NEW SNOW MELT PROJECTS IN KLAMATH FALLS, OR

Tonya L. Boyd
Geo-Heat Center

INTRODUCTION

A $1.3-million dollar project consisting of two bridge replacements was a joint effort by the Oregon Department of Transportation (ODOT) and the city of Klamath Falls. The two bridges replaced are on Eberlien Avenue and Wall Street, which spans over the A canal that furnishes irrigation water to the farmers south of town. The replacement of the Wall Street Bridge and approach road incorporated a snow melt system designed by Meredith Mercer of ODOT using geothermal for the street, bridge deck and sidewalks. Due to the location of the A canal, the Wall Street approach road has about a 13.25% grade to the bridge and can be very hazardous during the winter season. The cost of the snow melting system for the Wall Street Bridge was $170,000 for the hydronic tubing placement, and $36,000 for the mechanical equipment and plumbing. This is the second bridge project in Klamath Falls, which will utilize geothermal for snow melting (Lund, 1999). The geothermal heat will be provided by the city of Klamath Falls District Heating System. The project was completed in June 2003.

Oregon Institute of Technology also placing a new snow melting system on an existing stairway by the College Union building and a snow melt system in a new handicap ramp on the north side of the College Union building.

WALL STREET BRIDGE AND STREET PROJECT

The Wall Street Bridge and Street Project has approximately 10,330 ft^2 (960 m^2) of snow melting surface (Figure 1). The bridge deck and sidewalks snow melt area are 88.6 ft (27 m) by 42 ft (12.8 m) for a total of 3720 ft^2 (345.6 m^2) of surface area. The approach road and sidewalk snow melt area are 157.5 ft (48 m) by 42 ft (12.8 m) for a total of 6613 ft^2 (614.4 m^2) with an estimated heat output of 60 Btu/ft^2/hr (189 W/m^2).

A separate heat exchanger installed in the city's heat exchanger building will be used for the Wall Street Project, which will tap into the geothermal return water of the district heating system before it is injected into the ground. The heat exchanger specifications are 316 stainless steel plates with standard nitrile gaskets providing approximately 600,000 Btu/hr (174 kW) and designed for 150 psi (1,030 kPa) operating pressure (Figure 2). The heat exchanger will transfer heat to a 35% propylene glycol solution, which will be circulated in a closed loop to the approach road and bridge. The geothermal water side of the heat exchanger will enter at about 150ºF (66 ºC) and leave at 110ºF (43 ºC). The glycol solution side of the heat exchanger will enter at about 100ºF (38 ºC) and leave at about 130ºF (54 ºC). The geothermal loop side of the heat exchanger has a 1/3-hp (250 W) vertical

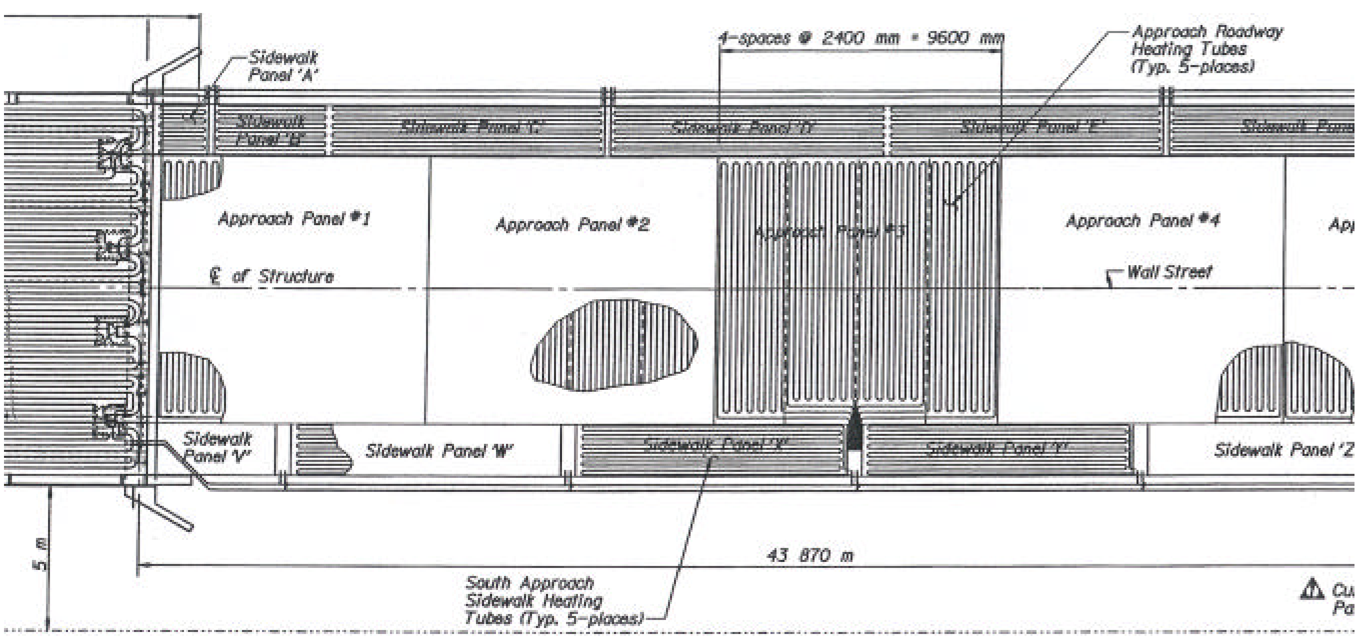

Figure 1. Portion of the Wall Street Project (ODOT, 2003)

in-line centrifugal pump installed with a flow rate of 40 gpm (2.5 L/s). The bridge loop side of the heat exchanger has a 1/2-hp (375 W) vertical in-line centrifugal pump installed in that side to circulate the solution with a flow of 45 gpm (2.8 L/s). This loop has more capacity installed than will be needed at this time. The system was designed for possible snow melt systems to be added in the future. An expansion tank is also connected to the heat exchanger, which has a minimum volume of 55 gal (210 L) and a minimum 22 gal (85 L) acceptance capacity. The system will run continuously during the winter season.

Figure 2. Snow melt heat exchanger in the city's Heat Exchanger building.

The approach road and bridge is about 1/2 of a mile (800 meters) from the heat exchanger building. The pipeline from the heat exchanger building to the approach road consists of a 4-in.(100 mm) high density polyethylene (HDPE) pipe when it leaves the building, then transitions into a 3-in. (75 mm) HDPE pipe at the approach road to the bridge.

The bridge project was completed in parts. The first part was removal of the existing bridge deck, then building of the new bridge deck. The bridge loop system was then tied into the bridge reinforcing steel. After the concrete was placed on the bridge deck and curing completed, they worked on the bridge sidewalks and loop system. Concrete was then placed on that part of the bridge and allowed to cure. They then worked on the bridge railing. While the bridge railing was being worked on, they removed the existing approach road material down to the sub-base. The road was then prepared and reinforcing of the road was placed. The loops for the approach road were tied into the reinforcing. The concrete was then placed and allowed to cure. The formworks for the sidewalks were completed, and the concrete placed and allowed to cure.

The mains control valve box (Figure 3), located on the southeast corner of the approach road, is where the main line is split into two lines. One line goes over to the north sidewalk with a 1-in (25-mm) supply and return line for the north sidewalks, and the other goes up the south side with a 3-in (75-mm) supply and return line for the manifolds located on the south side and the bridge deck manifolds.

Figure 3. Details of the main control valve box.

The glycol solution will be pumped through the tubing in the bridge deck and approach road. The tubing placed was Wirsbo 5/8-in (16 mm) ID hePEX (a cross-linked polyethylene), which was used on the other bridge deck (Lund, 1999). The loop system consists of about three miles (4,700 m) of tubing. The approach road has five approach panels consisting of four loops for a total of 20 loops. The bridge deck has 11 loops. The sidewalks of the bridge has two loops each. The approach road sidewalks has 11 separate loops, six on the north side and five of the south side.

The loop system for the bridge was placed longitudinally on the bridge deck with the loops ending on the approach roadside of the bridge (Figure 4). The loop systems for the bridge and approach road sidewalks was placed longitudinally (Figure 5). The approach road loop system was placed latitudinally with the loops ending on the south side of the road (Figure 6). All the loops are attached to reinforcing steel by wire at approximately eight inches (200 mm) on center. The ends of the loop systems for the bridge goes through the bridge deck. A protective sheath was placed around the tubing where the loops pass through the bridge deck.

There are a total of 12 manifold boxes used on this project. The bridge and bridge sidewalks has four manifold boxes placed underneath the east side of the bridge deck between the plate girders (Figures 7 and 8). The two manifold boxes nearest to the edge of the bridge has two 2-port supply and two 2-port return manifolds and the two manifold boxes in the center of the bridge has either 4-port supply and a 3-port return or the other way around (Figure 9). The middle loop down the centerline of the bridge has a supply loop on one manifold and a return loop on the other manifold.

Figure 4. Bridge decking loops attached to the reinforcing steel.

Figure 5. Bridge sidewalk loops.

Figure 6. The approach road loops placed latitudinally.

The north sidewalks consists of six loops have three manifold boxes each with a 2-port supply and 2-port return manifold. The south sidewalks (five loops) and the

Figure 7. Manifold under the bridge deck before they are placed in boxes.

Figure 8. Manifold boxes under the bridge.

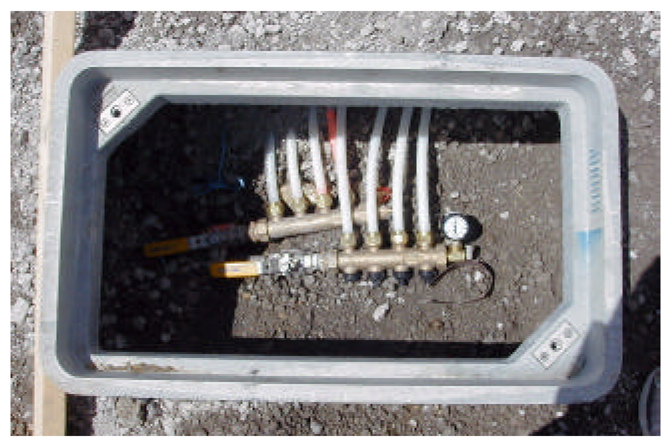

Figure 9. Detail of a manifold box for the south sidewalk.

approach road utilize five manifold boxes each with a 2-port and a 4-port supply, and a 2-port and a 4-port return manifold. The 2-port are for the sidewalk loops and the 4-port being for the road loop.

All the loop systems were pressure tested using air to check for leaks in the loops. The loops were continuously pressurized with 51 psi (350 kPa) air for at least 24 hours before concrete placement. The pressure was maintained during placement of the concrete and three days following placement.

The entire geothermal portion of the snow melting project was awarded at $170,000, which figures out at $16.45 per square foot. However, costs for state projects tend to be two to three times higher than private projects due to the requirements to pay prevailing wages and rigorous inspection standards. In addition, all plans are in metric, which may have posed a problem of conversion for local contractors.

To isolate the actual cost of purchasing and installing the pipes, the following items should be deducted. The supply line from the heat exchange building to the construction site, about 1/2 mile apart, is estimated to cost $50,000 to $80,000; the manifold boxes ran $600 a piece and testing of the system cost $10,000. Thus, the actual cost of the piping was around $7 to $10 per square foot. Non-state projects would probably run $3.50 to $4.00 per square foot.

OREGON INSTITUTE OF TECHNOLOGY PROJECT

The Oregon Institute of Technology (OIT) placed a snow melt system in an existing stairway by the College Union building. The project consisted of placing a slurring concrete mix over the existing stairway, then the tubing was tied to the formwork longitudinally with the stairway. They used a two-loop system for a total of 565 ft (172 m) of tubing placed, and the surface area that will be snow melted is 540 ft^2 (50 m^2) (Figure 10) (Keiffer, 2003).

The other snow melt system was incorporated into a new handicap ramp placed on the north side of the College Union building. This system also used two loops for a total of 489 ft (149 m) of tubing and the surface area to be snow melted is 469 ft^2 (43.5 m^2) (Keiffer, 2003).

Figure 10. Detail of the snow melt system for the stairs.

This brings the total amount of snow melting on the OIT campus to approx. 3,300 ft^2 (310 m^2). Both systems are connected to the campus heating system via the campus tunnel system (Boyd, 1999).

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