Autumn Trails Pioneers

PICP in Streets

Autumn Trails in Moline, Illinois demonstrates the cost-savings of permeable interlocking concrete pavement to developers, cities and homeowners.

George Bialecki, Jr. takes green building seriously. As developer of age 55+ communities, environmentally responsible design saves his projects money and sells his energy-saving units faster. For example, permeable interlocking concrete pavement (PICP) saved thousands of dollars by eliminating conventional stormwater drainage at Autumn Trails, an independent living community with 32 homes located in Moline, Illinois. The savings was so great that it made PICP cost-competitive with conventional asphalt and concrete pavements.

Figure 1 illustrates the plan for Autumn Trails developed by Mr. Bialecki's company, Alternative Energy Builders (www.123aeb.com) based in Moline, a leading-edge firm in environmentally responsible and energy-efficient development for those over 55. His projects have received Energy-Star® certification, a U. S. federal government program that recognizes energy efficiency in buildings.

At the invitation of the Chinese government, Mr. Bialecki has been chosen to represent the United States in the first International Sustainable Energy Demonstration community in the world before the 2008 Olympics located in Beijing, China. This "Future House" community is bringing ten nations together to showcase their country's best energy saving building practices. A few of the countries included are the U.S., China, Spain, Germany, England, Italy, South Korea and Japan.

Future House USA will not only be introducing PICP within their driveway and walkways but is working to assist the Chinese Ministry of Construction to incorporate PICP throughout the streets of this entire community.

Mr. Bialecki, states, " It is not only a must for the United States to be represented in this global collaborative effort, but most importantly, Future House USA must be focused on showcasing a home that will unify the international community in our collective search for housing and energy solutions." He also noted, "Across the globe, we all breathe the same air and drink the same water. It only makes sense that we all work together, as one world, to resolve our environmental concerns." This project is anticipated to attract over 5 million visitors from around the globe.

Even as an infill project in an older area of Moline, Autumn Trails sold out before construction began because operating costs for buyers were reduced as much as 85% compared to conventional building designs. Features such as geothermal heating made the highest winter monthly heating bill $40. Mr. Bialecki's designs also include reduced water consumption, improved indoor air quality and extensive use of recycled materials plus PICP to reduce runoff.

The key to his success is a marketing Home Biology 101™ where buyers are introduced to housing as a living organism that breathes, absorbs environmental elements and produces waste. Championed by futurist Buckminster Fuller

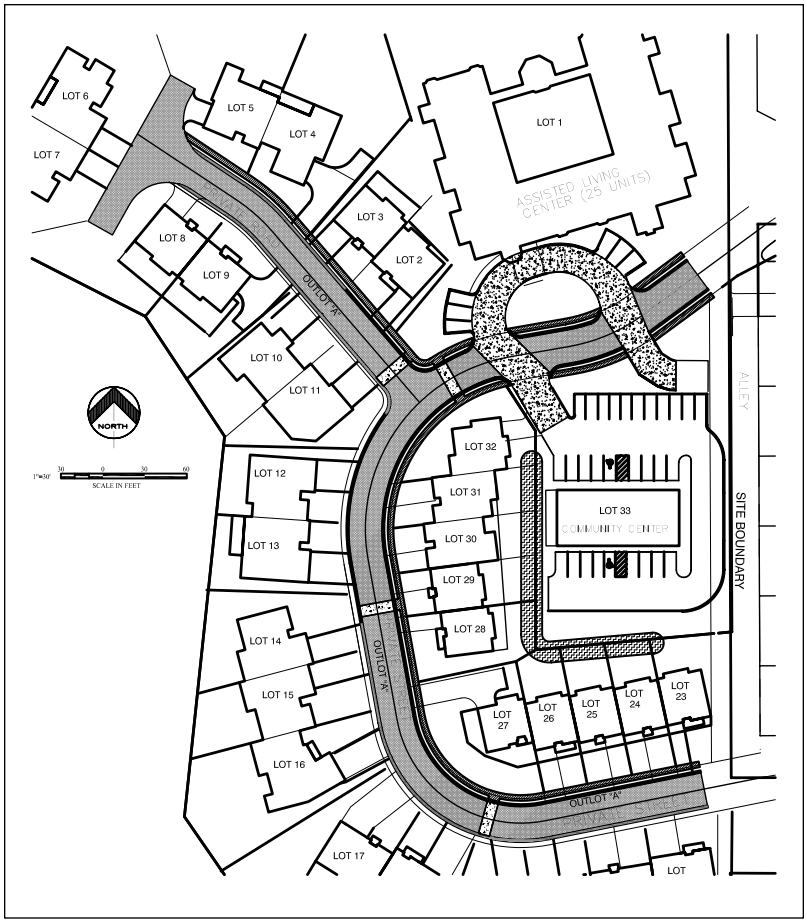

Figure 1. Autumn Trails includes independent and assisting living units tied together with PICP streets.

Item	PICP	Concrete	Asphalt
Paving/sf	$2.25	$8.00	$3.00
Excavating/sf	$1.00	$1.00	$1.00
Stone/sf	$2.00	$1.50	$1.50
Installation/sf	$4.00	(in paving cost)	$1.50
Curbs	$1.50	$1.50	$1.50
Maintenance	$0.20	0	Not known
Replacement	None	None	Every 12 years
Detention/Retention required	None	Yes	Yes
Storm Sewer System/sf paving	None	$3.00	$3.00
Total/sf	$10.95	$14.00	$11.50
Total/linear foot – municipal street	$171	$218	$179
Total/linear ft for 30 ft wide street	$230	$280	$230

Table 1. Cost Comparison of Pavement Systems for Autumn Trails, Moline, Illinois

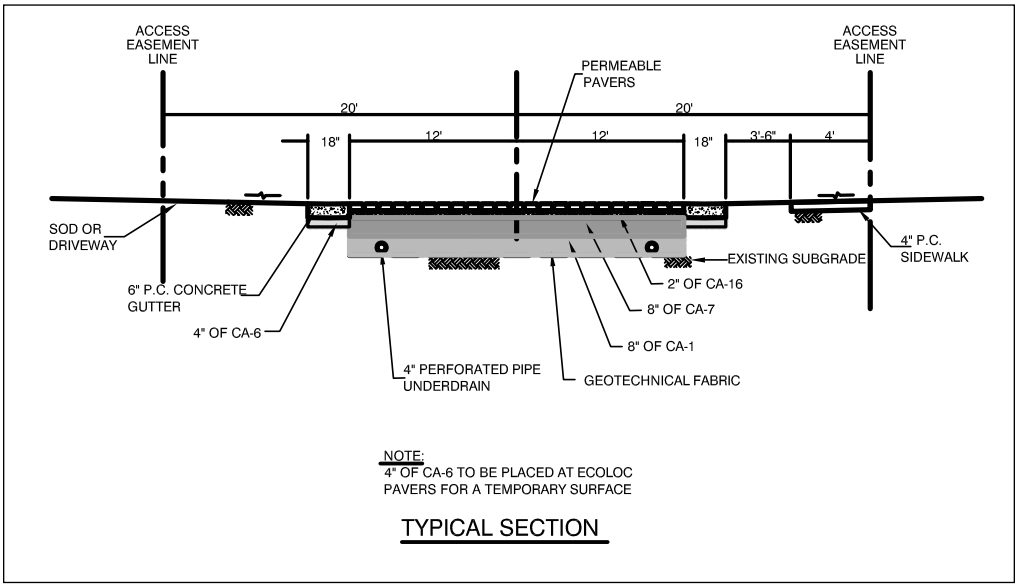

Figure 2. Typical PICP cross section includes a substantial base thickness for water storage and infiltration. The water and sanitary sewer lines run under the street.

Cost Savings from PICP

Mr. Bialecki selected PICP for many reasons. First and foremost, PICP was a great fit into his environmentally responsible approach while yielding significant cost savings. These include eliminating stormwater runoff fees and the burden on Moline's aged storm sewer system. By eliminating a detention pond more land was available for income-generating housing units at Autumn Trails.

in the 1960's, Mr. Bialecki translates this concept into reality by selecting products and systems that better respect the environment. Global environmental concerns are taken seriously by designing low-energy and low-consumption lifestyles for his customers. He knows his buyers are keenly aware of dwindling fossil fuel resources and increasing energy costs, decreasing water resources and carbon-emissions that impact global warming; and they certainly know those costs impact their checkbooks. Customers are willing to pay about 10% more initially than conventional construction for residences with lower operating costs using energy efficient designs and low-impact development tools such as PICP.

PICP met the municipal requirements for pervious/impervious ratio cover. Thanks to pervious soils, PICP eliminated storm sewer inlets and pipes. The cost comparison in Table 1 for the 39,000 sf or 2,500 lf (3,900 m^2 or 762 m) street portion of the Autumn Trails project demonstrates that savings which made PICP cost-competitive with asphalt.

In past projects, Mr. Bialecki found himself "… removing other people's stormwater. Whatever ran off from others' property became my problem and my cost to manage. Autumn Trails takes a different approach where we don't make our runoff someone else's problem, mostly because there is no run-

		CA-16	CA-7	CA-1
	Function	Bedding layer	Base reservoir	Subbase reservoir
Sieve Size	3 in. (76 mm)			100
	2½ in (63 mm)			95 ±5
	2 in. (50 mm)			60 ±15
	1½ in. (38 mm)		100	15 ±15
	1 in. (25 mm)		95 ±5	3 ±3
	½ in. (13 mm)	100	45 ±15	
	⅜ in. (10 mm)	97 ±3		
	No. 4 (4.75 mm)	30 ±15	5 ±5	
	No. 16 (1.18 mm)	2 ±2		

Table 2. IDOT Course Aggregate in Percent Passing

Figures 3 and 4. Compaction equipment completes the base surface prior to placing the bedding layer and screeding it smooth to receive the permeable pavers.

off thanks to the permeable pavers." City officials approved PICP and eliminating drainage inlets and pipes. Since the PICP street is privately owned and maintained by the community, it was difficult for city officials to object.

Autumn Trails features 39,000 sf (3,900 m^2) of 3.125 in. (80 mm) thick PICP units over a 2 inch (50 mm) thick bedding of Illinois Department of Transportation (IDOT) coarse aggregate CA-16. The CA-16 was also used to fill the paver openings. This material has an infiltration rate of over 500 in./hr (1270 cm/hr). When placed in the openings, this material yields an approximate effective infiltration rate of at least 50 in./hr (127 cm/hr). Even with a worse-case estimate of 90% reduced surface infiltration after decades of use, the CA-16 stones in the PICP openings are expected to maintain at least a 5 in./hr (127 mm/hr) surface infiltration rate, well above most rainfall events for Moline, Illinois.

The open-graded crushed stone base and subbase act as a reservoir to store and infiltrate water into the soil subgrade. The base consists of 8 in. (200 mm) of CA-7 over a subbase of 8 in. (200 mm) of CA-1. The CA-1 has perforated pipe running through both sides of its cross section to facilitate movement of excess water to French drains. The subbase rests on geotextile to separate it from the adjacent soils. Figure 2 shows a typical cross section.

The gradation of the CA-16, CA-7 and CA-1 enable each to choke into the layer beneath, thereby providing a stable base for the pavers and vehicles. The gradation of each aggregate type is shown in Table 2. The base and subbase together have an estimated storage volume (void space) of about 40%. Therefore, their total thickness, 16 in. (400 mm), can store about 6½ in. (165 mm) of rainfall coming from roofs, sidewalks and driveways. This storage volume accommodates common rainstorms and most heavy ones. The pavement is designed to overflow and drain at one end should there be saturated soil and base conditions during heavy rains. There is a small retention pond to catch overflows and that water is used for irrigating lawns.

Construction

An unusual construction aspect was the pavement was built in winter. Thanks to precast concrete units manufactured by an ICPI member in a factory (and not on-site) the pavers were ready for installation regardless of the outside temperature. A source of unfrozen aggregate was available nearby and the open-graded pavement base layers and pavers were placed in the winter months. This reduced the construction schedule by months, positively affecting financing costs and accelerating the opening date. This would not have been possible with conventional or pervious concrete and asphalt.

The base layers were placed and compacted with a 10-ton roller. Figure 3 shows the compaction process. After the CA-1 and CA-7 layers are

Figure 5. The permeable interlocking concrete pavers are supplied and installed in layers on the screeded bedding material, pea-sized aggregate (bedding sand is never used in PICP). Note the snow on the pavers doesn't interfere with installation and the border course against the concrete curb provides a finished edge.

compacted, the CA-16 is spread and screeded. The start of this process is illustrated in Figure 4. After the 2 in. (50 mm) thick CA-16 bedding layer is in place, the units were supplied to the project in a ready-to-install laying pattern. Layers of pavers are brought to the site stacked on pallets and each layer is clamped and placed by a mechanical installation machine shown in Figures 5, 6 and 7.

Once the pavers are in place, they openings are filled with the small CA-16 stones. Figure 8 shows this process. Excess stones are removed from the paver surface and the pavers are compacted with a plate compactor. Unlike pervious concrete which must cure in above freezing temperatures for seven days prior to traffic, the PICP surface is ready for vehicles after compaction.

An essential aspect of PICP construction is keeping the open-graded base materials free from sediment during placement and construction. This was addressed by building a temporary gravel road around the rear of the development for use by construction vehicles. According to Mr. Bialecki, "It's really a simple matter of informing your subcontractors ahead of time about where they should and shouldn't drive. The temporary road kept our tradesmen off of the permeable paving and enabled full access to the houses. In the end, the trades were excited to be a part of such a ground-breaking experience that we even saw them bringing family and friends to the site."The decision to use PICP came late in the project design. Mr. Bialecki's landscape contractor, Bob McLean, owner of Twins Landscaping and Design, introduced the idea. His recommendation was supported by successful PICP projects built by ICPI members at Morton Arboretum in Lisle, Illinois and Dominican University in River

Figure 6 and 7. Mechanical installation equipment places ready-made layers of the concrete pavers. The equipment generally reduces paver installation time by 50% to 70% compared to manual installation.

Figure 8. The paver openings are filled with the small stones (CA-16) and excess stones are removed from the paver surface prior to compaction.

Forest, Illinois. These raised Mr. Bialecki's confidence in using PICP at Autumn Trails. Together, Mr. Bialecki and Mr. McLean teamed up to design and install the PICP and hope to bring PICP's installation more into the mainstream.

He noted that snow melts more quickly on PICP because the water can drain directly into the pavement. The impact of this feature on reducing snow-plowing costs is likely to be positive and slip hazards from ice are definitely reduced. There's been no problem with pavement heaving or settlement because the water doesn't freeze in the base. The heat from the earth helps keep the water flowing. Snowplowing is done as with any other pavement.

While there are many PICP parking lot projects across the U.S. and Canada, Autumn Trails is one of the first successful PICP street projects. PICP has the structural capacity for low-volume streets and higher volumes under stabilized bases. As with Autumn Trails, PICP is part of a green building solution that works toward saving money for the developer and residents. Moreover, this street project with city-owned ones in Portland, Oregon and Waterford, Connecticut send a unique challenge to municipalities to use PICP in city streets as a means to comply with national, provincial, state and local stormwater regulations while reducing drainage costs. ❖