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MAGAZINE

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Architecture And Engineering Roundtable

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Airport Predictions For 2014

Cyber Security

SUSTAINABLE ASSET MANAGEMENT BEST PRACTICES

Your input is needed. Starting in January 2014, there will be a standard feature in *Airport Magazine* that recognizes the accomplishments, innovations and best practices for airport asset management and sustainability initiatives and programs. We are looking for article contributors for the next year.

Combining asset management and sustainability makes sense. Asset management provides a proactive approach to monitor long-term thinking about our facilities development and ownership; focuses on the total cost of facility ownership to better link capital investment and ongoing operating costs; provides clear data on project performance; institutes an industry-best management practice that maximizes and links the efficient use of available funds; and further integrates environmental, social and financial performance.

"Sustainability encourages stakeholders to communicate and inspire a commitment that business actions will be conducted within a framework of socially responsible values, such as fairness, inclusion, openness, and economic development for all," said Michael Cheyne, director of asset management and sustainability at Hartsfield-Jackson Atlanta International and sustainability issue leader for the AAAE Environmental Services Committee. "To be successful, we must create and foster a community dedicated to sustainability through best-in-class leadership and to implement solutions and practices that will reduce the carbon footprint of the airport.

"Airports only can be successful if our plans are developed through a framework of sustainable, creative, cost-effective, and proactive solutions combining economic, social, and environmental values to airport challenges while humanizing the vast scale of the airport environment," Cheyne noted.

Contact Cheyne at michael.cheyne@atlanta-airport.com with ideas and contributions for this column.

Reducing Heat in Airline Passenger Boarding Bridges

By Michael Cheyne, A.A.E., and Tanita Toatong

Thermal Coated Passenger Boarding Bridge at Atlanta's Gate E34

Hartsfield-Jackson Atlanta International (ATL), currently averaging 250,000 passengers a day, has been the world's busiest passenger airport since 1998. The terminal complex covers 130 acres and, as the largest employer in the state, the airport provides jobs for more than 58,000 employees. A facility of this size, serving nearly 300,000 people a day, obviously, uses significant resources.

The city of Atlanta, which owns the airport, is committed to environmental responsibility, saving energy and eliminating waste. In November 2011, the city's department of aviation released its first sustainable management plan for the airport, setting a goal to reduce ATL's per-passenger purchase of energy by 20 percent by the year 2020. The airport already has reduced consumption of paper, water and electricity and continues to study other opportunities to reduce, reuse and recycle resources.

One common airport feature, however, presents a challenge to conserving energy — the passenger bridge connecting the arrival/departure gate to the aircraft. Passenger bridges are constructed of metal, so, during Atlanta's hot summers, the sun's rays and outdoor ambient temperatures can raise temperatures significantly inside the bridge through a process known as external heat gain.

Mounted under each bridge is an air-handling unit that provides pre-conditioned (cooled) air to the aircraft while it is parked at the gate. It is not uncommon for a bridge to be configured with a supplemental cooling unit (such as a rooftop cooling unit), which is used exclusively for lowering the passenger boarding bridge temperature.

However, 96 percent of passenger boarding bridges at Hartsfield-Jackson International, including the bridges evaluated in this study, are not configured with such bridge-dedicated cooling systems.

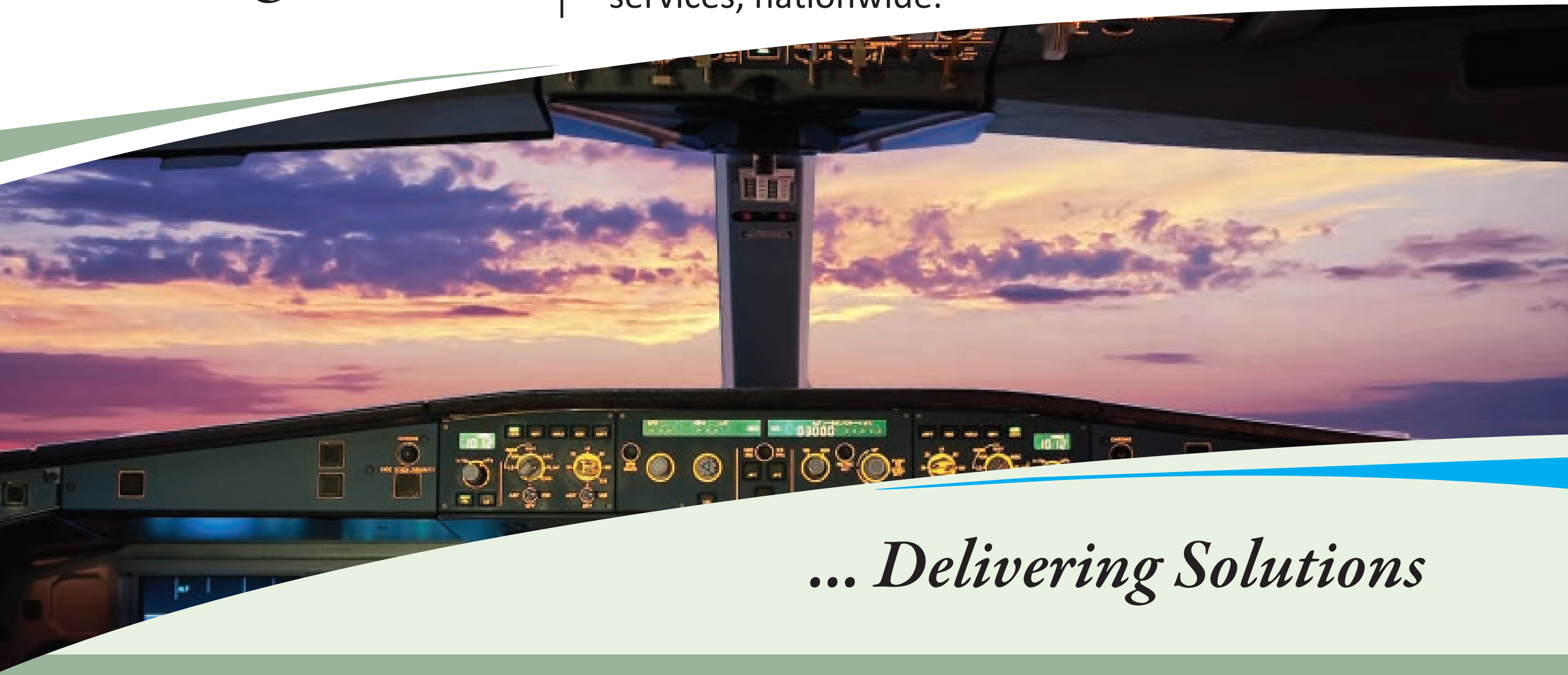
When the doors to the airplane and terminal are open as passengers board and disembark, preconditioned air from the plane and air from the terminal circulates within the bridge but does not cool the structure to the extent that is possible in the terminal itself or in the aircraft. In addition, energy use increases when hot air escapes into the terminal.

Heat Reduction Coating

In 2013, ThermaCote Inc. of Lawrenceville, Ga., which manufactures an environmentally friendly, water-based, spray-applied thermal barrier ceramic coating, offered the airport a chance to test its thermal barrier product, ThermaCote®. ATL's Asset Management and Sustainability Department agreed to use this opportunity to study the effectiveness of this product in reducing solar heat gain in the summer. Materials and labor costs for the test project were $9,990.

Local contractors applied ThermaCote® to all the surfaces outside of Gate E34. Nearby Gate, E36, was left untreated as a control unit. Both of these bridges receive direct sunlight all day.

Dry bulb thermometers at three points inside each bridge and one on the rooftop recorded temperature readings at five-minute intervals for 35 days from July 12 to Aug. 15, 2013. (See figure 1) A study team from the International Knowledge and Research Center for Green Building at



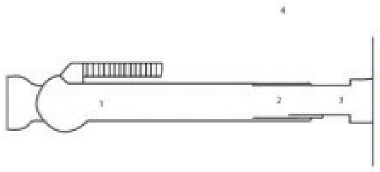


Figure 1

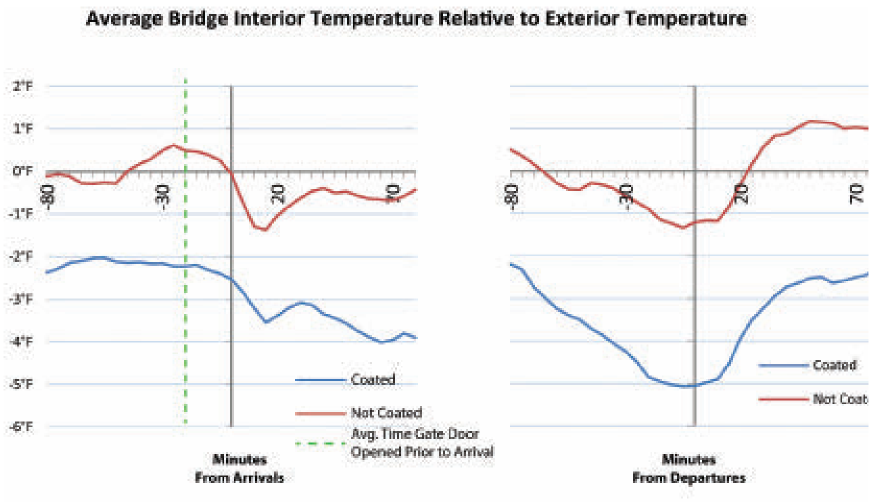


Figure 2

Southern Polytechnic State University in Marietta, Ga., analyzed the data to determine if the applied thermal barrier reduced temperatures within the coated bridge compared to the uncoated bridge.

During the sample period, gates E34 and E36 experienced nearly identical numbers of arrivals and departures and serviced relatively the same number of aircraft. Flights typically took place from 7 a.m. to

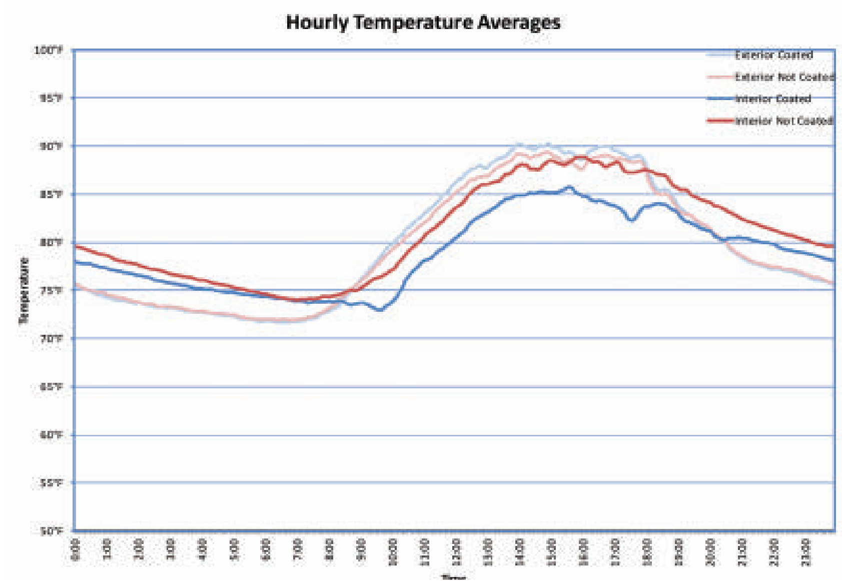


Figure 3

1 a.m., and the average gate time per flight was 110 minutes. Because the length between arrivals and departures varies, the study looked at temperatures before, during, and after each arrival and departure (see Figure 2).

As the graphs show, temperatures in both bridges dropped quickly in the 10 minutes after arrival, while passengers were disembarking and doors to the concourse were open. However, when the doors were closed, temperatures in the non-coated bridge rose back to previous levels, while in the bridge coated with ThermaCote®, temperatures continued to decline until boarding — 20 to 30 minutes before departure.

Dry bulb thermometer inside the bridge

Energy Savings

Temperatures in the bridge coated with ThermaCote® were consistently at least 2° to 3° (1.3°C) lower than in the uncoated bridge, beginning around 10 a.m. and continuing through the night The average temperature inside the uncoated bridge was 1.4° (0.8°C) higher than the outside temperature. The average temperature inside the coated bridge was 0.9° (0.5°C) lower than the outside temperature (see Figure 3).

Since the rate of air conditioning at the gates was unknown, the study calculated the heat load reduction from the difference in temperature change under equal AC power. Calculations revealed a heat load reduction of 69.5 BTU/h (0.02 kWh).

Considering the number of flights each day and the average turnaround time, the total energy savings for Gate E34 would be about 450 BTUs (0.13.kWh) per day, split between the concourse and the pre-conditioned air unit. Although not all bridges receive the same amount of direct sunlight, the thermal barrier could help lower interior temperatures and provide energy savings.

Potential Next Steps

This study was limited in its scope and time span. The airport needs to investigate further the effectiveness of a thermal barrier in reducing temperatures in the passenger bridges. Before broader implementation, the coating would have to be tested at more gates, in different locations, and over a longer period of time. While further testing is essential, the results of this limited preliminary experiment are intriguing. The airport is open to new ways to save energy and reduce costs. With further testing and optimization, a process like this one could provide one more way to help us reach our sustainability goals by 2020. The potential benefits go beyond energy savings. Charles Marshall, utilities manager-asset management and sustainability at Hartsfield-Jackson, stated, “This thermal coating technology appears to provide consistent lowering of heat gain within the passenger boarding bridges, which adds two benefits: customer comfort while using the passenger boarding bridges, and a decrease in cooling load as gate doors are opened for passenger bridge use.” All of this translates into savings, considering that more than 200 boarding bridges are used each day during peak cooling periods.

Several factors should be considered in any further testing or application of the coating. Thermal ceramic coating is an effective and environmentally friendly way to reduce solar heat gain. However, the application process should not occur when humidity levels are higher than 70 percent, as this drastically increases drying and curing time, as well as dry fall. In addition, leaving the bottom of the bridges uncoated should not have a significant impact on the cooling load due to the shade and height off the ground.

Of course, safety considerations are paramount when considering any change to airport equipment or facilities. Pilots were interviewed to determine whether the coated bridge presented any potential challenges to the cockpit. According to Delta pilot Sandy Brown, “There were no issues with glare at passenger boarding bridge Gate E34. It’s only slightly brighter in color than the rest of them. There’s no problem for us as pilots dealing with it.”

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October 2013

Hartsfield-Jackson International Airport

ThermaCote Paint Study

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Hartsfield-Jackson Internation Airport: Thermacote Paint Study

International Knowledge and Research Center for Green Building

By: Ian Elmore

Introduction:

This report concerns an experiment on the effectiveness of ThermaCote in reducing the heat load on passengers boarding bridges which was conducted at Hartsfield-Jackson Atlanta Airport from July 12 to August 15 2013.

Existing Conditions

Passenger boarding bridges, air bridges, skyways and jet ways refer to the enclosed, adjustable bridges that provide direct passenger access between the terminal and aircraft. The bridge is mechanically driven, and able to pivot, telescope, raise and lower in order to accommodate a range of aircraft.

The boarding bridges are not directly air conditioned. Mounted under the bridge is an air handling unit, which provides pre-conditioned air to the aircraft while it is parked at the gate. During boarding and disembarking, air is exchanged between both the aircraft and the bridge, and the concourse and the bridge. As a result, conditioning the air in the bridges is inefficient and uncomfortable.

ThermaCote

ThermaCote is described by its manufacturer as “a single component spray applied thermal barrier coating encompassed of ceramics and acrylics (water based).” It claims to increase the R value of assemblies by reducing thermal bridging, as well as reducing solar and radiant heat gain. Applied to the boarding bridge, it should reduce heat gain, lower interior temperature, and provide energy savings.

Procedure:

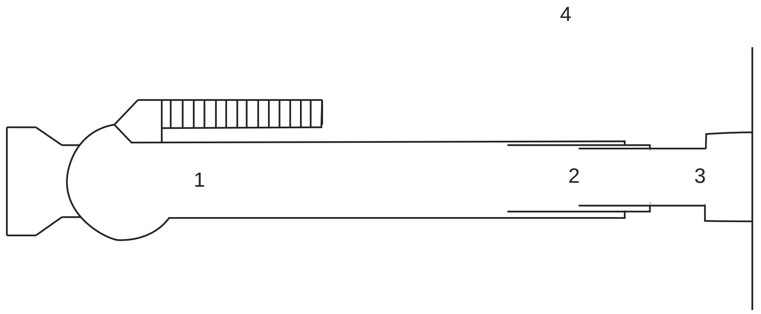


Figure 1

Two passenger boarding bridges were tested for a period of five weeks (July 12 to August 15). The bridge at gate E34 was treated with a 20 Mil (.5 mm) coat of ceramic thermal barrier (see Appendix A). The bridge at gate E36 was left untreated. Dry bulb temperature readings were taken at five minute increments at three points inside of each bridge, as well at outside of each bridge (see Figure 1, Appendix B).

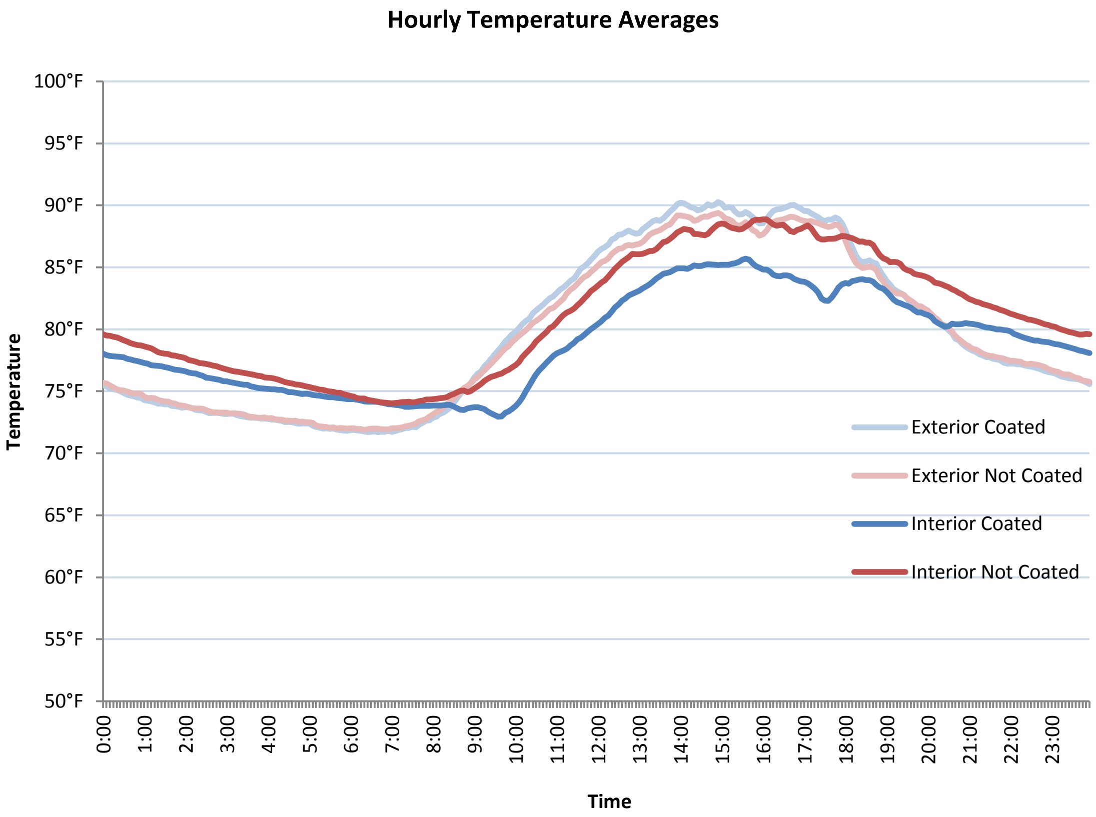
Results

Flights

During the sample period, the treated bridge experienced 125 arrivals and 114 departures, with a total of 130 unique flights and 103 flights with both arrival and departure times given. The uncoated bridge experienced 121 arrivals and 108 departures, with a total of 124 unique flights and 102 flights with both arrival and departure times given. There was an average of 3.7 and 3.5 aircraft in each gate respectively. Flights ranged from 7 am to 1 am. For aircraft with both arrival and departure times given, the average time in gate was 110 minutes, while the median was 79 minutes.

Temperature

During the sample period, outside temperatures ranged from 65°F (18.5° C) to 105° F (40.5° C). Outside temperatures at the treatment terminal were on average 0.23° F (.13° C) higher than at the control terminal. The average daily high was 95° F (35° C) while the average low was 71°F (21.5° C).



(Figure 2)

On average for the entire testing period, the interior temperature of the coated bridge was 2.3° F (1.3° C) lower than the uncoated bridge. While the average temperature inside of the uncoated bridge was 1.4° F (0.8° C) higher than the outside temperature, the temperature inside of the coated bridge was 0.9°F (0.5°C) lower than the outside temperature (see Figure 2)

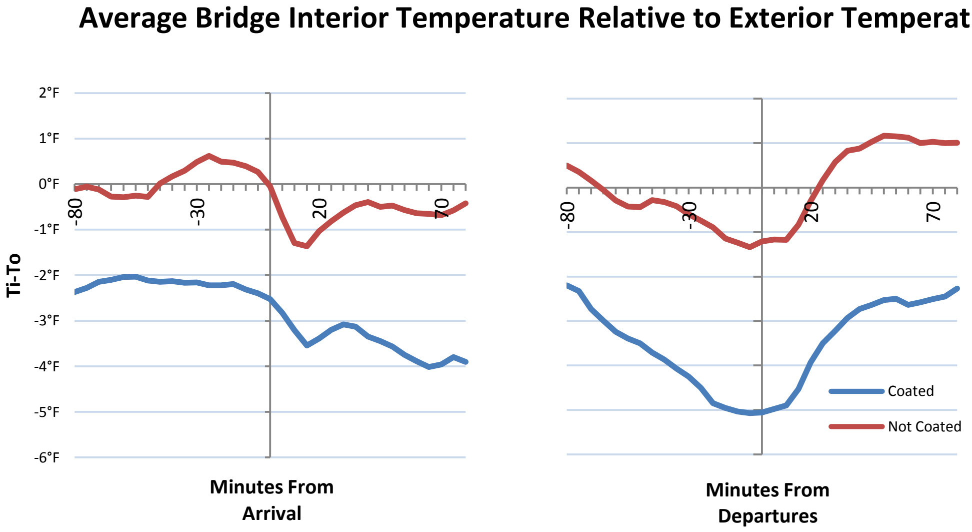


Figure 3

Since the length between arrivals and departures vary, looking at the temperatures before, during, and after each arrival and departure (figure 3) reveals the trends during these times (these charts are presented with greater detail in Appendix C).

As the graphs show, temperatures drop quickly in the 10 minutes after arrival, while passengers are disembarking the aircraft and the doors to the concourse are opened. While the non-coated bridge sees temperatures rise back to previous levels, the bridge coated with ThermaCote continues to decline in temperature until boarding (20-30 minutes before departure), when both temperatures drop again.

Heat Gain/Energy Savings

Without knowing the rate of air conditioning at either gate, we can calculate the heat load reduction from the difference in temperature change under equal AC power. For each flight with both arrival and departure time given, we can use the equation:

$$\frac{Temp_D - Temp_A}{Time_D - Time_A} \times M_{air} \times \ C_{air} \ = \frac{\Delta Energy}{\Delta Time}$$

Where

$Temp_d$ = Average interior temperature at departure

$Temp_a$ = Average interior temperature at arrival

$Time_d$ = Time of departure

$Time_a$ = Time of departure

M_{air} = The estimated mass of air in the bridge. As the bridge can vary in length from approximately 50 to 100 ft. in length (17.5-33.5 m), the volume of air at any given time must be estimated. For the purpose of calculation, the interior air volume will be assumed to average 5040 ft^3 (142.7 m^3), and the density of air will be averaged at 0.07 lb/ft^3 (1.15 kg/m^3).

C_{air} = The specific heat of air is 1.006 kJ/kg

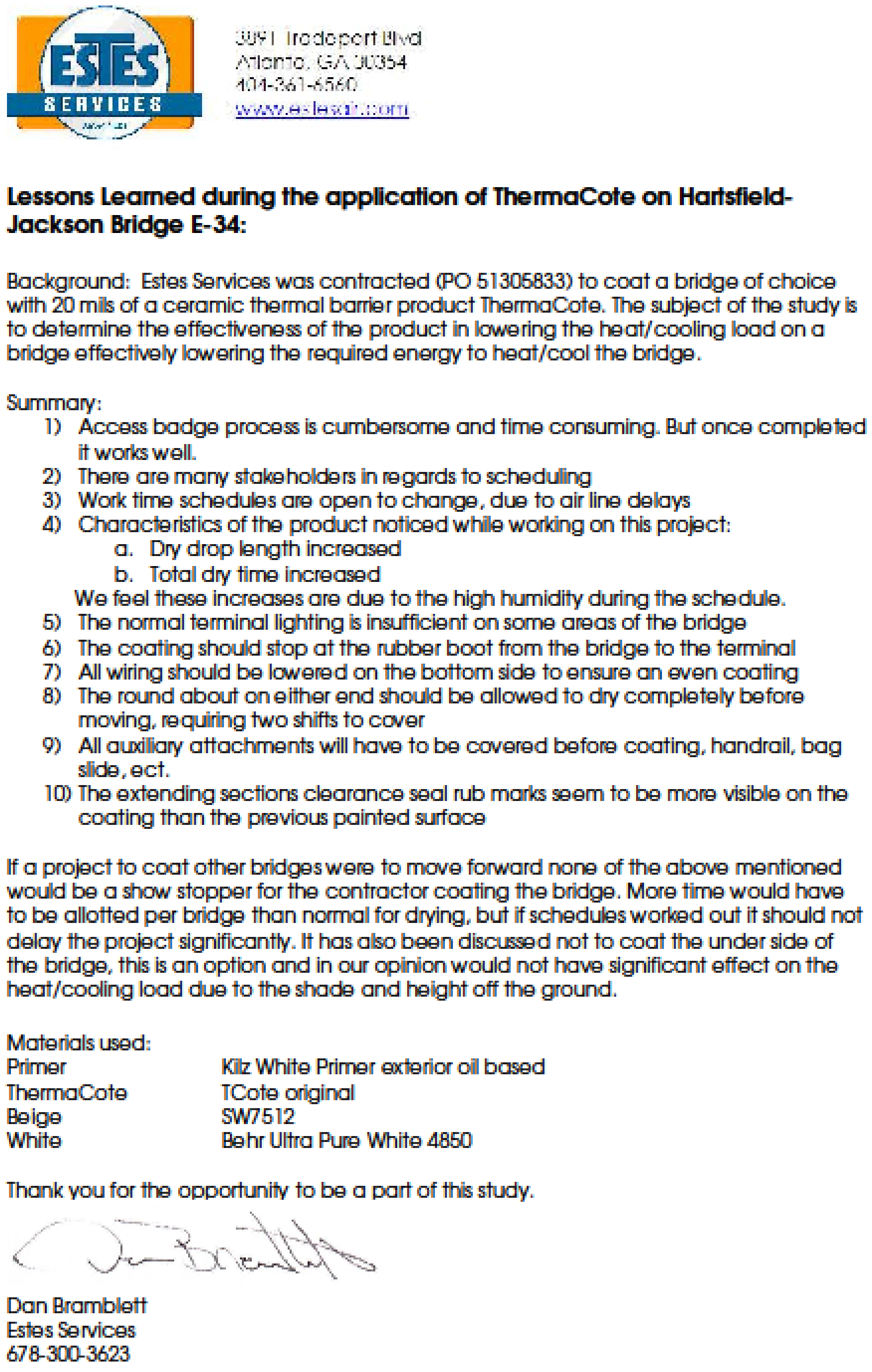
This gives an average net heat gain of -142.7btu/h (-0.04kW) for the treated terminal, and -73.2 btu/h (-0.02kW) at the uncoated terminal. Thus, the coated bridge experienced a heat load reduction of 69.5 btu/h (0.02 kW).

Given the number of flights a day and the average turnaround time, the total energy savings would be around 450 BTUs (.13 kWh) per day. This average includes flights from 7AM to 1AM and represents the average energy savings throughout the day. These savings would be split between the concourse and the preconditioned air coming from the plane.

Conclusions

- Temperatures in the bridge coated with TermaCote was consistently at least 2-3°F (~1.5°C) lower than in the uncoated bridge. The temperature difference appears around 10am and lasts through the night.
- The coated bridge was cooler at arrival, and continued to get cooler until departure. The coated bridge was consistently closer to human comfort levels.
- The coating appeared to reduced heat gain by an average of 69.5 btu/h (0.02 kW).
- The energy savings from the coated bridge were ~450 BTUs (.13kWh) a day. Those savings are split between the concourse and the preconditioned air handlers attached to the bridge.
- Since the product works in part by reflecting solar radiation, the savings do not necessarily apply to cold weather.

APPENDIX A:



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Lessons Learned during the application of ThermaCote on Hartsfield-Jackson Bridge E-34:

Background: Estes Services was contracted (PO 51305833) to coat a bridge of choice with 20 mils of a ceramic thermal barrier product ThermaCote. The subject of the study is to determine the effectiveness of the product in lowering the heat/cooling load on a bridge effectively lowering the required energy to heat/cool the bridge.

Summary:

1) Access badge process is cumbersome and time consuming. But once completed it works well.
2) There are many stakeholders in regards to scheduling
3) Work time schedules are open to change, due to air line delays
4) Characteristics of the product noticed while working on this project:
    a. Dry drop length increased
    b. Total dry time increased

   We feel these increases are due to the high humidity during the schedule.
5) The normal terminal lighting is insufficient on some areas of the bridge
6) The coating should stop at the rubber boot from the bridge to the terminal
7) All wiring should be lowered on the bottom side to ensure an even coating
8) The round about on either end should be allowed to dry completely before moving, requiring two shifts to cover
9) All auxiliary attachments will have to be covered before coating, handrail, bag slide, ect.
10) The extending sections clearance seal rub marks seem to be more visible on the coating than the previous painted surface

If a project to coat other bridges were to move forward none of the above mentioned would be a show stopper for the contractor coating the bridge. More time would have to be allotted per bridge than normal for drying, but if schedules worked out it should not delay the project significantly. It has also been discussed not to coat the under side of the bridge, this is an option and in our opinion would not have significant effect on the heat/cooling load due to the shade and height off the ground.

Materials used:

Primer	Kilz White Primer exterior oil based
ThermaCote	TCote original
Beige	SW7512
White	Behr Ultra Pure White 4850

Thank you for the opportunity to be a part of this study.

Dan Bramblett
Estes Services
678-300-3623

APPENDIX B: Photos of Installation

Left Outer Side Entrance

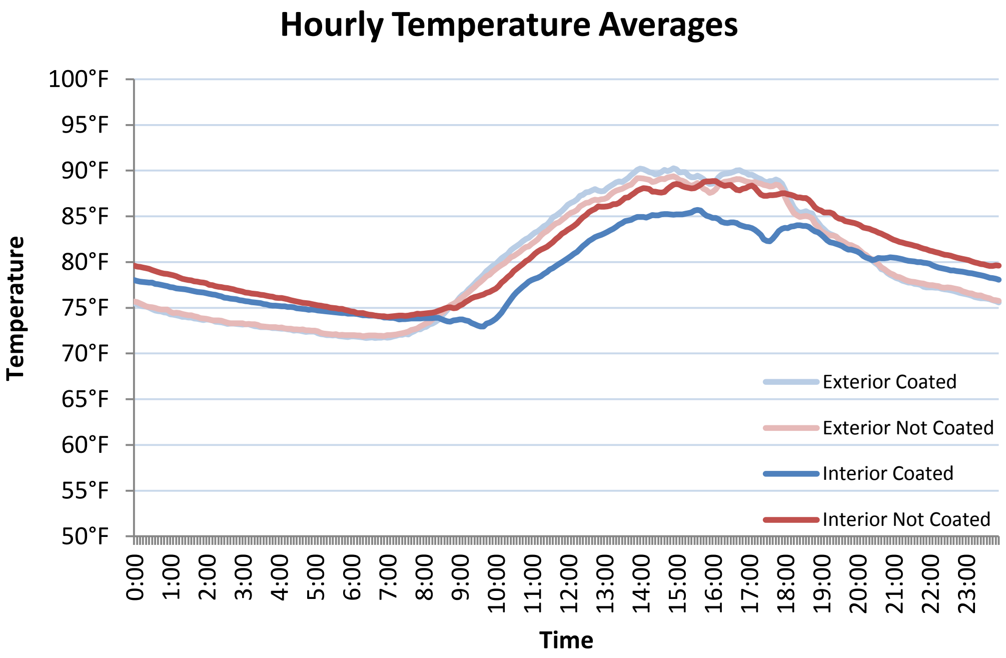
Left Outer Side

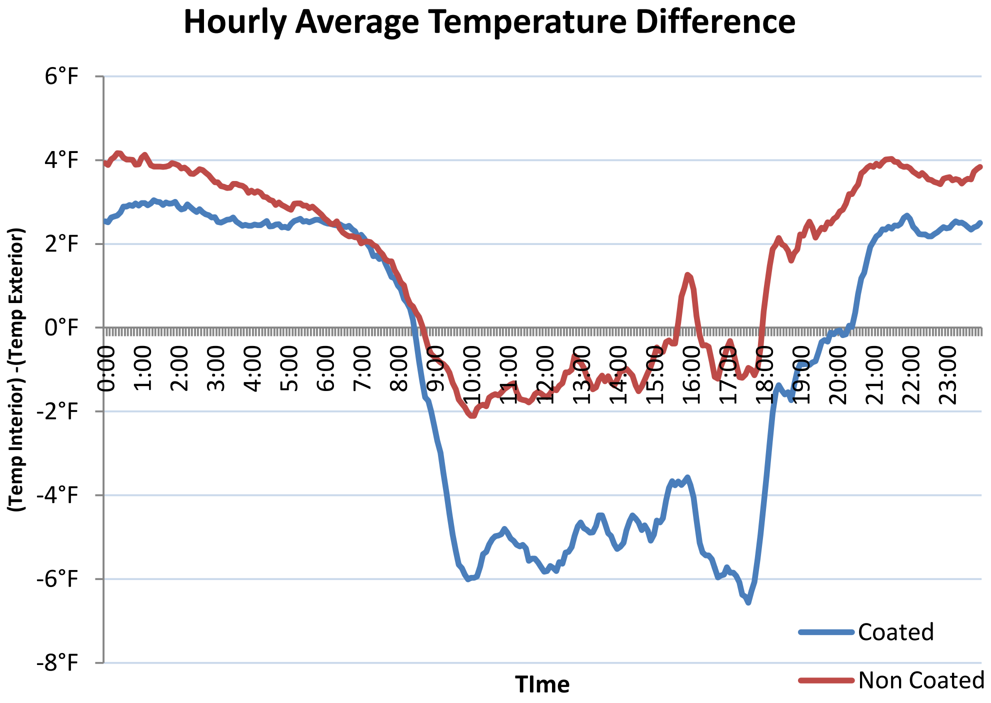
Inside View From Entrance

Bridge Data Logger

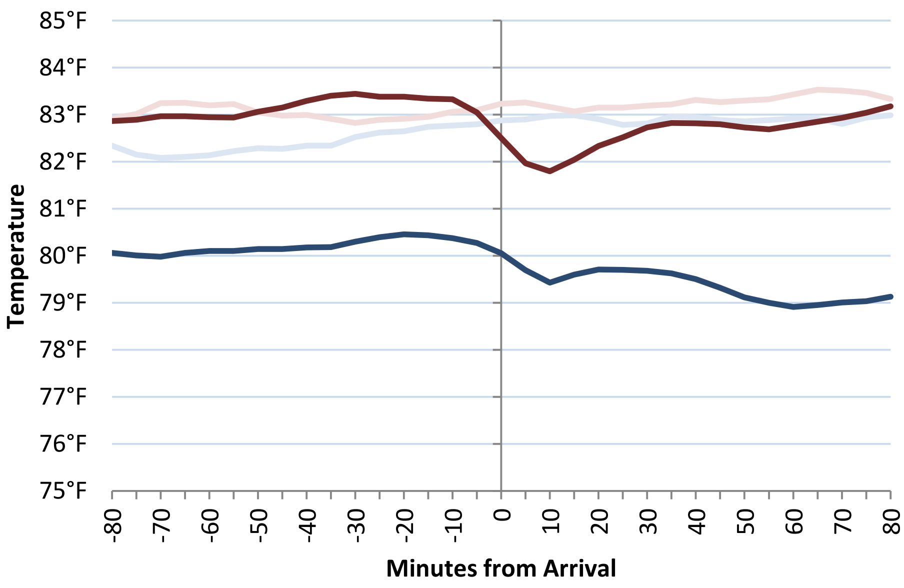
Typical Data Logger installation

APPENDIX C: Graphs

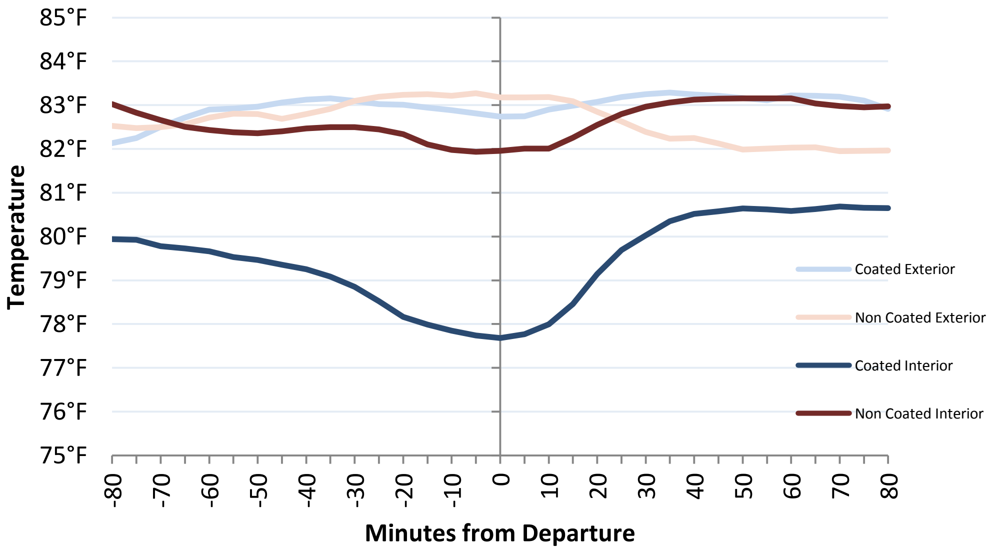




APPENDIX C: Graphs



Average Temperatures Relative to Arrival



Average Temperatures Relative to Departure