Key components of revitalizing Cascades Park included 40,000 sf (4,000 m²) of permeable interlocking concrete pavement plus super sized accessible playground equipment.

Permeable Pavers Score a Triple Double* in Bloomington's Cascades Park

Sometimes everything doesn't fit into the space allotted. This was the case with revitalizing Lower Cascades Park in the famous Indiana University basketball City of Bloomington (pop. 72,000). New life to a small, historic park included installing massive playground equipment and more parking. Asphalt was not a slam dunk for parking since there wasn't room for more paving and a detention pond. The solution immediately rebounded back as 40,000 sf (4,000 m²) of permeable interlocking concrete pavement. Indianapolis-based Landscape Architect Debra Schmucker, President of Cornerstone Planning & Design and commissioned by the City to draw up plans for the revitalized park found the sixth man in permeable interlocking concrete pavement.

Completed in September 2005, the project represents the first permeable pavement project built by the City for the Department of Parks and Recreation. Appropriately named for the lovely waterfalls that run through it, Cascades Park was Bloomington's first established in 1924. The Park was created to block the expansion of a nearby limestone quarry that would have tarnished this gem. In the Depression years, WPA and CCC took abundant limestone from the quarry for make work projects including walls that line Cascades Creek that bisects the park, shelters for drinking fountains and picnickers (see Figure 1) and a bathhouse for a swimming pool that once existed there.

According to Dave Williams, the City's Director of Operations and Development in the Parks and Recreation Department, Bloomington is a very 'green' community. Two issues enabled the City to consider permeable pavement. First, the City had recently spent $5 million for a stormwater detention and park project upstream from Cascades Park to help improve the water quality of Cascades Creek running through it.

Mr. Williams noted that the project utilized "five pre-treatment stormwater cleansing structures, detention ponds, two wetlands, thousands of wetland plants all in an effort to clean the stormwater before it headed into Cascades Creek. Taking the easy route and building asphalt lots and watching the oil, gasoline and other contaminants flow into the creek didn't make sense if we were going to continue our efforts to improve the stormwater quality and park ecology."

The second issue concerned limited space to construct two small detention ponds likely required to handle stormwater flows from asphalt lots in the park. "Removing already limited green space in

*Triple Double: when a basketball player scores double-digits in 3 categories during one game (points, *assists* and *rebounds* are most common, but it can also be *blocks* or steals); a sign of great versatility – from *Basketball Made Simple: A Spectator's Guide*

Permeable Pavers Score a Triple Double *Continued*

Figure 1. The permeable pavement eliminated the need for detention ponds that wouldn't fit on the site if conventional impervious pavement was used. Once a WPA project, the renovated picnic shelter make it easier to enjoy the huge trees, creek and waterfalls in the park.

Figure 2. Cascades Creek bisects two permeable interlocking concrete pavement parking lots in the park joined by this foot bridge. The filtering action of the permeable base protects the lovely Creek which passes through waterfalls.

the park to use for detention didn't make sense. Detention ponds (not required to be fenced in Indiana) were also a liability, plus aesthetic and maintenance concern," Mr. Williams noted. In addition, permeable pavement would promote the longevity of towering trees in the park.

Ms. Schmucker researched permeable pavements for the City. Research pointed towards permeable interlocking concrete pavement with high infiltration capacities. "Elimination of detention facilities, an acceptable appearance for this park environment (a major concern for the City); all of these design criteria helped satisfy the ongoing goal to think progressively and set a good example for the public," according to Mr. Williams. Costs were found to acceptable since the pavement combined paving and drainage costs into one facility. Moreover, permeable interlocking concrete pavement gained the approval of the City's utilities department without providing detention.

Other permeable pavement types were considered including porous asphalt but lack of applications in the immediate area and concerns with freeze thaw cycles eliminated this option. Porous concrete was proposed by a local supplier after the project bid with pavers. The City stayed with permeable interlocking concrete pavement because it would provide a cost-effective, visually attractive solution.

The mechanically installed permeable interlocking concrete pavement consists of 3⅛ in. (80 mm) thick paving units bedded on 2 in. (50 mm) of chip gravel, a 4 in. (200 mm) thick base of No. 57 stone and 5 in. (125 mm) thick No. 2 stone subbase. The openings in the paving units are filled with the same material as that used for the bedding. Each aggregate layer was compacted and pressed into the one below. Geotextile was not used between the soil subgrade and subbase since the No. 2 stone acted as a filter layer. Figures 3 and 4 illustrate mechanical placement of the pavers on the stone bedding layer.

Figures 3 and 4. Permeable interlocking concrete pavement was mechanically placed over a 2 in. (50 mm) of chip gravel, a 4 in. (200 mm) thick base of No. 57 stone 5 in. (125 mm) thick No. 2 stone subbase.

Permeable Pavers Score a Triple Double *Continued*

Figure 5. A soldier course against the cast-in-place concrete curb facilitates mechanical placement by proving space for machine clamp to insert paver layers without interfering with the curb.

ICPI members supplied the permeable pavers and the installation subcontractor, also an ICPI member, was a veteran at mechanically installing permeable interlocking concrete pavements including some of the largest projects in the country. The project general contractor was Tri-County Builders of Bedford, Indiana, who has done prior projects for the City of Bloomington.

Borings indicated silty clay soils with adequate infiltration. The soil subgrade was graded to 1% slope to allow for some infiltration and eventual drainage. The soil subgrade is mixed with bedrock so a 4 in. (100 mm) diameter perforated drain pipe was installed around the perimeter of the parking lot at bottom of the base to drain overflows.

No specific drainage design criteria were applied to establishing the storage capacity of the open-graded, crushed stone base. This wasn't viewed as critical since runoff from practically all storms would be detained, some infiltrated into the soil subgrade and the remainder filtered by the base and slowly released. The engineers in the City's utilities department were satisfied with the specifications provided for storage and infiltration provided by Ms. Schmucker. Toward project completion, the remnants of hurricane Katrina dumped 3 in. (75 mm) of rainfall on the park in one day. The proof of the system working was no ponding anywhere in the three parking lots built to accommodate 125 cars. While witnessing this, Mr. Williams said, "It was at that moment that I knew we had made a good decision."

The total park renovation cost $820,000 including playground equipment and furnishings. The pavers and bedding material with installation were bid at $192,500. Walks and curbs were $80,271 and $90,000 for overall site work including parking lot grading, the stone base and soil erosion stabilization. A significant portion of the contract included new playground equipment.

Prior to renovation with permeable pavement, the park had an insufficient number of parking spaces to support programmed activities. Its old condition, somewhat remote location and lack of programmed events didn't rank the park as the most popular place to recreate among Bloomington's citizens. The recent renovation brought additional parking, the most accessible playground equipment in the City's park system, improved lighting and better restroom facilities.

With this breath of new life, the Parks and Recreation Department is planning events for 2006 including concerts and special programs. In the meantime, the park and its pavement have received positive reviews and comments from the public. The City's Environmental Commission applauded the use of permeable pavement on the project. And they should since permeable interlocking concrete pavement scored a net-only, three-point goal by eliminating detention, preserving stream ecology and giving new purpose to an historic place. ❖

Figures 6 and 7 demonstrate permeable interlocking concrete pavement passing two important tests. The pavement passed the water infiltration test when water from the truck immediately disappeared into the surface. Just a few days prior to this test the parking lot took in a 3 in. (75 mm) rain storm with no runoff. The pavement also passed the high heel test demonstrating compatibility between fashion and environmental responsibility.