



CENTER FOR EDUCATION AND RESEARCH IN CONSTRUCTION

Department of Construction Management, College of Built Environments

Research and Training with UW Faculty and Students



Center for Education and Research in Construction (CERC)

CERC: Applied Research & Training

> What is CERC? Who is CERC?

> Partnerships showing **Variety and Impact**

- UW Capital Planning and Development: LED Lighting Study
- PacTrans (US DOT): Public Private Partnerships and Roadway Safety
- Sound Transit: Asset Data & Building Information Modeling

Build It and They Will Come

- > A Department of Construction Management
(first graduates in 1965)
- > A Unique Lab Facility
 - former Navy building @ Magnuson Park, 1975
 - Our lab: Building 5, Bay B (25,000 sq.ft., high-bay/low-bay)
 - Labs and classrooms
 - Build-out for CM 2004-2009
 - > Materials and Methods Lab
 - > Virtual Construction Lab
 - > Collaboration suites
 - > Classrooms and Library



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Then and Now - Materials and Methods Lab

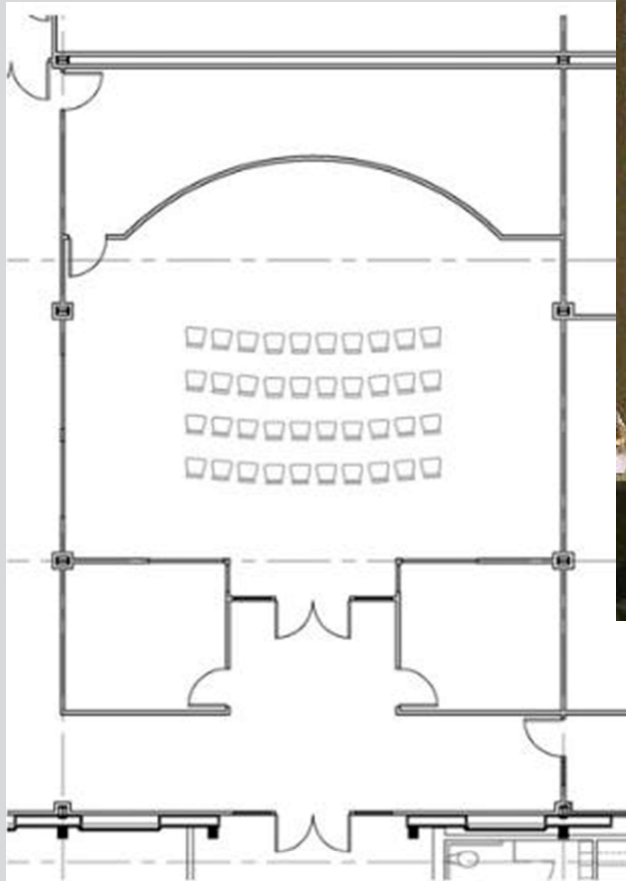


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Virtual Construction Lab



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Industry Made It Happen

Industry – Academia Partnership



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CERC – Who We Are Today

Research and Training

SHARE Lab: Safety & Health

ESC Lab: Energy & Sustainability

CTOP Lab: Communication & Technology

Project Delivery: Design-Build & Public Private Partnerships



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CERC – SHARE Lab

Laboratory for Safety and Health
Advancement through Research
and Education

- > iSafe Field Inspection System
- > Computer Animated Fall
Protection Training
- > 3D Virtual Construction Safety
Training



SHARE Research Funders:

Hewlett Packard, Inc. (HP)

Occupational Safety and Health Administration (OSHA)

National Science Foundation (NSF)

National Institute for Occupational Safety and Health (NIOSH)

Royalty Research Fund

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CERC – ESC Lab

Laboratory for Energy & Sustainability
in Construction

- > Energy-related risk management
- > Phased Investment
- > Energy Retrofit Loan Analysis
- > Optimized portfolio analysis for
community-based photovoltaic
investment



ESC Research Funders:

The Center for Construction Research and Training
Oregon Department of Transportation
PacTrans
ELECTRI International

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CERC – CTOP Lab

Laboratory for Communication,
Technology and Organizational
Practices

- > BIM to BUILDER workflow
- > Team Practices for energy design
- > How and why IPD and collaborative strategies are more reliable
- > Rebaselining workflows for collecting as-is data for existing buildings



CTOP research funders:

Skanska Building USA, Inc.

Sound Transit

U.S. Army Corps of Engineers

General Services Administration

University of Washington Capitol Projects Office

National Science Foundation

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CERC – Project Delivery

Expertise in Design-Build and PPP

- > Public Private Partnerships
- > Contractual terms for safety
- > Contractual safety incentives
- > Improved roadway safety
- > Tools to monitor contractor performance
- > Tools to forecast time and costs



Project Delivery research funders:

PacTrans (US DOT)

WS DOT

UW Capitol Development and Planning

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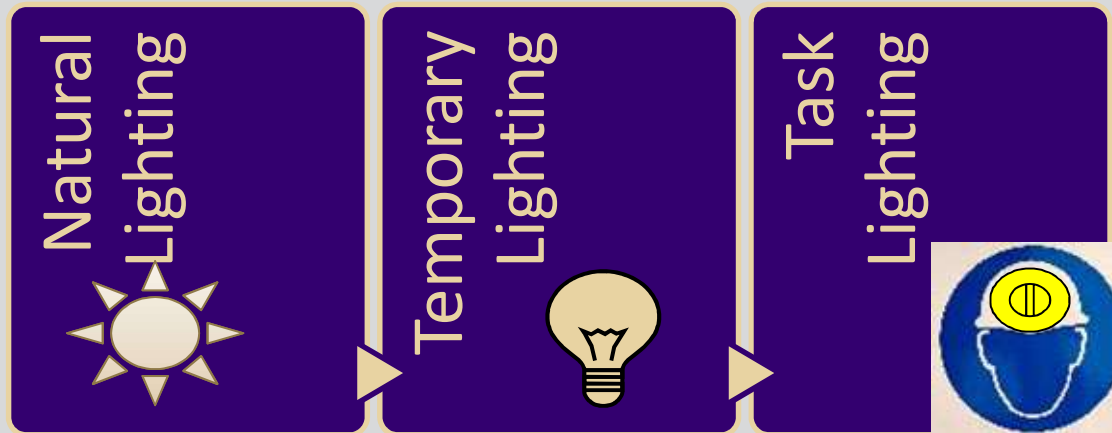
Partnership UW Capital Planning and Development

Safety Technology: LED for Temporary Construction Lighting

Dr. Ken-Yu Lin

Associate Professor
Construction Management

Safety _ Cost _ Energy



Egress Lighting ↑

Electrical Sub

Bid Package ↑

G.C.

General Req. ↑

Project Owner

Traditional Temp. Lighting Setup



Incandescent lamps (100W or 150W)
suspended from the slab deck at a
10' x 10' grid.
(Smith, 2007)



Suspended compact fluorescent lamps,
(Clear-Vu Lighting, www.clearvulighting.com)

Low Voltage LED Lighting Setup



<http://clearvulighting.com/portfolio/flex-sls-achieves-university-washingtons-safety-sustainability-goals-increased-light-levels-improved-safety-reduced-operational-maintenance-costs-environmental-responsi/#>

Case Study Project

- UW Bothell Phase 3
 - **Location:** Bothell, WA
 - **Facility Size:** 75,000 ft²
 - **Type of Project:**
 - Academic Building
 - New Construction
 - **Construction Duration:** 17 Months
 - **Total Project Cost:** \$68 Million
 - **GC/CM:** Lease Crutcher Lewis
 - **EC/CM:** Nelson Electric
 - **LED Manufacture:** Clearvu Lighting



<http://lewisbuilds.com/news/uw-bothell-science-and-academic-building-lesson-lean-construction>



<http://pm.uw.edu/cpo/cpoutlook/uw-bothell-discovery-hall>

LED Lighting Setup @ UWB P3

- Meeting the 5 FC OSHA requirement



Temporary lighting power cables installed within concrete slab



Temporary lighting whips and light fixtures dropped and exposed below ceiling deck

Installation_Costs



Data Collection



Interview with Clear-Vu representative



Site interviews with project staff



Survey questionnaires distributed to workers on site



Cost information derived from Nelson Electric and others

Survey Findings

- 21 response (of which 19 were analyzed)
- Agreement level (1~5 Likert scale)

Description	Average rating	
	LED lighting	TRAD lighting
Distracted from work	2.43	3.25
More disruption	2.10	3.06
More coordination efforts	2.10	3.13

Survey Findings

- 21 response (of which 19 were analyzed)
- Agreement level (1~5 Likert scale)

Description	Average rating	
	LED lighting	TRAD lighting
Amount of light provided	3.70	2.69
Consistent and well distributed	3.50	2.38
Productive	3.75	2.94
Visually comfortable	3.84	2.73
Safe operation of work	4.00	3.20
Distracted from work	2.43	3.25
More disruption	2.10	3.06
More coordination efforts	2.10	3.13

Conclusion: Safety _ Cost _ Energy

- LED lighting is perceived as **safer** than traditional lighting
 - 5 FC **OSHA requirement** not met with traditional lighting
 - LED support **immediate use** of temp. lighting
- LED required additional pre-construction **planning** and **higher installation cost**
- With 5 FC, the cost of LED is **comparable** if not less
- However, cost saving might belong to **different** parties

Impact: Seattle City Light Rebate for LED projects

Made positive change on the job sites