

Establishment of a Building Audit Procedure and Analysis for the Kansas Department of Transportation Phase 2A: Buildings

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Introduction

Over the past few years, state governments and entities have become concerned with the energy consumption and efficiency of their facilities. An effective manner to identify potential to reduce energy and water consumption and increase building efficiency as well as track the effect of improvements is to establish a facility's baseline resources use as completed in phase one of Kansas Department of Transportation (KDOT) research program. This baseline information when compared to similar facilities can be used to justify changes to improve the current facility. KDOT has funded a second phase of research that focused on establishing a proper auditing procedure as an additional and more complete method of identifying the areas within their buildings that should be considered for improvement. This second phase of the research not only established a procedure for the audit but also created a list of the most common areas within KDOT owned facilities that may be considered for improvement. This list of recommendations can be used as a starting point but can also be further analyzed for their economic viability using the spreadsheet created to calculate the life cycle costs and return on investments. The audit procedure, as well as the economic spread sheet, was created in a manner that individual facility managers will be able to use them to assess the buildings under their supervision.

Project Objective

KDOT desires to reduce the energy consumption and the carbon footprint of its facilities. In order to do so, the efficiency of the facilities must be improved. The research conducted in Phase 2A determined a minimum acceptable level of construction and operation for KDOT facilities, established an energy audit procedure, and recommended improvements to existing facilities.

Project Description

In order to suggest changes and improvements to new and existing KDOT buildings, a baseline needed to be selected. After examining industry accepted codes and standards, the codes of surrounding states and the determinations of the Department of Energy, ASHRAE Standard 90.1-2010 was selected to be the baseline, the minimum acceptable requirements for construction and renovation. ASHRAE Standard 90.1-2010 applies to all KDOT facilities, including both new buildings and renovations to existing buildings. ASHRAE Standard 90.1-2010 establishes requirements for all aspects of the building, specifically the building envelope, the HVAC system, the electrical and lighting systems, and the domestic hot water system.

Project Results

Once ASHRAE Standard 90.1-2010 was selected as the minimum acceptable requirements for energy, an energy audit procedure was created in order to survey and compare the existing facilities to the baseline. Six KDOT facilities, one from each district, were then audited using the procedure. The facilities selected were the subarea buildings in Atchison, Belleville, Russell, Altamont, Larned, and Jetmore. From the data collected during the audits, changes were recommended in order to increase the efficiency of each facility.

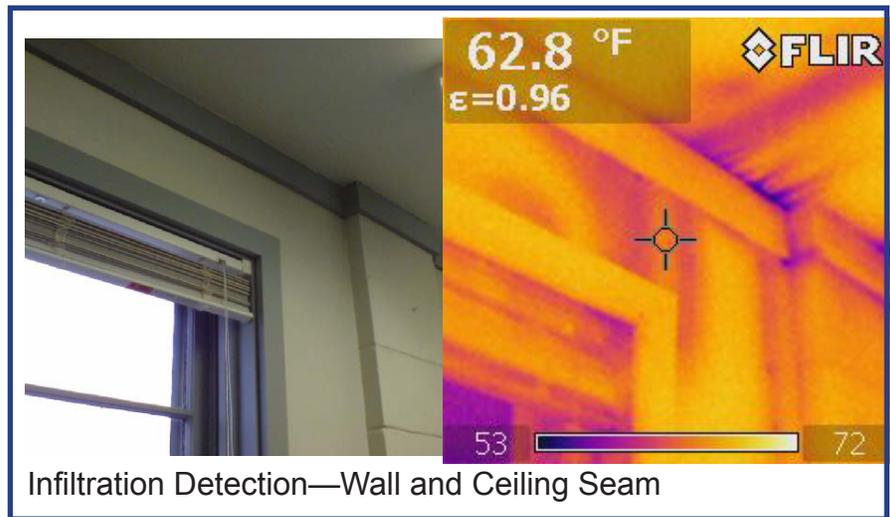
The Net present cost, NPC and the Return on Investment, ROI were calculated for each recommended change in order to determine which recommendations were feasible. The final recommended changes include installing double-pane steel or aluminum windows, installing programmable low voltage thermostats, upgrading to T5 lamps and fixtures, downsizing to either instantaneous water heaters or six-gallon point of use small capacity storage water heaters, and caulking and sealing.

Further recommendations include the continual auditing of KDOT facilities. Each facility should be audited once every two years. In doing so, any problems such as air leakage, burned out lamps, or equipment malfunction will be detected and can be fixed before significantly reducing the building's overall efficiency. The audit procedure, worksheets, spreadsheets, and Excel document should be used to audit in each facility.

Changes and improvements are gradual and depend on the continual cycle of auditing and improving in relation to the baseline. In the future, a new baseline will need to be adopted as the building construction industry, equipment availability, and energy codes evolve. This report contains the necessary tools to implementing an auditing procedure, determining the crucial and feasible changes, monitoring the energy consumption and costs through the Energy Star Portfolio Manager, and eventually selecting a new set of minimum requirements for energy in order to reduce KDOT's energy consumption and carbon footprint even further.

Project Information

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