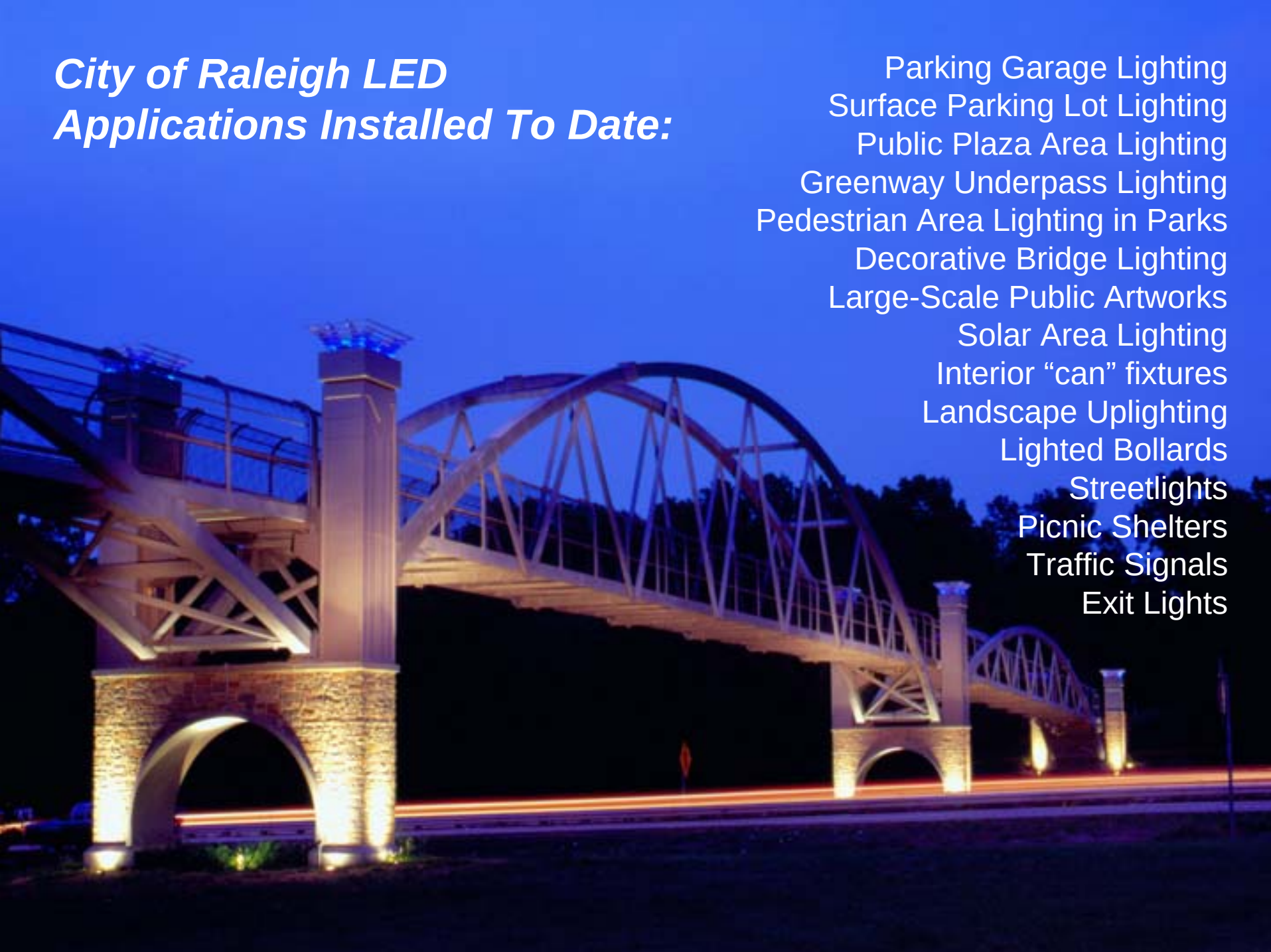
Learning About LED

Our Experience in Raleigh, NC

Daniel A. Howe

Assistant City Manager



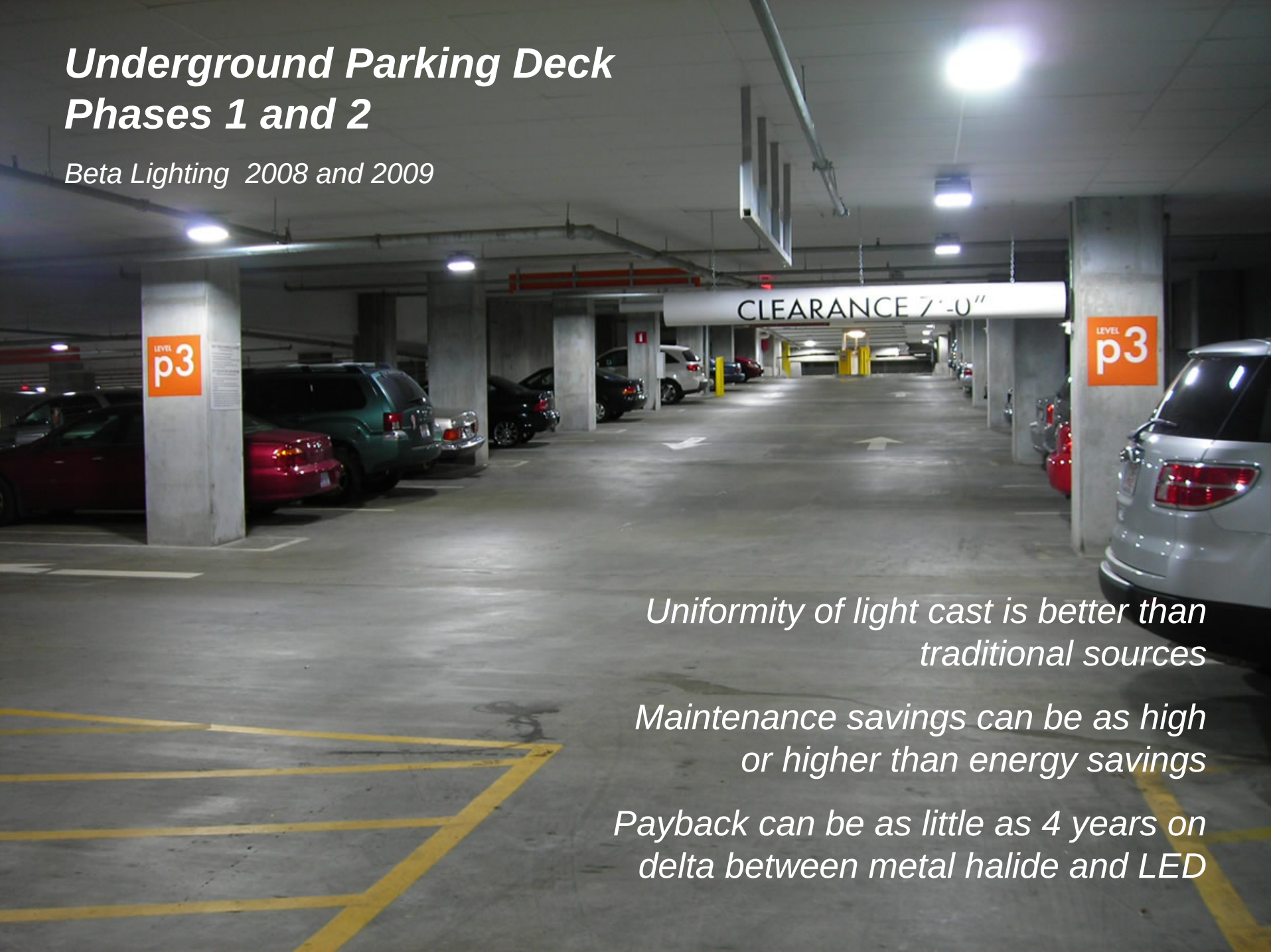
City of Raleigh LED Applications Installed To Date:

Parking Garage Lighting
Surface Parking Lot Lighting
Public Plaza Area Lighting
Greenway Underpass Lighting
Pedestrian Area Lighting in Parks
Decorative Bridge Lighting
Large-Scale Public Artworks
Solar Area Lighting
Interior “can” fixtures
Landscape Uplighting
Lighted Bollards
Streetlights
Picnic Shelters
Traffic Signals
Exit Lights

Parking Deck Pilot Project

Lighting Science, Inc. 2007


Users perceive light as higher QUALITY – brighter and safer despite casting fewer lumens
Parking Deck Pilot Project
Lighting Science, Inc. 2007



Underground Parking Deck Phases 1 and 2

Beta Lighting 2008 and 2009

Uniformity of light cast is better than traditional sources

Maintenance savings can be as high or higher than energy savings

Payback can be as little as 4 years on delta between metal halide and LED

Convention Center Streetlights

Beta Lighting 2008

Convention Center Block Streetlights

Beta Lighting 2008

LED streetlights can meet NCDOT standards

When they do, the street is generally perceived to be overlit

Progress Energy Streetlight Pilot – Cabarrus St.

Beta Lighting 2009

One-for-one replacements can work despite casting less light on the street.


ST
300
Cabarrus St. 6000K
Wilmington St. 4700K
PUBLIC
PARKING
People do not feel strongly about a difference in color temperature from 6000K – 4700K
Progress Energy
Street Light Test
Beta Lighting 2009

Carolina Pines Park

Beta Lighting 2008

Use of motion detectors and other controls is acceptable – actually preferable, in residential settings

Marsh Creek Parks Maintenance Yard

Progress Solar Solutions 2009

Temporary Parking Lot for Campbell Univ. Law School

Progress Solar Solutions 2009

Temporary Parking Lot for Campbell Univ. Law School

Progress Solar Solutions 2009

Solar LED appears to be viable today for the right application

Performance contracting reduces overall cost – allows municipalities to gain benefit of tax credits


Ability to dim works very well in urban settings .


Maintenance advantages


Avoid going custom


Only some interior LED is viable economically

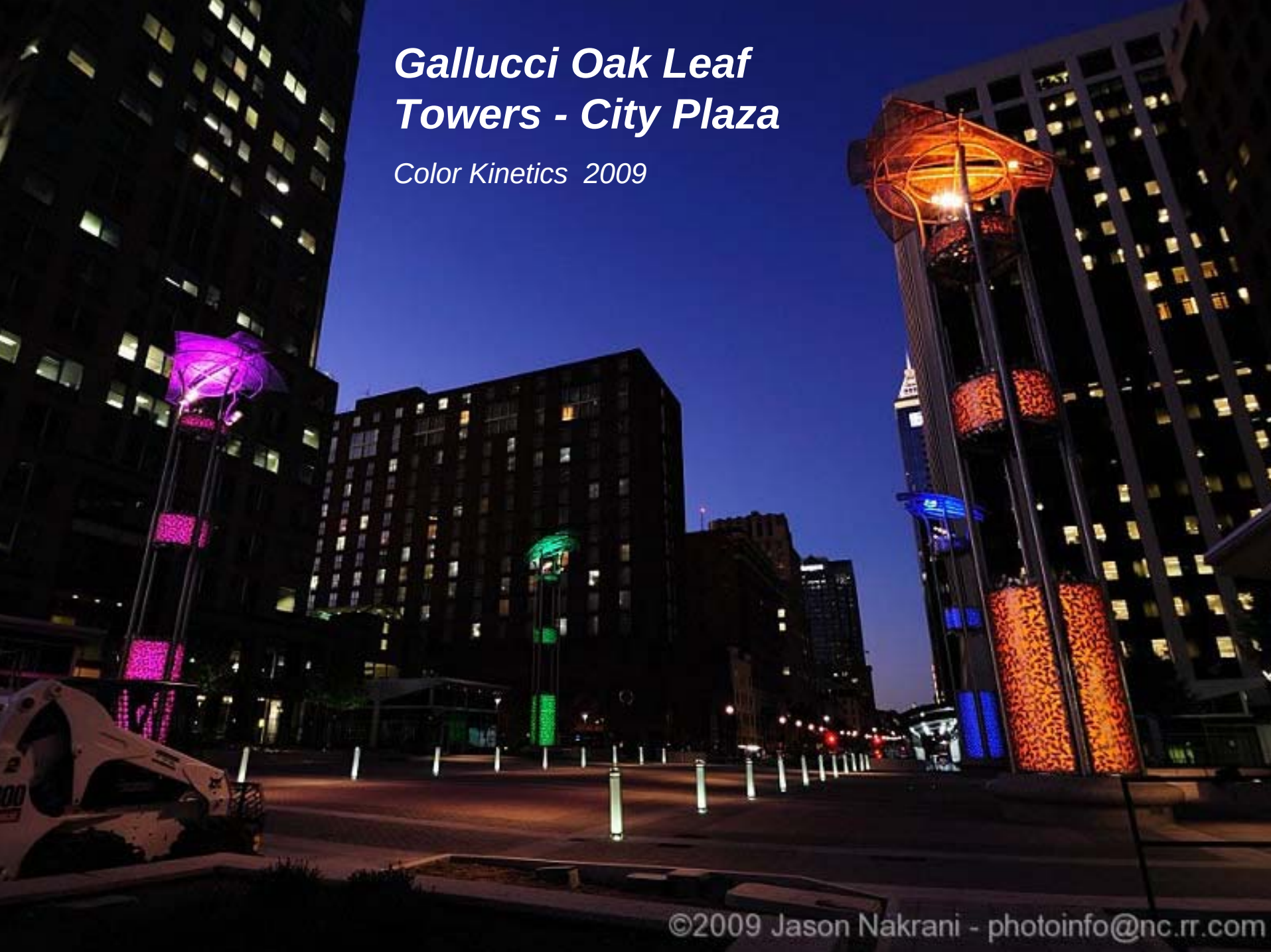

Cree Shimmer Wall
Color Kinetics 2008
CREE

Cree Shimmer Wall

Color Kinetics 2008

Fountain / Bollards / Landscape Uplighting
City Plaza

Color Kinetics, DesignPlan Lighting, 2009


Gallucci Oak Leaf
Towers - City Plaza
Color Kinetics 2009
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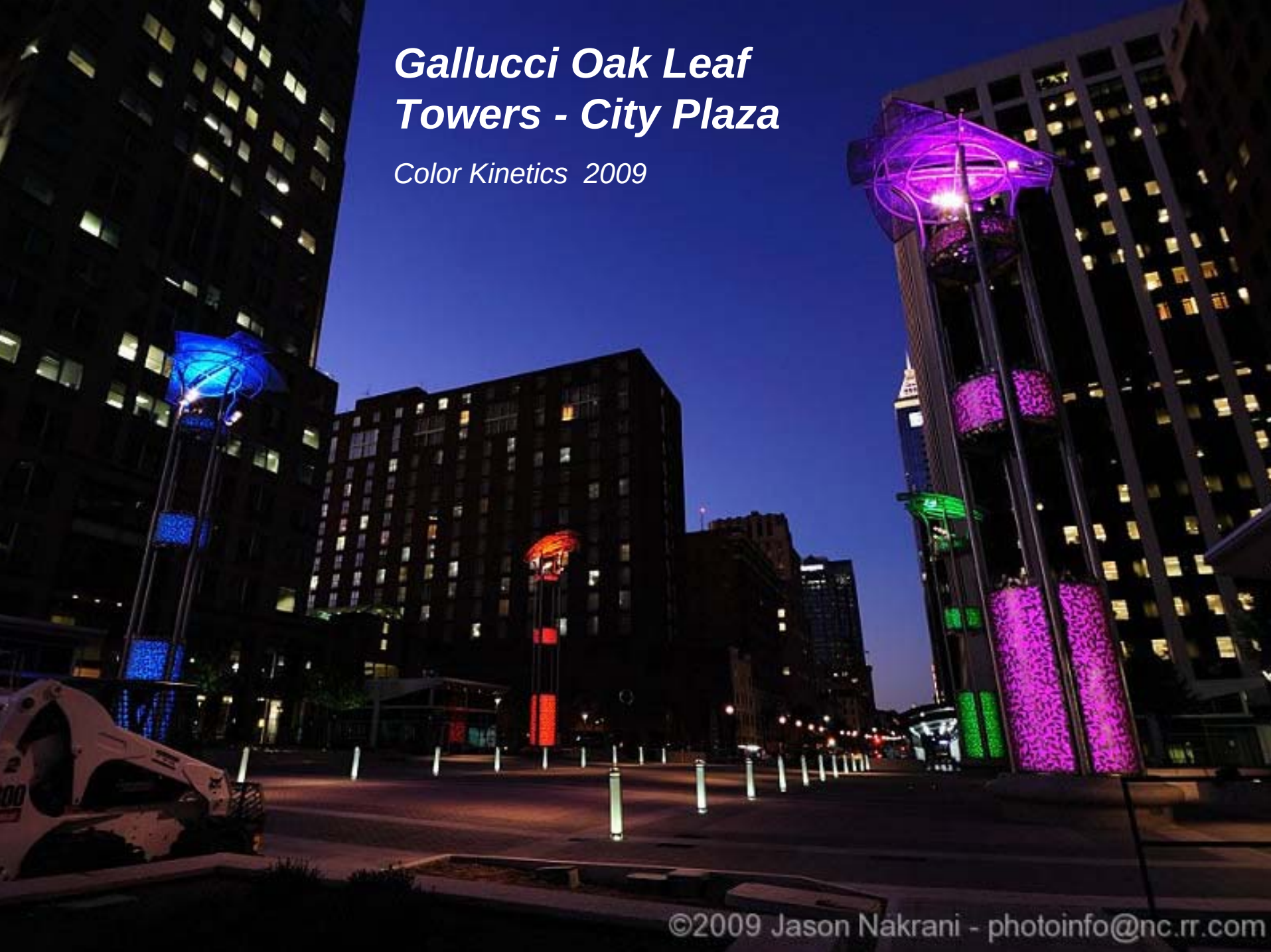
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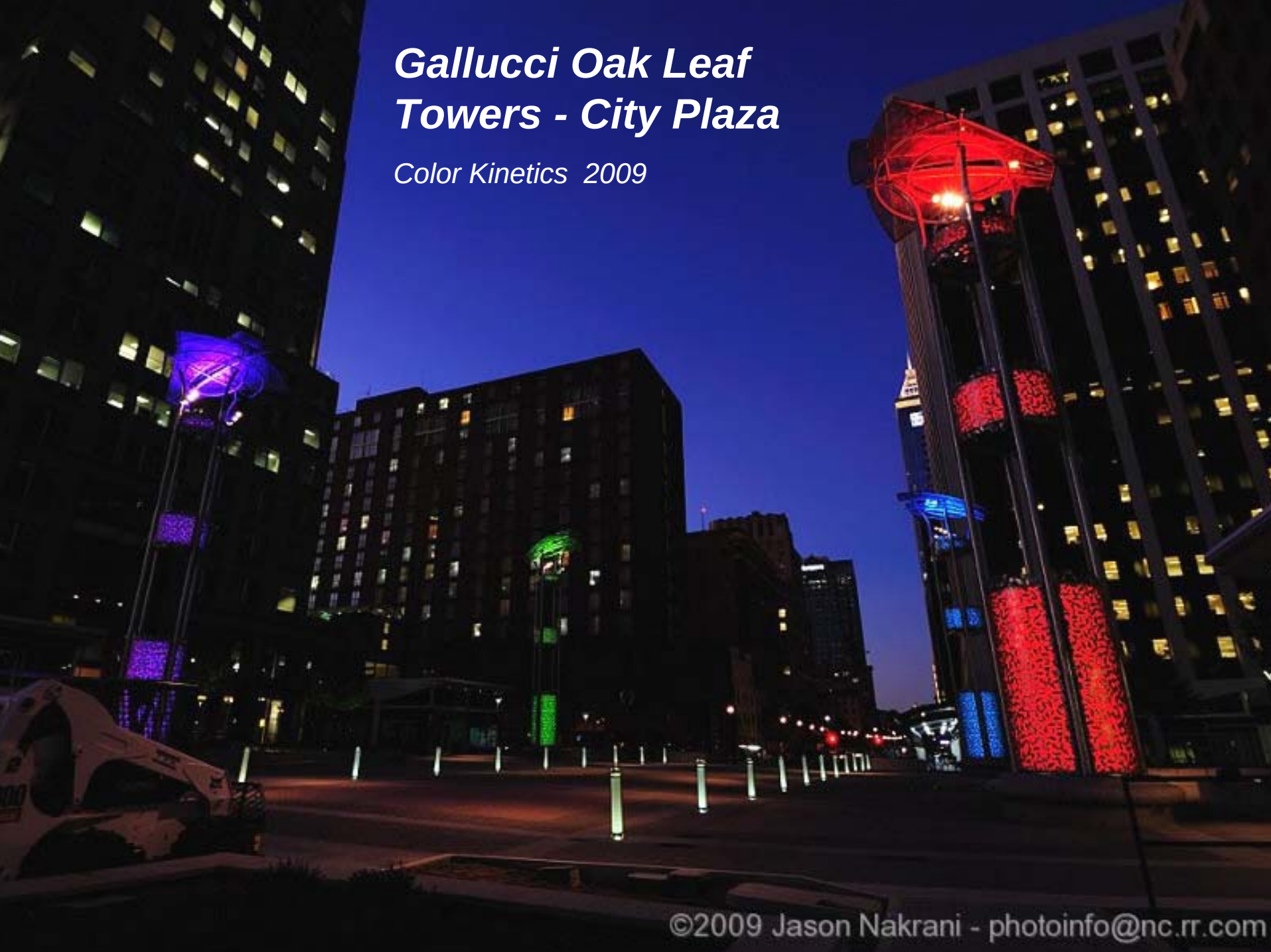
Gallucci Oak Leaf
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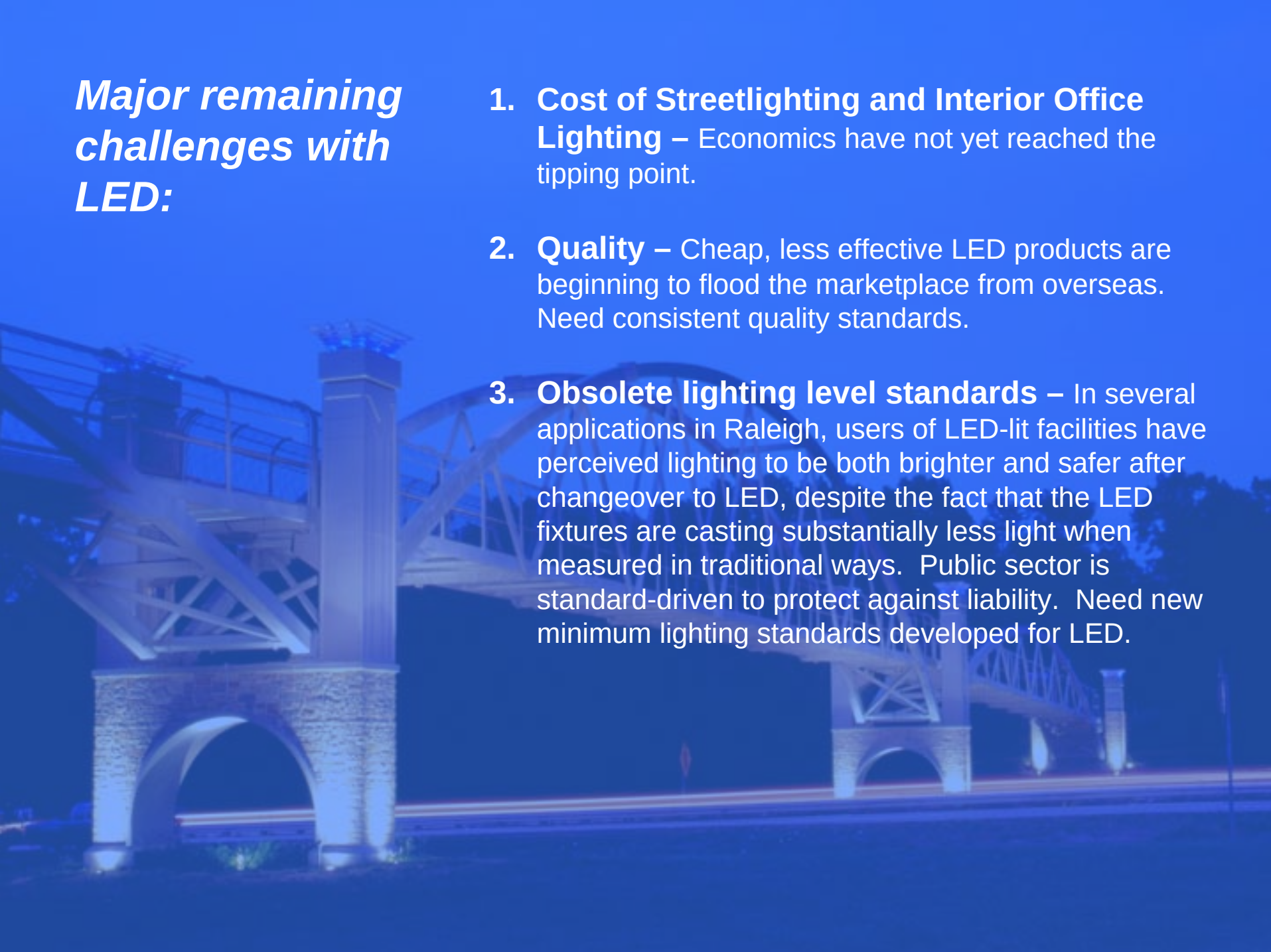
Gallucci Oak Leaf Towers - City Plaza

Color Kinetics 2009


at&t raleigh
winterfest
Solar Area
Lighting
City Plaza
Progress Solar
Solutions 2009



Major remaining challenges with LED:

1. **Cost of Streetlighting and Interior Office Lighting –** Economics have not yet reached the tipping point.

2. **Quality –** Cheap, less effective LED products are beginning to flood the marketplace from overseas. Need consistent quality standards.

3. **Obsolete lighting level standards –** In several applications in Raleigh, users of LED-lit facilities have perceived lighting to be both brighter and safer after changeover to LED, despite the fact that the LED fixtures are casting substantially less light when measured in traditional ways. Public sector is standard-driven to protect against liability. Need new minimum lighting standards developed for LED.

LED Fixture Quality Check List ("12 Questions")

	Question	One Good Answer
☐	Who is your LED supplier?	Citizen, Cree, Nichia, Osram, Philips, Seoul Semiconductor. Stay with top suppliers to guarantee quality, reliability, and IP. Don't accept "that's proprietary" for an answer. You have a right to know how much technical and legal risk you are running with this purchase.
☐	Did they provide an IESNA LM-80 test report for the LEDs?	Any good LED manufacturer will supply this to the fixture maker; any that does not or can not is a huge red flag… (Note: No LED company can or will have this data until about 10/2009; interim reports are available in the mean time)
☐	What is the max operating temp and max T_j?	The answer the fixture maker gives should make sense for the application. The LED junction temperature (T_j) should not be typically more than 80-90ºC over the entire expected operating range of the fixture.
☐	What's the expected L_{70} fixture lifetime?	Everybody says 50k hrs, but 1k to 100k are possible as well. Make him convince you he knows the number, and WHY. Don't forget to ask about the driver lifetime as well.
☐	Can you supply an IESNA LM-79 test report? .ies files?	**Yes. If not, RUN!** This is fundamental and essential for any LED fixture. There are more than a dozen accredited labs in the US and the cost of the testing is only a few hundred dollars. This report also contains LPW and other important metrics. Don't accept no for an answer on this one.
☐	What are the delivered lumens and LPW of the fixture?	Unlike traditional lamps, LEDs are a directional light source so raw lamp lumens are much less important with LED. Make sure the light DELIVERED in the application meets your requirements (FC/lux).
☐	Is the chromaticity in the ANSI C78.377A color space and is it stable over time?	This is critical for indoor fixtures, relatively uncritical for outdoor. The ANSI standard for LED is a rough approximation for the ANSI CFL standard. Lamps outside of this could look tinted blue, green, or red.
☐	How much does the color vary from fixture to fixture?	7-step MacAdams ellipse should be acceptable for most applications, 4-step if you are picky, but many/most LED fixtures can not currently not meet this (ref: ANSI CFL is 7-step). What is important is that he speaks this language, understands question, and has a well-grounded answer.
☐	What is the Power Factor of your fixture?	Energy Star is 0.7 and 0.9 for residential and commercial applications respectively. There is no reason a well designed driver can not deliver 0.9 – or much better – today.
☐	Have you applied for DOE Energy Star? Why/why not?	The DOE Energy Star criteria is another way to screen out poor quality product. He should have a good answer for not applying for this. (Indoor applications only)
☐	Is your fixture RoHS compliant? Mercury free?	**Yes. If not, RUN!** This is a key question on sustainability and there is no reason that these regulations can not be met with commonly available electronic assembly processes.
☐	What is your warranty?	DOE Energy Star requires 3yrs. Some manufacturers have longer. Point again is to make sure he understands the reliability of his system and is willing – and able – to stand behind it.

Thank you.

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