



The Green Building Industry has continued to grow even during the current economic downturn that has hit the construction industry particularly hard. A recent report by McGraw Hill "Green Outlook 2011: Green Trends Driving Growth," found that green building represented 25 percent of all new construction activity in 2010 and that the value of green building construction projects were up 50 percent in 2010 compared to 2008 – from \$42 billion to \$55 billion-\$71 billion. Growth in the industry is projected to continue to \$135 billion – 48% of the construction market – by 2015 while the U.S. Bureau of Labor Statistics show nine fatalities as a result of falls in Washington State, 9 families that lost a loved one in 2010. This rapid expansion has led to the implementation of new and improved systems and construction techniques and more exacting regulations and specifications. These innovations can create confusion on the job site if workers do not have an understanding of what they are building and how it may change their work environment. Green building systems are new components of a building that save energy, generate power, collect water, treat waste, enhance biodiversity and do so as part of a building or its site. Examples include but are not limited to: bioswales, cisterns, ground coupled heat exchangers, green walls, living machines, membrane bioreactors, micro hydro, pervious paving, rainwater collection, sewer heat recovery, solar hot water, solar power, under floor air systems, vegetated roofing, etc. The safety hazards of falling, being struck by an object and the potential for overexertion are the same for a green building system as a non-green building system but the major difference is that safety professionals aren't yet aware of all the emerging green building systems. Until safety professionals have the opportunity to learn about the what, when,

where and why of these systems, it will be more challenging to take preventative action when setting up site safety plans. Unique composite working groups, installation requirements, construction sequencing and operations and maintenance considerations all need to be discussed and shared before a strong preventative safety approach to any green building system can be established. Currently there is a large divide between these new systems and the education/training that is required to ensure green building projects promote the health and safety of our construction workforce. This industry informed training has been design to fill the current knowledge gap that exists to ensure all of our green building projects are as safe as they can be.

Slide 2

### Course Outline

- o Introduction to Sustainability, Green Building & Safety
- o 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

CAUTION CAUTION CAUTION 

Here is a look at the course outline. We'll start out with a brief introduction to this training and how it was developed.

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### About the Project

**Safety and Health**  
Washington State Department of Labor and Industries

**Project Goals**

- 1. Develop a comprehensive safety and health program for green building projects.
- 2. Provide training and resources for construction professionals.
- 3. Promote the use of safety and health best practices.
- 4. Increase awareness of safety and health issues.
- 5. Reduce the number of workplace injuries, illnesses, and fatalities.

**Project Outcomes**

- 1. A comprehensive safety and health program for green building projects.
- 2. Training and resources for construction professionals.
- 3. Promotion of safety and health best practices.
- 4. Increased awareness of safety and health issues.
- 5. Reduced number of workplace injuries, illnesses, and fatalities.

CAUTION CAUTION CAUTION 

The Washington State Department of Labor and Industries Safety and Health Investment Projects (SHIP) grants are awarded to projects with the purpose of: Preventing workplace injuries, illnesses, and fatalities and for the development and implementation of effective return-to-work programs for injured workers to reduce long-term disability in Washington State.

The goal of the following curriculum is to support construction safety professionals in developing the tools and resources they need to ensure safety on new green building systems.

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This SHIP grant was awarded to a team of industry partners that all worked collaboratively, pulling from a wide range of experience, to build a relevant and effective curriculum for construction and facilities maintenance safety professionals.

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The team met multiple times throughout the curriculum development stage of the project to ensure the content presented today was as effective as possible.

Slide 6



We'll start today by doing a quick round of introductions.

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

Slide 7



Play video for course introduction:  
<http://www.youtube.com/watch?v=7336mKNW7Rs>

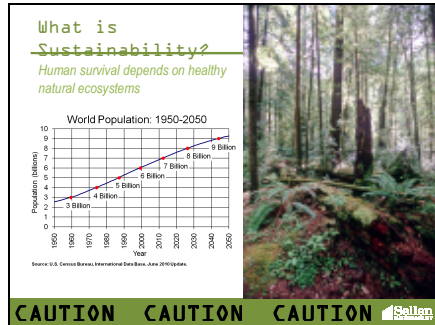
Slide 8



Sustainability is a term that is being used in all kinds of contexts recently. But what does it really mean?

Before we can dive into green building systems, it is important for everyone to have a collective understanding of “sustainability” and “green building.”

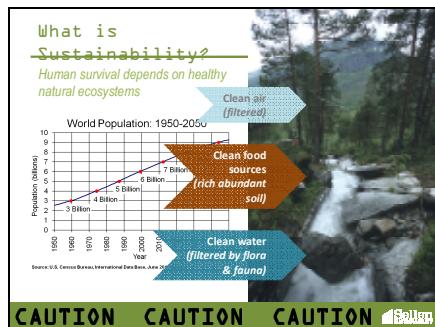
Slide 9



INSTRUCTOR: Ask the class to define sustainability. Reinforce that they are defining the broad term sustainability not as it relates to green building or the building industry. Use a whiteboard or large notepad to write down participants answers.

This exercise is a great way to show that there is a wide range of perspectives on the meaning of sustainability. The goal of the exercise is to draw out those perspectives and to get everyone on the same page.

Slide 10



Ultimately sustainability comes down to a need to preserve, protect and promote clean air, clean soil, and clean water. Human nature depends on clean air, clean soil and clean water to survive – a fact that is hard for anyone to deny. Whether or not you believe in climate change or global warming we all can appreciate a need to sustain these essential resources. If we continue to develop, consume, and grow as we are now with a population that is expected to grow by 3 billion by 2050, will we be able to preserve those things?

Slide 11



So why are you here in this room today anyway? Would you rather be in a place like this?

INSTRUCTOR: Ask the audience for a show of hands.

And why is that? Most of us love being outdoors. We love nature. But if we continue to develop the way that we are now, none of us will have places like this to enjoy.

The image shown here is of homes in Norway that have been around for over 300 years. In Norway, as with many other cultures, people appreciate how nature works. They appreciate their impact and their role in preserving nature and have always lived in a way that makes them good stewards of the environment. The green roofs shown here aren't complex systems that we are starting to see now, they are simply the earth that was moved in order to make room for the house. The grass, shrubs, and even small trees that are moved to make room for a house just goes back on top of the house to allow the existing ecosystem to continue to work as it always has.

Slide 12



So why are you here in this room today anyway? Would you rather be in a place like this?

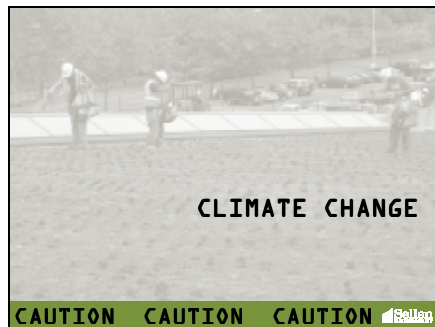
INSTRUCTOR: Ask the audience for a show of hands.

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How are our actions impacting our ability to sustain clean air, clean water, and clean soil, and how are those actions impacting our climate?

Slide 14



And what it really comes down to is seeing beyond the trees. What we mean by that is seeing our resources in a way that reflects their true value.

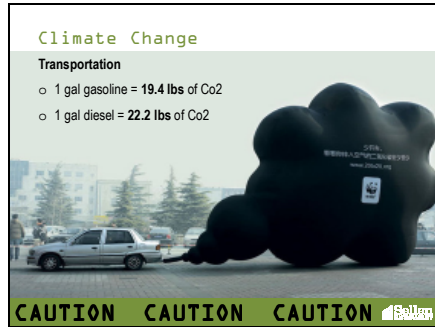
INSTRUCTOR: Ask the audience - How much does a 2x4 cost at the hardware store?

A few dollars, maybe less? How do we put a price on such a valuable resource that provides us clean air, clean water, clean soil, all of the things that we agreed we depend on to survive. If we really think about the value of things like trees and the ecosystems that they support are we paying what we should be for that 2x4?

Seeing beyond the trees is just one small example of how our perceptions and decisions are having an impact on the environment. Let's look at a few more.



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Shown here is an image of the amount of air pollution that is generated by driving a car for one day! Pretty astonishing, huh? Did you know that one gallon of gasoline burned produces 19.4 lbs of CO<sub>2</sub>? A gallon of diesel burned produces 22.2 lbs of CO<sub>2</sub>.

INSTRUCTOR: Ask the audience – does anyone know how 7 pounds of gas (roughly one gallon) turns into 19.5 pounds of CO<sub>2</sub>?

The answer is when the gasoline is burned the carbon molecules in the gasoline bond together with oxygen molecules in the air that then take up more space and more create CO<sub>2</sub> molecules which weigh more than the original Carbon molecules in the gasoline.

CO<sub>2</sub> info source:

<http://www.epa.gov/oms/climate/420f05001.htm>

Image via World Wildlife Foundation

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INSTRUCTOR: Ask the audience – When we begin to think about the amount of emissions we generate by burning a single gallon of fuel, what are the implications for say shipping wood from Brazil or Steel from Korea to a jobsite in say Seattle, Tacoma, or Spokane?

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INSTRUCTOR: Ask the audience – Does anybody know which project this is?

This is an image of the University of Washington's Red Square when it was built in the late 1960's.

INSTRUCTOR: Ask the audience – How much has changed in our industry since this?

The building industry is historically slow to change and is still using the same practices and same materials that it has been for years! Not that all of our materials or practices are bad, but are we really doing the best that we can to reduce our impact while improving safety on our jobsites?

Slide 19



The question we have to ask ourselves is are we changing fast enough? How long do we have before we end up like the city/society on the left vs. the city/society on the right?

Slide 20

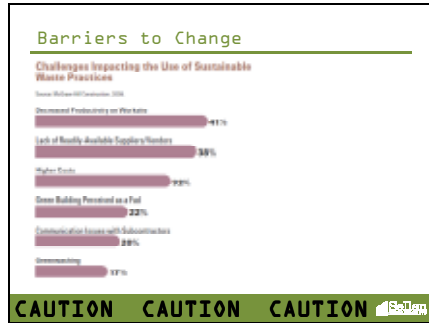


INSTRUCTOR: Ask the audience – If we all agree that we're not moving fast enough, what is stopping us or slowing us down?

Use a whiteboard or large notepad to write down participants answers.



Slide 21



Shown here are the results of McGraw-Hill study conducted to determine what Contractor's perceive as the barriers to implementing waste recycling.

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### What's Driving Change?

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

CAUTION CAUTION CAUTION

A number of factors that are currently driving change towards more sustainable practices in the building industry include:

- A demand to build sustainably for less cost
- Reduced operational costs
- Position for market differentiation
- Companies/organizations want to satisfy their client demand
- Respond to employees
- Demonstrate environmental responsibility

Slide 23

### What's Driving Change?

- o Formaldehyde Standards for Composite Wood Act - July 7, 2010
- o WA State 2009 State Energy Code Draft
- o WA State Legislature Chapter 39.35D RCW - High-performance public buildings
- o City of Seattle Green Factor
- o GHG shall be regulated by the Clean Air Act
- o International Green building Code

CAUTION CAUTION CAUTION

Government regulations are another factor that is driving change. Here are just a few examples of the types of legislation/regulation that is being implemented throughout the country.

#### **Formaldehyde Standards for Composite Wood Act- July 7, 2010**

January 2013 all products sold in the US will have to meet formaldehyde emission standards of about .09 parts per million- strictest standards in the world. Requires 3rd party testing/certification. EPA shall enforce this regulation with imported products.

#### **EPA's Construction and Development Effluent Limitations Guidelines" (C&D ELG)**

Applies to all individual construction sites (over 10 acres) and will be in enforced upon renewal of permit or application for new project permit.

The ELG imposes an enforceable numeric limit on stormwater discharges from sites

disturbing 10 acres or more at any one time, require monitoring to ensure compliance with the numeric limit, and require nearly all construction sites to implement a range of prescriptive erosion and sediment controls and pollution prevention measures.

WA State proposed Construction Stormwater General Permit (CSGP) currently contains most of the regulations in the ELG, but there are some changes being proposed in the WA State CSGP.

The most significant change proposed to the Washington CSGP consistent with ELG is to impose a maximum daily numeric effluent limitation of 280 NTU for construction sites equal or larger than 10 acres. Ecology is proposing that the new limit be applicable on the effective date of the permit anticipated to be January 1, 2011.

The draft CSGP does add several prohibited discharges that are required under the ELG including: wastewater from washout of concrete; wastewater from washout and cleanout of stucco, paint, release of oils, curing compounds and other construction materials; fuels, oils, or other pollutants used in vehicle and equipment operation and maintenance; soaps or solvents used in vehicle washing; wheel wash or tire bath wastewater; and discharges from dewatering activities.”

#### **WA State 2009 State Energy Code Draft**

Current amendments to this code being considered are:

to achieve the energy savings specified in Resolution 30280

to incorporate ASHRAE/USGBC/IESNA Standard 189.1, and

to improve implementation of existing amendments.

## High-performance public buildings

All major facility projects of public agencies receiving any funding in a state capital budget, or projects financed through a financing contract as defined in RCW 39.94.020, must be designed, constructed, and certified to at least the LEED silver standard.

## City of Seattle Green Factor

The Green Factor is a landscape requirement designed to increase the quantity and quality of planted areas in Seattle while allowing flexibility for developers and designers to meet development standards

## GHG shall be regulated by the Clean Air Act

Three years ago the Supreme Court ruled that the term “air pollutant” included green house gases, therefore subjecting them to the regulations of the Clean Air Act.

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And what if we had “green teams” or a “green force?”

INSTRUCTOR: Show video

While we may not necessarily have uniforms or formal green police titles, we are all responsible for doing our part and encouraging others to do their part as well.

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When we look at the construction industry's shift to green building it is interesting to look at the parallels to the industry's shift towards safer work practices 20 years ago.

**INSTRUCTOR:** Ask the audience – How long do you think it will take for sustainability and green building to become standard practice like safety is for most companies and jobsites throughout our state and the nation today?

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We have defined broad based “Sustainability” but what does that look like when it’s applied to our industry?

INSTRUCTOR: Ask the audience – What is green building?

Use a whiteboard or large notepad to write down participants answers

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The USGBC defines green building as:

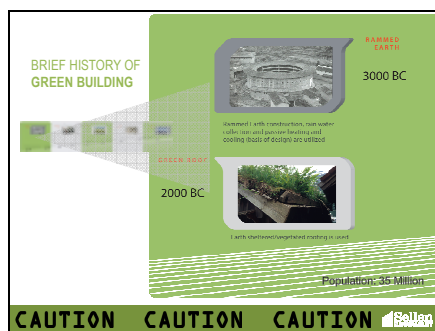
better siting, design, construction, operation, and maintenance that increases the efficiency with which buildings and their sites use and harvest energy, water and materials, and reduces building impacts on human health and the environment.

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Shown here is a brief timeline of sustainable practices. When we begin to dissect new sustainable practices and green building systems it is funny to look back in time and see how many of these “new systems” have been around for hundreds of years.

Slide 29

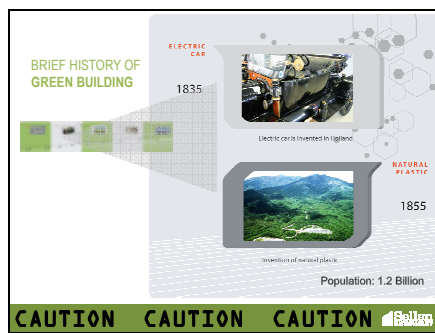


Way back around 3000 BC people were building using rammed earth. Rammed earth is created by taking local, readily available materials, such as mud and clay, and compacting them into forms to create walls . In addition to using local, sustainable materials, rammed earth buildings require thick walls resulting in thermal mass and, like the upper image shown here, typically are designed to last hundreds if not thousands of years. Building for longevity is much more sustainable than building the temporary structures that we are building these days that are designed to last maybe 20-30 years at most.

As early as 2000 BC vegetated roofing

became a common practice in most European Countries. Geared with an understanding and an appreciation of nature, early developers that installed green roofs used the simplest systems possible. All that they did was take the earth that was moved for the construction of a building and replace it on top of the roof. These systems protected the habitat that had been existing for years prior to the building while preserving natural resources.

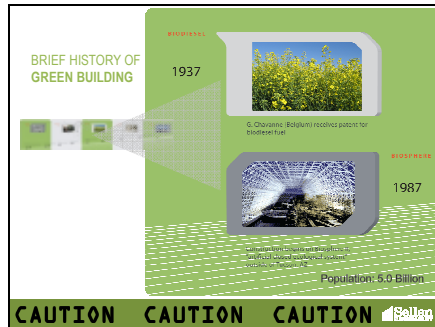
Slide 30



In 1835 the first electric vehicle was invented in Holland. It's funny to think that it has taken almost 200 years for electric vehicles to finally become "cool".

Like the electric car, natural plastics, as seen in things like new soda bottles, have been around since 1855 and yet are just now being deemed a new more sustainable option.

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As fuel prices continue to rise we are beginning to see a push towards introducing "new" fuel sources such as biofuels, another technology that has been around since 1937. Nearly every piece of construction equipment or machinery runs on diesel, making the industry an ideal candidate for biofuels.

The biosphere was a failed attempt by a large group of scientists to create a full scale replica of a natural eco-system. The scientists spent years trying to figure out which types of plants, animals, soil mixes, air flows, etc., would allow humans to survive inside a completely enclosed, sealed off, and self sustaining ecosystem.

What they found out was it's a lot harder than it seems. The soil had too much organic matter which lead to intolerable levels of CO2 in the air making researchers and inhabitants overly tired and often really sick. The air was too thin, the plants didn't clean enough of it,

and when one inhabitant cut his finger they couldn't get it to stop bleeding no matter what they tried.

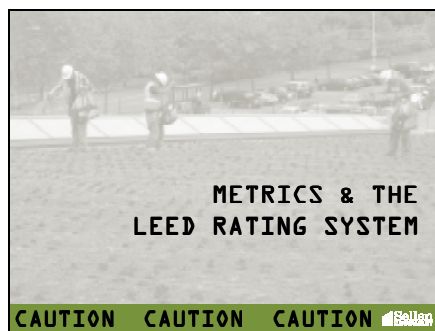
Slide 32



After four years of struggling to make the biosphere a reality even the world's most brilliant minds realized that nature is a lot more complex than it seems. A lesson that we can all learn from the biosphere project is that we really do need to work hard to preserve and protect our environment and the resources that we have available.

In 1998 a group of construction industry professionals developed the LEED Rating System in hopes of encouraging the design and construction industry to adopt more sustainable practices.

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How are we currently measuring how green a building is? One of the most widely recognized green building metrics is the LEED Rating System. Since its adoption, the LEED Rating System has done quite a bit to shift the construction industry into deeper shades of green, and it continues to be the most commonly used rating system throughout the world.

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Green building metrics and standards are increasingly being developed. Some standards and rating systems, such as Greenroads, are looking at a specific type of project or type of construction, others, like the Green Factor, are looking at specific systems like vegetated roofing or living walls. A wide range of standards, from LEED to the Living Building standard, have been developed to assess just how green a building project really is. Let's take a look at one of the standards that is really pushing the industry to build more sustainably.



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**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.

- 79 local chapters
- 14,141 member companies & organizations
- 175,023 LEED Professional Credential holders




**CAUTION CAUTION CAUTION** 


In the mid 1990s a group of industry professionals, including a Sellen Construction employee, got together and decided that the industry needed a tool to define, measure, and track the performance of green buildings. That group launched the US Green Building Council (USGBC) with a 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.

As you can see the USGBC has grown significantly since it was founded. There are now 79 local chapters, nearly 15,000 member companies and organizations, and over 175,000 LEED Professional credential holders.

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**LEED Rating System**




**CAUTION CAUTION CAUTION** 

As the LEED Rating System continues to develop it is beginning to encompass the complete lifecycle of buildings with new ratings systems out for Existing Buildings Operations and Maintenance, Homes, and Neighborhood Development.

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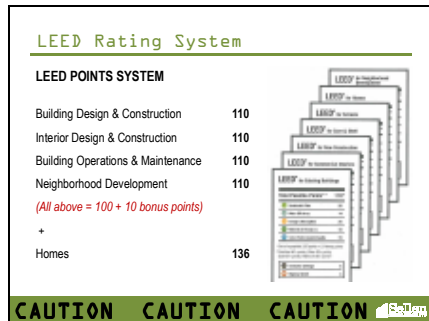
**CAUTION CAUTION CAUTION** 

Similar to the tools we use in the field to build our projects, the USGBC developed the LEED Rating System to be used as a tool to rate how sustainable a project really is. While not perfect, the LEED Rating System has been one of the biggest driving factors for our shift to more sustainable design, construction, and operations practices.

Shown here is a look at the LEED Scorecard and associated roles and responsibilities. The credits in orange represent the credits that are typically associated with the general contractor. The credits in yellow and green are credits typically associated with a design build subcontractor or consultant, and the

credits in all green are credits typically associated with the owner, architect, or third party consultant hired by either the owner or architect.

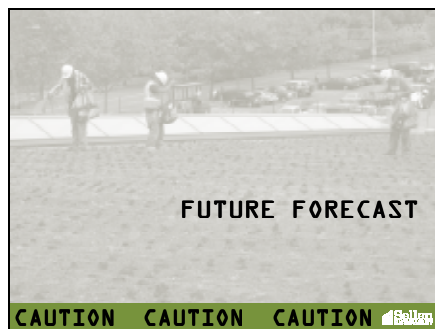
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Quick breakdown of the LEED point system. The points are broken into categories which address the following issues. By implementing company wide green building best management practices you can greatly improve the number of credits your projects will be able to achieve while reducing your environmental and fiscal impacts.

*Site* planning that promotes sustainability  
*Water* conservation and efficiency  
*Energy* conservation and efficiency  
*Materials* conservation and “cradle-to-cradle”  
*Indoor* environmental *quality*

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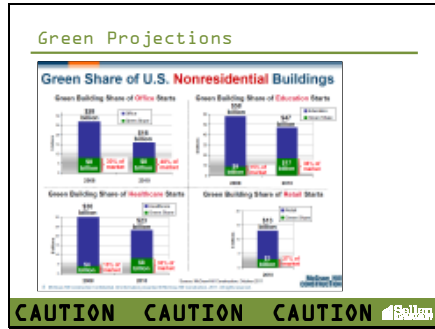
Some skeptics think that green building is just a passing trend, but what does the future of green building really look like?

Slide 40



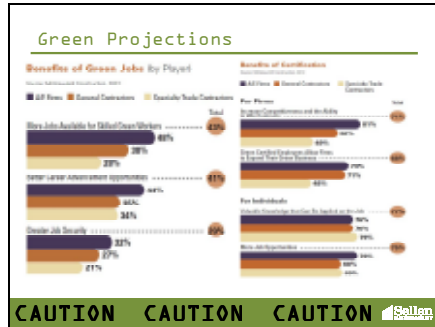
Over the past 5 years we have seen a huge shift in the number of LEED/Green Building projects that are being built. As can be seen here, green building is not a trend that is going away any time soon.

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Here is how the new green building projects are expected to break down. As can be seen, a lot of educational clients are looking for green spaces with office and healthcare projects are close behind.

Slide 42



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Slide 43



(PRIOR TO PRESENTATION, CHECK STATISTICS ON WEBSITE TO CONFIRM CURRENT NUMBER OF PROJECTS PURSUING LIVING BUILDING CHALLENGE AND TO DOWNLOAD MORE SAMPLE PROJECT SLIDES)

The Living Building Challenge was created by the Cascadia Green Building Council, the local chapter, in the Northwest, of the USGBC) as an attempt to push the building industry to move beyond LEED Platinum. The goal behind the challenge is to create buildings that are an integral part of their surrounding ecosystem, or in other words, buildings that live or are self sustaining.

Living Buildings are regenerative buildings. They must produce their own energy, treat their own waste, and provide all of their water on-site. Living Buildings cannot use designated harmful products in their design or during their construction, they must support the local community, they even have to provide a certain percentage of food depending on the number of the end users of

the building.

There are more than **70** projects pursuing certification using Living Building Challenge, and several are already in their operational phase.

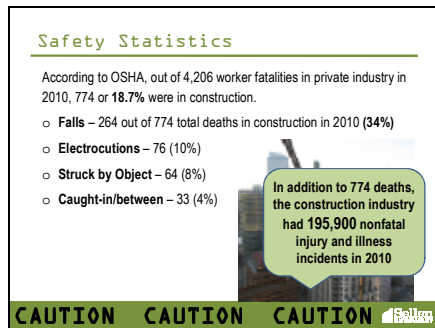
(TOP) Robert Bateman Centre in Victoria, BC  
(BOTTOM) Oregon Sustainability Center in Portland, Oregon

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While the green building industry continues to grow people are becoming more aware of the unique systems, situations, and responsibilities that are being created by sustainable construction practices. Let's take a look at the current assessment of green building and safety.

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

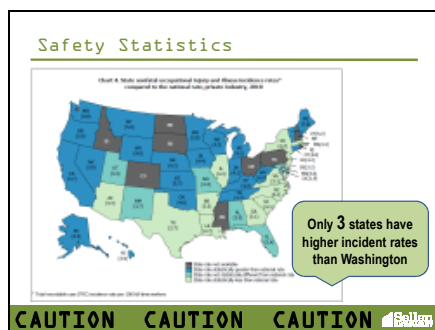
- **Falls** – 264 out of 774 total deaths in construction in 2010 (**34%**)
- **Electrocutions** – 76 (10%)
- **Struck by Object** – 64 (8%)
- **Caught-in/between** – 33 (4%)

Source:

<http://www.osha.gov/oshstats/commonstats.html>

[http://www.bls.gov/news.release/archives/osh\\_10202011.pdf](http://www.bls.gov/news.release/archives/osh_10202011.pdf)

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Shown here is a look at “State nonfatal occupational injury and illness incidence rates” compare to the national average for private industry, which includes construction.

Source:

[http://www.bls.gov/news.release/archives/osh\\_10202011.pdf](http://www.bls.gov/news.release/archives/osh_10202011.pdf)

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### Safety Statistics

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**
- Carpenters – **880**
- Electricians – **310**
- Laborers and freight, stock, and material movers, hand – **1,680**
- Installation, maintenance, and repair occupations – **2,250**
- Building and grounds cleaning and maintenance occupations – **2,190**
- First-line supervisors/managers of landscaping, lawn service, and groundskeeping – **360**

**In 2010 the construction industry in WA had 10 fatalities**

**CAUTION CAUTION CAUTION**

According to the Washington State Department of Labor and Industries, in 2010 the building industry in Washington State had **10,630** nonfatal injury and illness incidents broken down as follows:

- Construction and extraction occupations – **2,660**
- Carpenters – **880**
- Electricians – **310**
- Laborers and freight, stock, and material movers, hand – **1,680**
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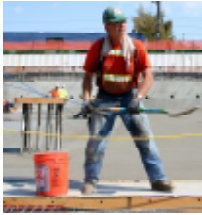
Source:

<http://www.lni.wa.gov/ClaimsIns/Files/DataStatistics/blsi/NONFATALPrivateCDWA2010.pdf>  
<http://www.lni.wa.gov/ClaimsIns/Files/DataStatistics/blsi/FATAL2010CFOIWA.pdf>

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### Typical Safety Concerns

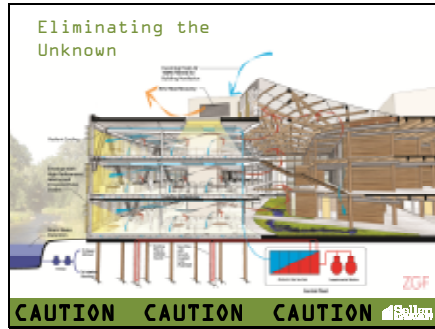
- Personal Protective Equipment
- Health Hazards
- Scaffolds
- Stairs and Ladders
- Falls
- Electrical
- Caught-in or Between
- Struck-by
- Excavations



**CAUTION CAUTION CAUTION**

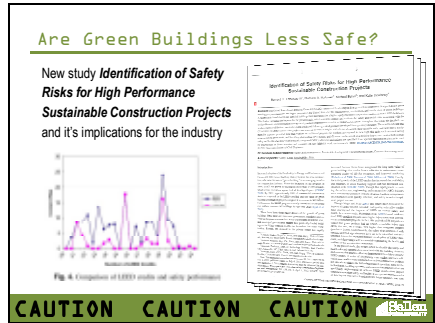
The list shown here is the list of safety concerns that OSHA training addresses.

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As green building systems are new features that are being added to our projects, the main focus when assessing safety risks is eliminating the unknowns.

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INSTRUCTOR: Ask the audience – Do you think green buildings are more or less safe?

If more safe why? If less safe why? Are the safety concerns the same?

Two recently published studies suggest that green buildings may be less safe than typical construction projects. But why might that be?

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Green building projects introduce field personnel to a number of new situations and systems that they otherwise may not be familiar with. Education and training is a critical component in ensuring that everyone goes home safely whether they are working on a green building project or one that isn't implementing sustainable practices. And that is exactly what we are trying to do today.

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INSTRUCTOR: Ask the audience – If training is key to ensuring safety on green building projects, what skills do we need to develop or be training our field crews?