INTEGRATING SAFETY & SUSTAINABILITY









Course Outline

- o Introduction to Sustainability, Green Building & Safety
- Introduction to Green Building Systems & Best Practices
- o Safety through Design
- o Green Building Benefits to Safety
- o Sustainable Practices Roles & Responsibilities
- o Prevention in the Field
- o Company Wide Approach to Safety & Sustainability

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About the Project

Safety and Health Investment Projects

What's it all about?

In 2007, the Washington State Legislature established the Safety and Health Investment Projects (SHIP) Grant Program. The program is managed by the Division of Occupational Safety and Health (DOSH) in the Department of Labor & Industries (L&I).

The SHIP Grant Program awards occupational safety and health grants for projects that develop new and innovative practices to stimulate workplace safety.

Priority will be given to proposals that involve cooperation between employers and employees or their representatives.

How Does It Work?

Eligible grants will aim to prevent injuries and illnesses, save lives, and educate workers and employers about workplace hazards and safe workplace practices.

Proposals submitted by applicants will be reviewed by SHIP Grant Program staff, and then by a SHIP Advisory Committee of business and labor representatives who will help L&I select projects for funding.



Frequently Asked Questions (FAQs) about the SHIP Grant Program

Q. Where do I get an application?

- A. You'll find applications and helpful instructions on our Web site at SafetyGrants.Lni.wa.gov.
- Q. Are there monetary limits on the amount I can request?
- A. Some restrictions may apply; check our Web site for details.

Q. What type of project will receive priority for a SHIP grant?

- A. Employer/employee sponsored projects aimed at accident prevention will receive priority. L&I will also consider funding proposals for:
 - The development of technical innovation and engineering controls
 - Best practices
 - Education and training
 - Other priorities as identified by L&I
- Q. What types of activities can not receive SHIP funds?
- A. You can not use SHIP funds for:
 - Lobbying or political activities
 - Supporting, opposing, or developing legislative or regulatory initiatives
 - Any activity not designed to reduce workplace injuries, illnesses, or fatalities
- Reimbursing employers for the normal costs of complying with safety and health rules

Q. Who decides if my project will be approved and funded?

A. SHIP Grant Program staff will review and score applications for eligibility, completeness, and project applicability. The SHIP Advisory Committee will then review the applications and forward recommendations to the Assistant Director of DOSH. The Assistant Director has final approval authority.

Q. How will I know if my application is accepted or denied?

- A. Applicants will receive written notification of the status of their application.
- Q. What if I disagree with the rejection or denial of my application?
- A. You may appeal in writing explaining the reasons your application merits reconsideration.
- Q. If my application is rejected or denied, can I resubmit it?
- A. Yes, but you must specifically address the reasons the application was originally rejected or denied.



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Project Development



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Project Development

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Introductions

o Name?

- o Company/Organization?
- o Experience with Safety?
- Experience with Green
 Building?









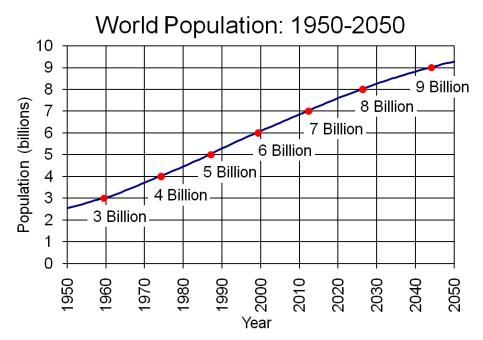
DEFINING SUSTAINABILITY

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What is Sustainability?

Human survival depends on healthy natural ecosystems



Source: U.S. Census Bureau, International Data Base, June 2010 Update.



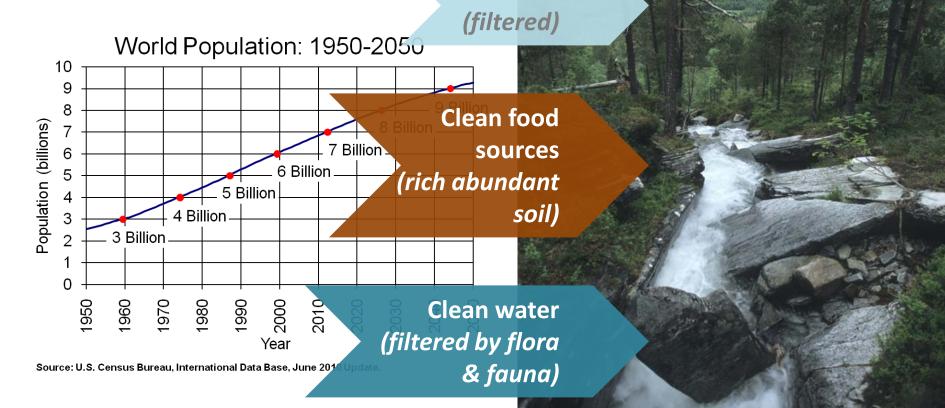
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What is Sustainability?

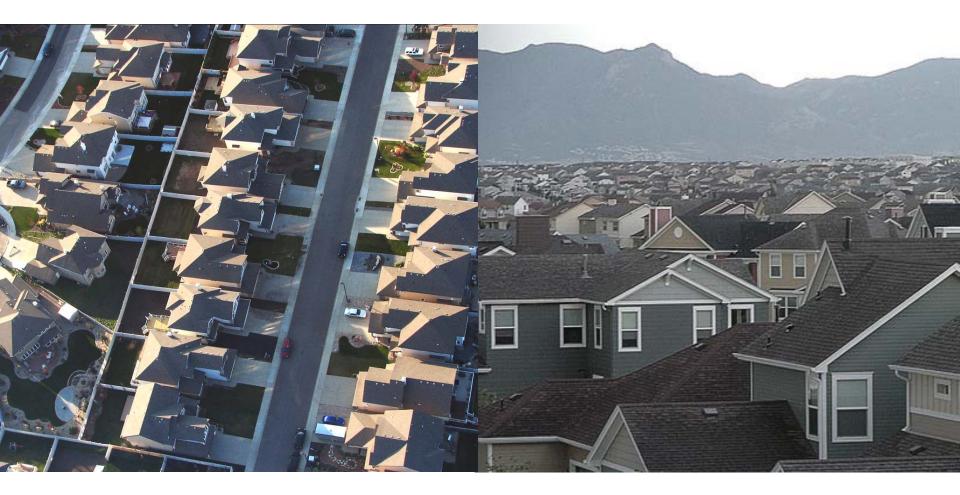
Human survival depends on healthy natural ecosystems





Is this Sustainable?

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Would you rather be Here?

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CLIMATE CHANGE







Seeing Beyond the Trees



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Climate Change

Transportation

- o 1 gal gasoline = **19.4 lbs** of Co2
- o 1 gal diesel = 22.2 lbs of Co2

少开车。 图看你非人交""您们二氧化器名9多9 www.20to20.org







Climate Change

Implications

- o Ship wood from Brazil
- o Ship steel from Korea

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BUILDING INDUSTRY







ARE WE CHANGING TAS ENOUGH?

Che futuro vogliamo? Due possibili scenari per il 2020. <u>A sinistra</u>, le conseguenze dello sviluppo attuale: smog, sporeizia, ingorghi. <u>A destra</u>, un modello di citte



WHAT'S STOPPING US?

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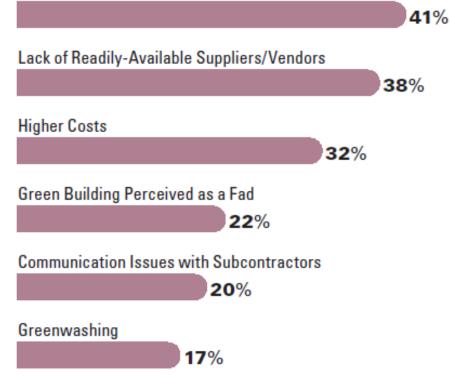
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Barriers to Change

Challenges Impacting the Use of Sustainable Waste Practices

Source: McGraw-Hill Construction, 2009.





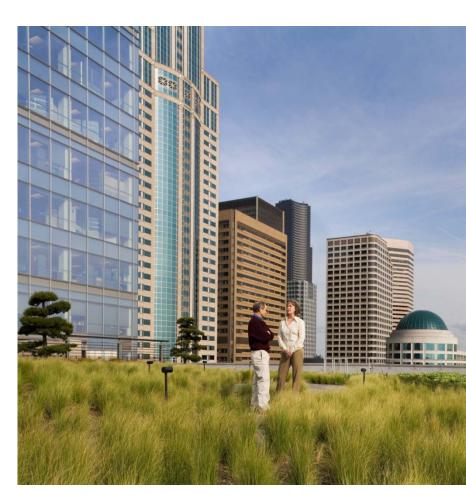
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What's Driving Change?

- Build sustainably for less cost Ο
- Reduce operational costs Ο
- Position for market differentiation
- o Satisfy their client demand
- Respond to employees Ο
- Demonstrate environmental \bigcirc responsibility





What's Driving Change?

- Formaldehyde Standards for Composite
 Wood Act July 7, 2010
- o WA State 2009 State Energy Code Draft
- WA State Legislature Chapter 39.35D RCW
 High-performance public buildings
- o City of Seattle Green Factor

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o GHG shall be regulated by the Clean Air Act

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o International Green building Code









Changing a Culture

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http://www.youtube.com/watch?v=NxTNZUhesZk



Parallel to Safety Culture



Skill • Integrity • Responsibility

ABOUT US MEMBERSHIP INFO FIND A CONTRACTOR JOBSITE MEMBER LOG IN SEARCH

Member Benefits

20 Year Safety Team Members

Government Affairs

Safety Services

- Services, Products, Training <u>AGC Safety Team</u> C Safety Forums Rules and Regulations Member Safety Contacts Links
 - Labor Relations

Group Retro

- **AGC Future Leaders**
- **Education and Training**
 - Contract Documents
 - Member Discounts
 - Construction News
 - Where's the Work?
- Membership Directory
 - Northwes
 - Contact Us
- AGC of America THE ASSOCIATED CINERAL CONTRACTORS OF AMERICA Quality People. Quality Projects.

Bookstore • ConsensusDOCS



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- Congratulations to these AGC Safety Team members for being a part of the Safety Team for 20 years!
 - Abbott Construction
- Absher Construction Company
- Active Construction, Inc.
- Bayley Construction, GP
- Ceco Concrete Construction
- Cope Construction Company
- Deeny Construction Company, Inc.
- Emerald Paving, Inc.
- Ferguson Construction, Inc.
- Fisher & Sons, Inc.
- Foushee & Associates, Inc.
- GLY Construction
- Haskell Corporation
- Jones & Roberts Company
- Joseph S. Simmons Construction, Inc
- Korsmo Construction, Inc.
- Lakeside Industries
- Lease Crutcher Lewis WA, LLC
- Leonard and Company
- Max J. Kuney Company
- Mowat Construction Company
 Northwest Cascade, Inc.
- Northwest Cascade, If
 Pease & Sons, Inc.
- Pease & Sons, Inc.
 Pease Construction, Inc.
- Penny Lee Trucking, Inc.
- Poe Construction, Inc.
- Quigg Bros., Inc.
- R V Associates, Inc.
- Sellen Construction Co., Inc.
- Sunset Pacific General Contractors, Inc.
- Wade Perrow Construction, LLC (WPC)

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DEFINING GREEN BUILDING





What is Green Building?

Green Building

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...is better siting, design, construction, operation, and maintenance

that increases the efficiency with which buildings and their sites use and harvest energy, water and materials,

and reduces building impacts on human health and the environment.



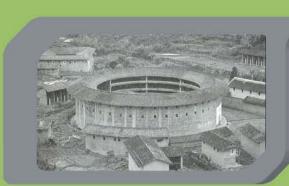
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Brief History of Green Building

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Rammed Earth construction, rain water collection and passive heating and cooling (basis of design) are utilized



3000 BC



GREEN ROOF

2000 BC

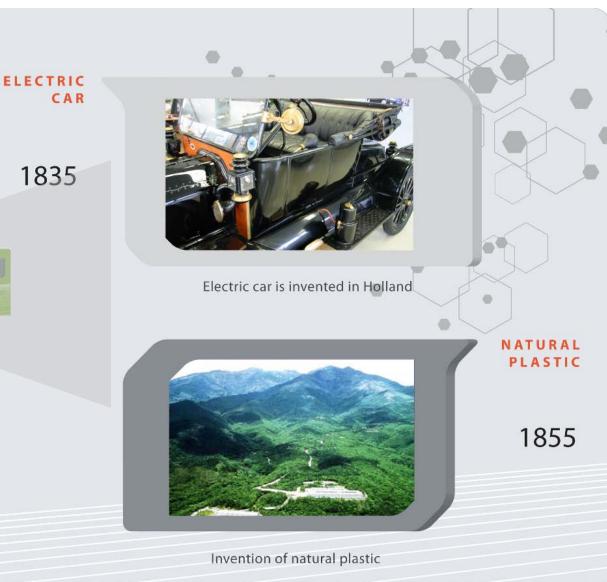


Earth sheltered/vegetated roofing is used

Population: 35 Million







Population: 1.2 Billion









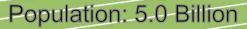
G. Chavanne (Belgium) receives patent for biodiesel fuel



BIOSPHERE

1987

Construction begins on Biosphere II, "artificial closed ecological system," outside of Tucson, AZ



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1991

BIOSPHERE

Biosphere construction is completed, used for intended purpose through 1994

LEED STANDARDS

1998



LEED (Leadership in Energy and environmental Design) standard created to promote green building practices

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Population: 6.0 Billion

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METRICS & THE LEED RATING SYSTEM

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Metrics

- o Greenroads
- o City of Seattle Green Factor
- o Built Green
- o Washington State Energy Code
- o International Green Building Code
- o Living Building Challenge





SEATTLE×green factor





USGBC

USGBC MISSION

To transform the way buildings and communities are designed, built and operated, enabling an environmentally and socially responsible, healthy, and prosperous environment that improves the quality of life.

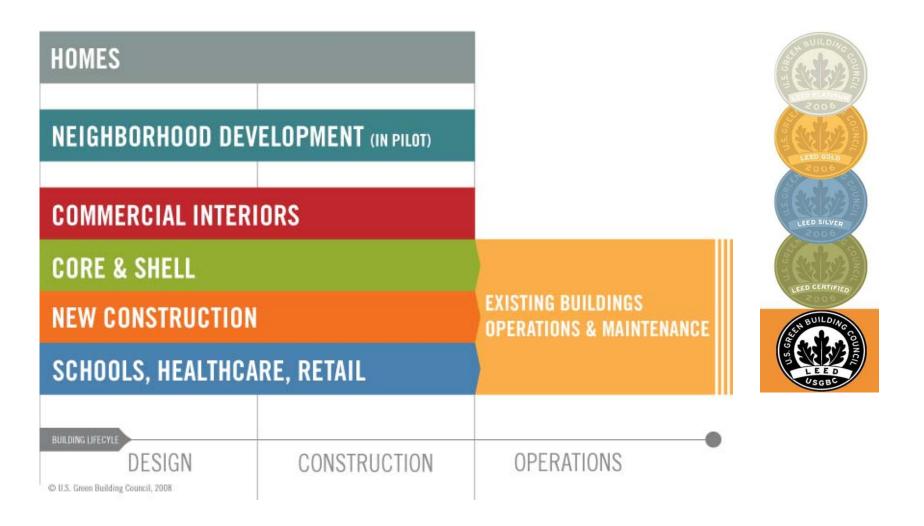
- o 79 local chapters
- 14,141 member companies & organizations



• **175,023** LEED Professional Credential holders



LEED Rating System



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17 Contractor Responsibility Design Build Subcontractor or Consultant Architect / Owner / Consultant Responsibility



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| USGE | BC | ~ | Project | ew Construction v3 | Scorecard Date | | | | Architect / Owner / Consultant Responsibility | - 161 |
|-------|---------------|-------|--|---|------------------------|---------|--------------|----|---|-------|
| Yes ' | ? | No | GEED TOT N | | Date | Yes | ? | No | | |
| | 1 | NO | Sustainable | Sitas | 26 Points | 10 | <u>,</u> | | Materials & Resources 14 | Po |
| Р | <u> </u> | | | Construction Activity Pollution Prevention | Required | P | | | | Re |
| F | - | | | Site Selection | Required | F | | | c Credit 1.1 Building Reuse, Maintain 55% of Existing Walls, Floors & Roof | Re |
| _ | + | | | | 5 | | - | | C Credit 1.1 Building Reuse, Maintain 55% of Existing Walls, Floors & Roof | |
| _ | + | | | Development Density & Community Connectivity | 5 | | | | | |
| _ | - | | | Brownfield Redevelopment | 1 | | | | C Credit 1.1 Building Reuse, Maintain 95% of Existing Walls, Floors & Roof | |
| | \rightarrow | | | Alternative Transportation, Public Transportation Acce | | | | | C Credit 1.2 Building Reuse, Maintain Interior Nonstructural Elements | |
| | _ | | | Alternative Transportation, Bicycle Storage & Changir | - | 1 | | | c Credit 2 Construction Waste Management, 50% Recycled or Salvaged | |
| | \rightarrow | | | Alternative Transportation, Low-Emitting & Fuel-Efficie | ent Vehicles 3 | 1 | | | c Credit 2 Construction Waste Management, 75% Recycled or Salvaged | |
| | | | | Alternative Transportation, Parking Capacity | 2 | 1 | | | c Credit 3 Materials Reuse, 5% | |
| | | | | Site Development, Protect or Restore Habitat | 1 | 1 | | | Credit 3 Materials Reuse, 10% | |
| | | | d Credit 5.2 | Site Development, Maximize Open Space | 1 | 1 | | | c Credit 4 Recycled Content, 10% (post-consumer + ½ pre-consumer) | |
| | | | d Credit 6.1 | Stormwater Design, Quantity Control | 1 | 1 | | | c Credit 4 Recycled Content, 20% (post-consumer + ½ pre-consumer) | |
| | | | d Credit 6.2 | Stormwater Design, Quality Control | 1 | 1 | | | c Credit 5 Regional Materials, 10% Extracted, Processed & Manufactured Regionally | |
| | | | Credit 7.1 | Heat Island Effect, Non-Roof | 1 | 1 | | | C Credit 5 Regional Materials, 20% Extracted, Processed & Manufactured Regionally | |
| | | | d Credit 7.2 | Heat Island Effect, Roof | 1 | 1 | | | Credit 6 Rapidly Renewable Materials - 2.5% | |
| | 1 | | d Credit 8 | Light Pollution Reduction | 1 | 1 | | | c Credit 7 Certified Wood - 50% | |
| Yes ' | ? | No | • | | | Yes | ? | No | lo | |
| | 6 | | Water Effic | iency | 10 Points | 6 | 5 | | Indoor Environmental Quality 15 | P |
| P | | | d Prereq 1 | Water Use Reduction | Required | P | | | d Prereq 1 Minimum IAQ Performance | Re |
| | | | d Credit 1.1 | Water Efficient Landscaping, Reduce by 50% | 2 | Р | | | d Prereg 2 Environmental Tobacco Smoke (ETS) Control | Re |
| 11111 | | 1 1 1 | c Credit c Credit c Credit c Credit d Credit d Credit d Credit d Credit d Credit d Credit | 3.2 Construction IAQ Management Plan, Before Occi 4.1 Low-Emitting Materials, Adhesives & Sealants 4.2 Low-Emitting Materials, Plaints & Coatings 4.3 Low-Emitting Materials, Flooring Systems 4.4 Low-Emitting Materials, Composite Wood & Agrifi 5 Indoor Chemical & Pollutant Source Control 6.1 Controllability of Systems, Lighting 6.2 Controllability of Systems, Thermal Comfort 7.1 Thermal Comfort, Design 7.2 Thermal Comfort, Verification 8.1 Daylight & Views, Daylight 75% of Spaces | | | 111111111111 | P | 1 d Credit 3 Water Use Reduction, 35% Reduction 1 d Credit 3 Water Use Reduction, 40% Reduction Yes ? No Water Use Reduction, 40% Reduction 24 Energy & Atmosphere Fundamental Commissioning of Building Energy Systems P C Prereq 1 Fundamental Refrigerant Management P C Prereq 3 Fundamental Refrigerant Management 19 d Credit 1 Optimize Energy Performance I G Credit 2 On-Site Renewable Energy, 1% I G Credit 2 On-Site Renewable Energy, 5% | 3 |
| | | | | 8.2 Daylight & Views, Views for 90% of Spaces | | | 1 | | Credit 2 On-Site Renewable Energy, 7% | |
| Yes | - | ? | No | | | | | | d Credit 2 On-Site Renewable Energy, 9% | |
| 1 | | 2 | | ion in Design | e | 5 Point | S | | d Credit 2 On-Site Renewable Energy, 11% | |
| | | | d Credit | | | | 1 | | d Credit 2 On-Site Renewable Energy, 13% | |
| | _ | 1 | d | Innovation or Exemplary Performance | | | 1 | | C Credit 3 Enhanced Commissioning | |
| | | 1 | d | Innovation or Exemplary Performance | | | 1 | | 2 d Credit 4 Enhanced Refrigerant Management | |
| 1 | | | d | Innovation | | | 1 | | 3 C Credit 5 Measurement and Verification | |
| | | | d | Innovation | | | 1 | | Credit 6 Green Power | |
| | | | d Credit | 2 LEED [®] Accredited Professional | | | 1 | | | |
| Yes | s | ? | No | LEED Noordallou I forcoronal | | | | | | |
| - | 7 3 | 38 | Totals | | Possible Points | 55 | | | | |
| _ | | 1. 10 | 10 011 | ······································ | | | | | | |
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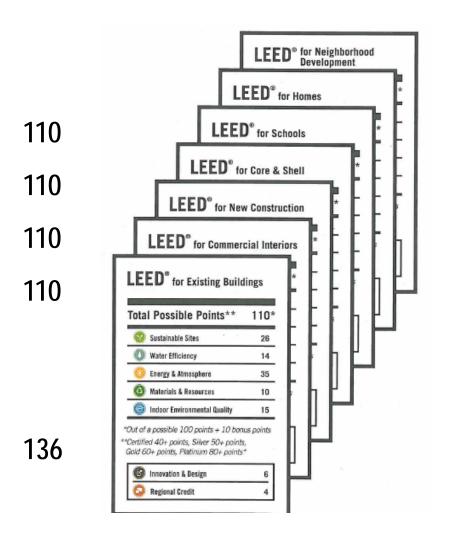
LEED Rating System

LEED POINTS SYSTEM

Building Design & Construction Interior Design & Construction Building Operations & Maintenance Neighborhood Development *(All above = 100 + 10 bonus points)*

+

Homes



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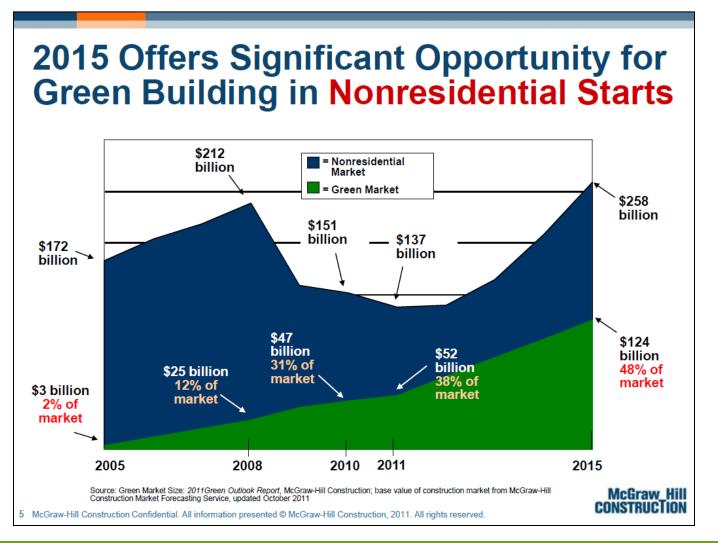
FUTURE FORECAST







Green Projections



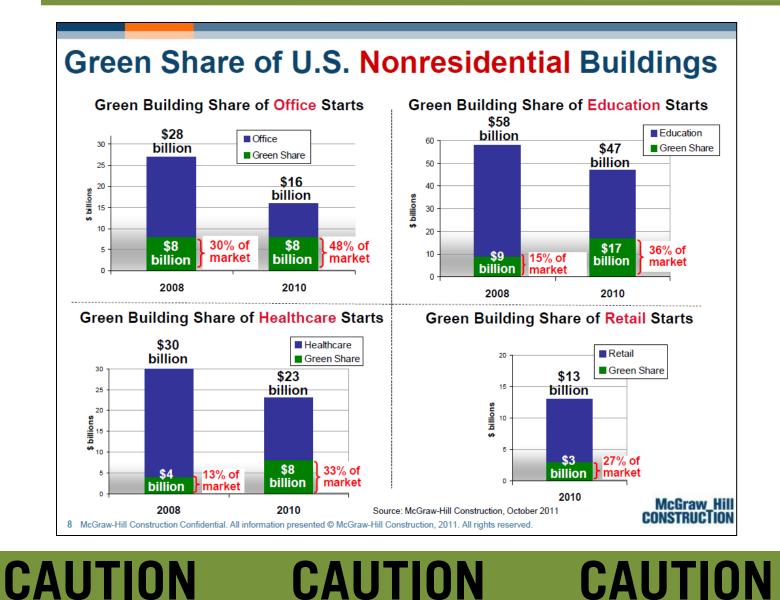
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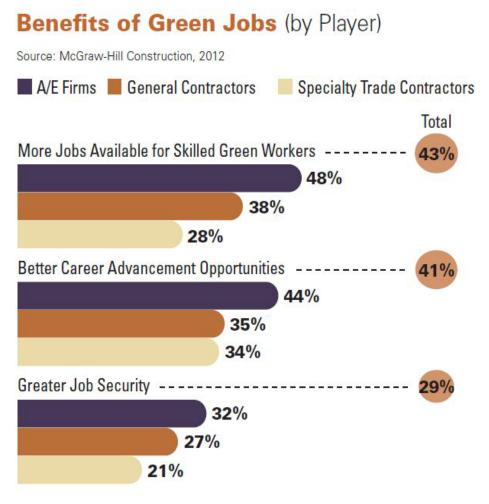
Green Projections

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Green Projections



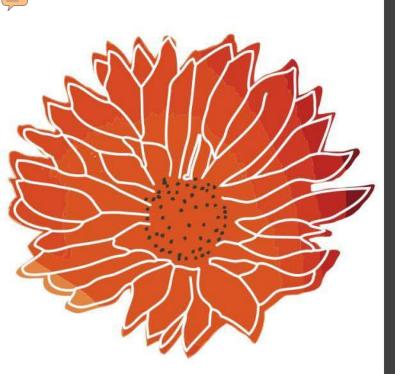
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Benefits of Certification

Source: McGraw-Hill Construction, 2012



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THERE ARE DOZENS OF PROJECTS IN PURSUIT OF THE CHALLENGE...



Sustainable Energy Centre at Cambrian College Castellan James + Partners



Oregon Sustainability Center GBD + SERA Architects

GREEN BUILDING & SAFETY







According to OSHA, out of 4,206 worker fatalities in private industry in 2010, 774 or **18.7%** were in construction.

• Falls – 264 out of 774 total deaths in construction in 2010 (34%)

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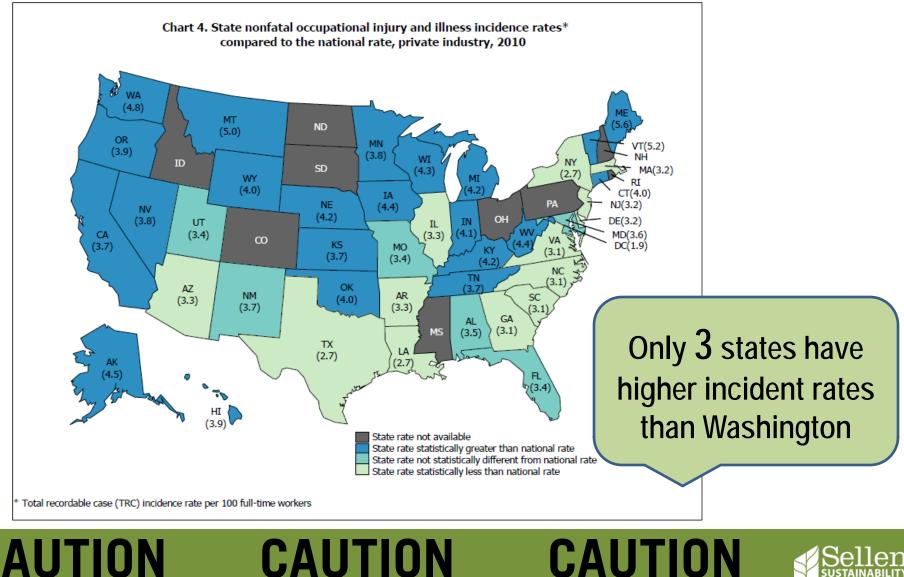
- Electrocutions 76 (10%)
- Struck by Object 64 (8%)

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Caught-in/between – 33 (4%)

In addition to 774 deaths, the construction industry had 195,900 nonfatal injury and illness incidents in 2010

Safety Statistics



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In 2010 the building industry in Washington State had **10,330** nonfatal injury and illness incidents broken down as follows:

- Construction and extraction occupations 2,660
- o Carpenters 880
- o Electricians **310**
- Laborers and freight, stock, and material movers, hand
- Installation, maintenance, and repair occupations 2,2
- o Building and grounds cleaning and maintenance occu
- First-line supervisors/managers of landscaping, lawn s groundskeeping - 360

In 2010 the construction industry in WA had 10 fatalities

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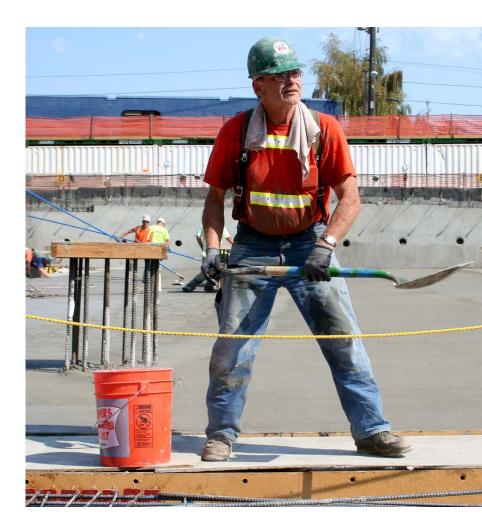


Typical Safety Concerns

- o Personal Protective Equipment
- o Health Hazards
- o Scaffolds
- o Stairs and Ladders
- o Falls
- o Electrical
- o Caught-in or Between
- o Struck-by

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o Excavations

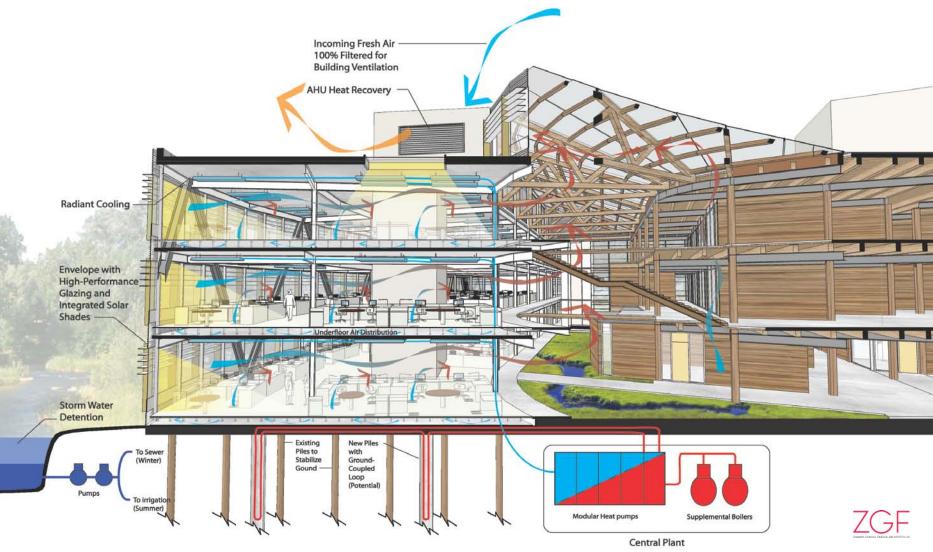


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Eliminating the Unknown

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Are Green Buildings Less Safe?

New study *Identification of Safety Risks for High Performance Sustainable Construction Projects* and it's implications for the industry

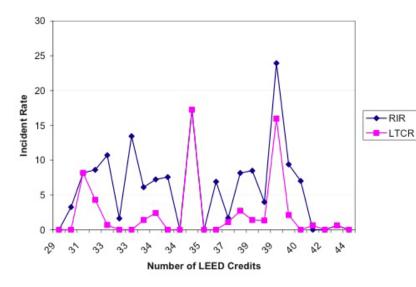
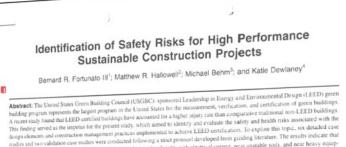


Fig. 4. Comparison of LEED credits and safety performance

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studies and two validation case studies were conducted runnowing a struct protocol use compact and gate and the validation case studies were conducted runnowing a struct protocol use compact and exposed to work at height, with electrical current, near unstable soils, and near heavy equipment for a preader period of time than workers on stadiational projects. (2) workers are exposed to new high-risk tasks such as construction arise, installing green rook, and installing phonorhaic (20) panels are structule at positive impact on construction worker arise, installing green rook, and installing phonorhaic (20) adhesives and sealants are specified. It is expected that these results can be used usely and health when how value forganic compound (VOC) adhesives and sealants are specified. It is expected that these results can be used by proteintoners to focus attention and resources on new highrid, work environments. DOI: 10.1061/ASCE/CO.1943-7862.0000446, 0.2012 American Society of COI Denviers.

CE Database subject headings: Safety; Risk management, Sustainable development, Environmental issues; Construction management,

Author keywords: Safety; Leed; Sustainability; Risk.

Introduction

Increased adoption of the Leadership in Energy and Environmental Design (LEED) Green Building Rating System for new construction, observise knoon as "green building," is an energying trend in the construction industry. Since the inception of the program in 1998, LEED has grown to encompose more than 14,000 projects, which cover 3.6 billion square feet of developed space (USGRIC 2009) By 2011, approximately 10% of commercial construction starts are expected to be LEED-certified and the value of green building construction projects is expected to increase to \$60 billion. Furthermore, the LEED program ereenly committed to certifying one milion commercial buildings by the year 2020 (Syal et al 2007).

There have been three major drivers of the growth of green building. First, there are numerous government mandates and inentires for green construction. Many departments of federal, state, and manicipal governments require new publically funded buildings to be LEED certified or offer tax incensives for LEED certiication. Second, the demand in the private sector bas rapidly

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Note: The manuscript was submitted on January 30, 2011; approved on July 1, 2011; published on January 30, 2011; published on January 30, 2011; published on January 4, 2011. Discussion period open and September 1, 2012; apparte discussions must be submitted for individual popers. This paper is part of the Januard of Canadratical Regimers, and Management, Vol. 18, No. 4, April 1, 2012; OASCE, ISSN 0733-0946070254-01525100.

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increased because firms have recognized the long-term value of pren buildings that results from a reduction in maintenance costs, enhanced quality of life for occupants, and improved marketing (Eicholter et al. 2008; Fuerst et al. 2008; Miller et al. 2008). Finally, the initial growth of the LEED market has increased the availability and reliability of green building supples and has decreased construction costs (USGBC 2009). Though this rapid growth is exciting, the architecture, engineering, and construction (AEC) industry must evaluate the potential impacts of green building components on construction cost, quality, schedule, and safety in order to optimize project success.

Through Mago and Syal (2007) and others have evaluated the impacts of LEED on cost, schedule, and quality, only a few studies have investigated the impacts of LEED on worker safety and health. In a recent study, Rajendran et al. (2009) found evidence that LEED-certified projects incur higher langur states than conventional construction projects. In fact, this analysis of 86 projects revealed that green projects had an OSHA recordable injury rate (RIR) that was, on average, 485 higher than nongreen projects (p-value = 0.186). Unfortunately, the safety risks associated with specific LEED obligh thermation have yet to be identified and documented. Given the expected increase in adoption of LEED standards toch knowledge will be essential to protecting the health and welfare of the construction workforce.

In the present study, the writers aimed to identify the safety and health risks and opportunities associated with the building elements and construction practices that are implemented to achieve specific LEED credits. A series of six primary case studies and two validiation care studies were conducted on active construction projects in Colorado to address the following research question: How do the technologies, building systems, and construction practices that are specifically implemented to achieve LEED certification impact construction worker safety and health? It is expected that the results of this inquiry will set a foundation for future research into new

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WHAT ISSUES

NEED TO BE ADDRESSED?

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WHAT ARE THE SKILLS NEEDED?

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