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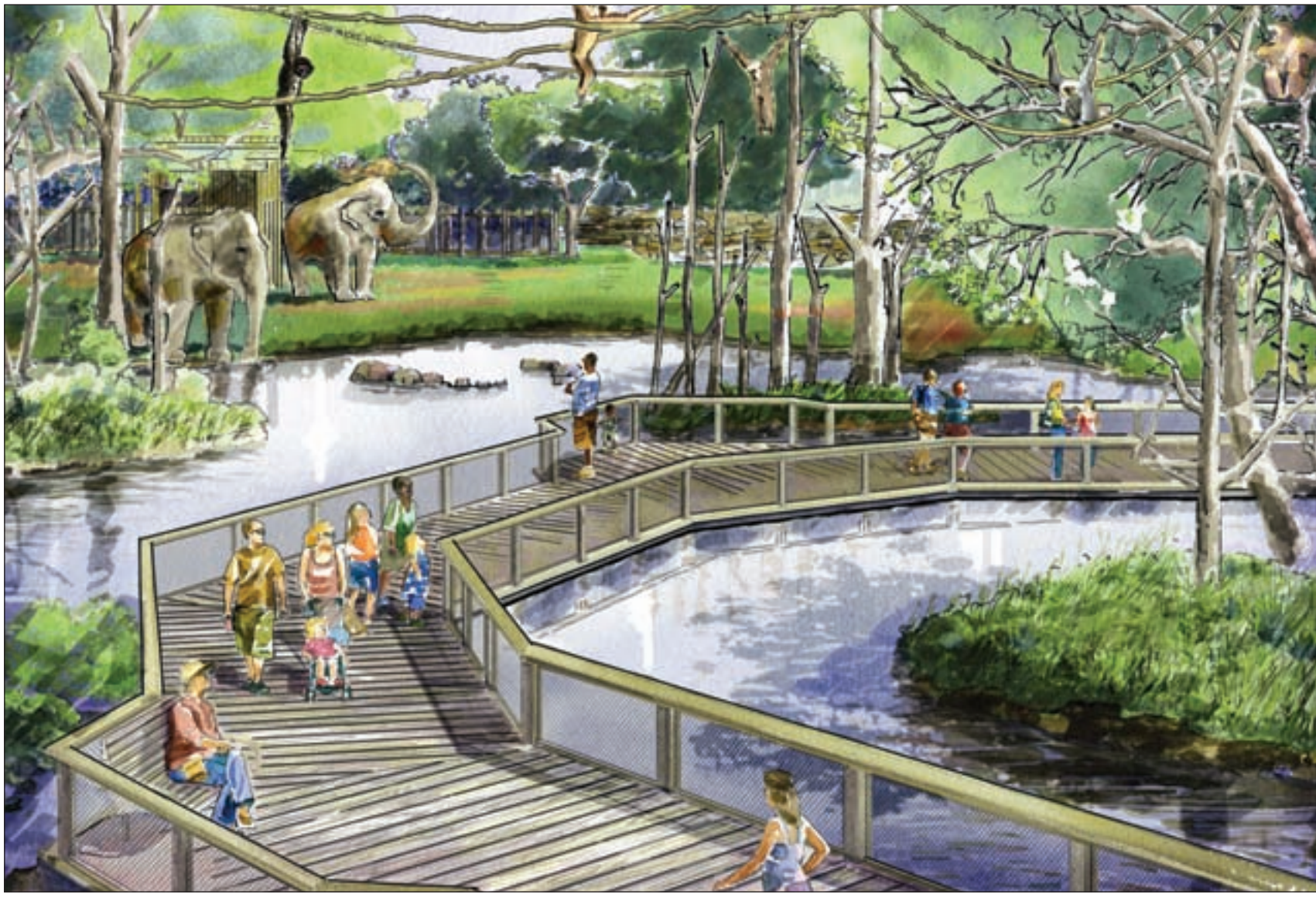
| CASE STUDY |

PEX pipe project at Denver Zoo wins award



The Denver Zoo's new 10-acre Asian Tropics complex uses sub-surface heating systems to provide comfort and safety for both visitors and animals. The indoor heating and outdoor snow and ice melting systems utilize crosslinked polyethylene (PEX) pipe encased in various thermal mass types, delivering heat energy through warm fluid transfer. Supporting the zoo's core ideals to be environmentally conscious in all operations, the PEX piping systems allow for reduced energy consumption, lower upfront installation and ongoing management costs and extended life-cycle, designed to last as long as the buildings, with minimal maintenance.

Initially, the major zoo expansion faced considerable challenges to meet piping construction schedules and stay on budget, considering that nearly six miles of pipe were required. Once the engineer and installer realized that the flexible, large diameter pre-insulated PEX pipe, available in long coils, could reduce both installation time and costs as compared with traditional steel or copper rigid piping systems, economical goals were within sight.

The project used some 31,000 feet of PEX pipe. Because of the project's scope, performance capabilities, cost-savings and sustainability features, it was acknowledged as the Plastics Pipe Institute's (PPI) building and construction division 2011 "Project of the Year." The award was presented to the pipe system's equipment manufacturer, REHAU Inc. (Leesburg, Va.), during PPI's annual meeting in April 2012. PPI is the major trade association representing all segments of the plastic pipe industry; its annual awards program cites exceptional projects.

"The Denver Zoo wonderfully displays the advantages and benefits possible through application of PEX pipe systems," stated Tony Radoszewski, executive director of the PPI. "Use of this technologically advanced pipe helps provide inside comfort to zoo animals and outdoor safety to visitors, and the project clearly demonstrates the attributes of PEX systems versus all others. PEX pipe provides faster installation, has the flexibility to avoid obstacles and utilities and enables the efficient transfer of the heated fluids to save energy, one of the major objectives of the project. These system capabilities align perfectly with the core values of the Denver Zoo organization, which is committed to fostering progressive sustainability efforts. The PEX pipe provides a smart, green and reliable system that advances this commitment. The zoo has been recognized with numerous awards as the greenest in the country."

Duplicating Asia in Denver

The Asian Tropics complex opened in June 2012 and allows visitors to

Continued on p 58

Continued from p 56

explore the rich history of animals in Asian culture. Designed to provide a natural environment for the animals, the complex also features numerous aspects of sustainable design.

The overall design of the heating and melting systems is expected to save $150,000 a year in energy and waste hauling costs by converting more than 90 percent of the zoo's waste into clean, usable onsite energy and reducing the zoo's annual landfill contributions by 1.5 million pounds. This, along with retaining heat through the use of the PEX radiant systems, has led the zoo to seek LEED certification at the Platinum level for the Toyota Elephant Passage at the Platinum level, the highest certification achievable from the U.S. Green Building Council.

The Asian Village is home to three large-animal habitats for Asian elephants, Indian rhinos and Malayan tapirs. These feature shade structures, deep pools for wading and swimming, mud wallows, scratching posts and even hot tubs for cooler days. To accomplish this, nearly 3,000 feet of large-diameter pre-insulated PEX energy-transfer pipe is used to distribute heated fluid to various areas and buildings within the complex from a heat plant including four gas-fired 500,000 Btu/h condensing boilers. The large diameter PEX was installed using an electrically-fused polymer fitting system with an integrated resistance wire. The fusion machine automatically sets the welding parameters and heats the wire to the required temperature to fuse the sections together.

In parts of the complex, more than 13,000 feet of REHAU's 5/8-inch oxygen barrier crosslinked polyethylene pipe was used for the snow and ice melting systems installed in all the pedestrian walkways, bridges and exhibit entryways, as well as in the dock area, to provide a safe, clear path for visitors and zoo employees during snowy months. Nearly 15,000 feet of ½-inch RAUPEX O2 Barrier pipe was used for the radiant systems in the rhino and elephant holding buildings, which will provide a warm, familiar climate for the animals during the Colorado winter season.

"We understand that the design engineers for this project considered using rigid metal pipes of copper and steel," stated Radoszewski, "which would have required extensive fabrication, welding, insulating and waterproofing onsite. More importantly, rigid metal pipes would not have had the flexibility to follow the contours of the land and avoid existing obstacles and utilities."

Heating & Plumbing Engineers Inc. (Denver) was the mechanical contractor responsible for the installation of the PEX piping systems. "The flexible nature of PEX, particularly when compared with alternative materials like insulated copper and steel, was crucial when working around the zoo's existing utilities," said Porter May, preconstruction and project manager at the company. "A rigid piping system would just not have been an option, given the gains and losses of elevation, as well as the severe angles to which the underground piping needed to conform." ●