The Cost of LEED—An Analysis of the Construction Costs of LEED and Non-LEED Banks

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Abstract This study is an analysis of the initial building costs for two Leadership in Energy and Environmental Design (LEED) banks and eight non-LEED banks with similar building types and sizes located in western Colorado. The purpose of this study was to compare the costs of these banks, and to assess costs directly associated with LEED certification. The analysis examines total building costs, square footage costs, soft costs, and hard costs per MasterFormat Division. The study finds that the building costs of the LEED banks are similar to and within the same ranges as non-LEED banks. Additionally, the direct cost associated with seeking LEED certification is estimated to be below 2% of the total project cost.

Many in the building industry perceive green and/or Leadership in Energy and Environmental Design (LEED) certified buildings to be much more expensive than conventional buildings (Building Design & Construction [BD&C], 2003; McGraw-Hill Construction, 2005; Turner Construction, 2005). This perception has been the single largest obstacle to greater mainstream acceptance of green building design (Kats, 2003), as evidenced in studies citing cost as the number one barrier facing green building (BD&C, 2003; McGraw-Hill Construction, 2005; Turner Construction, 2005; Galuppo and Tu, 2010).

For example, the readers of BD&C revealed their perceptions in a 2003 survey: 44% said sustainable design was viewed as adding significantly to first costs, while 42% felt the market was not interested or not willing to pay a premium for sustainability. Thirty-five percent felt sustainable design was hard to justify, even on the basis of long-term savings.

According to Turner Construction’s 2005 Green Building “Market Barometer” survey, 75% of executives at organizations involved with green buildings felt green construction costs were higher than for traditional buildings (Turner Construction, 2005, p. 16). Further, those same executives estimated green construction costs to be 13% higher than traditional construction costs, while executives without green building experience estimated the costs to be 18% higher (Turner Construction, 2005, p. 16). Additionally, the survey respondents of McGraw-Hill Construction’s 2006 Green Building SmartMarket Report indicated “higher first costs” as the most serious obstacle to green building (McGraw-Hill Construction, 2005).

In a similar study conducted by Galuppo and Tu (2010) of NAIOP and PREA members, the vast majority of survey respondents believed the cost of energy-
efficient building to be higher than a traditional building with comparable features. A number of respondents (21%) estimated additional costs to be more than 10%. This study also found that over 90% of lenders, equity investors, and developers believed energy-efficient buildings cost more. Forty percent of the lenders believed that energy-efficient buildings cost in excess of 10% more than conventional construction.

According to these surveys, significantly higher construction costs are a common perception associated with green buildings and LEED certification and one that has persisted over time. Evidence from previous studies and reports, however, identifying the actual costs associated with LEED certification demonstrate that construction costs for LEED buildings are far below the perceptions reported by many in the industry.

Previous Studies

The U.S. General Services Administration (GSA) was the first to address the cost of LEED certification and commissioned a study to identify the costs associated with the pilot phase of LEED v1.0. The 2002 study concluded that a 2.5% to 7% construction cost premium was necessary for federal buildings to achieve the various levels of certification if the standard GSA design guidelines were met (BD&C, 2003, p. 29). More specifically, the study found that: (1) a LEED v1.0 certification would add “little or no increase in project costs”; (2) a federal building in Oklahoma City would require a 2% premium to reach LEED v1.0 Silver; (3) a LEED v1.0 Gold certification for a federal courthouse in Denver would have added 7% to the construction costs; and (4) other typical federal projects could reach LEED v1.0 Silver with about a 2.5% premium.

Later, in response to updated LEED requirements, the GSA (2004) commissioned another study to estimate costs to develop LEED certified federal facilities in compliance with the more stringent LEED version 2.1. For the construction of a 262,000-square-foot new federal courthouse, the GSA LEED Cost Study estimated that achieving a LEED Certified/Silver rating decreased cost by 0.4%–4.4%, a savings of $0.75 to $10 per square foot (GSA, 2004). A Gold rating for a new courthouse was estimated to add 1.4%–8.1% to the construction costs or $3–$18 per square foot (GSA, 2004). The study found that the overall cost premium was surprisingly limited when GSA projects made use of “no cost” or “low cost” credit opportunities. Under some cost scenarios, project costs actually decreased (GSA, 2004). The conclusion of the report was that LEED certification could be achieved within a standard GSA project budget without a green building allowance (GSA, 2004).

The most definitive LEED construction cost analysis to be conducted early in the application of LEED design and construction standards was conducted by Kats et al. (2003). In order to determine the cost of building green compared to conventional design, the costs of 33 green buildings from across the United States were compared to conventional designs for those same buildings. The analysis reported an average premium for green buildings of about 2%, or $3 to $5 per
square foot (Kats et al., 2003, p. 15). The study found to achieve the basic level of LEED certification increased costs less than 1% while achieving Silver certification resulted in a premium of just over 2%. To achieve the highest certification level of Platinum resulted in a premium of 6% (Kats et al., 2003, p. 15). The majority of increased costs were due to increased architectural and engineering design time, modeling costs and time necessary to integrate sustainable building practices into projects (Kats, 2003).

Matthiessen and Morris (2004) examined the cost of LEED from multiple perspectives in a study funded by Davis Langdon, a global construction consulting company. First, the study assessed the cost of incorporating individual sustainable elements. Second, the study compared the total construction costs of 138 buildings: 45 LEED seeking and 93 non-LEED buildings. Third, the final cost of LEED buildings were compared to their original budgets. Consistent with the previous studies, this report found that most projects achieved LEED certification for 0 to 3% over the initial budget (Matthiessen and Morris, 2004). Over half the projects had original budgets set without regard to sustainable design and received no additional funding to achieve their sustainable goals and LEED certification. Of those that did receive additional funding, the range was 0–3% of the initial budget and usually only for specific enhancements, such as photovoltaic systems (Matthiessen and Morris, 2004).

In addition, the data suggested that the cost per square foot for buildings seeking LEED certification was within the range of costs for similar non-LEED seeking buildings without sustainable features (Matthiessen and Morris, 2004). No statistically significant difference was found between the costs of LEED certified buildings compared to non-LEED certified buildings. Matthiessen and Morris (2004) concluded that many construction projects can achieve sustainable design and LEED certification within their budget or with very little additional funding.

More recently, Davis Langdon (2007) expanded upon this study as to provide a wider look at the cost of green by examining a larger sample of projects and additional building types. The authors state that the more recent study reveals essentially the same results as the 2004 study. “There is no significant difference in average costs for green buildings as compared to non-green buildings,” (Davis Langdon, 2007, p. 3). They concluded that many projects achieve LEED certification within their budgets and in the same cost range as non-LEED projects.

Contrary to current perceptions related to costs premium (Galuppo and Tu, 2010), these studies demonstrated that many new construction projects are achieving LEED certification within the same cost range as non-LEED buildings or with only slightly higher costs. What is missing from these studies is the inclusion of bank building. The GSA study focused on building types typically owned by the government and the two studies funded by Davis Langdon focused on academic buildings, laboratories, community centers, and ambulatory care facilities. It is interesting that lenders tend to have the most pessimistic view of green construction costs, while at the same time the buildings they work in have not been included in studies addressing the issue of cost associated with increased energy efficiency and/or LEED certification. Some evidence does suggest that the
results from the studies reviewed here do apply to banks. Gary Saulson, Director of Corporate Real Estate for PNC Financial Services Group, says that “each new 3,650-square-foot LEED certified branch costs from $1.3 to $1.4 million—$150,000 less than the competition is building non-green banks for while using 40%–50% less energy than a typical branch” (McGraw-Hill Construction, 2005, p. 38). While this is significant, more evidence of both the costs associated with green banks and the benefits are needed.

Research Questions

Due to the discrepancy between the premium perception associated with green buildings held by many in the building and lending community and the results of previous research on costs of LEED certified buildings, a need exists to further analyze the costs associated with LEED certification. The research question guiding this study is “Can LEED banks be designed and constructed for costs comparable to non-LEED banks?”

The following sub-questions will guide the data analysis:

1. How do total building costs (TBC) of LEED banks compare to costs of non-LEED banks?
2. How do the square foot costs of LEED banks compare to costs of non-LEED banks?
3. How do the soft costs of LEED banks compare to costs of non-LEED banks?
4. How much are the direct costs associated with LEED certification?

Methodology

A collective case study design was implemented to address the research questions to see if previously published findings on the costs associated with LEED certification hold true for banks. Collective case study research attempts to address an issue in question while adding to the literature that helps us better conceptualize a theory involves the selection and use of several instrumental cases (Hancock and Algozzine, 2006). To this end, Stake (1995) points out that case study research is not sampling research and that selection of a case study should be guided by both the goal to maximize what can be learned and an ability to access needed information.

Identification of Cases

Cases included in this study were chosen from the historical cost data of Alpine Banks, who owns and operates 37 banks in the Western Slope area of Colorado. Two of the 37 banks have been designed and construction to meet LEED for New Construction (LEED NC) requirements. As an owner/developer of their own projects, it was important for Alpine Banks to better understand the costs associated with LEED certification as they move forward with the design and
construction of future projects. Because of their interests in the costs associated with LEED certification, they were willing to provide unhindered access to design and construction costs from past projects. Further, all of the cases selected are located in similar geographical locations, resulting in similar code/design requirements, eliminating many of the regional differences (e.g., wind and snow load requirements) in the designs.

After identifying the pool of possible cases for inclusion in this study, the next step was to identify those cases which would be included in the final analysis. This decision was based on the time of construction and whether a project was LEED certified or not. It was found that two of the 37 projects had been LEED certified. Projects built prior to 1997 were determined ineligible due to the lack of reliable cost data for these projects. The result was a group of ten bank locations for inclusion.

All ten cases in this study were constructed between 1997 and 2008 (Exhibit 1). Of these, one is LEED certified and another is certified as LEED Silver. The remaining eight did not seek LEED certification. The difference between the two groups is simply that two of the LEED certified banks were designed and constructed to achieve LEED certification, while LEED certification was not a goal for the eight other banks. Non-LEED buildings often qualify for 10–20 LEED points by nature of their design, location, and other factors (Matthiessen and Morris, 2004). All the cases included in the study have many similar features, regardless of whether or not LEED certification was sought. Since they are all owned by the same institution and were built over a relatively short timeframe, they were all designed according to the same fundamental design criteria of Alpine Banks. These features include high performance HVAC systems, durable high-end materials and finishes, industry-specific banking equipment, security system features, as well as drive-thru facilities with canopies and systems to convey documents. The ten banks are all relatively similar building types with sizes ranging from 2,730 to 5,122 gross square feet (Exhibit 2). The projects are broken into three categories based on size: small, medium, and large. Five projects are small, ranging from 2,730 SF to 3,078 SF, four projects are medium size, ranging from 4,240 SF to 4,455 SF, and one falls into the large category at 5,122 SF.

**Data Collection Form**

A data collection form was developed using Microsoft Excel software. The Excel workbook was used to organize the construction cost data associated with the cases. The first tab sheet was the Project Summary sheet, which categorized basic information about the bank facility and the associated project costs. The Project Summary sheet included both soft costs and hard costs for the 16 CSI Divisions for each bank. Cost data was tracked using the Construction Specification Institute’s (CSI) MasterFormat 1995 Divisions. A summary of the costs for all 16 CSI Divisions for each project is provided in the Appendix.

Following the Project Summary sheet, the workbook had a sheet dedicated to the soft costs (e.g., design, engineering, and consulting fees) for each project. Another
Exhibit 1 | Impact of LEED Certification on Bank Construction Costs

<table>
<thead>
<tr>
<th>Location</th>
<th>Year</th>
<th>Building SF</th>
<th>Size Category</th>
<th>Total Project Cost&lt;sup&gt;a&lt;/sup&gt;</th>
<th>Total Building Cost&lt;sup&gt;b&lt;/sup&gt;</th>
<th>Soft Costs&lt;sup&gt;c&lt;/sup&gt;</th>
</tr>
</thead>
<tbody>
<tr>
<td>Breckenridge</td>
<td>2003</td>
<td>5,122</td>
<td>Large</td>
<td>$3,429,973</td>
<td>$3,197,193</td>
<td>$382,950</td>
</tr>
<tr>
<td>Clifton</td>
<td>2001</td>
<td>3,078</td>
<td>Small</td>
<td>$2,249,713</td>
<td>$2,032,186</td>
<td>$89,084</td>
</tr>
<tr>
<td>Delta</td>
<td>2008</td>
<td>4,240</td>
<td>Medium</td>
<td>$2,883,841</td>
<td>$2,537,911</td>
<td>$172,637</td>
</tr>
<tr>
<td>Frisco</td>
<td>2007</td>
<td>4,320</td>
<td>Medium</td>
<td>$2,865,928</td>
<td>$2,563,407</td>
<td>$139,184</td>
</tr>
<tr>
<td>Fruita</td>
<td>2007</td>
<td>4,320</td>
<td>Medium</td>
<td>$2,633,904</td>
<td>$2,432,851</td>
<td>$169,458</td>
</tr>
<tr>
<td>Horizon Drive</td>
<td>1997</td>
<td>2,809</td>
<td>Small</td>
<td>$2,086,952</td>
<td>$1,938,620</td>
<td>$161,082</td>
</tr>
<tr>
<td>Mesa Mall</td>
<td>1999</td>
<td>2,916</td>
<td>Small</td>
<td>$2,078,551</td>
<td>$1,950,518</td>
<td>$159,936</td>
</tr>
<tr>
<td>Montrose</td>
<td>2001</td>
<td>2,907</td>
<td>Small</td>
<td>$2,573,353</td>
<td>$2,336,207</td>
<td>$135,053</td>
</tr>
<tr>
<td>Ridgway (LEED Silver)</td>
<td>2008</td>
<td>4,455</td>
<td>Medium</td>
<td>$2,834,945</td>
<td>$2,568,978</td>
<td>$161,257</td>
</tr>
<tr>
<td>Rifle South (LEED Certified)</td>
<td>2007</td>
<td>2,730</td>
<td>Small</td>
<td>$2,343,577</td>
<td>$1,717,174</td>
<td>$161,657</td>
</tr>
</tbody>
</table>

Notes:

<sup>a</sup> Total project cost is the sum of all 16 CSI Divisions and does not include land costs. Total cost per CSI Division is provided in the Appendix.

<sup>b</sup> Total building cost equals total project cost less CSI Division 2: Site Work.

<sup>c</sup> Soft costs are fees related to the design, engineering and consulting associated with a project.
sheet was dedicated to each of the 16 CSI Divisions. Each tab sheet listed a general description of the work, the date procured, and the amount. The amount per CSI Division was totaled at the bottom of each tab sheet and reflected on the Project Summary page.

**Collection, Triangulation, and Normalizing of Data**

Cost information for the initial design and construction of all projects was collected and triangulated from a variety of sources. These included bank personnel (e.g., accounting representatives, bank presidents, and facilities management) and the projects’ architects and general contractors. Triangulation of the data between these various sources helped to ensure reliability and validity of the data. The accounting representatives generated expense reports for the design and construction for each bank from the bank’s Fixed Asset Software (FAS) system. The FAS reports were triangulated with bank president’s records, as well as invoices and pay applications from contractors, consultants, and material suppliers. All contractors used a form similar to the American Institute of Architects (AIA) G702 and G703 forms for application for payment. The form categorized the descriptions of work and related costs into the 16 CSI MasterFormat Divisions.

Before comparing construction costs for the ten projects, the costs of all projects were normalized for location and time using RSMeans’ Location Factors and Historical Cost Indexes. First, all project costs were normalized based on a national average using RSMeans Location Factors (RSMeans Company, c 1996–). The purpose of a location factor is to compare the cost of construction at a particular location to the national average (RSMeans Company, c 1996–). Location factors take into account the impact of building location on the costs of materials and installation. Next, costs were adjusted to 2011 using RSMeans...
Historical Cost Index for 2011 for each location. The purpose of the Historical Cost Index is to convert building costs from the date of construction to the same point in time. The Historical Cost Index is based on nine different building types, 66 commonly-used construction materials, labor hours for six types of construction trades, and equipment rental for six types of equipment typically used in installation of the 66 materials tracked.

Results

After normalizing the data for time and location, costs was evaluated in the following ways:

1. The total building costs of LEED banks were compared to those of non-LEED banks.
2. The square footage costs of LEED banks were compared to those of non-LEED banks.
3. The architectural and engineering fees of LEED banks were compared to those of non-LEED banks.
4. The direct costs associated with LEED certification.

Total Building Cost and Costs/SF

Total building costs (TBC) are costs associated with designing and constructing the building and do not include site work (Division 2). TBC were calculated for all 10 projects by summing costs for all 16 CSI Divisions, less Division 2 (Exhibits 1 and 3). The TBC for the non-LEED bank locations ranged from $1.938 million for Horizon Drive to $3.197 million at Breckenridge. Total building costs for the two LEED projects were $1.717 million for 2,730 SF (or $629/SF) for Rifle South
and $2.568 million for 4,455 SF (or $577/SF) for Ridgway. The LEED projects were within the range for TBC for all of the non-LEED projects.

In the small project group, non-LEED TBC ranged from $1.938 million at Horizon Drive to $2.336 million at Montrose. The TBC for Rifle South, the LEED project in the small group, was $1.717 million, below the range for the non-LEED projects. Within the medium group, TBC ranged from $2.432 million at Fruita to $2.563 million at Frisco. The LEED project in this group was Ridgway, which had TBC of $2.568 million, essentially equal to the top of the range for the medium group.

Square footage costs (Exhibit 4) were calculated by dividing the total building costs by the gross square footage of each bank facility (Exhibit 1). The square footage cost for non-LEED bank locations ranged from $563/SF at the Fruita location to $804/SF at the Montrose location. In comparison, the square footage costs for the two LEED projects were $577/SF for Ridgway (LEED Silver) and $629/SF for Rifle South (LEED Certified). When comparing square footage costs of the LEED projects to the non-LEED projects, they were within the range of square footage costs for all ten projects. The range this cost for the non-LEED small projects ranged from $660/SF at Clifton to $804/SF at Montrose. The square footage costs for Rifle South, the LEED project in the small group, was below the range of the small non-LEED projects at $629/SF. The square footage costs for the non-LEED medium group ranged from $563/SF at Fruita to $599/SF at Delta. Ridgway, the LEED project for this group, was within this range, with costs of $577/SF. The $624/SF cost for Breckenridge, the largest project in this study, falls in between the small and medium projects (Exhibit 5).
Soft Costs

According to previous studies, the majority of increased costs for green buildings are due to increases in soft costs (e.g., design, engineering, and consulting fees) (Kats, 2003). For the LEED projects, soft costs also included costs associated with LEED certification (e.g., registering projects with the U.S. Green Building Council, added project administration and documents, and applying for LEED certification). Soft costs were also analyzed based on total soft cost, soft cost per square foot, and soft cost as a percentage of total building cost (TBC). The total soft costs for non-LEED banks ranged from $89,084 for the Clifton location to $382,950 for the Breckenridge location (Exhibits 1 and 5). In comparison, soft costs for Rifle South were $161,657 and $161,257 for Ridgway, well within the total range for the non-LEED projects.

Total soft costs (TSC) for the small group ranged from $89,084 at Clifton to $161,082 at Horizon Drive for the non-LEED projects. TSC for Rifle South, the LEED project in this group, was slightly above the TSC range for the small projects at $161,657. TSC for the medium group ranged from $139,184 at Frisco to $172,637 at Delta for the non-LEED projects. The LEED project in this group, Ridgway, was within this range, with a TSC of $161,257.

The soft costs associated with square footage for the non-LEED projects in the small group ranged from $29/SF at Clifton to $75/SF at Breckenridge (Exhibit 6). Rifle South’s soft costs were $59/SF, within the upper end of the soft costs for the non-LEED locations. Ridgway’s soft costs of $36/SF were also within the non-LEED range, but were closer to the lower end of the range. Within the small
project group, soft costs ranged from $29/SF at Clifton to $57/SF at Horizon Drive. Soft costs for the LEED project in this group (Rifle South) was $59/SF, slightly higher than the non-LEED range for small projects. Within the medium group, soft costs ranged from $32/SF at Frisco to $41/SF at Delta for the non-LEED projects. Ridgway, the LEED project in this group, had soft costs of $36/SF.

As a percentage of total building costs (TBC), soft costs for the non-LEED banks range from 4.38% to 11.98% (Exhibit 7). The soft costs for Rifle South were 9.41% of the TBC, placing it within the non-LEED soft cost range, but toward the higher end of the range. Ridgway’s soft costs of 6.28% of TBC were well within the range for the non-LEED banks.

For the small group, the percentage of soft costs to TBC ranged from 4.38% at Clifton to 8.31% at Horizon Drive for the non-LEED projects. The percentage for Rifle South was high for the small group at 9.41%. Within the medium group, the percentage of soft costs to TBC ranged from 5.43% at Frisco to 6.97% at Fruitia for the non-LEED projects. The percentage for Ridgway was 6.28%, well within the range for the medium group.

Direct Costs of LEED Certification

The direct costs associated with LEED certification were estimated to be $37,200 for each project (Exhibit 8). These costs were part of the soft costs tracked under CSI Division 0. It should be noted that the cost of LEED certification does not change based on the level of LEED certification sought. The direct costs for
The Cost of LEED

Exhibit 7 | Soft Costs as a Percentage of TBC Adjusted for Location and Time of Construction (2011 dollars)

Exhibit 8 | Costs Associated with LEED Certification

<table>
<thead>
<tr>
<th>Description of LEED Cost</th>
<th>Amount</th>
</tr>
</thead>
<tbody>
<tr>
<td>LEED Registration</td>
<td>$450</td>
</tr>
<tr>
<td>LEED Certification Review</td>
<td>$1,750</td>
</tr>
<tr>
<td>Modeling to Satisfy LEED Credits</td>
<td>$5,000</td>
</tr>
<tr>
<td>Commissioning for LEED</td>
<td>$10,000</td>
</tr>
<tr>
<td>LEED Management Fees (In-house LEED Project Administrator)</td>
<td>$10,000</td>
</tr>
<tr>
<td>Additional Design Fees Related to LEED</td>
<td>$5,000</td>
</tr>
<tr>
<td>Additional Construction Fees Related to LEED</td>
<td>$5,000</td>
</tr>
<tr>
<td>Total Costs Directly Associated with LEED</td>
<td>$37,200</td>
</tr>
</tbody>
</table>

seeking LEED certification were below 2% of TPC and between 1.5% and just over 2% of TBC (Exhibit 9).

The LEED certification process involved two costs associated with the U.S. Green Building Council (USGBC). The first cost was the fee to register the project for LEED certification, which was $450 for each of the LEED banks. The registration
Exhibit 9 | Costs Associated with LEED Certification as a Percentage of Total Project and Building Costs

<table>
<thead>
<tr>
<th>Bank</th>
<th>LEED Certification Level</th>
<th>LEED Costs(^a)</th>
<th>LEED Costs as % of TPC(^b)</th>
<th>LEED Costs as % of TBC(^c)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ridgway</td>
<td>LEED Silver</td>
<td>$37,200</td>
<td>1.31%</td>
<td>1.45%</td>
</tr>
<tr>
<td>Rifle South</td>
<td>LEED Certified</td>
<td>$37,200</td>
<td>1.59%</td>
<td>2.17%</td>
</tr>
</tbody>
</table>

Notes:
\(^a\) Calculations of LEED costs provided in Exhibit 8.
\(^b\) Total project costs (TPC) are provided in Exhibit 1.
\(^c\) Total building costs (TBC) are provided in Exhibit 1. TBC = TPC - CSI Division 2: Site Work.

fee was the same amount charged to USGBC member organizations, regardless of project size and type (USGBC, 2009). The second cost was the fee for certification review, which was $1,750 for each of the LEED banks. The certification review cost was dependent on project size and member status.

Energy modeling is a requirement for LEED certification. The purpose is to demonstrate the percentage improvement in the proposed building’s performance compared to a baseline building’s performance (USGBC, 2009). This involves conducting a whole building project simulation and energy analysis. Modeling costs for the Rifle South and Ridgway bank projects were about $5,000 each.

LEED certification requires Fundamental Building Commissioning as a prerequisite to certification (Kibert, 2005). The intent of building commissioning is “to verify that the project’s energy-related systems are installed, and calibrated to perform according to the owner’s project requirements, basis of design and construction documents,” (USGBC, 2009 p. 29). Although commissioning can be used on non-LEED projects, commissioning costs were treated as added costs required for LEED certification in previous studies reviewed. Therefore, commissioning costs in this study were also considered as added projects costs required for LEED certification. Commissioning costs were $10,000 for each LEED certified bank.

Documentation and management of the LEED certification process for the Rifle South and Ridgway LEED projects were conducted by an in-house LEED Accredited Professional. The hours spent on LEED management were tracked separately from this individual’s other responsibilities within the company. The estimated amount of time spent on LEED administration and documentation was 200 hours per project. In addition, an estimated 20 hours per project was spent on construction monitoring and photographing. The resulting 220 hours for LEED Management were billed at an hourly rate of $45/hour. The direct cost to manage the LEED process in-house was estimated and rounded up to $10,000 per project.

Additional design fees directly related to LEED certification were limited to very small increases in design time for LEED charrettes, product research, and time
necessary to complete submittals requirements for LEED certification. A $5,000 amount has been estimated to cover this additional time.

A $5,000 amount has been estimated to cover minimal additional construction activities determined to be directly related to complying with the requirements of the following LEED credits:

1. Sustainable Sites Prerequisite 1: Construction Activity Pollution Prevention
2. Materials and Resources Credit 2.1–2.2: Construction Waste Management
3. Materials and Resources Credit 4.1–4.2: Recycled Content
4. Indoor Environmental Quality Credit 3.1: Construction IAQ Management Plan

Discussion

Total Building Costs and Square Footage Costs

The TBCs for the non-LEED banks ranged from $1.938 to $3.197 million (Exhibits 1 and 3). With a difference of over $1.2 million, this was much wider than anticipated. However, when considering the TBC range in relation to the range of building sizes of the cases, three sub-groups of banks became apparent and clarify the findings. Five of the banks had gross building sizes of around 3,000 SF or less and the TBC ranges from $1.717 to $2.032 million, a difference of $300,000. Four banks had gross building sizes of between 4,000–4,500 SF, and TBC ranged from $2.432 to $2.568 million, a difference of only $136,000. The last group was comprised of a single property at over 5,000 SF and a TBC of $3.197 million.

Four of the five smallest banks (Horizon Drive, Mesa Mall, Clifton, and Montrose) are non-LEED facilities and share relatively the same building plan and size. Additionally, these banks were designed and built by the same architectural firm and general contractor. Three of these banks are located in the Grand Junction area (Horizon Drive, Mesa Mall, and Clifton) and the fourth is about 60 miles away in Montrose. Of the banks located in and around Grand Junction, the geographic and socioeconomic conditions of these areas are very similar. These similarities are reflected in many of the cost indicators used in this study. For example, the three banks in the Grand Junction area have TBCs ranging from $1.938 million to $2.032 million and square footage costs ranging from $660/SF to $690/SF. Additionally, the hard costs per CSI division are very similar.

Despite these similarities, other costs varied considerably for the non-LEED banks. For instance, the Montrose facility, a non-LEED project, was completed in 2001 for $2.336 million (TBC). The Clifton bank was completed in the same year, using the same building plan and project team, but cost significantly less (Exhibit 3). Additionally, the Montrose facility’s square footage cost was $804/SF, which is the highest of all the locations in the study and notably higher than the similar
banks (Exhibit 4). The higher costs were determined to result from redundant mechanical systems including a gas-fired system and a geothermal system. The redundant systems costs explain why the bank has a higher square footage cost for Division 15—Mechanical of $38/SF.

The fifth bank in the group of smaller locations is the Rifle South location, a LEED certified bank completed in 2007. Despite incorporating many green features into the design, LEED certification was not part of the project’s original scope. The project team decided to pursue LEED certification after construction had started on the project. Fortunately, many LEED prerequisites were already satisfied within the original project scope and design. For example, the site is one acre and required to comply with the State of Colorado’s storm water discharge permit, thus satisfying a LEED Sustainable Site prerequisite. Additionally, the small size of the building allowed the mechanical engineer to serve as the commissioning agent. This avoided additional costs to commission systems that had already been designed and purchased. Rifle South’s TBC was $1.717 million, which is on the lower end of the range for similar sized banks included in this study and on the lower end of the range of square footage costs for the small group.

This Rifle South project also included innovative features that were not included in any other facility. These features included a 6.5 kW photovoltaic (PV) solar electric system and a lighting control system (LCS). The PV system is located on the drive-thru canopy and is estimated to generate almost 20% of the building’s electrical energy usage. The LCS takes advantage of good natural daylighting conditions; when natural light levels are adequate, the electric lighting automatically dims, saving on electricity consumption. Given the small size of the building, both the solar electric and lighting control systems contribute to and in increased square footage costs for Division 16—Electrical.

Ridgway is among the group of larger banks with 4,455 SF (Exhibit 2). The bank had a total building cost of $2.568 million and a square footage cost of $577/SF. Both of these cost indicators were in the range of similar sized locations (Exhibits 3 and 4). The Ridgway facility was actually the third LEED project for Alpine Banks. The other project, which was not been included in this study, was an interior remodel that sought certification under the LEED for Commercial Interior requirements in 2007, prior to the Ridgway project. There was a carryover of individuals who had worked on the LEED CI project to the Ridgway project. This increased experience and knowledge of LEED certification resulted in a more streamlined incorporation of LEED requirements into the overall project delivery, minimizing additional costs.

To summarize the analysis of TBC, it was found that the TBCs for the LEED projects were within the range established by the non-LEED projects. Within the small and medium groups, the TBCs for the LEED projects were within the range of the non-LEED projects, although Ridgway was at the top of the range for the medium projects. With respect to square footage costs, it was found again that the LEED projects were within the range of these costs established by the non-LEED projects both overall and within the small and medium groups.
Soft Costs

Soft costs for both LEED projects included in this study were within the non-LEED bank ranges for total soft costs (TSC). The two LEED projects did not experience any unanticipated additional soft costs related to the LEED certifications. Additional soft costs directly related to LEED certification for both LEED banks were limited to minimal increases in design time for LEED charrettes, product research, and the time necessary to complete submittals for LEED documentation, as well as modeling and LEED management. With respect to TSCs, the LEED projects were within the overall range established by the non-LEED projects. The TSCs for the LEED project in the small group were high for that group. The TSCs for the LEED project in the medium group were well within the range established by the non-LEED projects. When TSCs were compared to TBCs, again the LEED projects were within the over range for the non-LEED projects and the LEED project in the small group was high while the LEED project in the medium group was within the range for that group.

Direct Costs

The in-house LEED management costs for the LEED projects were estimated at $10,000 each. If an in-house LEED project administrator had not been available, an outside consultant would have been necessary to manage the LEED process. In 2007–2008, outside consultants’ LEED management fees for small commercial facilities in Colorado were typically in the $30,000–$40,000 range (J. Plaut, personal communication, June 4, 2009). Other LEED project administrators in Colorado have estimated the time spent on LEED management at 400 to 800 hours (M. Reott, personal communication, June 4, 2009). If it had been necessary for the developer to contract with an outside consultant, the fees could have increased to $30,000. This would have increased LEED direct costs to $57,200 per project. In this situation, LEED direct costs would have been 2%–3% of the total project costs and 3%–4% of the total building cost.

Conclusion

The data and analysis presented in this paper address the question “Can LEED banks be designed and constructed for costs comparable to non-LEED banks?” To answer this question, ten case studies were selected for analysis. Cases were grouped by gross square footage into small, medium, and large groups. Design and construction costs were normalized based on location and time. These results demonstrated that across very similar projects, it was possible to achieve LEED certification for minimal additional costs. The findings of this study demonstrate the costs associated with the LEED projects were always within the overall range of the non-LEED projects. Within sub groups, it was found that for the project team with less experience, soft costs for the LEED project tended to be just above the range of the non-LEED range. For the project team with more documented experience with LEED, costs associated with LEED tended to be at the middle or low end of the range established using similar non-LEED buildings. This was an
unexpected, but interesting result, which demonstrated how the project team’s experience with LEED can impact project costs. The results showed that as the project team gained more experience with LEED requirements and certification, there was a decline in costs associated with LEED certification.

This study found that design and construction costs for the two LEED banks are within the same overall cost ranges as the non-LEED banks. Seeking LEED certification added 2%–3% to total building costs and less than 2% to the total project cost, depending upon whether the company used an in-house LEED project administrator or outside consultant. These results both confirm and extend previous research on the costs associated with LEED certification to include bank facilities, hopefully encouraging more banks to consider incorporation of LEED requirements into their projects, building their experience with and understanding of LEED certified and energy-efficient buildings.

This study did not consider the impact of LEED requirements on either post occupancy satisfaction or the cost of facility operation and maintenance. Future studies addressing these issues are needed to increase adoption of LEED requirements and energy efficiency in buildings.
### Appendix

**Building Cost Data by Construction Specification Institute’s (CSI) MasterFormat 1995 Divisions**

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<th>Div. 2</th>
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## Appendix (continued)

Building Cost Data by Construction Specification Institute’s (CSI) MasterFormat
1995 Divisions

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References


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