COOL Parking Deck Coatings

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A Structure is More Than Just Concrete – It's an Investment

- Large Investment in the Structure.
- Coatings Extend Service Life.

Why do We Do This?

- Protection
- Water barrier/ moisture egress
- Anti-slip Properties
- Appearance
- Chloride salt intrusion – protect the rebar.

Top Level Parking Decks

This type of material is used mainly on top parking decks where resistance to UV degradation is most critical.

High Wear Areas

- Entrances and Exits wear and tear, spinning wheels.
- Added traction.
- Plus sidewalk traffic at entrance.
- Snow removal equipment, road salts.

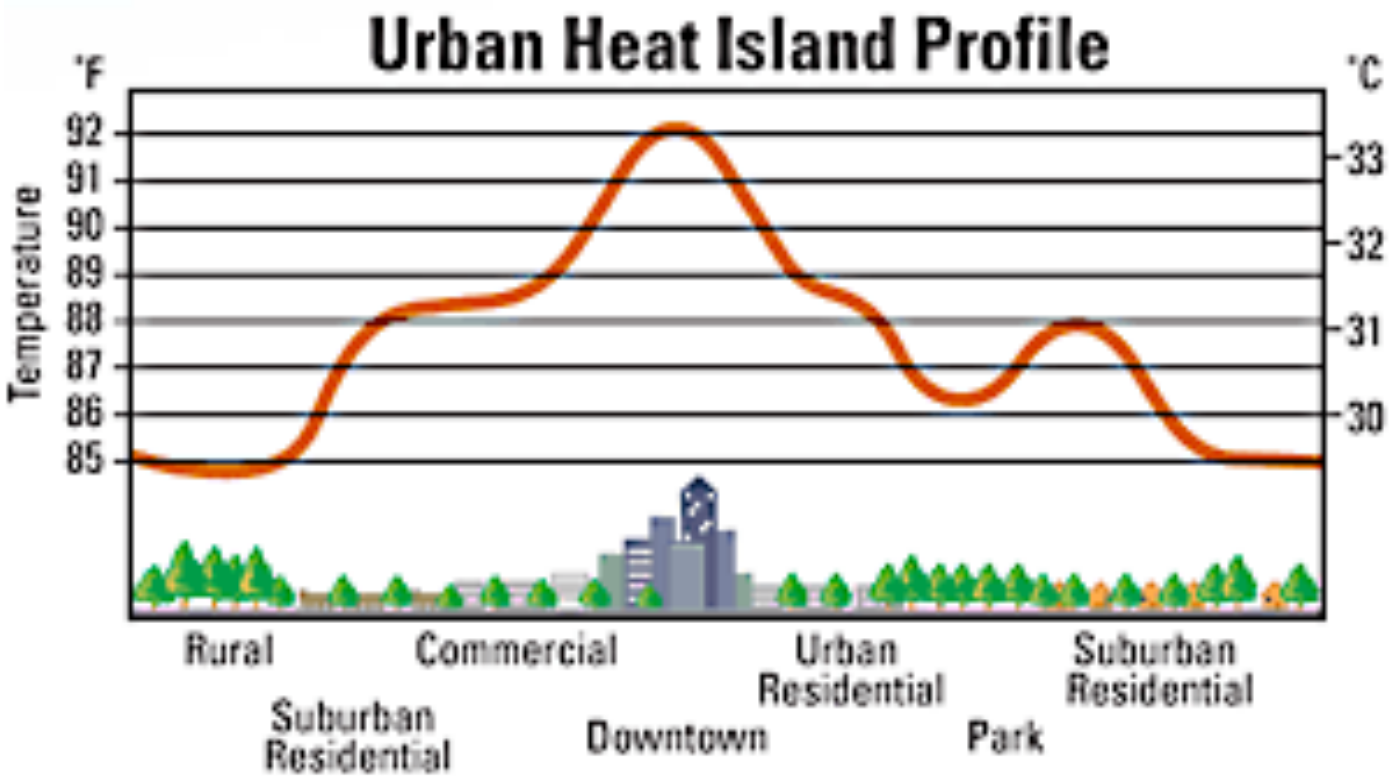
Parking Deck Entrance

Cool Parking Deck Coatings

- Just one part of the total picture. A combined effort.
- Reflective roofs, vegetated roofs, trees, reflective walls, reflective concrete.
- Improve the sustainability of these coatings.

Vegetated roof Chicago City Hall

Why? Warmer in Cities



Thermographic Image

The Heat Island Effect

What is Hot and What is Not!

Sacramento, CA

Example: The 1995 Chicago Heat Wave

- The **1995 Chicago heat wave** was a heat wave which led to approximately 600 heat-related deaths over a period of five days. In the United States, the loss of human life in hot spells in summer exceeds that caused by all other weather events combined, including lightning, rain, floods, hurricanes, and tornadoes. The heat wave heavily impacted the wider Midwestern region, with dozens of additional deaths in both St. Louis and Milwaukee as well.

Aggravating Factors

- Impacts in the Chicago urban center were exacerbated by an urban heat island that raised nocturnal temperatures by more than 2 °C (3.60 °F). Urban heat islands are caused by the concentration of buildings and pavement in urban areas, which tend to absorb more heat in the day and radiate less heat at night into their immediate surroundings than comparable rural sites. Therefore, built-up areas get hotter and stay hotter.

- Los Angeles is thought to average 5 to 7º F warmer than early in the 20th century. LA hit a record high of 113º F Sept. 27nd this year.

One Week Temp Spreads

- **Statistics**
- Chicago's daily low and high in 1995:
- July 11: 73-**90** °F (23-32 °C)
- July 12: **76-98** °F (24-37 °C)
- July 13: **81-106** °F (27-41 °C)
- July 14: **84-102** °F (29-39 °C)
- July 15: **77-99** °F (25-37 °C)
- July 16: **76-94** °F (24-34 °C)
- July 17: 73-89 °F (23-32 °C)
- there were 11% more hospital admissions than average for comparison weeks and 35% more than expected among patients aged 65 years and older. The majority of this excess (59%) were treatments for dehydration, heat stroke, and heat exhaustion.

This Year

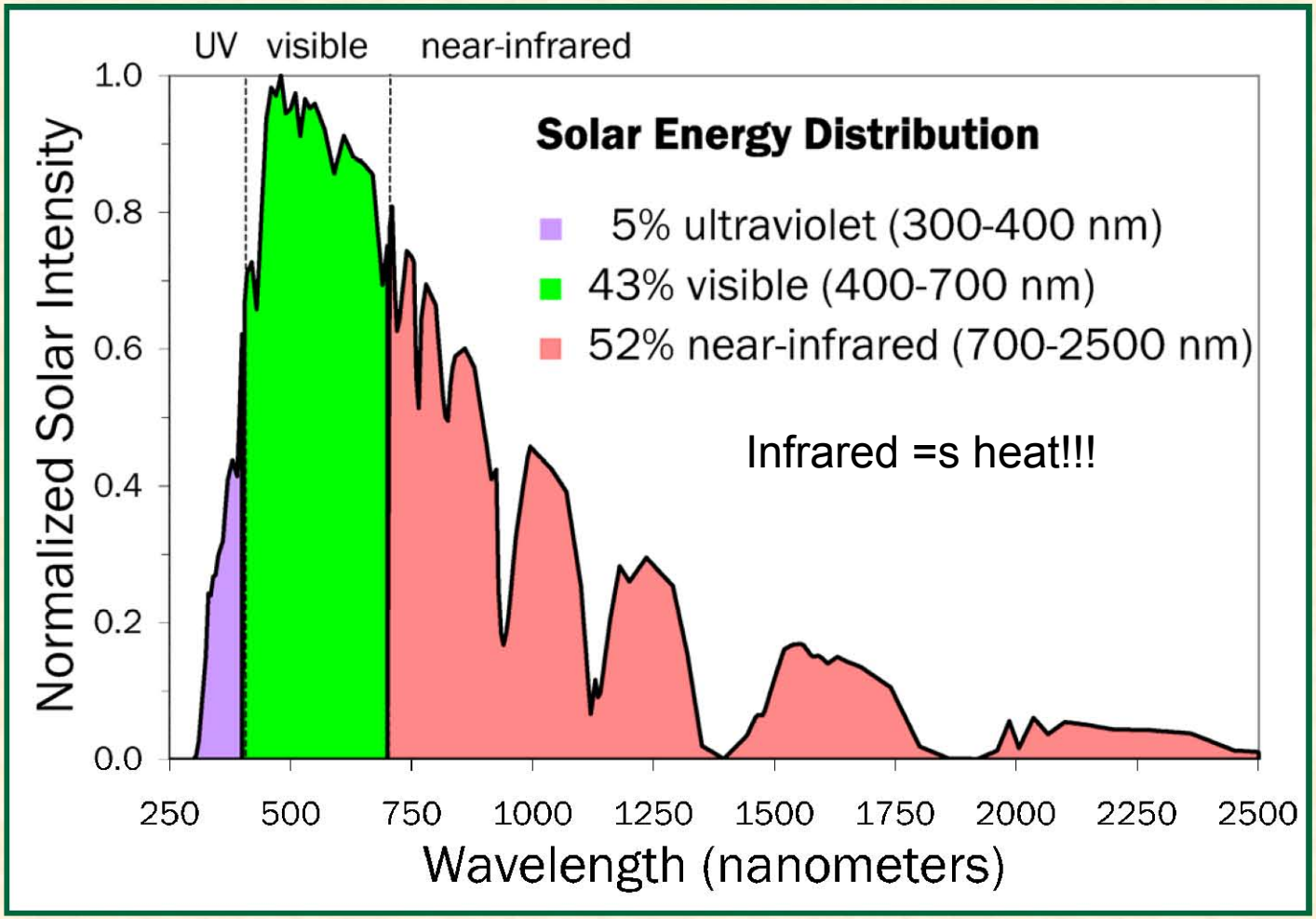
- Just had more recent heat waves.
- Warmest summer ever in Rhode Island and Connecticut. This year.
- Highest low temperature ever recorded in Minneapolis, MN. This year.
- Predictions are that this will be considered a "cool" summer in the next twenty years.

LEED BUILDING CERTIFICATION

- Just one part of multiple steps/options to obtain points.
- LEED Credit (USGBC program)

  Leadership in Energy and Environmental Design.
- Certified, silver, gold, platinum levels depending on points gained.

Solar Energy Spectrum



SS Credit 7.1 Heat Island Effect: Non Roof

- Worth1 Point
- Intent is to reduce heat islands (thermal gradient differences between developed and undeveloped areas) to minimize impact on microclimate and human and wildlife habitat.
- Requirements
- OPTION 1
- Provide any combination of the following strategies for 50% of the site hardscape (including roads, sidewalks, courtyards and parking lots):
  - Shade (within 5 years of occupancy)
  - **Paving materials with a Solar Reflectance Index (SRI) of at least 29**
  - Open grid pavement system

Or Option 2

- Place a minimum of 50% of parking spaces under cover (defined as under ground, under deck, under roof, or under a building). **Any roof used to shade or cover parking must have an SRI of at least 29.**
- Potential Technologies & Strategies
- Shade constructed surfaces on the site with landscape features and utilize high-reflectance materials for hardscape. Consider replacing constructed surfaces (i.e. roof, roads, sidewalks, etc.) with vegetated surfaces such as vegetated roofs and open grid paving or specify high-albedo materials to reduce the heat absorption.

Chicago Sustainable Sites

- • Erosion & Sedimentation Control (LEED Prerequisite 1)
- • Site Selection (LEED Credit 1)
- • Alternative Transportation: Public Transportation Access
- (LEED Credit 4.1)
- • Alternative Transportation: Bicycle Storage & Changing Rooms
- (LEED Credit 4.2)
- • Alternative Transportation: Parking Capacity (LEED Credit 4.4)
- • Stormwater Management: Rate and Quantity (LEED Credit 6.1)
- • *Heat Island Effect: Non-Roof (LEED Credit 7.1)*
  SRI 29
- • *Heat Island Effect: Roof (LEED Credit 7.2)*
  SRI 78
- • Light Pollution Reduction (LEED Credit 8)

What is SRI

- The Solar Reflectance Index (SRI) is a measure of the constructed surface's ability to reflect solar heat, as shown by a small temperature rise. It is defined so that a standard black (reflectance 0.05, emittance 0.90) is 0 and a standard white (reflectance 0.80, emittance 0.90) is 100. To calculate the SRI for a given material, obtain the reflectance value and emittance value for the material. SRI is calculated according to ASTM E 1980-01. Reflectance is measured according to ASTM E 903, ASTM E 1918, or ASTM C 1549.
- Emittance is measured according to ASTM E 408 or ASTM C 1371. Default values for some materials is available in the LEED-NC v2.2 Reference Guide.

SRI is!

- In short, SRI is an index factor that combines solar reflectance and thermal emittance values.

Solar Reflective Index Calculator

ASTM E-1980 (Applicable to LEED 2.2)

ctions: To obtain SRI fill in designated cells with SRV & Emissivity ratings and hit enter.

Enter SRV Rating	Enter Emiss Rating	(Do not tamper with cell formula)	SRI Factor conv = 5	SRI Factor conv = 12	SRI Factor conv = 30	SRI/5	SRI /12	SRI/ 30	SRI avg
43.0	0.86		0.57	0.56	0.55	47	48	49	48

LEED-NC (New Construction) -------- 2.2 Low Slope Requirement = 78

LEED-NC (New Construction) -------- 2.2 Steep Slope Requirement = 29

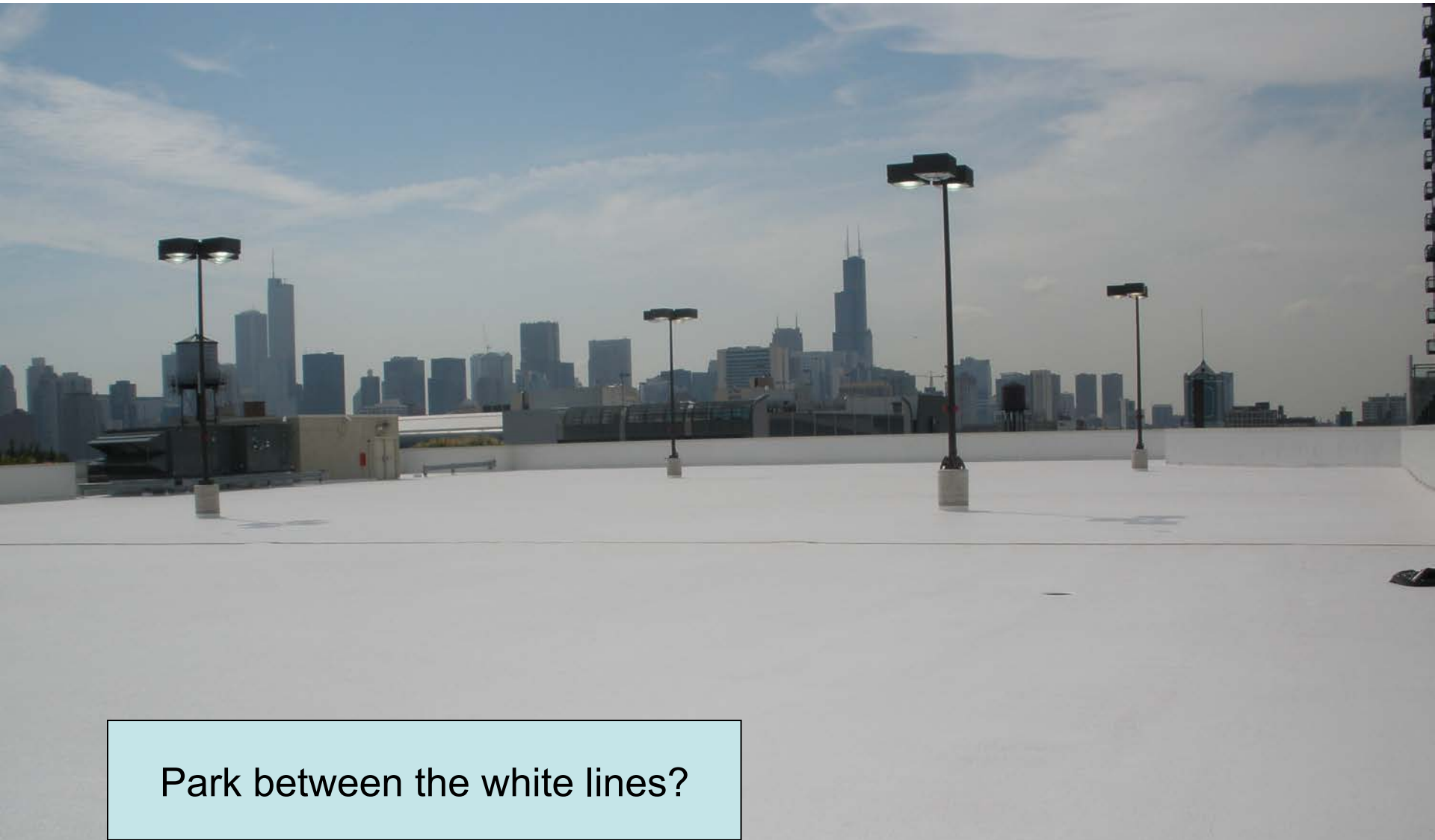
White reflective topcoat

White is best!

Loaded with Titanium Dioxide pigment.

Application by Squeegee, Trowel & Roller

Looks like January



Park between the white lines?

In A Conventional Coating

- Biggest bad actor is carbon black pigment.
- It absorbs 96% of solar radiation in both visible and IR ranges.
- Coatings made from carbon black do have good emissivity, thus the reason car radiators are black; to dissipate heat quickly. The negative is they also absorb large amounts (then into concrete slab) of heat easily.

Conventional Black Coating (Canada)

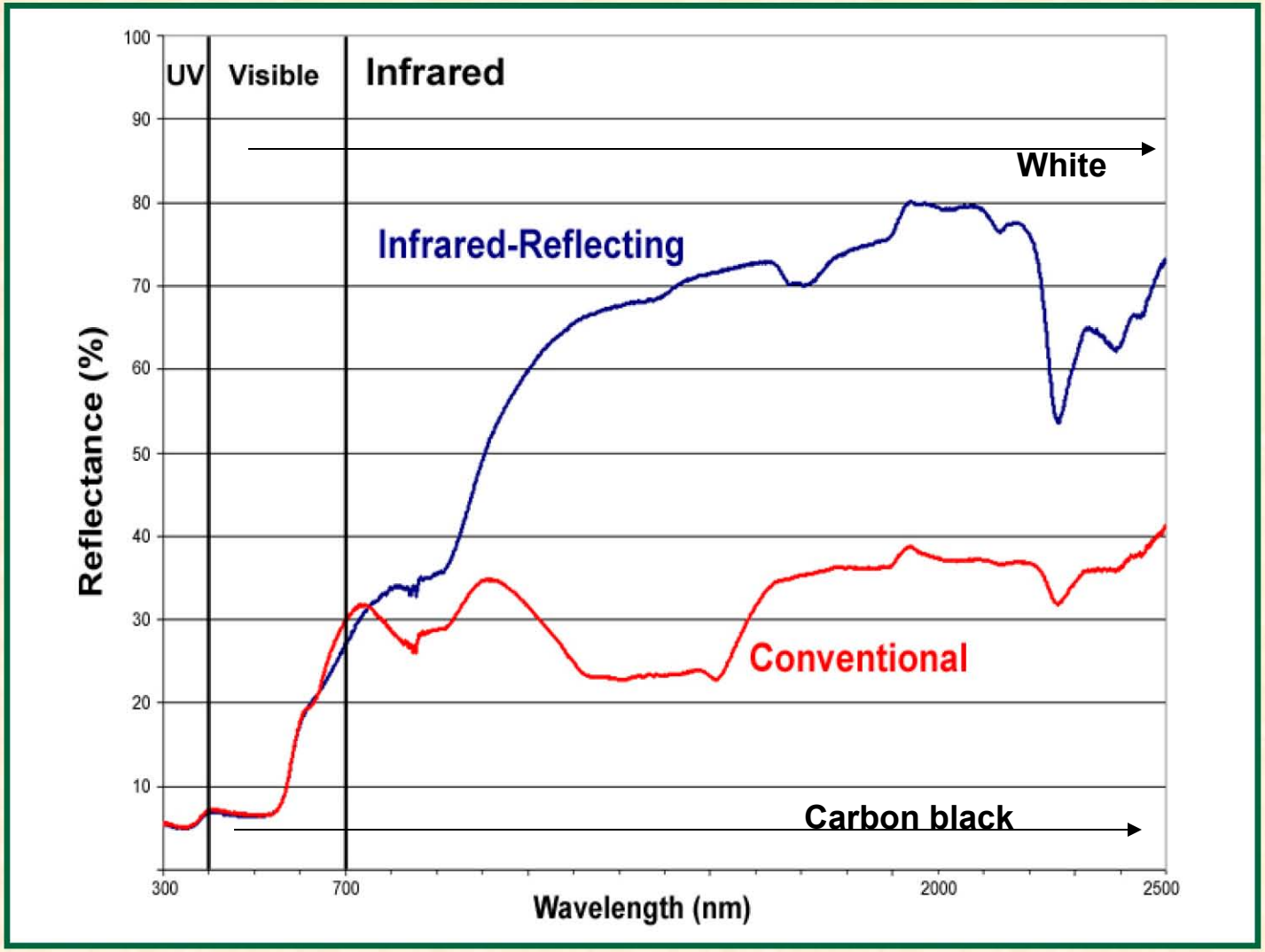
LEED Structures

- Utilize Infra-Red Reflecting Pigment Technology. Roofs, sidewalks, parking.
- Parking decks are usually gray, but other colors are possible (Blues, Greens, Browns, Tans and more reflective Blacks).

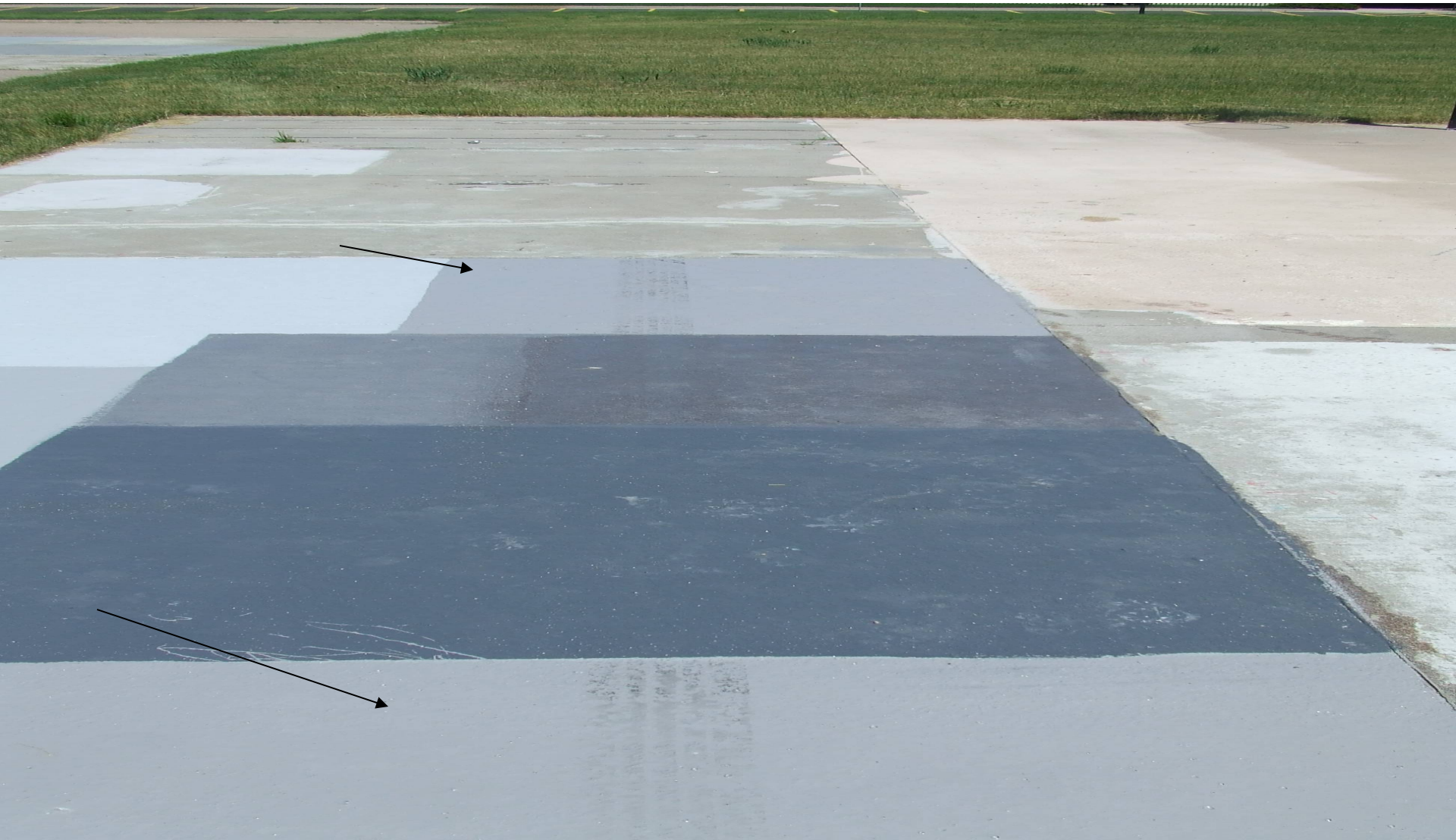
Added Features

- Solar Reflectivity
  - Cooler Surface (10º to 40º F lower), therefore cooler cars! Cooler feet! Cooler air temps.
  - Theoretical Increase in Coating Life.
  - Lessens Urban Heat Island Effect
  - Help in LEED Building Certification
  - Alternate to “Green” vegetative roof which takes up more space. Less maintenance.

Conventional vs. Infrared Pigments



Gray Reflective Application Testing



Aggregate Hand Broadcast

This photo shows the applicator using the hand chicken feed method for broadcasting aggregate. Different aggregate can change reflectivity numbers slightly along with amounts of aggregate.

Gray Larger Scale

Colorado Application

45 th Parallel N Test Application

Eden Prairie, MN

Dallas TX test application

Left Reflective, Right Normal
66º and 70º F

Air Temp 51º F Wind NE 8mph September 29th 2009 1:00pm

White vs. Darker Coating
58º vs. 72º F

Air Temp 51º F, Wind NE 8 mph September 29th 2009 1:00pm

August 12th 2010 12:45pm
Outside Air Temp 88º F, no wind
Shakopee, MN

126º F Normal Coating

117º F Reflective Coating

9 degree surface temperature difference

August 12th 2010 12:46pm
Outside Air Temp 88º F, no wind

126º F Normal Coating

108º F White Coating

18 degree surface temperature difference

Heat Lamp Testing

There is Another Way!

Thank You & Discussion

- Questions?