, it also created a major challenge that required an innovative solution as passengers were forced to cross the unguarded railroad tracks by foot. In order to ensure the safe flow of pedestrians using the station, it was determined that an underground passageway was needed.

Given the extensive daily rail traffic, the line could be shut down for no more than 48 hours, making time of the essence. In addition, the tunnel needed to structurally withstand the forces of one of the busiest rail lines in California; meet aesthetic requirements on the interior; and meet stringent, multi-layer inspections on a tight budget.

Only one material could meet all the requirements, so SANBAG chose precast construction and commissioned StructureCast due to its proven track record. A box culvert cast into 16 sections was produced, including skylights with cast-in block, approach slab lintels and platform units. The segments,
weighing 58 tons each, needed to be cured, pre-fit, delivered and ready for installation at 7 a.m. on the first day of construction in order to conclude installation by midnight – a total of 17 hours for installation of the precast segments.

All sections were inspected and loaded onto trucks the day prior to delivery. The delivery was staggered with the first piece arriving on site at 7 a.m. and subsequent pieces arriving throughout the day. Installation started on time and the last piece was set just after 11 p.m. The city, SANBAG, and even the rail line were all pleased with the results. The use of a precast concrete design and the “just in time” delivery system allowed this project to be an overwhelming success.

Company Profile
StructureCast
8261 McCutchen Road
Bakersfield, CA 93811
(661) 833-4490
www.structurecast.com

UNDERGROUND
THIRD PLACE

Utility Concrete Products was the first company to install a StormTrap system, and has now been chosen to install the first StormTrap II product. The newly designed product offers additional benefits that ensure precast remains the best option for specifiers.

For Canadian National’s new intermodal automated gate system in Chicago, the system offered a 20% savings versus a cast-in-place option, and was chosen over steel or plastic. Despite the installation crew being new to the system, the StormTrap II system was installed in just one day, instead of several weeks for a cast-in-place system.

There was also no time needed for curing or coverage to final grade. Once installed, the surface was immediately ready for construction traffic loads. The system installed is able to store 35,847 ft³ of stormwater and is comprised of 78 total pieces. Each piece is 5 ft. 2 in. tall and pieces were cast in three lengths.

Another advantage is easy access to the system after installation due to the clear spans and open galleries the system allows. Throughout the life of a stormwater detention system, debris and other settlement from stormwater collects in the storage systems. The arch, matrix boxes and corrugated pipe configurations of other materials make it difficult, if not impossible, to clean.

Company Profile
Utility Concrete Products, LLC
2495 West Bungalow Road
Morris, IL 60450
(815) 416-1000
www.utilityconcrete.com

ABOVE GROUND
HONORABLE MENTION

Company Profile
Oldcastle Precast Modular
200 Keystone Drive - Telford, PA 18969
(215) 257-2255 - www.oldcastleprecast.com
ANDREW S. ROSELL  
MEMORIAL FIRE BOWL  
Location: Diamond Lake, Wash.  
Company Profile  
Wilbert Precast  
2215 East Brooklyn - Spokane, WA 99217  
(509) 325-4573 - www.wilbertprecast.com

MALIBU LEGACY PARK  
Location: Malibu, Calif.  
Company Profile  
Universal Precast Concrete, Inc.  
P.O. Box 641296 - San Jose, CA 95164  
(408) 799-8888 - www.universalprecast.com

NORTH MAIN CORONA METROLINK PARKING STRUCTURE  
Location: Corona, Calif.  
Company Profile  
StructureCast  
8261 McCutchen Road - Bakersfield, CA 93311  
(661) 883-4490 - www.structurecast.com

UNDERGROUND HONORABLE MENTION

CITY OF GONZALES PUMP STATION #19  
Location: Gonzales, La.  
Company Profile  
Gainey’s Concrete Products, Inc.  
28021 Coker-Vail Road - Holden, LA 70744  
(225) 567-2700 - www.gaineysconcrete.com

VERONA AVENUE RECONSTRUCTION  
Location: Elizabeth, N.J.  
Company Profile  
Garden State Precast -  
P.O. Box 702 - Farmingdale, NJ 07727  
(732) 938-4436 - www.gardenstateprecast.com

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