HONEST ABE

Modeling Sustainable Strategies at Lincoln High School

THE LINCOLN HIGH SCHOOL RENOVATION & EXPANSION

Tacoma's Lincoln High School was originally built in 1913, comprising three 3-story wings in an "L" shaped plan. The existing structure stands as a classic example of the large, comprehensive high school, with classrooms aligned on wide, double-loaded corridors. In 2001, the school received a Gates Grant and capital projects bond funding to proceed with the programmatic and architectural conversion to a "small schools" structure.

The full scope of work envisioned by Tacoma Public Schools and the project team spans the comprehensive renovation, restoration and modernization of the original 140,000 school building; the addition of approximately 28,000 GSF of instruction and support space; and the overall transformation of this large building into a "small schools" environment housing six different learning academies---all of this while retaining the historic architectural character of this landmark community building.

The in-progress state of the project affords the unique opportunity to study the viability of implementing sustainable design features into the school.

THE WSSP PILOT PROGRAM GRANT STUDY AT LINCOLN

One of the five schools selected for the WSSP Pilot Project Grants is historic Lincoln High School in Tacoma, WA. Lincoln is currently in the Design Development phase of an extensive modernization and expansion program, and offers a unique opportunity not only for the study of green building practices in a large, urban facility, but also for the demonstration of the applicability of such practices in a building that is over 90 years old.

The specific study components and methodologies (six of which are outlined below) are founded on four specific stages:

1. Collecting data
2. Modeling strategies
3. Calculating cost viability
4. Organizing and reporting the results

The study is currently moving into the final phases of organization and reporting. The information below provides a summary overview of each study topic and details as to the intention and methodologies of each investigation.

FOR MORE THAN JUST ONE SCHOOL

The most exciting aspect of the study is the opportunity to inform the Washington State Legislature of the results with the aim of using quantifiable data to inform the composition and implementation of policies regarding sustainable design in school construction.

The studies at Lincoln will expand relevancy beyond Lincoln itself by modeling different variables. By modeling the measurements taken at Lincoln with data from Tacoma, WA; Forks, WA; and Spokane, WA, the study will produce results for Puget Sound, coastal and eastern Cascadia. Additionally, some study segments will model data for average classroom sizes (in addition to the "historic" large sizes found at Lincoln).

In the end, this study will produce a measured evaluation of sustainable practice viability in Cascadia, and takes an exciting step forwarding in growing sound sustainable design policy in Washington state.

Go with the grain

Using wood in lieu of steel

Protocol Category
Materials - Credit 6 and Credit 8

Protocol Directives
6.1: At least 20% of cost of wood-based materials and products are from sustainable forest certified by third party.

8.1: Install materials that are manufactured within a 500-mile radius for 20% of building materials.

8.2: Install materials that are extracted, harvested or recovered from within a 500-mile radius for 20% of building materials.

Proposed Solution
Where structurally feasible at the new North Wing addition, substitute wood and engineered wood products for structural steel framing and partition framing.

Study Methodology
The study will calculate the difference between the baseline (materials and energy) costs of the steel systems and certified wood solutions. The primary data to be reported comprises the following:

1. Baseline cost/square foot of steel structure
2. The total amount of board feet, glulam members and other engineered wood products required for the proposed solution.
3. Cost/square foot of the proposed solution's alternative structural system using three criteria: a). wood that is non-certified; b). wood that is SFI-certified; c). wood that is FSC-certified. Availability and lead time information for the three types of wood will be provided.
4. Baseline calculation of thermal loss and associated energy cost impact due to wood studs at perimeter walls.
5. New calculation of thermal loss and associated energy cost impact due to wood studs at perimeter walls.
6. Non-data information submitted: Short narrative summarizing a). impact of using the three wood certification criteria; b). pros and cons of using wood in lieu of steel; c). life cycle energy costs of wood and steel; d). lessons learned and recommendations.

Got rain?

Taking advantage of Cascadia's rainfall to reduce potable water consumption

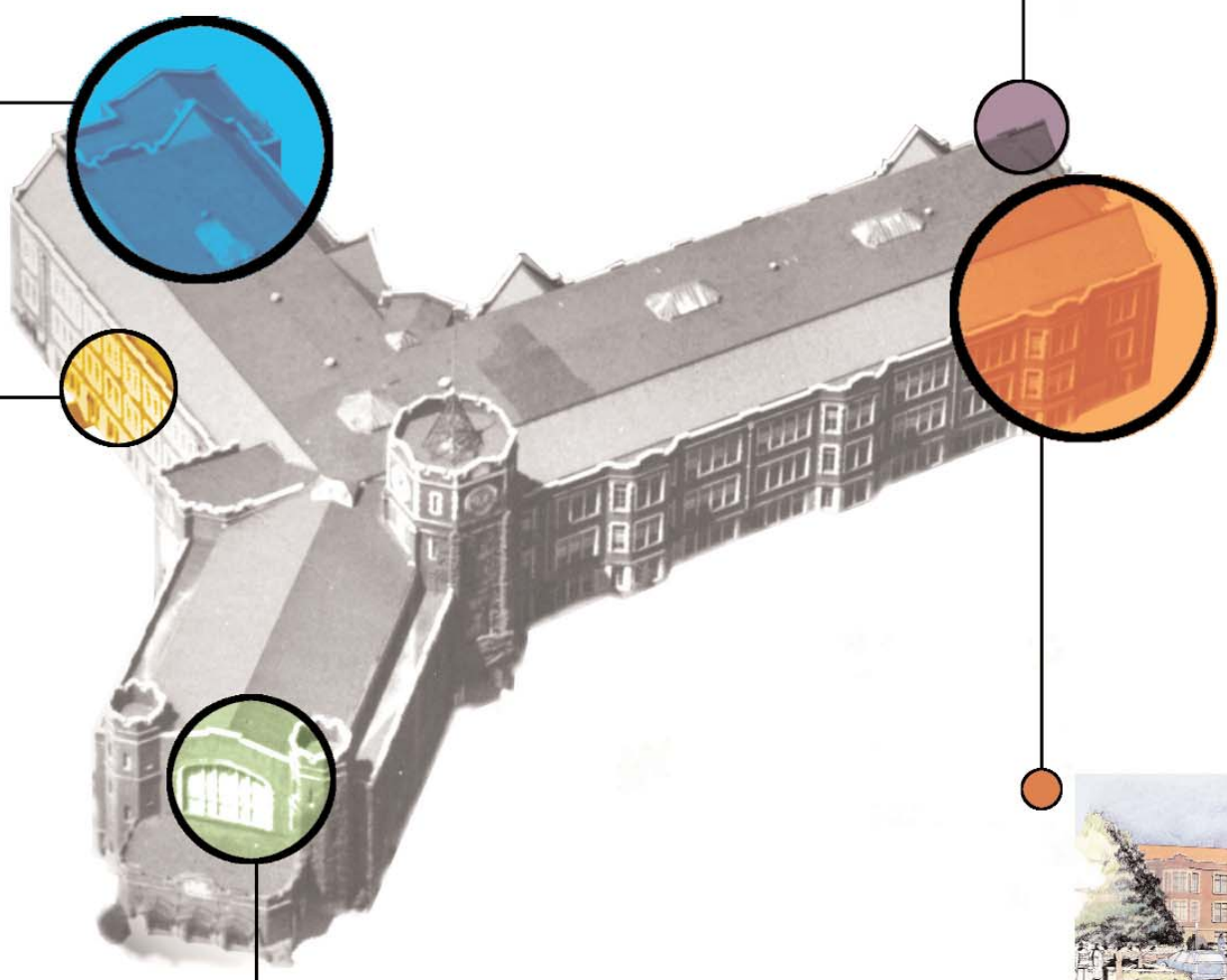
Protocol Category
Water - Credit 2

Protocol Directive
2.2: Reduce potable water use by at least 20% beyond building baseline.

Proposed Solution
Reduce potable water consumption through modeling a gray water system for toilet room waste conveyance.

Study Methodology
By calculating the difference between the baseline fixtures' known water usage and that of the gray water system, the study will determine whether the water saved by this strategy satisfies a 20% savings over the baseline. Additionally, the study will provide costing on baseline usage and proposed gray-water system usage. The primary data to be reported comprises the following:

1. Baseline water consumption: gross consumption and calculated consumption for waste conveyance by gender and by water closet vs. urinal. Utility rates for water supply and waste conveyance will be provided.
2. Cost estimate to construct a gray water system for waste conveyance. The total cost and the cost per gallon will be provided.
3. Payback calculation of cost of gray water system base on water rate.
4. Life Cycle Cost Analysis on pre-filters necessitated by the cistern system.
5. Non-data information submitted: commentary on the regulatory barriers of installing a gray water system.



The trouble with RUBBLE

Breaking down the benefits of building materials re-use

Protocol Category
Materials - Credit 2

Protocol Directive
2.1 Maintain (reuse) at least 75% of previous structure and shell.

2.2 Maintain (reuse) an additional 25% (100% of total) of existing structure and shell.

2.3 Maintain (reuse) 100% of existing building and at least 50% of non-shell systems.

Proposed Solution
Re-use building rather than raze and build new.

Study Methodology
This study will calculate and document the volume of materials saved in the re-use of existing building portions---these calculations will then be provided to the Bridge Consultant for use in calculating embodied energy savings in building retention vs. raze and build new. The primary data to be reported comprises the following:

1. Calculation of the volume (in cubic yards) of major materials contained in the portions of Lincoln High School to remain.
2. Calculation of the amount of material use that was avoided by reusing the old building.
3. Calculation of the volume of major materials contained in a rebuilt new building on the same site, and of the same size and exterior skin as the original building.

Here Comes THE Sun

Using daylight-controlled dimmable lighting to reduce energy consumption and operational costs

Protocol Category
Energy - Credit 1

Protocol Directive
1.1: 10% (4 pts) to 50% (12 pts) reduction in total net energy use from NREC baseline, or include all prescriptive criteria (4 pts)…

Proposed Solution
Install daylight-controlled dimmable classroom lighting.

Study Methodology
This study will model the impact of daylight-controlled dimmable lighting on first costs and on operational costs. The study will quantify and illustrate energy-savings through daylight-controlled dimmable lighting by calculating the difference between the baseline fixtures' known power usage and that of the proposed solution. The primary data to be reported comprises the following:

1. Energy savings (kilowatts/hour) from controlling the lighting levels by the amount of available daylight. This data is from computer modeling using historic weather data for the site, and physical dimensions of the existing rooms and window openings at Lincoln High School.
2. Calculation of the kilowatt/hour break-even number when electrical costs will pay for the costs of daylight-controlled dimmable classroom lighting.
3. Calculation of the impact on the mechanical system from the heat gain/loss of operating daylight-controlled dimmable classroom lighting.
4. Non-data information submitted: short narrative summarizing a). pros and cons of using daylight-controlled dimmable lighting in lieu of non-dimmable lighting; b). lessons learned and recommendations.

CONSERVATION OR PRESERVATION?

Reconciling the pros and cons of replacing historic windows

Protocol Category
Energy - Credit 1

Protocol Directive
1.1: 10% (4 pts) to 50% (12 pts) reduction in total net energy use from NREC baseline, or include all prescriptive criteria (4 pts)…

Proposed Solution
Replace all windows with NREC-compliant windows approximating the appearance, dimensions and sightlines of the existing (historic) windows

Study Methodology
This study will calculate the difference between the energy loss of a baseline window and the proposed window solution, and illustrate associated costing. The primary data to be reported comprises the following:

1. Calculation of the thermal performance of existing windows (expressed in U-value and in BTU/square foot/year); calculation of number of windows and window area.
2. Cut sheets and thermal performance information for replacement windows.
3. Cost of restoring baseline condition windows (expressed in cost/square foot of glazing).
4. Costs associated with installing replacement windows.
5. Payback for installation in Tacoma.

Relevance and Ramifications
In Lincoln's case, the existing windows stand as part of the building's historic fabric, and a proposed replacement of the windows opens the debate between the value of energy savings afforded by new windows, and the value of landmark eligibility in keeping the old. This discussion will take place for any similar project, but the results of a study such as this will provide hard data against which project stakeholders may make informed decisions.

Learning and Leadership
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