Office of Science and Technology
Meeting the Urbanization Challenge
Smart City Solutions from Austria and California
LCT ONE: Case Study of an Eight Story Wood Office Building
October 11, 2013

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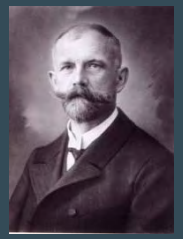
CREE BUILDINGS

The Natural Change in Urban Architecture

A 4TH GENERATION FAMILY BUSINESS

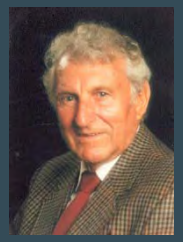
PART OF ROHMBERG GROUP – GENERAL CONTRACTORS

1892



The building company was founded by master builder **Cornelius Rhomberg** who managed the company until his death in 1912.

1938

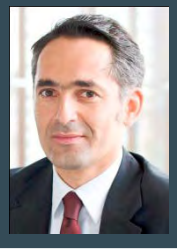


The company „Rhomberg Bau“ was founded by distinguished businessman master builder **Walter Rhomberg**

1963

Master builder **Walter-Heinz Rhomberg** enters the company.
He takes over the operative management board from 1972 to 2002.

1999



DI **Hubert Rhomberg** enters the company.
Since April 1st, 2002 he leeds the operative management board.

Natural Change in Urban Architecture

Develop a timber based construction system for sustainable multi-storey buildings in urban environments

LifeCycle Tower

- Timber construction system up to 30 floors / 100 m
- Industrial pre-fabrication
- Passive house standard and power generation

ARUP WIEHAG TIMBER CONSTRUCTION TU Graz

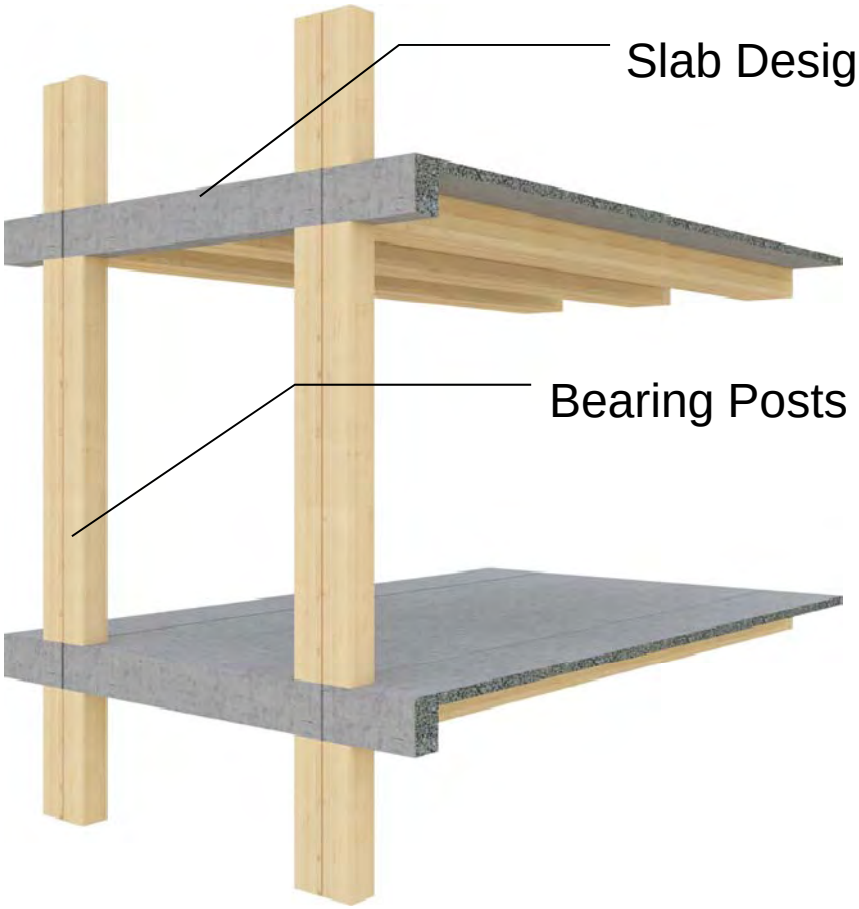
Architekten **Hermann Kaufmann ZT GmbH**

HOLZ FORSCHUNG AUSTRIA

FFG HAUS der Zukunft bmvit

CREE INSIDE

Slab and Posts



Core, Floors and Walls

Cree Tall Wood Buildings

http://www.youtube.com/watch?v=wNblLm3m8UM
http://www.creebuildings.com/us/

Nabih's Experience

Austria

- Multi-family projects
- Pre-fabricated in wood
- Low energy standard

Nabih's Experience

Ireland
Imported low energy, pre-fabricated homes from Austria

Berkeley
Remodeled home to Passive House Standard

LIFE CYCLE TOWER – LCT ONE

Study for Austrian Trade Commission

Opportunities for transferring know-how between Austria and the USA

Consulting
Architectural, structural and energy consulting services including the Passive House Standard.

Products
Development of high performance products

Systems
Development of modern, industrial construction methods.

MOTIVATION
for the
LIFE CYCLE TOWER

ECOLOGICAL AND SOCIAL CHALLENGE

We don't inherit the Earth from our Ancestors;
we borrow it from our children
Native American Proverb

If 5 billion people lived in our "western" manner…

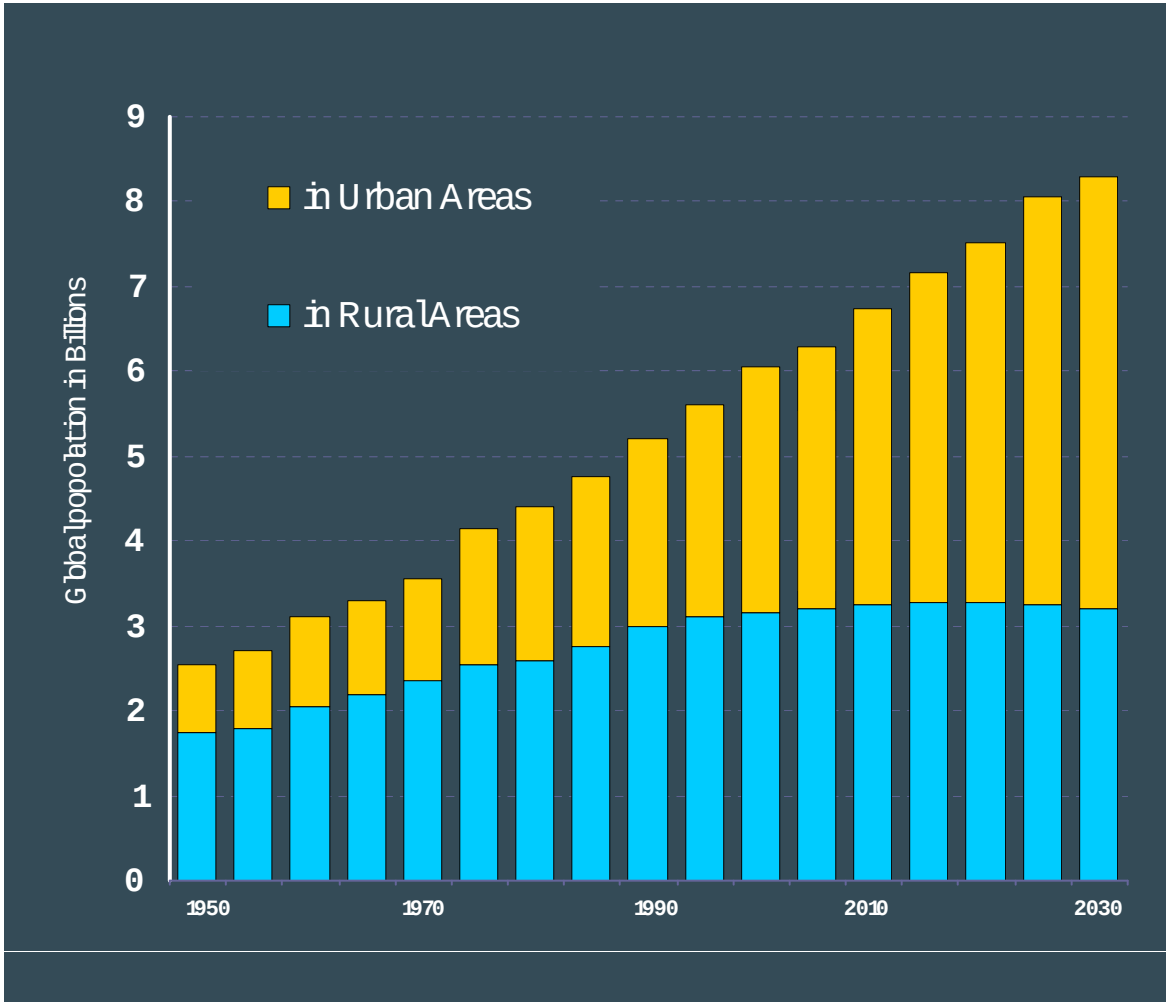
...we would need the resources of more than 2 planets!

Source: Prof. Dr. Schmidt-Bleek, Wuppertal-Institut

FUTURE IS URBAN

More than half of humanity now lives in cities - and that figure will likely reach 75% by 2050.

Source: National Nations



INFRASTRUCTURE
UNSUSTAINABLE PATTERNS

Worldwide, the building industry is responsible for:

- 40% consumption of resources [1)]
- 30% - 40% emission of greenhouse gas [1)]
- 60% of the transportation [2)]
- 25% - 40% consumption of energy [1)]
- 30% - 40% of solid waste generation [1)]

1) Source: UNEP SBCI – United Nations Environment Program

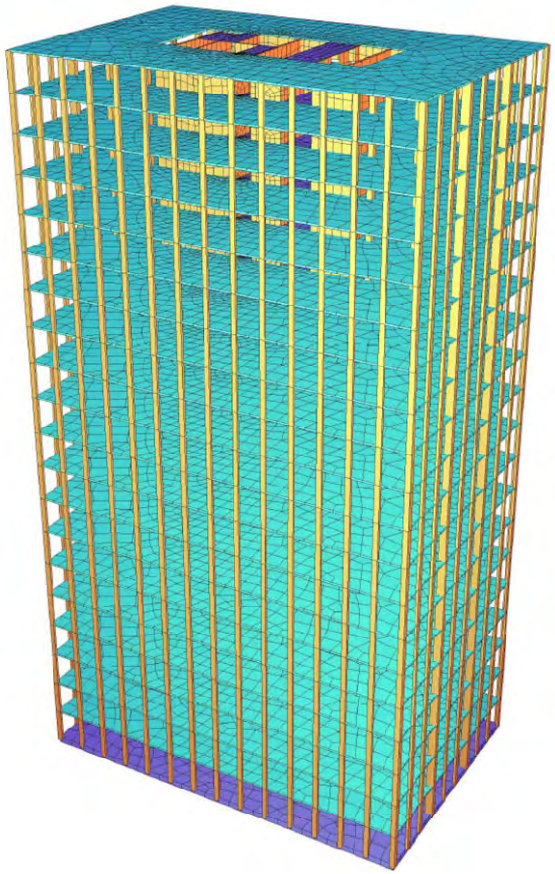
2) Ton kilometer

TRADITIONAL BUILDING INDUSTRY

- We build every building manually
- Using very complex methods
- Long construction schedules
- High consumption of energy and resources
- Commercial buildings are exclusively built out of steel and reinforced concrete

RESEARCH

DEVELOP LIFE CYCLE SYSTEMS



Include:

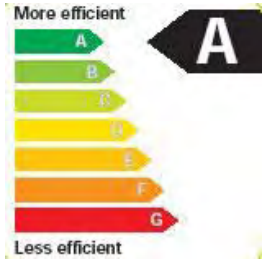
- Structural
- Façade
- Mechanical
- Electrical
- Fire Sprinkler
- Alarm System
- Code Analysis
- Energy Targets

The amount of wood used as the main building material for a 30-story LifeCycle Tower re-grows in United States forests within 3.5 minutes

LIFE CYCLE ASSESSMENT

MATERIAL SELECTION → MANUFACTURE → OFF-SITE ON-SITE CONSTRUCTION → OCCUPANCY ENERGY-EFFICIENCY MAINTENANCE → DEMOLITION → RECYCLE / REUSE DISPOSAL

Ecological Backpack



Passive House ZNE

Urban Mining

How do we use the resources of the planet?

The items of daily life are heavier than we think:

	Jeans	Cell	Desktop	Gold ring
Product-weight	0.6 kg	0.3 kg	5 kg	0.005 kg
Ecological Backpack	32 kg	500 kg	1500 kg	2000 kg

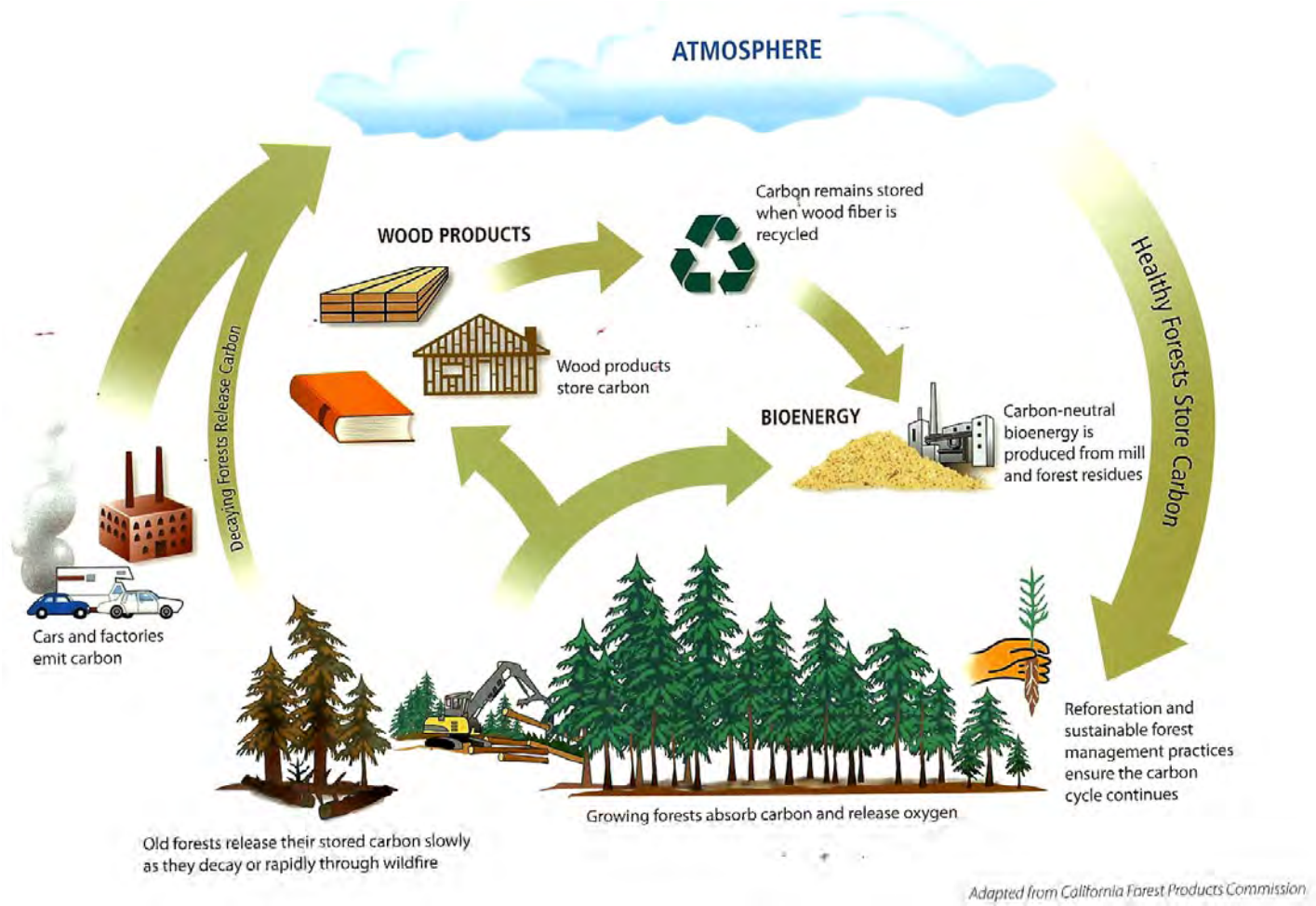
Source: Schmidt-Bleek 2000, *Das MIPS-Konzept*, Droemer Knaur, München

Urban Mining: rubble is valuable.

You do not have to go to great lengths to produce something that already exists: the term urban mining is becoming significantly more relevant in the field of sustainable building.

MATERIAL SELECTION

FORESTRY CARBON CYCLE – IT'S SUSTAINABLE



MANUFACTURING

ENGINEERED, HIGH PERFORMANCE TIMBER PRODUCTS

Glue laminated timber

Finger jointed framing lumber

Structural members

Cross Laminated Timber

OFF-SITE CONSTRUCTION

ASSEMBLE AND FABRICATE COMPONENTS

Computer Numerical Control (CNC) wood working machinery

Precision workmanship

Assemble on Tables

Flip components over

Assemble completed wall, floor and roof components

ON-SITE CONSTRUCTION

ASSEMBLE COMPONENTS AND ERECT

Wall components

Floor components

Roof components

Mechanical system components

PRODUCT DEVELOPMENT

TRADITIONAL METHODS OF DELIVERING BUILDINGS

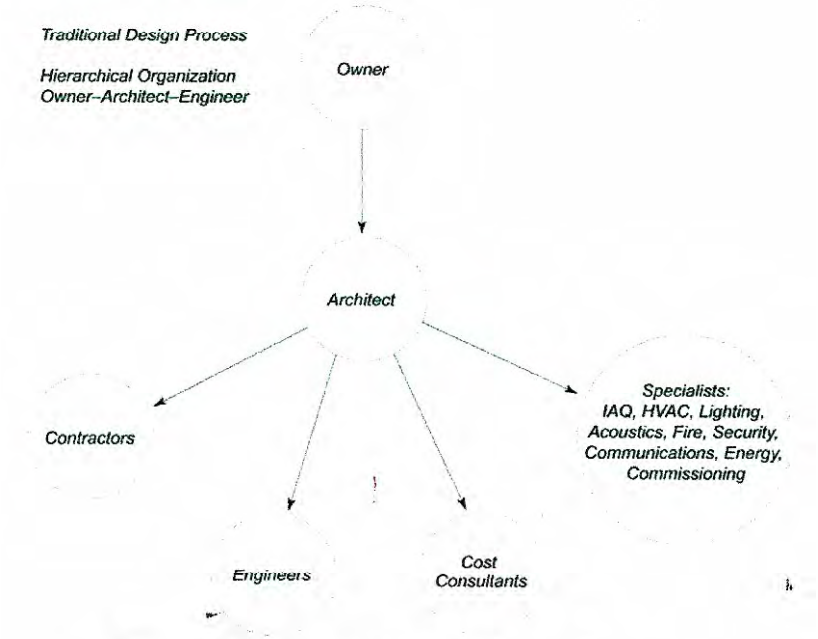


Figure 2-1 Traditional Project Design Team
Adapted from ASHRAE (2009)

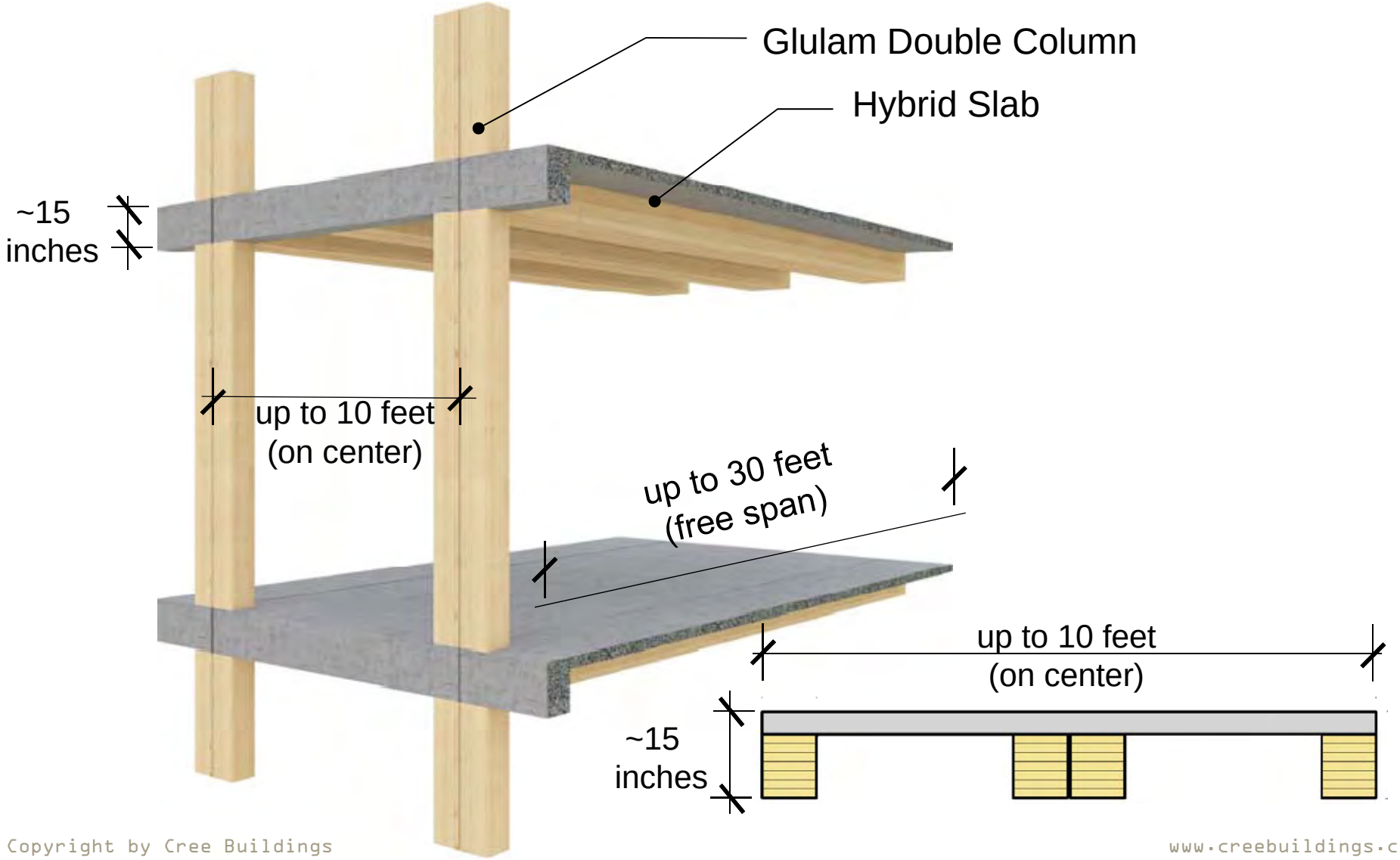
TRADITIONAL METHOD
DESIGN – BID - BUILD

INTEGRATED DESIGN PROCESS

DESIGN / BUILD SYSTEM APPROACH
Cree's in-house Integrated Design Process

Core

DESIGN / BUILD SYSTEM APPROACH
Cree's in-house Integrated Design Process

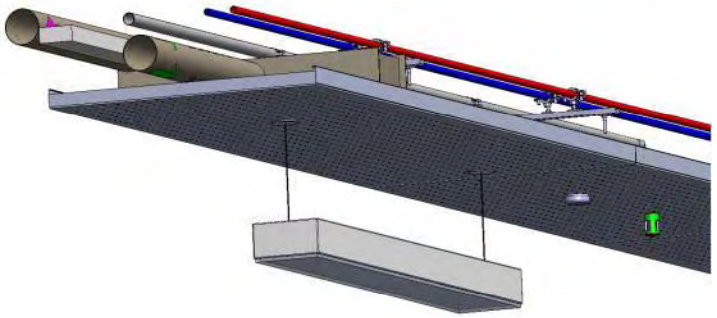


DESIGN / BUILD SYSTEM APPROACH

Facades

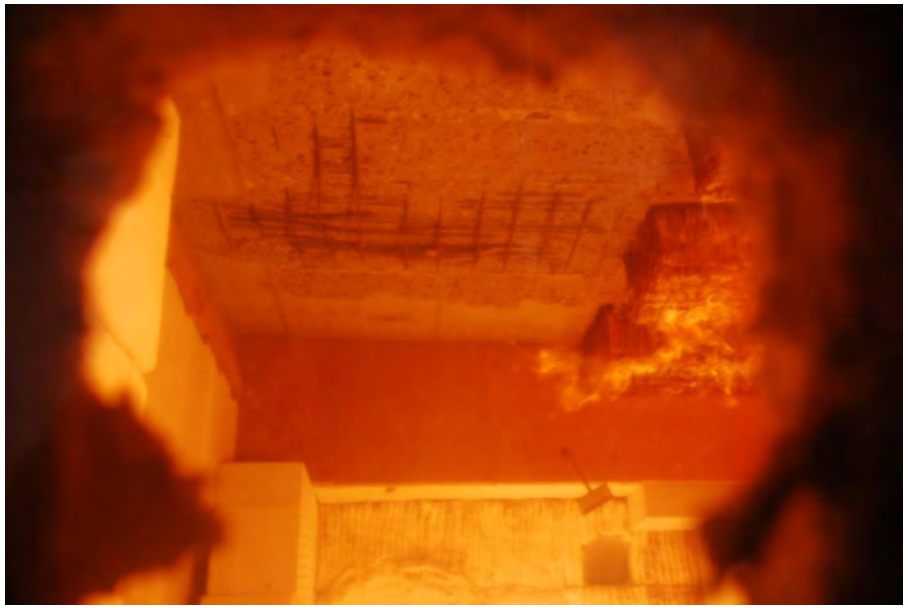
MEP

Heat- and cooling bar
+ fire alarm system
+ sprinkler system
+ illuminating
+ ventilation

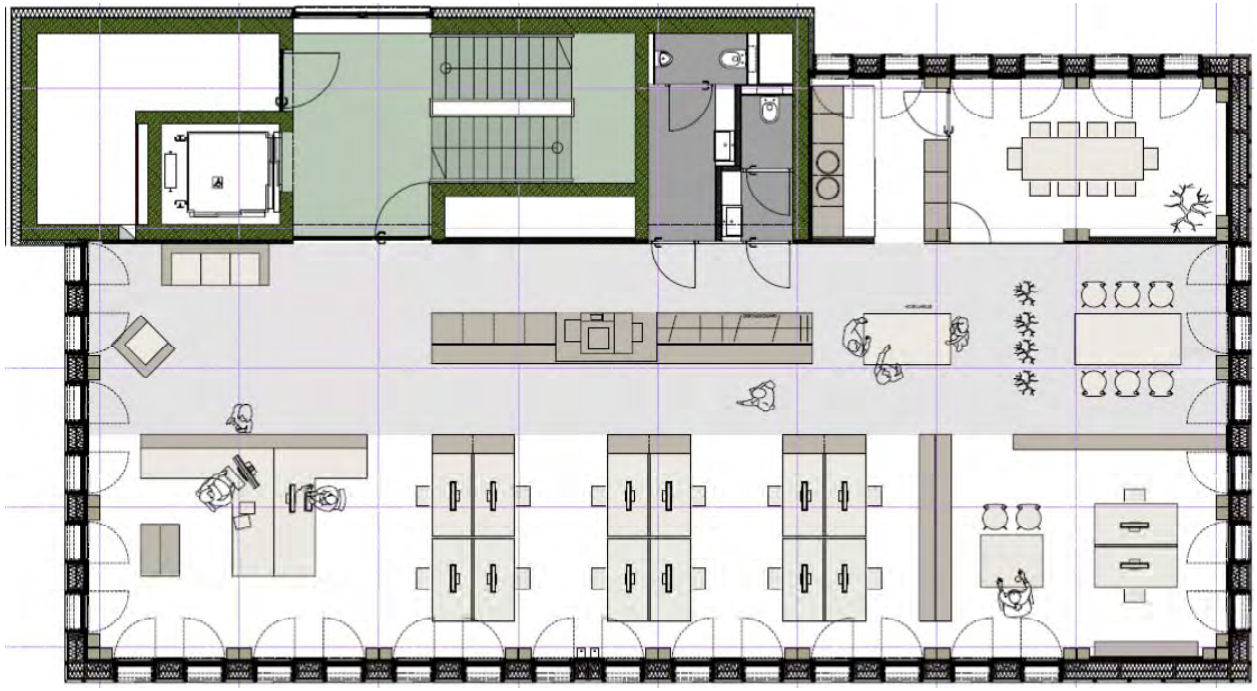


SLAB DESIGN

TESTED SYSTEM IN EUROPE - MAY OBTAIN ICC CERTIFICATION FOR USA



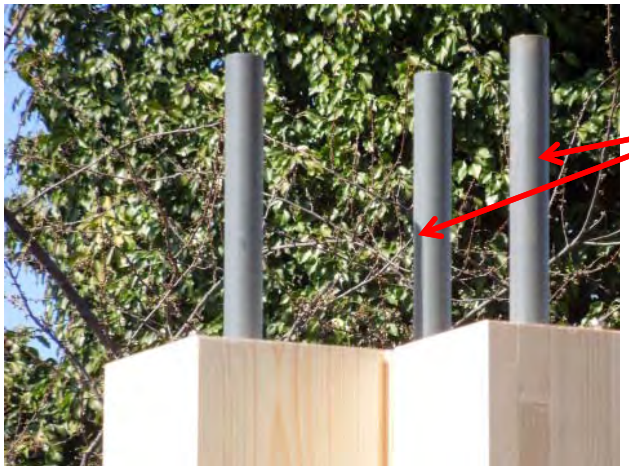
LCT ONE
A Case Study

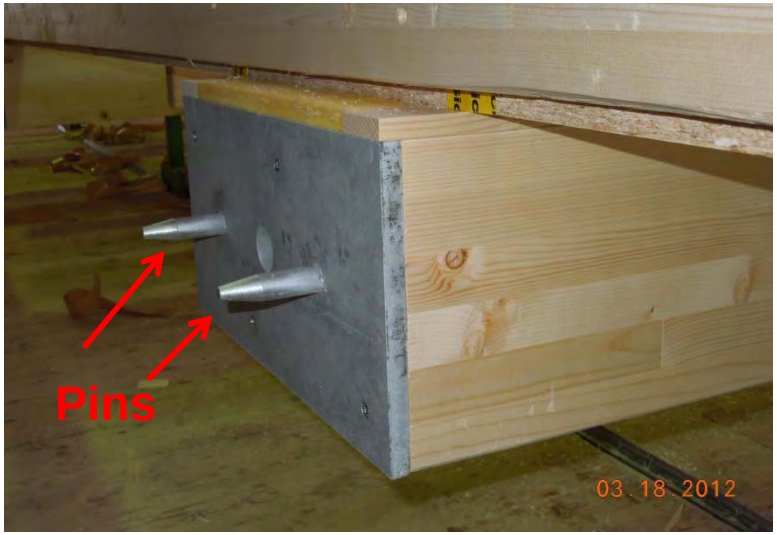


LCT ONE

OFF-SITE - PREFABRICATION – hybrid wood / concrete floor slabs

OFF-SITE - PREFABRICATION – Load Bearing Posts

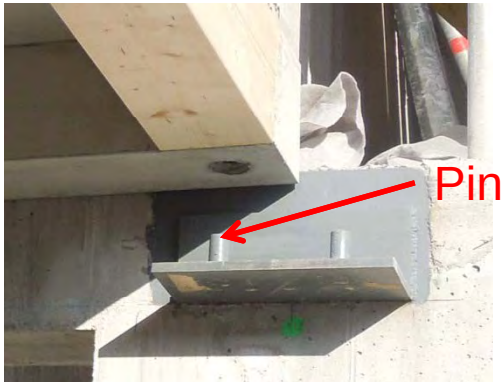




ON-SITE – INSTALL WALLS – Ground floor

INSTALL – FLOOR SLABS

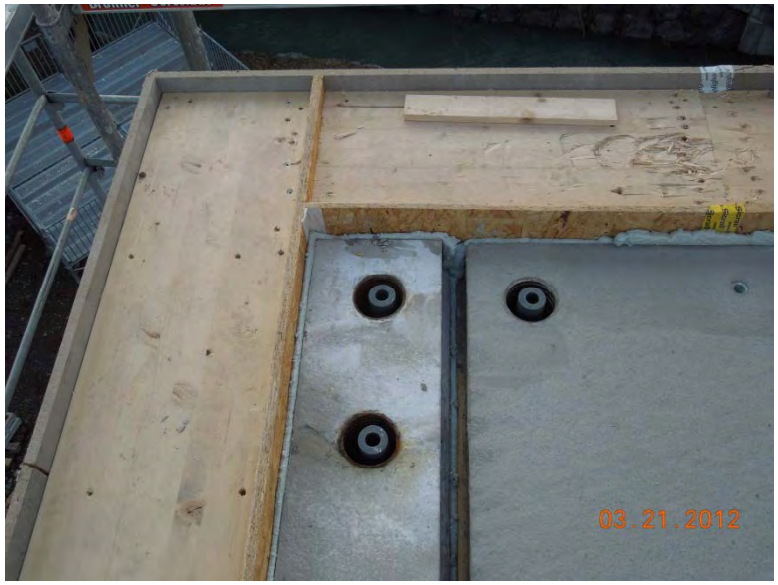
INSTALL – FLOOR SLABS THROUGH TUBES AND PINS

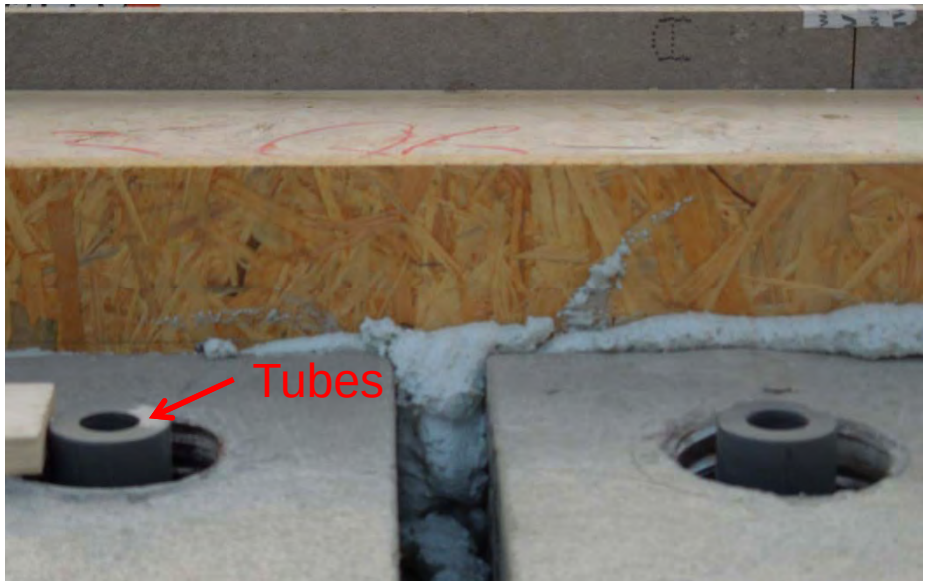


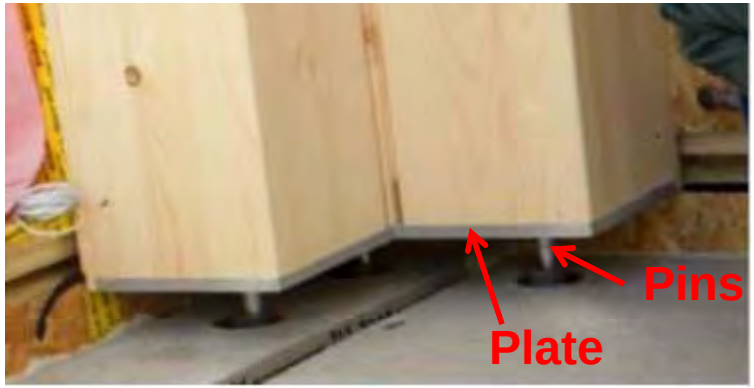
Close up

Close up

TUBES - PROTRUDING ON TOP OF SLABS

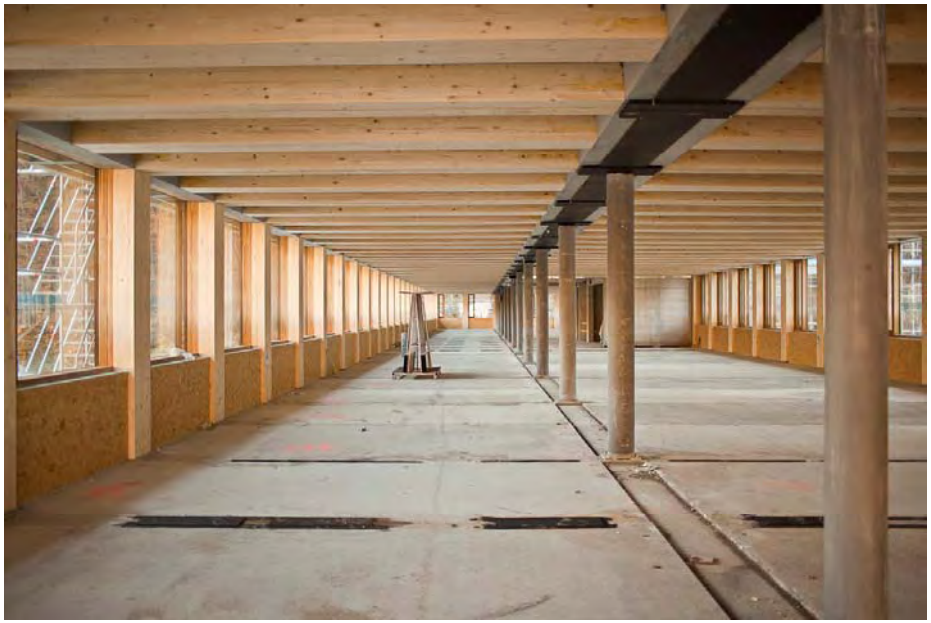




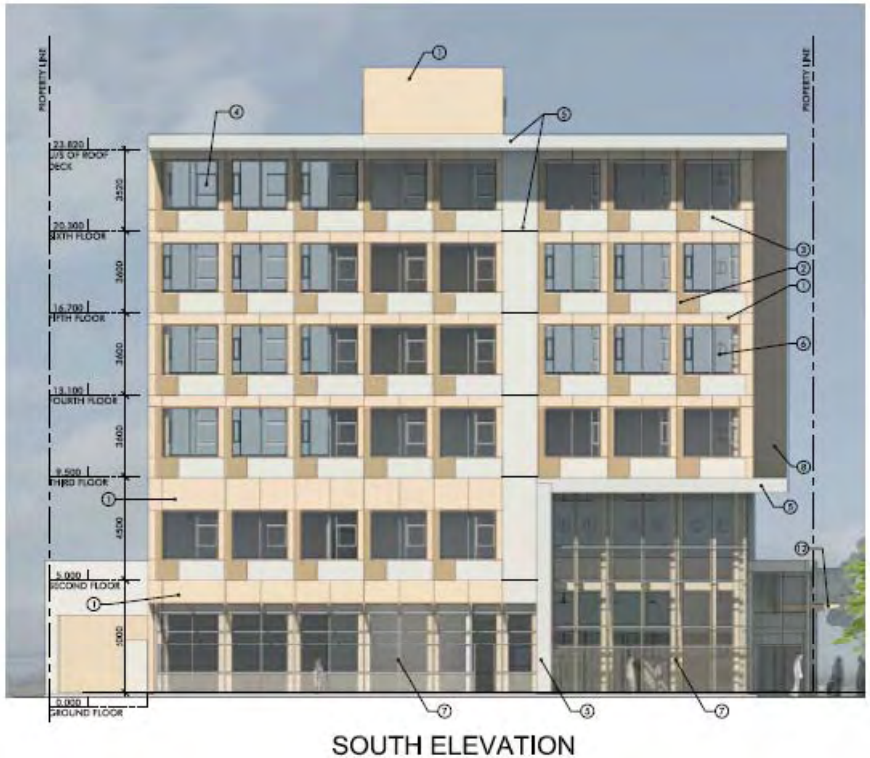


INTERIOR – Exposed timber – watertight and airtight

OTHER PROJECTS



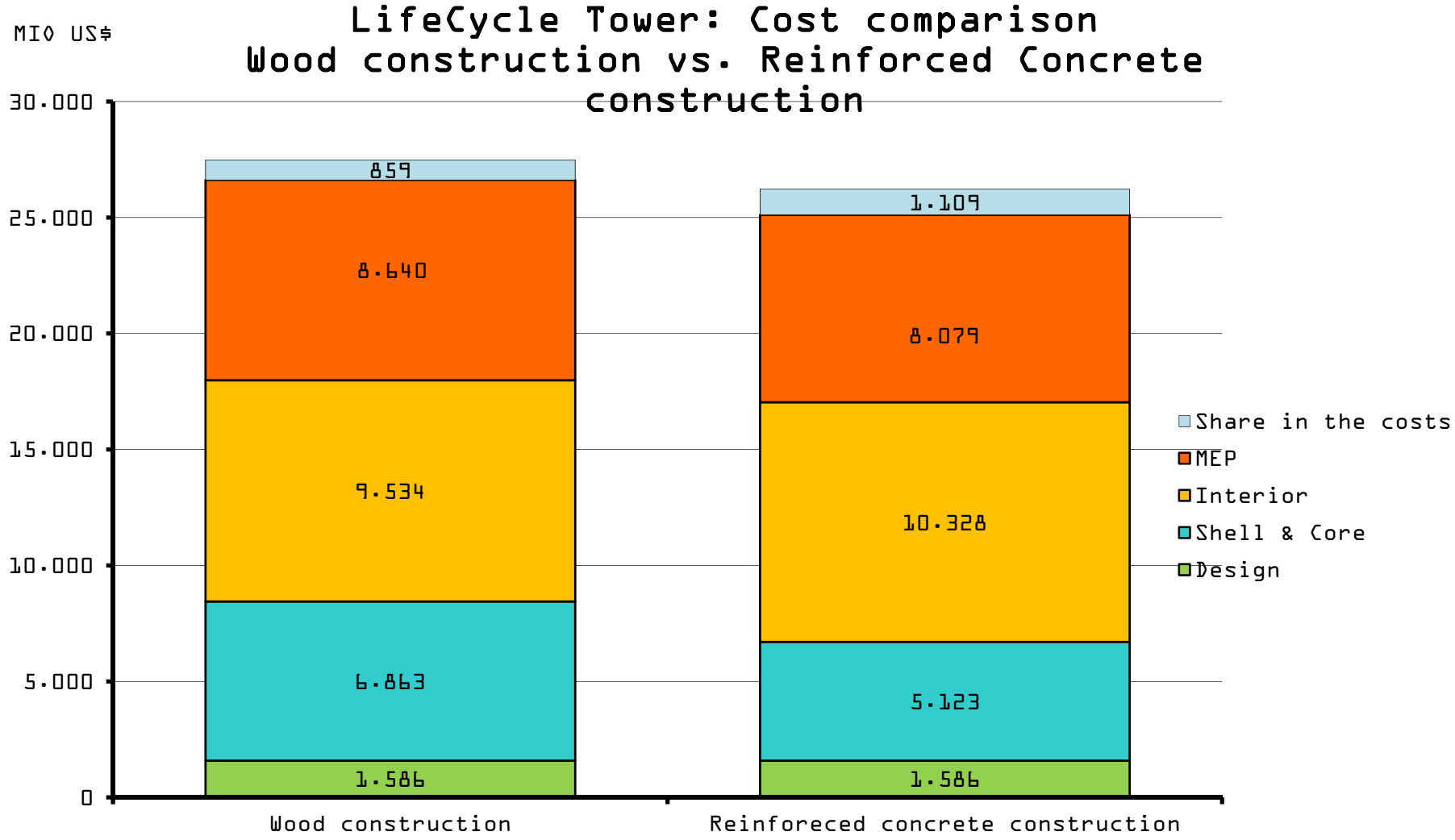
EAST ELEVATION



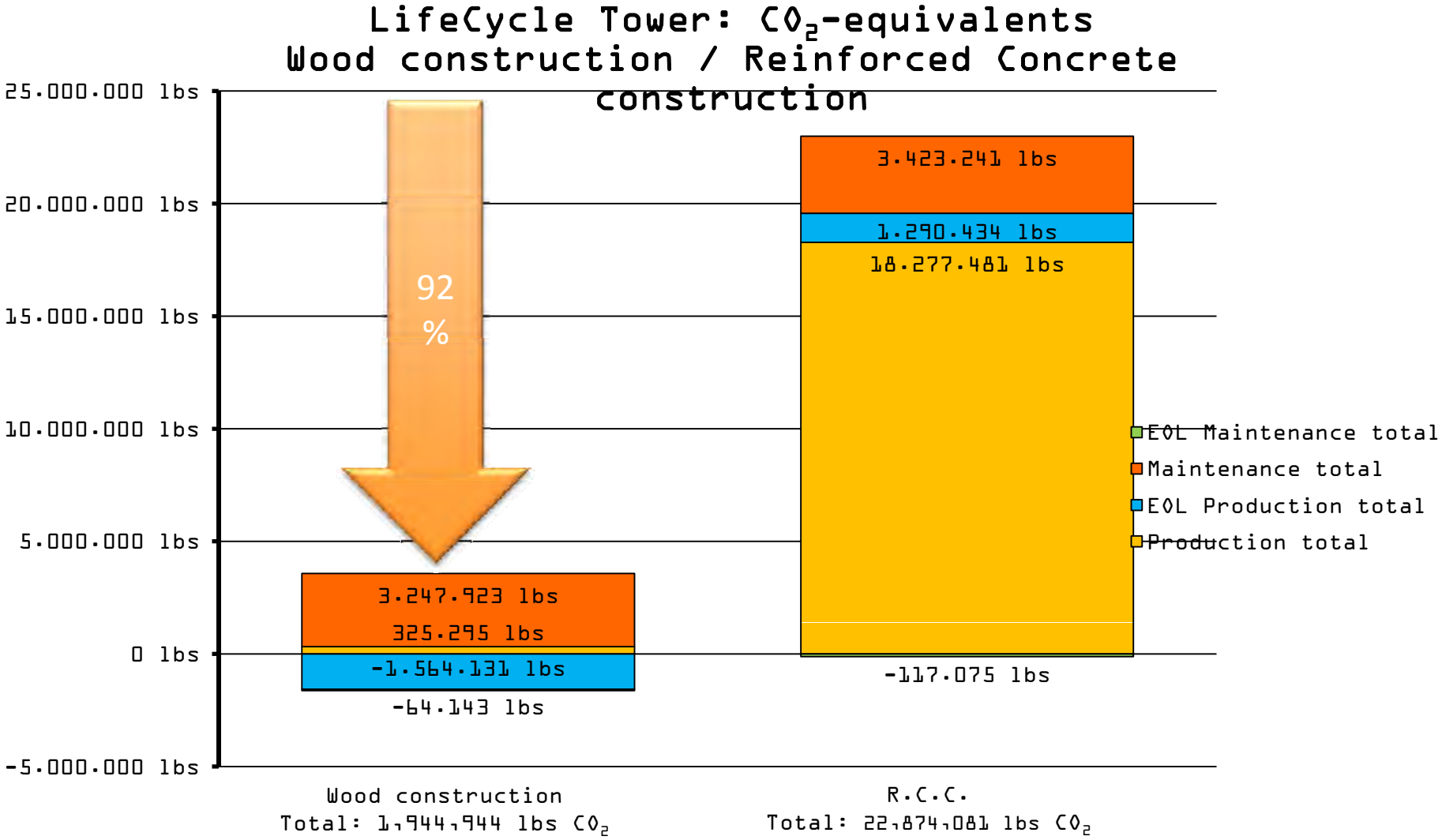
SOUTH ELEVATION

PERFORMANCE

COST COMPARISON



CO_2 EQUIVALENTS



CURRENT TRENDS IN THE WOOD INDUSTRY

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Ministry Home

Home

Building and Safety Standards

Building and Fire Codes

Modern Building

Ministry of Energy and Mines
Office of Housing and Construction Standards

Residential Mid-Rise Wood-Frame Code Change

In May of 2008, Minister Rich Coleman announced government's intention to increase the maximum height for wood-frame residential construction from four to six storeys. These new BC Building Code requirements were approved in January 2009 and become effective April 6, 2009 giving the residential construction sector time to prepare for implementation.

New Provision # 1 – Building Height Clause 3.2.2.45.(1)(B) & (C)

Summary

This code change for building height requires that buildings built under 3.2.2.45 are less than 18 metres to the uppermost floor level of the top storey, which precludes the use of top floor mezzanines to achieve additional height without triggering high building requirements.

3.2.2.45. Group C, up to 6 Storeys, Sprinklered

1) A *building* classified as Group C is permitted to conform to Sentence (2) provided

b) it is not more than 6 storeys in building height, and

c) has a maximum height of less than 18 m measured between *grade* and the uppermost floor level of the top *storey*, and

USDA NEWS RELEASE

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Washington, DC 20250-1300 • Voice: (202) 720-4623 • Email: oc.news@usda.gov • Web: http://www.usda.gov

Release No. 0143.11

Contact:
Office of Communications (202)720-4623

USDA Leads the Way on Green Buildings, Use of Wood Products

WASHINGTON, March 30, 2011 -- Agriculture Secretary Tom Vilsack announced today USDA's strategy to promote the use of wood as a green building material. At an event this evening to launch the International Year of the Forest, Secretary Vilsack will lay out a three-part plan addressing the Forest Service's and USDA's current green building practices.

Strategies:

- U. S. Forest Service will preferentially select wood in new building construction.
- U.S. Forest Service will …demonstrate the innovative use of wood as a green building material for all new structures of 10,000 square feet or more…
- "Our country has the resources, the work force and the innovative spirit to reintroduce wood products into all aspects of the next generation of buildings", Forest Service Chief Tom Tidwell
- A recent Forest Service lifecycle analysis found that harvesting, transporting, manufacturing and using wood in lumber and panel products in building yields fewer air emissions – including greenhouse gases – than resource extraction, manufacturing and using other commonly-used building materials. In fact, wood based wall systems can require significantly less total energy for manufacturing than thermally comparable buildings using other common material systems.

76th OREGON LEGISLATIVE ASSEMBLY--2011 Regular Session

House Bill 3429

Requires Oregon Department of Administrative Services to adopt rules regarding use of wood in buildings constructed by public body using state funding. Prohibits use of state funding for buildings not conforming with rules. Requires department to consult with representatives of local government, building trades, wood products industry and other parties before adoption or modification of rules.

Makes rules applicable to buildings for which initial disbursement of state funding occurs on or after July 1, 2012.

Declares emergency, effective on passage.

A BILL FOR AN ACT

Relating to the wood content of buildings constructed using state funding; and declaring an emergency.

Whereas wood is a strong, lightweight and flexible building material; and

Whereas wood is organic, sustainable, natural, recyclable and renewable; and

Whereas wood products require less water and energy and are more carbon efficient to manufacture than any other material; and

Whereas wood sequesters carbon for or beyond the life of a wood product; and

Whereas wood products reduce greenhouse gases in the atmosphere by being energy and carbon efficient and by sequestering carbon; and

Whereas wood is cost-effective and abundant, allowing wood to easily be sourced locally; and

Whereas wooden building systems have superior seismic performance; and

Whereas wood has a much lower thermal conductivity than comparable building materials; and

Whereas the use of wood for building supports the economy of Oregon and its rural communities; and

Whereas wooden buildings are long-lived and are easy to renovate, expand and adapt for changing uses; and

Whereas wood is visually appealing, warm and inviting; now, therefore,

Timber facades – Cross Laminated timber

Forte Building – 10 stories in Melbourne, Australia

CREE IS LOOKING FOR PARTNERS

- DEVELOP DEMONSTRATION PROJECT
- START UP PRODUCTION FACILITY
- ADAPT TECHNICAL SOLUTION TO LOCAL BUILDING REGULATIONS
- DEVELOP A RESIDENTIAL SYSTEM
- OPTIMIZE COSTS

Webcor Presentation

LCT ONE: CASE STUDY OF AN EIGHT STORY WOOD OFFICE BUILDING

October 8, 2013

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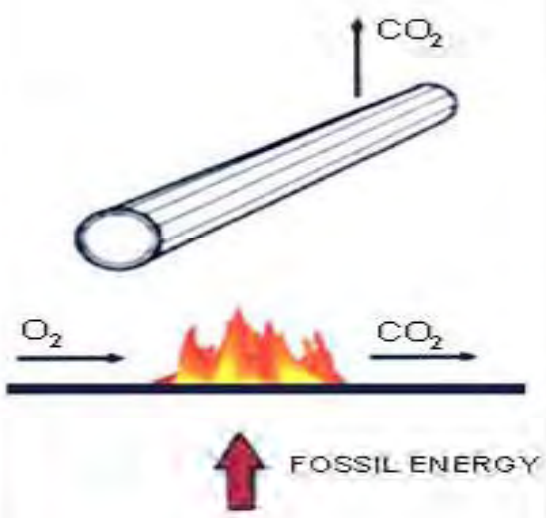
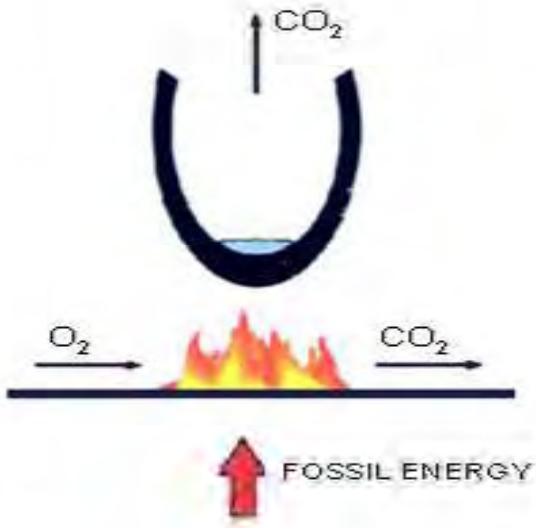
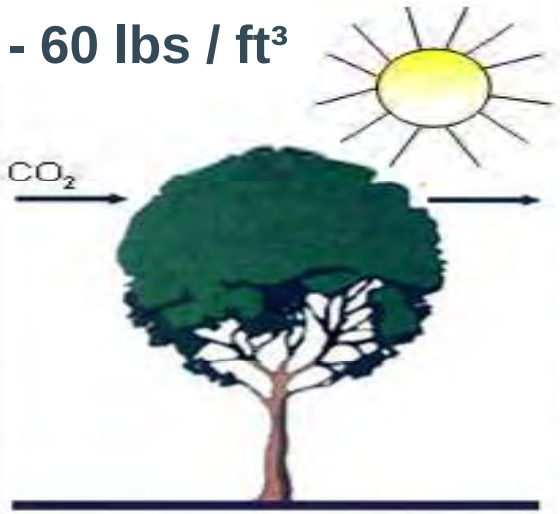
CREE BUILDINGS

The Natural Change in Urban Architecture

Embodied Energy

Compare Concrete – Steel - Wood

CEMENT	STEEL	WOOD
150 lbs/ ft³	**485 lbs/ ft³**	**28 lbs/ft³** SOLAR ENERGY
+ 2,060 lbs CO2 / ft³	**+ 1,250 lbs CO2 / ft³**	**- 60 lbs / ft³**
		 **60 kWh/ft³**
142 kWh/ft³	**250 kWh/ft³**	**5 kWh/ft³**