

Chicago's Green & Garden Roofing Codes & Technology

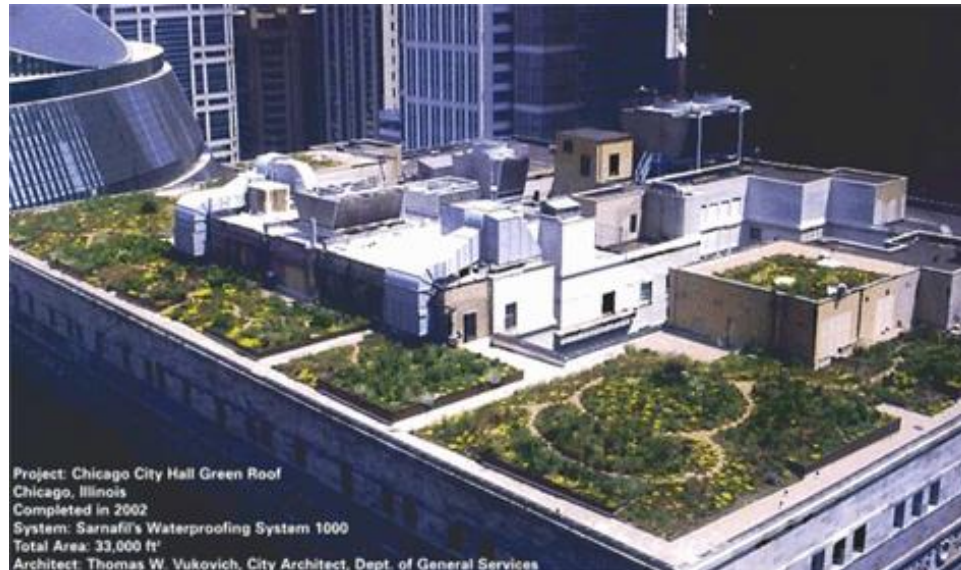


CRCA & CRC @ NRCA
International Symposium 2011

Chicago's Green & Garden Roofing Codes & Technology

Thanks !!

*NRCA, ORNL, NRC International
Roofing Symposium
Peer Reviewers, Team*



Chicago's Green & Garden Roofing Codes & Technology

- ***CRCA – Late 1800's – Members...***
 - Membership Meetings, Trade Show & Seminars, Education...
 - Scholarship - Celebrate Students
 - Awards
 - Relationships....



Chicago's Green & Garden Roofing Codes & Technology



- Chicago's Union Roofing Contractors

Chicago's Green & Garden Roofing Codes & Technology Learning Objectives

- History
- Issues – Technical, Science
 - Slow water drainage
 - Save Energy – Reflectivity, Insulation
 - Urban Heat Island Reduction
 - Code Requirements

Chicago's Green & Garden Roofing Codes & Technology

- **Green & Vegetative Garden Roof Issues**
 - **Technical**
 - **Specification Sections**
 - **Chicago Energy Code 2009**
 - **International Building Code – 2006 – Vegetative Systems – Code Silent**
 - **International Building and Fire Code 2012- Vegetative- New Requirements**
 - **Installed Costs**
 - **Insurance**
 - **Warranty**
 - **Licensing**
 - **Workforce Education & Safety**
 - **More....**

Chicago's Green & Garden Roofing Codes & Technology

- **Being Green... Yesterday, Today**



McHugh Photo



Whole Foods Photo

Chicago's Green & Garden Roofing Codes & Technology

- **Being Green...Autos; Small - Engineering**



1976....cars got smaller....then engineers & scientists went to work

Chicago's Green & Garden Roofing Codes & Technology

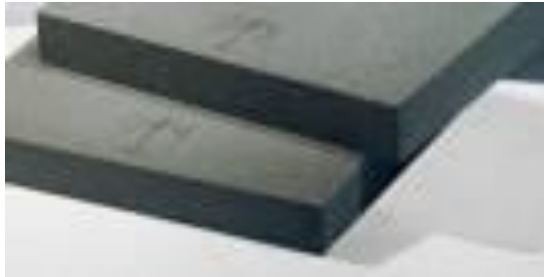
- **Being Green – Buildings – HVAC, Glazing**



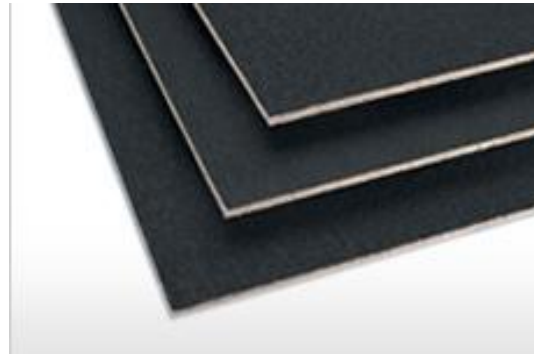
Thermafiber Photo

Chicago's Green & Garden Roofing Codes & Technology

- **Being Green – Roof Insulations – to 1970's**



Pittsburgh Corning Photo



JM Photo



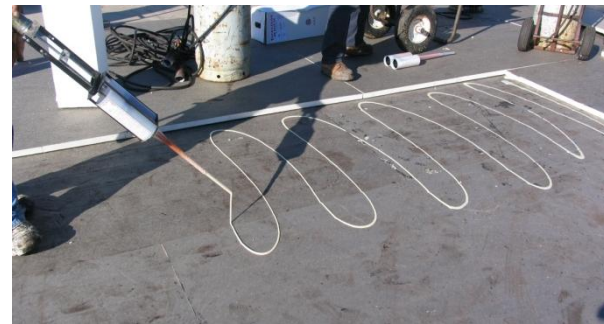
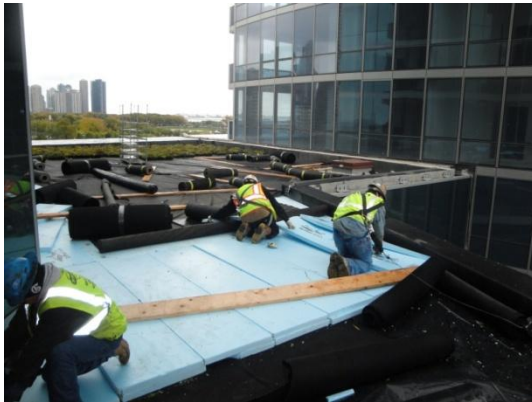
IKO Photo



Roxul photo

Chicago's Green & Garden Roofing Codes & Technology

- **Being Green – Roof Insulations**
 - Insulation, post 1970's, XEPS, EPS, ISO, etc.



Chicago's Green & Garden Roofing Codes & Technology

- **Being Green...Roof Membranes
Cool Roofing Catches On**



Chicago's Green & Garden Roofing Codes & Technology

- **Being Green....in Chicago, Heavy is Cool**



Chicago's Green & Garden Roofing Codes & Technology

- **Being Green...In Chicago, Black to Lighter**



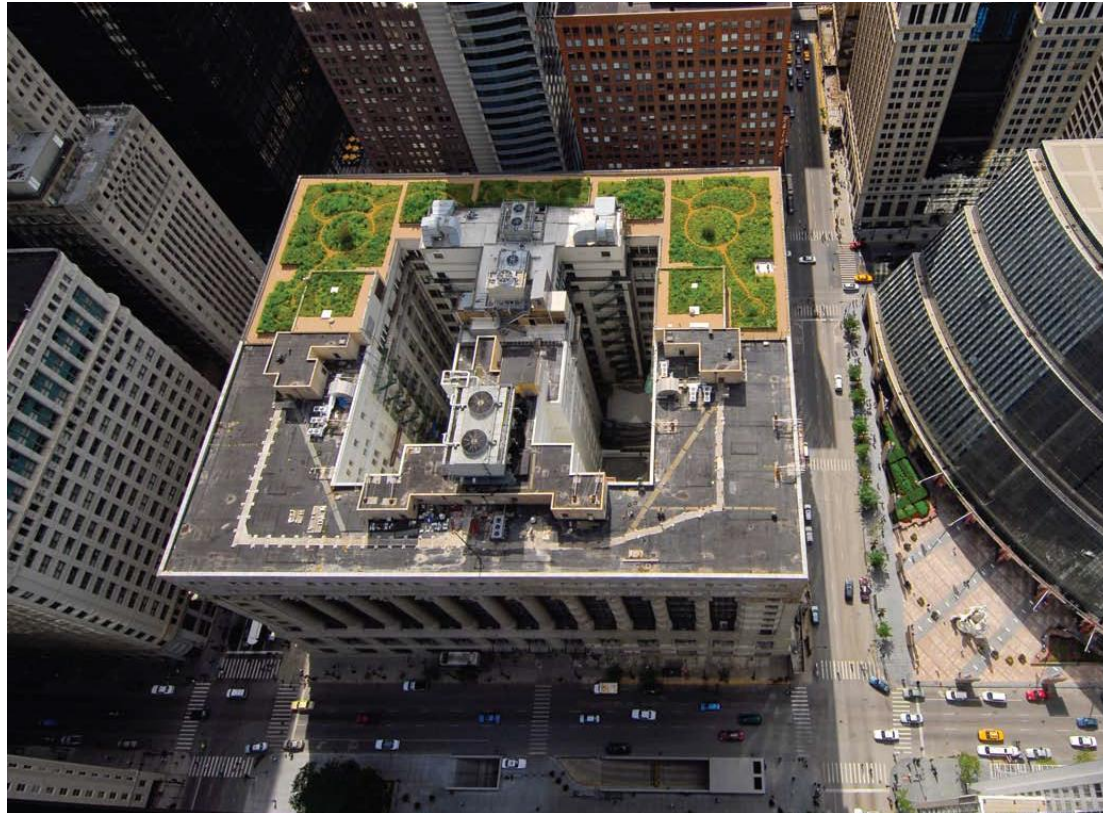
Chicago's Green & Garden Roofing Codes & Technology

- **Being Green – Mass...Ballast, Pea Gravel**



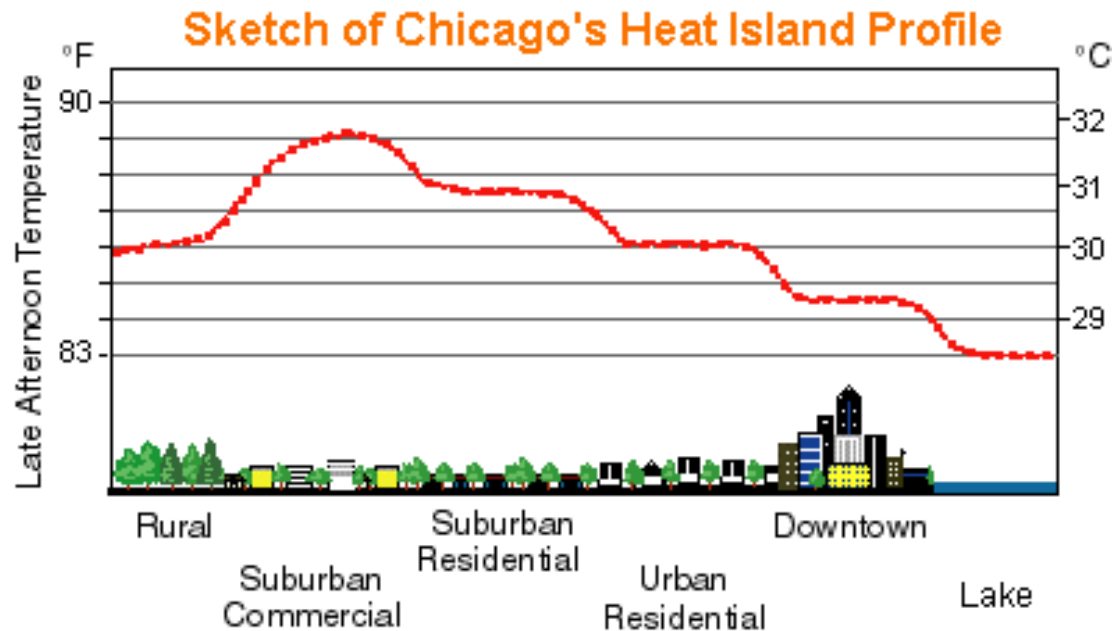
Chicago's Green & Garden Roofing Codes & Technology

- Chicago...Black to Vegetative Green, PV



Chicago's Green & Garden Roofing Codes & Technology

- Why?
- Chicago's Urban Heat Island (UHI) & Temperature, Pollution Reduction



Gray, Finster Chart - NWU

Chicago's Green & Garden Roofing Codes & Technology

- The story...Chicago Energy Code Team
- ***Roofing Industry Alliance***
 - CRCA Contractors, Manufacturers, Associates
 - NRCA – Mark Graham
 - SRI - Rene Dupuis
 - ORNL - Andre Desjarlais
 - Others...Roofers Union, RCI



Chicago's Green & Garden Roofing Codes & Technology

- Roofing Industry Alliance Research
 - Why Garden Vegetative
& Cool Roofs in Chicago??
 - Several Papers, Graham/DuPuis, Desjarlais...



RESEARCH – COOL & MASS

- Complete Impact of Roof Mass on “Coolness”



Slide - Andre Desjarlais, ORNL

BALLAST STUDY INSTRUMENTATION

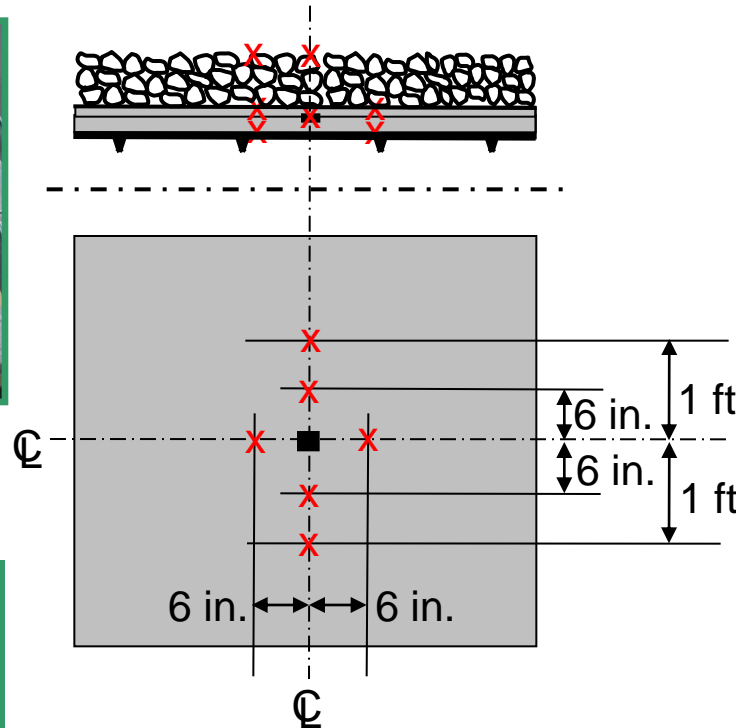
10 lb/ft² Stone



17 lb/ft² Stone



24 lb/ft² Stone



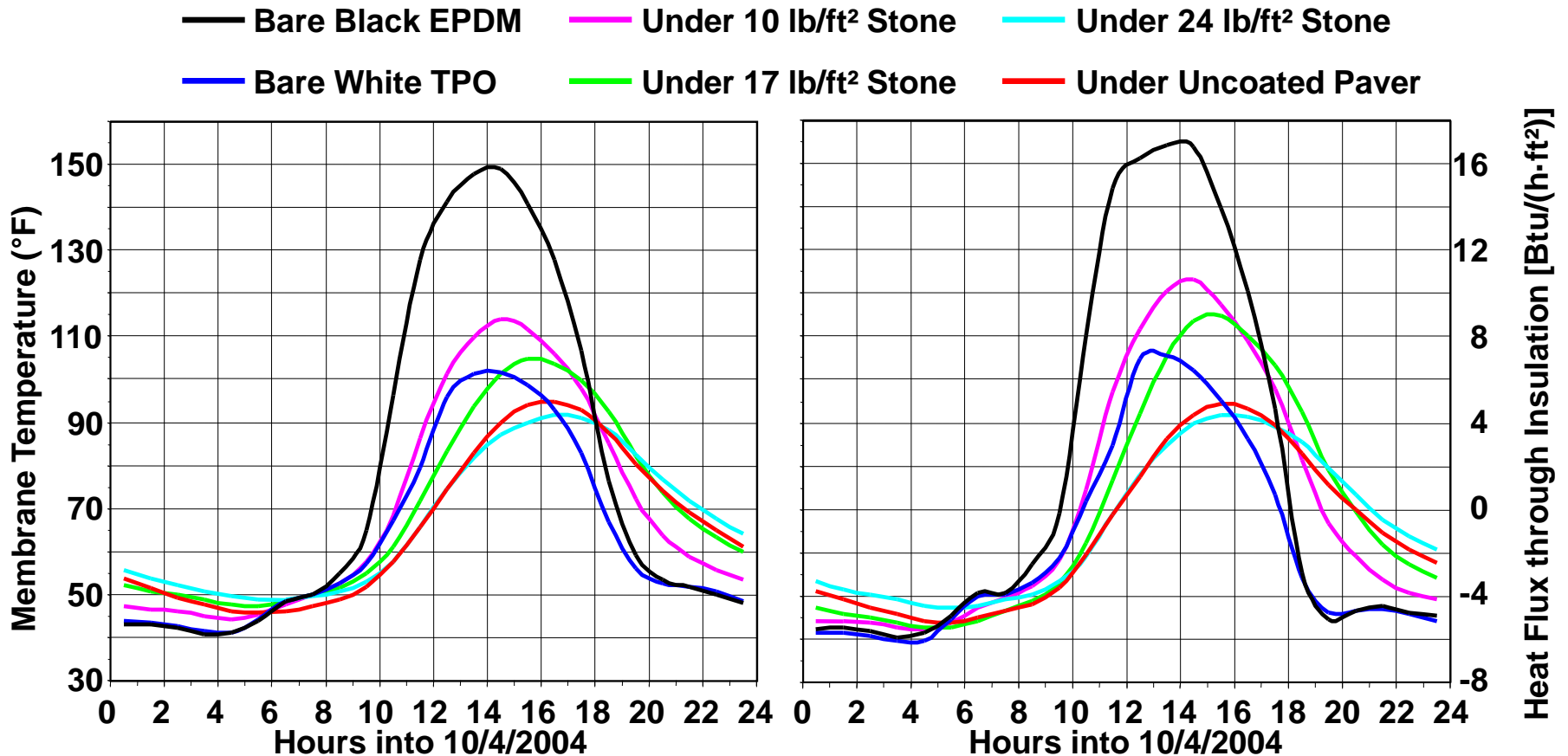
- x Thermocouples
- Heat Flux Transducer

24 lb/ft² Paver



Andre Desjarlais, ORNL
@ CRCA Trade Show &
Seminars...

Test Results – Six Month Exposure Data



**Andre Desjarlais, ORNL
@ CRCA Trade Show &
Seminars...**

Chicago's Green & Garden Roofing Codes & Technology

- ***And,....can we fix a water problem too??***
- ***Chicago's Landscape....***
 - Flat, Marshy Land
 - Heavy Clay Underbase, Glacial Lake Chicago
 - Poor drainage
 - Short, Sluggish Chicago / Calumet Rivers
 - Human Alterations
 - Shoreline Filled
 - City Raised
 - Reversed River Flow
 - New Lagoons, Ponds, Harbors
 - Suburbs = less drainage

» Source: Encyclopedia of Chicago



Chicago's Green & Garden Roofing Codes & Technology

Why a Vegetative Green Roof?

- **Flooding in Chicagoland – Damage, Disease**
 - **12 Biggies since 1849 –**
 - 1849, 1855, 1938, 1952, 1954, 1961, 1973, 1986, 1987, 1996, 2007, 2008, 2010?
 - **Most record setting crests set after 1948**
 - **Suburban Development....**
- **Drainage Project Solutions**
 - **Illinois & Michigan Canal - 1848**
 - **Reverse Chicago River – 1900**
 - **Sanitary & Ship Canal – 1900**
 - **North Shore Channel – 1910**
 - **Cal-Sag Channel – 1922**
 - **Locks – Chicago River – 1938**
 - **TARP – Deep Tunnel**

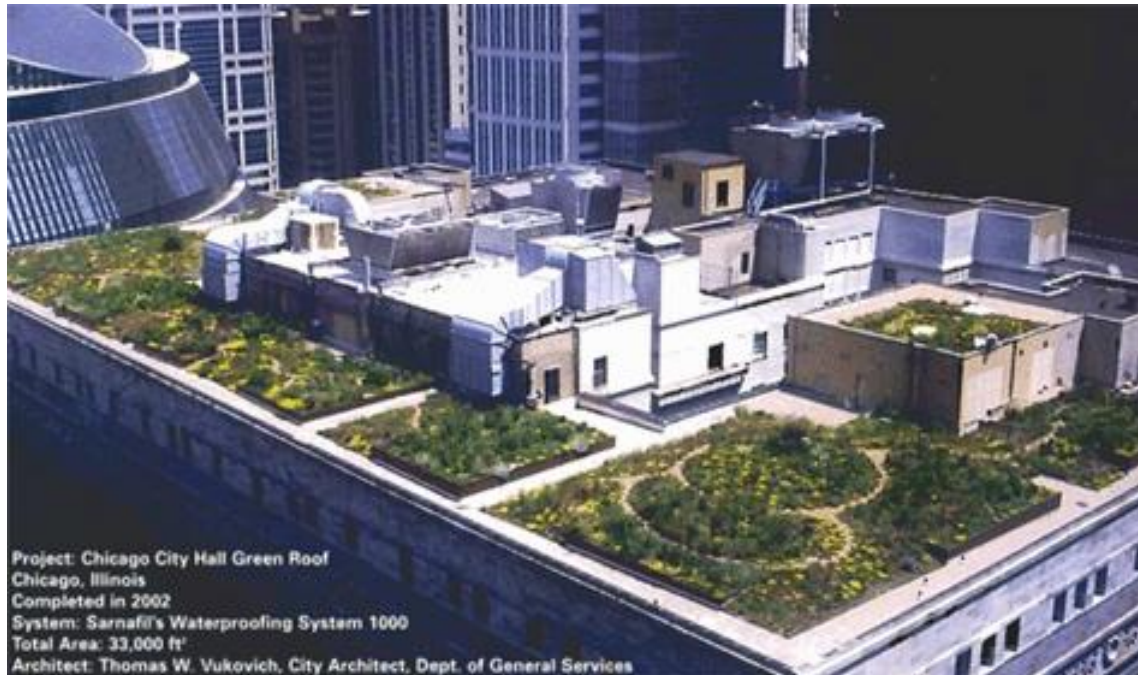


Chicago's Green & Garden Roofing Codes & Technology

Chicago's Water Drainage Solutions

- **Solutions??**
 - **Porous Paving Systems**
 - **Chicago's Alley Project**
 - **Block “L” Pavers**
 - **Pervious Concrete**

Chicago's Green & Garden Roofing Codes & Technology **SOLUTION:** **Vegetative Green Roofs**



Project: Chicago City Hall Green Roof
Chicago, Illinois
Completed in 2002
System: Sarnafil's Waterproofing System 1000
Total Area: 33,000 ft²
Architect: Thomas W. Vukovich, City Architect, Dept. of General Services

Chicago's Green & Garden Roofing Codes & Technology

Chicago's Water Drainage Solutions

- **Solutions – Allow Vegetative Roofs**
- **Slow Water Drainage, Hold Water**



CRC Photo

Chicago's Green & Garden Roofing Codes & Technology

- History...2009 Chicago Energy Code Team
- ***Roofing Industry Alliance***
 - CRCA Contractors, Manufacturers, Associates
 - NRCA – Mark Graham
 - SRI - Rene Dupuis
 - ORNL - Andre Desjarlais
 - Others...Roofers Union, RCI



Chicago's Green & Garden Roofing Codes & Technology

- 2009 Chicago Energy Code - Research
 - Why Garden Vegetative
& Cool Roofs in Chicago??



RESEARCH – COOL & MASS

- Complete Impact of Roof Mass on “Coolness”



Andre Desjarlais, ORNL

BALLAST STUDY - INSTRUMENTATION

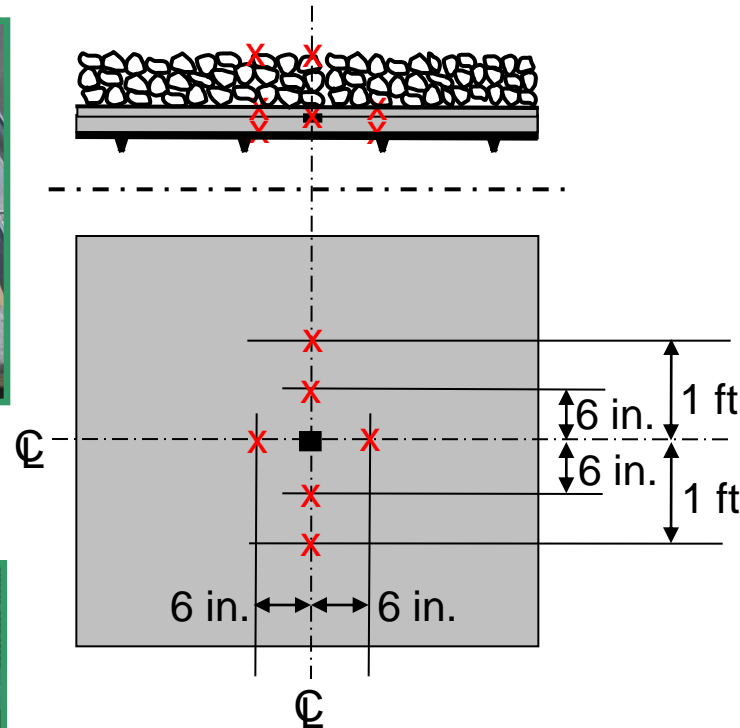
10 lb/ft² Stone



17 lb/ft² Stone



24 lb/ft² Stone



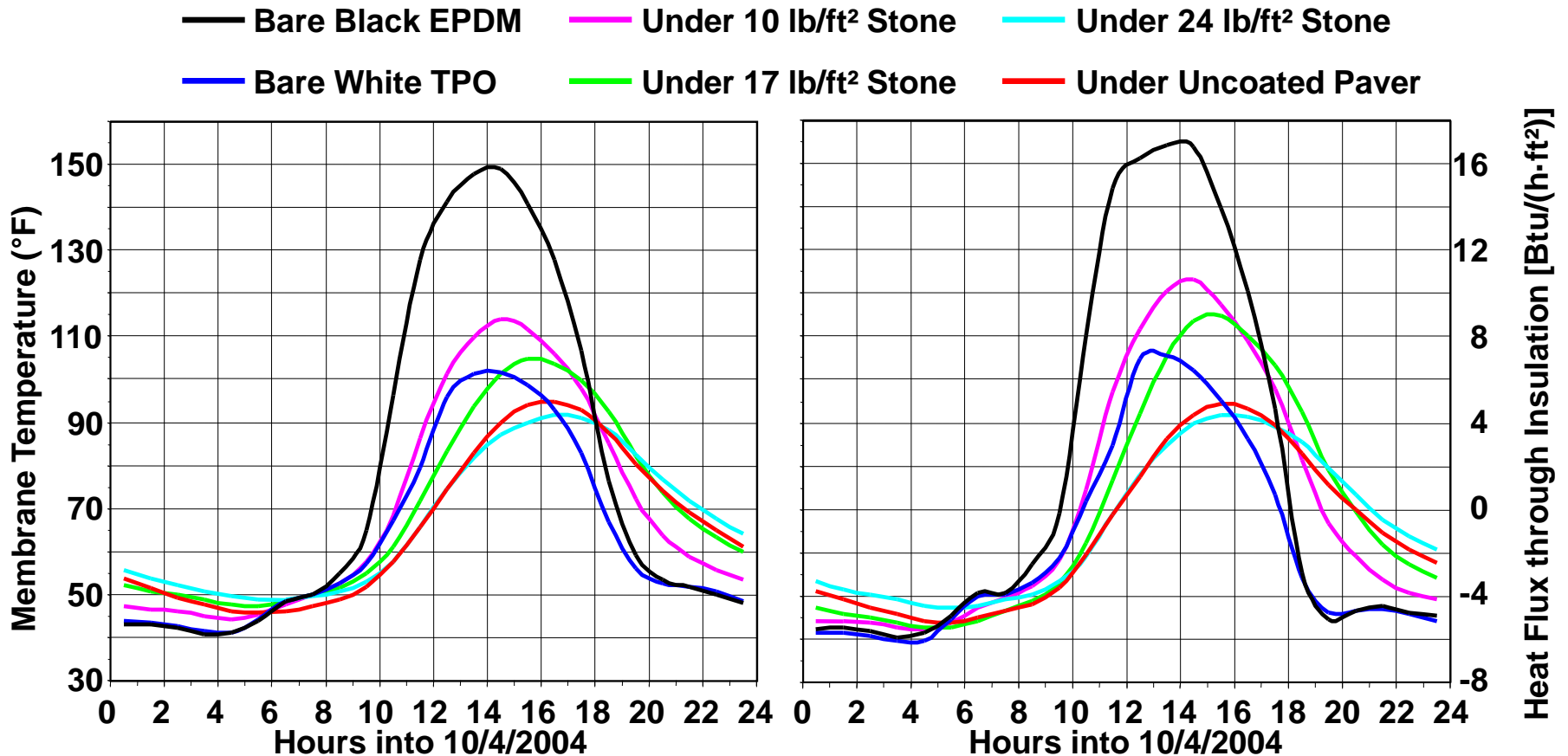
- x Thermocouples
- Heat Flux Transducer

24 lb/ft² Paver



Andre Desjarlais, ORNL
@ CRCA Trade Show &
Seminars...

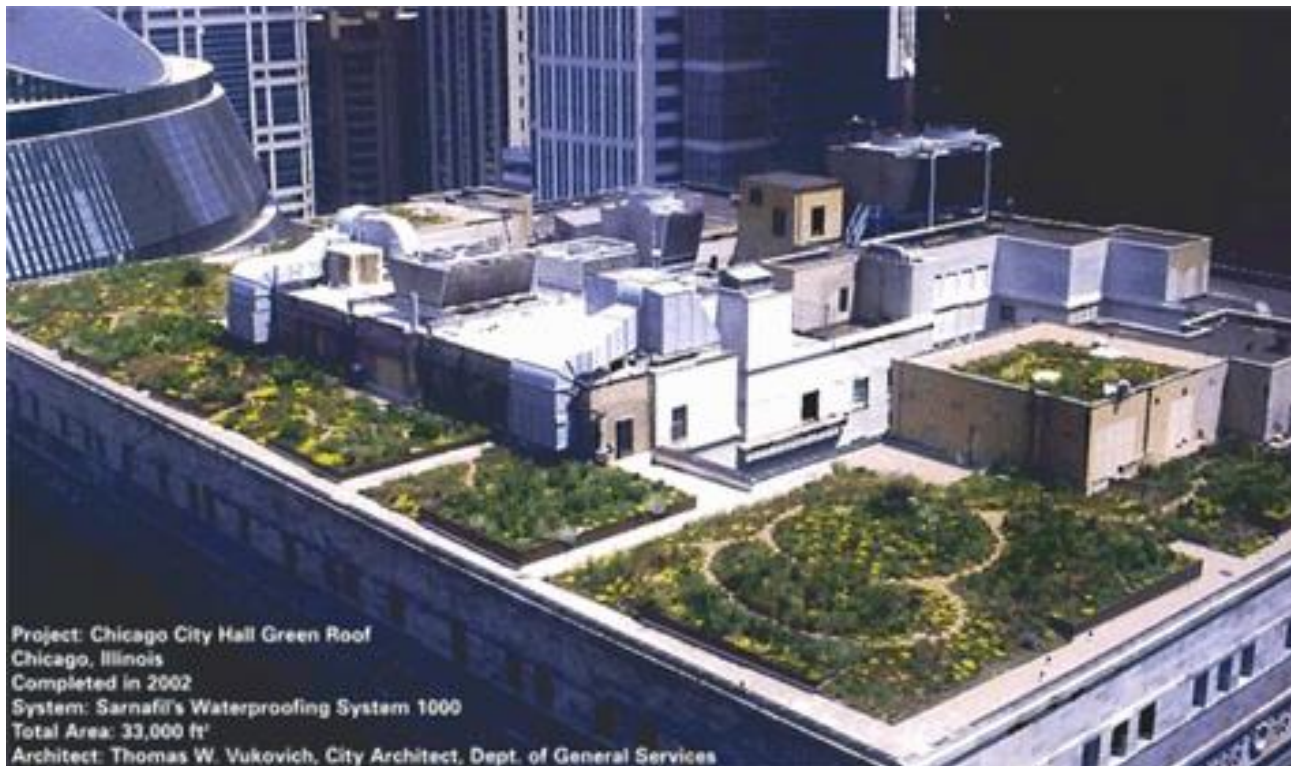
Test Results – Six Month Exposure Data



Andre Desjarlais, ORNL

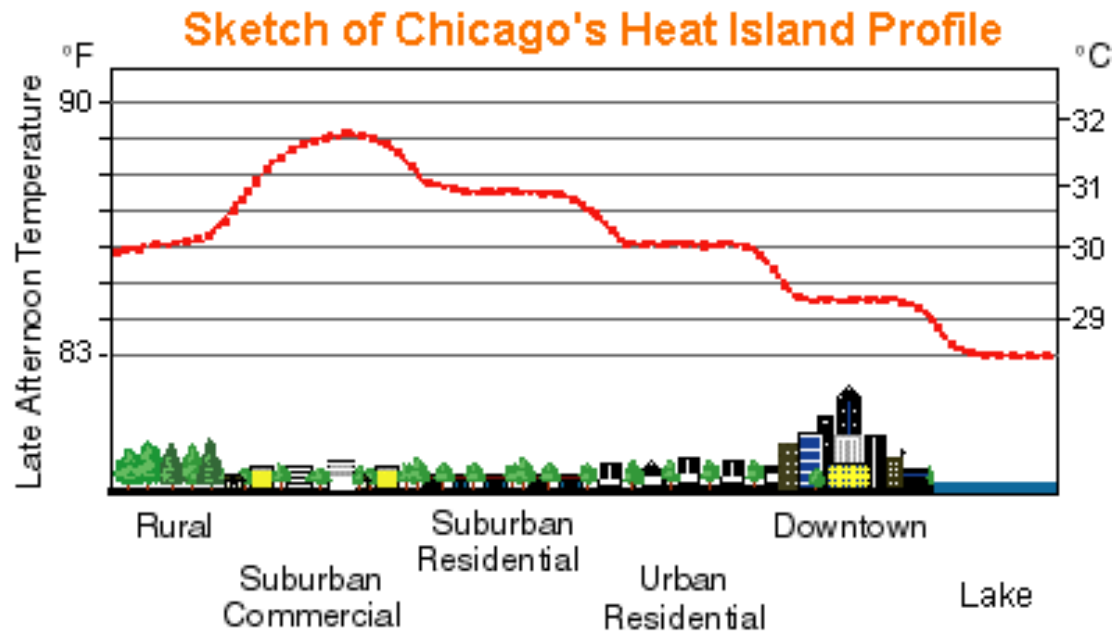
Chicago's Green & Garden Roofing Codes & Technology

New 2009 Chicago Code Requirement Developments – 2001-2009



Chicago's Green & Garden Roofing Codes & Technology

- Chicago's Urban Heat Island (UHI) & Temperature, Pollution Reduction



Gray, Finster Chart - NWU

Chicago's Green & Garden Roofing Codes & Technology

- ***CRCA Meetings with City of Chicago***
 - 2001 – 2001 – City, Alliance Meetings
 - 2003 – CRCA & Commr. Roberson
 - 2004 & 2005 – CRCA & Commr. Kaderbeck
 - 2005 – & 2006 - CRCA & Commr. Knight
 - 2007 – CRCA & Commr. Rodriguez
 - '07/08 – CRCA & Deputy Commr.'s
 - Oct. 2008 – CRCA @ Council Committee Hearing
 - Aldermen – Stone, Rugai
 - Nov. 2008 – City Council Approval
 - Apr. 2009 – Commr. Monocchio
 - Sept. 2011 – Commr. Merchant



Chicago's Green & Garden Roofing Codes & Technology

- ***CRCA Meetings***

- 2001 – CRCA / NRCA & City Meet
 - Air Shed Study Review
 - Reflectivity & Energy Optimization Discussions
- 2008 – CRCA / NRCA / Alliance Meetings
 - City of Chicago & Others....
- ***2009 – New Chicago Energy Code
Ordinance 04-22-2009
“Earth Day”***



Chicago's Green & Garden Roofing Codes & Technology

- ***New Requirements*** - April 22, 2009
- Earth Day...new Energy Code
 - Reduce Urban Heat Island Effect
 - Lower City temperature to conserve energy
 - Low Slope Roofs - <2" : 12"
 - Medium Slope Roofs – 2" :12" to 5" : 12"
 - Energy Conservation
 - Reduce Demand for Energy - Insulation

As a Result...Codes

Cool / Green & Insulated Roofs

- ☐ Chicago Objective – Based on Research...

 - ☐ No BLACK ROOFS

 - ☐ Higher solar reflectance & More Insulation

- ☐ In **Chicago Code** – .72 or .50 Reflectivity

 - ☐ Exceptions – 15lbs. Ballast; Reroofing

 - ☐ Ballast is 'means to hold the roof'

 - ☐ 'Mass is Mass'

 - ☐ 15lbs-17lbs, not significant difference

 - ☐ Garden Roofs

 - ☐ Photovoltaics

 - ☐ R-20 Insulation Required, for now...

- ☐ In **ICC IECC 2009** Code; ASHRAE 90.1

 - ☐ Reflectivity Not Required

Chicago's Green & Garden Roofing Codes & Technology

- New Chicago Energy Code 2009
 - Based on ICC Requirements.
 - International Energy Conservation Code - 2003
 - Chicago Amendments
 - Chicago Language
 - Chicago Code Books
 - » Index Publishing Company
 - » American Publishing Company

Chicago Energy Code

- **Section 18-13-101.5.3.1 - .5.4.3**
 - “...minimize the urban heat island effect.”

Chicago Energy Code

Section 18-13-101.5.3.1 – Exceptions – Low & Medium Slope

1. Extensive & Intensive Green Roofs

- Vegetation – US EPA; Photovoltaic,
Solar Thermal Equipment

2. Rooftop Deck – cover 1/3 total gross rooftop area

Remainder....meet reflectance....

Roofing Industry Update

Chicago Energy Code

Section 18-13-101.5.4.1 – 3 Reflectance Values

- 1. ASTM E903; E1918**
- 2. Portable Reflectometer at/near Ambient Conditions (Variances-Gravel)**
- 3. Display Verification Labels:**
 - 1. Cool Roof Rating Council**
 - 2. Energy Star**

Roofing Industry Update

Chicago Energy Code

Section 18-13-101.5.4.1 – 3

Reflectance Values

1. New Construction

- *Meet or Exceed .72 initial, OR .50 3yr. Aged*

2. Exceptions

- **Ballasted Roofs – 15 lbs./sf Aggregate,**
 - Minimum Ballast Reflectance, .30
- **Ballast – “River rock, aggregate or larger, pavers, *or other means of weighing down* a roofing membrane over a substrate to resist wind uplift.”**
 - 15lbs./sf Over Single Ply – *Mass is Mass*
 - BUR + Flood w/Gravel, *SYSTEM* totaling 15 lbs./sf meets
 - Pavers

Roofing Industry Update

Chicago Energy Code

Section 18-13-101.5.4.1 – 3

**Reflectance Values - Full or Partial
Replacements**

Full or partial replacements or retrofits of existing low sloped roofs originally permitted prior to January 1, 2009 by substituting the original materials or roofing system with new materials shall utilize roofing products that meet or exceed an initial reflectance value of 0.72 or a three-year installed reflectance value of 0.5 as determined by the Cool Roof Rating Council or Energy Star.

Insulation installation must be maximized per section 18-13-101.4.

Roofing Industry Update

Chicago Energy Code

Section 18-13-101.5.4.1

- **Reflectance Values - Full or Partial Replacements**
- **Exception**
 - **50% Green Vegetative, remainder .3**
 - **Rooftop Deck**
- **Replacing Ballasted & Very Low Sloped Roofs....**

Roofing Industry Update

Chicago Energy Code

Section 18-13-101.5.4.1

- **Exception - Replacing Ballasted Roofs....**
 - one of the following two sets of requirements must be met:
 - (i) the reflectance value for the entire roof shall be a minimum of 0.30 and a minimum of 15 lbs/sq. ft. of ballast coverage over the entire roof shall be provided,
 - or (ii) the reflectance value shall be a minimum of 0.72 or a three-year installed reflectance value of 0.5 as determined by the Cool Roof Rating Council or Energy Star.

Roofing Industry Update

Chicago Energy Code

Section 18-13-101.5.4.1

- **Reflectance Values - Replacing Ballasted & Very Low Sloped Roofs....<1/4" : 12"**
 - Aggregate .30
 - *"The exposed top layer of aggregate must substantially cover the roof area, such that the maximum exposure of the underlying water-repellent layer is no more than 5% of the total area of the roof."*
- Allows Coal Tar, Dead Level Asphalt
- Insulation – **MUST USE LTTR 6.0**, to same thickness or greater....if low curb heights.
- **'Spirit of Code' – If 1" perlite, replace with 1" ISO**

Roofing Industry Update

Chicago Energy Code

Section 18-13-101.5.4.1

- **Repairs - Reflectance Values - ...Existing Roof ...the portion repaired shall meet or exceed the reflectance value in effect when the roof was originally permitted.**
 - **Insulation - Meet Original Thickness, but...Min. LTTR - 6.0 per inch thickness**
 - *Accommodates low flashings...*

Roofing Industry Update

Chicago Energy Code

Section 18-13-101.5.4.1

- **Insulation - Reroofing**
 - **Insulation - Meet new code...unless not possible.**
 - *18-13-101.4.1 Existing buildings. Except as specified in this article, this chapter shall not be used to require the removal, alteration or abandonment of, nor prevent the continued use and maintenance of, an existing building or building system lawfully in existence at the time of adoption of this chapter.*
 - **Min. LTTR - 6.0 per inch thickness –**
 - **Accommodates Low Curbs, Windows at walls, for flashings...**

Chicago's Green & Garden Roofing Codes & Technology

Chicago 2009 Energy Code

- **Single Ply Smooth & Ballasted**
 - TPO Smooth
 - PVC
 - EPDM
- **BUR & Gravel (.30)**
 - Asphalt, Coal Tar
- **SBS Modified Bitumen**
- **Hot Rubberized Asphalt**
- **Vegetative Garden Roofs**
- **PV & Solar Thermal**



Chicago's Green & Garden Roofing Codes & Technology

- Garden Roofs in 2009 Code
- Definitions
 - Extensive – “Thin”
 - Intensive – “Thick”



Chicago's Green & Garden Roofing Codes & Technology

Roof System Installation – Critical to Success



Chicago's Green & Garden Roofing Codes & Technology

- **Vegetative Roof Spec Issues**
 - **Technical Issues**
 - **Insurance Required**
 - **Warranty**
 - **Licensing**
 - **Specification Sections**
 - **International Building Code – 2006 – Vegetative Systems – Code Silent**
 - **International Building and Fire Code 2012- Vegetative- New Requirements**
 - **Workforce Education & Safety**
 - **Installed Cost**

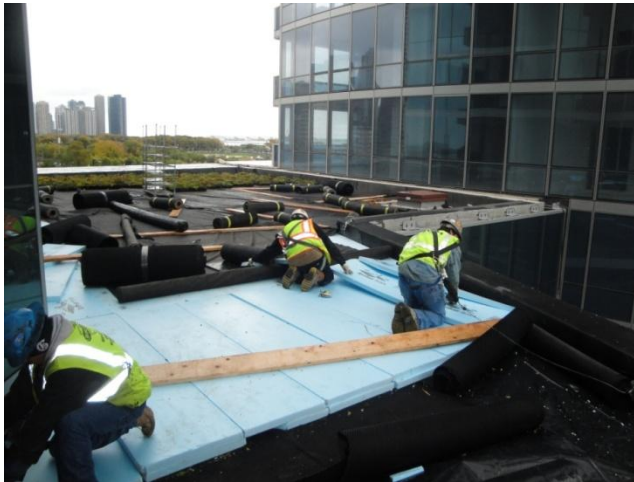
Chicago's Green & Garden Roofing Codes & Technology

- **Vegetative Roof Spec Issues**
 - **Technical Issues**
 - **Wind Uplift – Thickness; wind loads from Chapter 15, IBC**
 - **Weight Distribution at placement**
 - **Water Testing**
 - **Serviceability...it leaks, who digs?**
 - **Placement Importance**
 - **Cost if damaged, then covered**



Chicago's Green & Garden Roofing Codes & Technology

- **Vegetative Roof Spec Issues**
 - **Insurance Required**
 - **General Liability**
 - **Workers Compensation**



Chicago's Green & Garden Roofing Codes & Technology

- **Vegetative Roof Spec Issues**
 - **Warranty**
 - **Single Source – What if it Leaks?**
 - Why?
 - Who's responsible?
 - **Manufacturer Preferences**
 - Roofer
 - Landscaper sub?



Chicago's Green Movement

- **Vegetative Roof Spec Issues**
 - **Licensing – Illinois Dept.
of Professional Regulation**
 - **Roofers are licensed to protect the building owner and manager, building engineer**

Chicago's Green Movement

Chicago & CRC – What's Next?

- **Vegetative Roof Spec Issues**
 - International Building Code – Vegetative
 - **IBC Code Silent, 2003, 2006, 2009,**
 - **IBC & IFC 2012...**
 - Chapter 15 TITLE – Roof Assemblies and Rooftop Structures
 - Chapter 15, Building Code- S10 NASFM – Increase roof covering one level above the level indicated in the table.
 - Chapter 15 – SCOPE –govern the design, materials, construction and quality of roof assemblies and rooftop structures.
 - Comply with the fire code....

Chicago's Green Movement

Chicago & CRC – What's Next?

- **Vegetative Roof Spec Issues**
 - **International Building Code – Vegetative**
 - **IBC & IFC 2012...**
 - Fire Resistance = Low Sloped Roofs
 - “Immediate Removal of Dried”
 - Wind Resistance
 - Fire Breaks

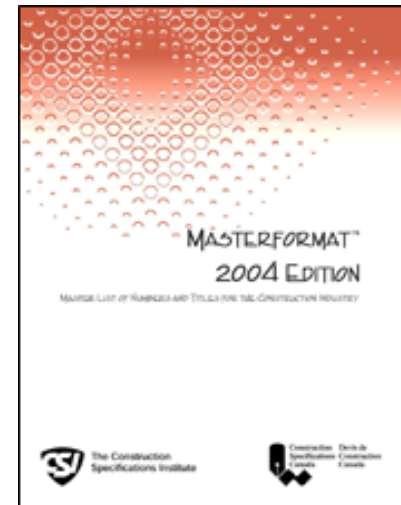




Chicago's Green & Garden Roofing Codes & Technology

How to Specify Vegetative Garden Roofs

- **Specifications Classified In Division 7, Roofs**
 - **CSI's MasterFormat 2004 – 2011**
- **07-33-63 - Vegetated Roofing**



Chicago's Green & Garden Roofing Codes & Technology

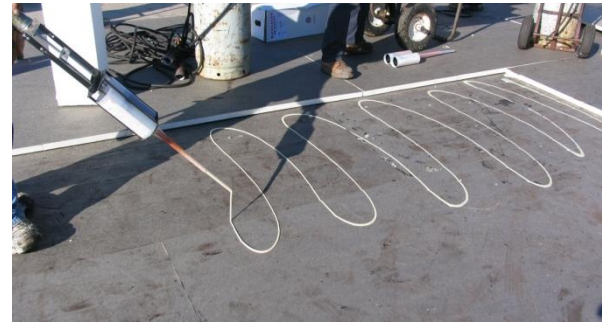
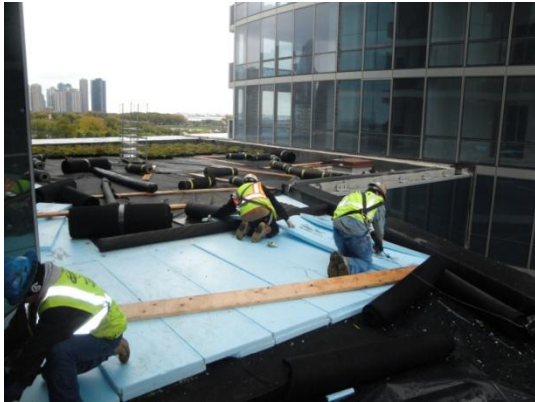
- **Lots of Benefits - Green Roofs**
 - **Urban Heat Island Reduction**
 - **Reduces City Temperature**
 - **Reduced Energy Usage**
 - **Isolates Roof Membrane**
 - **UV Exposure**
 - **Foot Traffic**
 - **Water Retention –**
 - **Saves Deep Tunnel**
 - **Slows water runoff until saturation**
 - **More...Next Presenter...**

Chicago's Green & Garden Roofing Codes & Technology

- **Chicago's 2009 Energy Code ...**
 - **Chicago's Building Inventory**
 - **Dead Level Roofs**
 - **Building Owner Financial Limitations**
 - **Ballasted EPDM Still Allowed**
 - **Exceptions for Flashing Heights**
 - **Reflectivity Dims over Time**
 - **Vegetative, PV Green Roofs allowed**

Chicago's Green & Garden Roofing Codes & Technology

- **Future...IECC 2012 Insulation Values
& Building Owner Limitations...**



Chicago's Green & Garden Roofing Codes & Technology Learning Objectives

To understand Garden & Other Roofs

- History

- Issues – Technical, Science

 - Slow water drainage

 - Save Energy – Reflectivity, Insulation

 - Urban Heat Island Reduction

 - Code Requirements

CRCA & CRC Members

- **One Call, Single Source Responsibility**





Chicago's Green & Garden Roofing Codes & Technology



**Bill McHugh, CRCA & CRC Exec.
Director**

4415 W. Harrison St., #436 ~ Hillside, IL
60162 USA ~ +1-708-449-3340

bill@crca.org ~ bill@chicagoroofing.org

Rod Petrick, CRCA Industry Affairs

rod@ridgeworthroofing.com

708-598-0039