

THE AGE OF UNINTENDED CONSEQUENCES

Chronicles of an Asphalt Planet



What started as crude oil mixed with rocks to cover dusty gravel roads for the model-T only 150 years ago is now a \$46 Billion Dollar global industry. Asphalt is now the most widely used sub-surface material for building roads worldwide. Mankind would not have been able to establish today's major trade routes connecting Cities, States and Nations to facilitate commerce had we not figured out how to make asphalt. And why not... back then, crude was cheap, and no one understood the problems related to heat.

As asphalt use spread, especially in urban zones, we eliminated the “CITY DUSTBOWL,” but jumped into the “CITY FRYING PAN.” *“Its like a bad twilight zone episode, where an advanced civilization uses its resources and technology to build a promising new world, but it turns out to be a giant skillet where the people cook themselves to death.”*

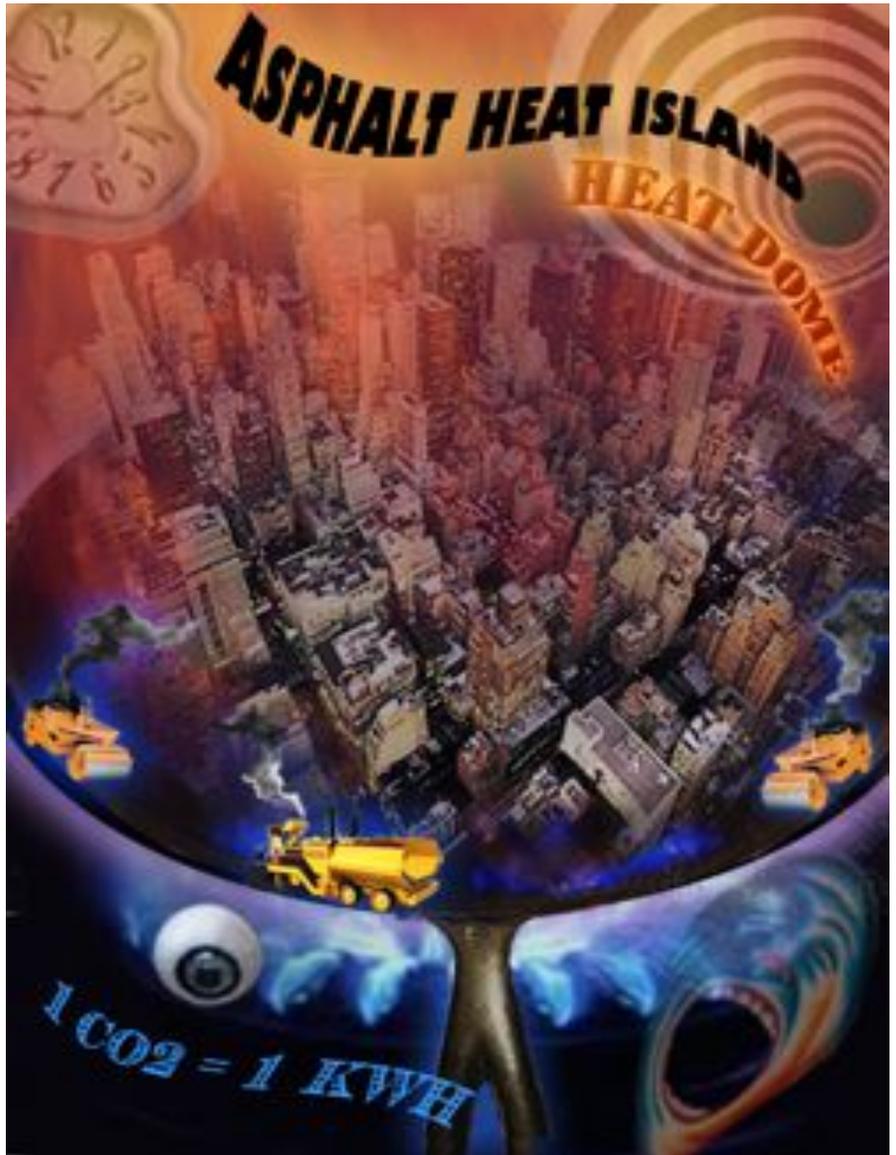
THE COLOR OF TROUBLE

The fact that asphalt is the color “BLACK” is the core issue causing the rise in heat affecting our cities. Adding insult to injury, carbon black and toxic coal tar are added to sealcoat emulsions use for maintaining asphalt. That beautiful new freshly slurried “BLACK” road or parking lots we see are actually contributing cancer producing carcinogens, toxicity in the water table, and the measurable increase in city heat. Recent studies show that the toxic particles in slurry sealers also blow around the city in “toxic dust” and are tracked into homes. Children are at the highest risk from this exposure.

Between roofs, parking lots and roads, 60% of city surfaces are now covered with “BLACK” asphalt, and being resurfaced with toxic “BLACK” sealcoat emulsions every 2-3 years. With asphalt average temperatures up to 70°(F) hotter than ambient air on peak heat days, when the sun goes down the asphalt re-releases this thermal energy to heat up the city again at night. It is well documented that airports are averaging as much as 10°(F) hotter at night than in the daytime summer heat which can soar to 170°(F).

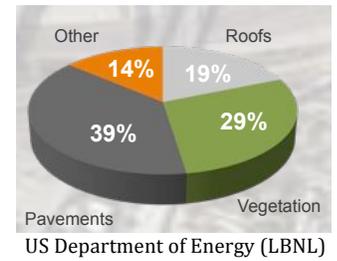
ASPHALT HEAT ISLANDS

The fact is that asphalt, which now dominates every city replacing cooling vegetation, is causing this concentrated heat. The source of this heat includes parking lots, airports, roofs, amusement parks, and even children's school yards. With the march of progress, somehow over the years, science managed overlook the obvious heat signature of this “BLACK” material. Cities have also failed to regulate the massive use of this black goo now effecting public health and safety. Today's population density brings an unintended consequence to life in the city called “Asphalt Heat Islands”



PARKING LOT PLANET

Scientists today know that urban heat is man made. It is a direct result of prior disregard by city planners and urban developers to consider the hot toxic building materials we use in our cities, but especially asphalt. Combine with the destruction of cooling vegetation...and just what do we have?.... Joni Mitchell was right when she said “you don’t know what you’ve got til’ its gone...paved paradise, and put up a parking lot.” Arizona State University’s Mikhail Chester, PhD. recently completed a study taking inventory of the number of parking lots there are in America alone. The results revealed the shocking total square feet of parking spaces now out numbers the total square feet of roads; almost 2 billion spaces, averaging 10’ x 20’ is equivalent to 400 billion square feet of black asphalt just for parking (*Parking infrastructure: energy, emissions, and automobile life-cycle environmental accounting; July 29, 2010; stacks.iop.org/ERL/5/034001*). Dr. Chester goes on to say there are now 8 parking spaces allotted for every American whether they own a car or not.

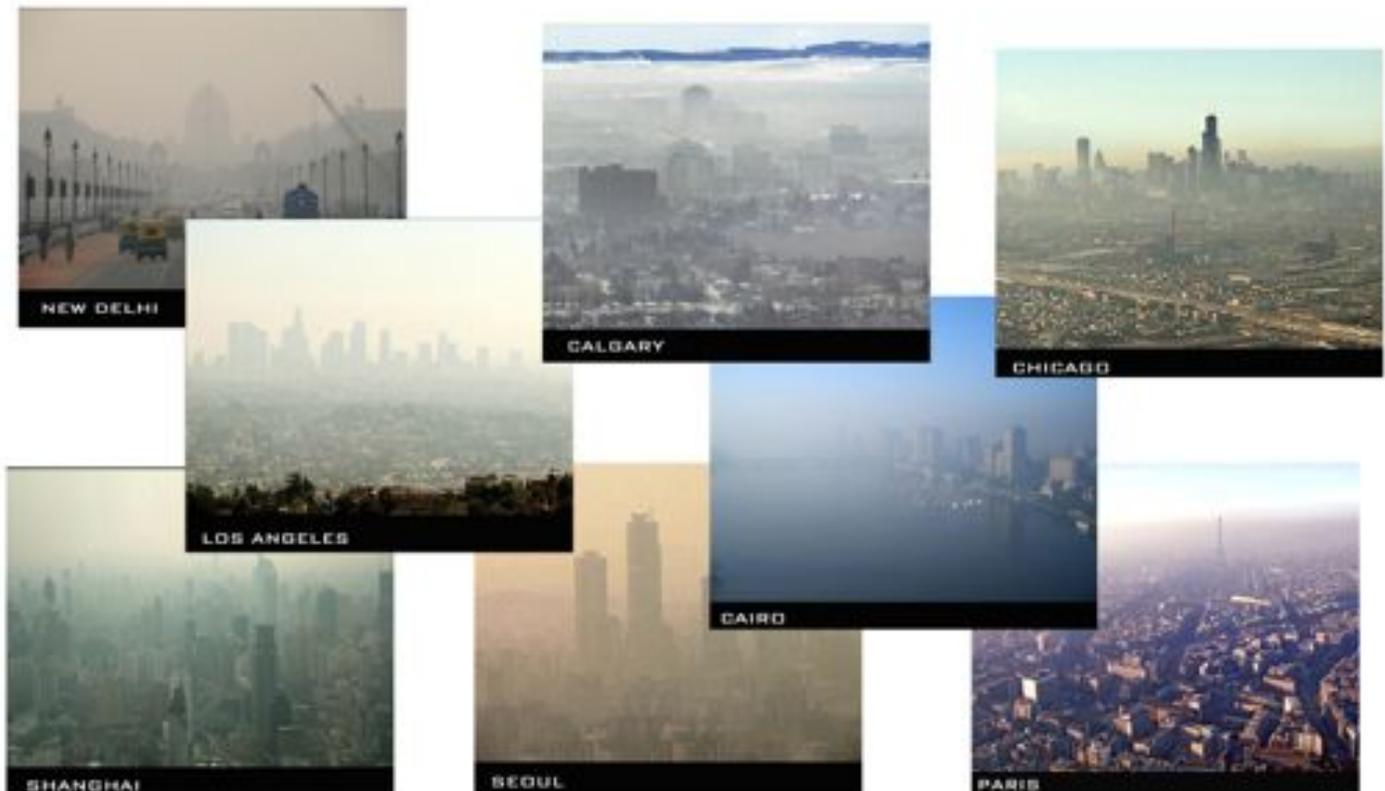


Obviously, **parking lots are one of the worst uses of land in human history.** In addition, high petroleum prices combined with global economic weakness is resulting in significant cutbacks in road repairs and infrastructure maintenance worldwide. Cities, and local governments are finding it increasingly more difficult to maintain asphalt paved surfaces due increased expense and economic cutbacks. As an example, the London Olympics may be unable to repair the roads in time for the games (AIA 2012 Report). The fact is that global escalating urban heat combined with the rate of deterioration of city infrastructure is now out pacing the rate of sustainable redevelopment.



HOT & SMOGGY “POTHOLE METROPOLIS”

Confucius warned “If you do not change the direction in which you are going, you will end up where you are headed.” By the year 2020, most of world’s population will be crowded into major cities. Statistics indicate the following: United States 84.9%; England 91.1%; China 53.2%; Russia 73.2%; Canada 82.3%; Germany 77.3%; Japan 69.8%; Mexico 80.1%; Korea 84.2%; Singapore 100%; Saudi Arabia 84.2%. With more people comes more pollution; more drain on the power grid; more urban heat; and more smog.



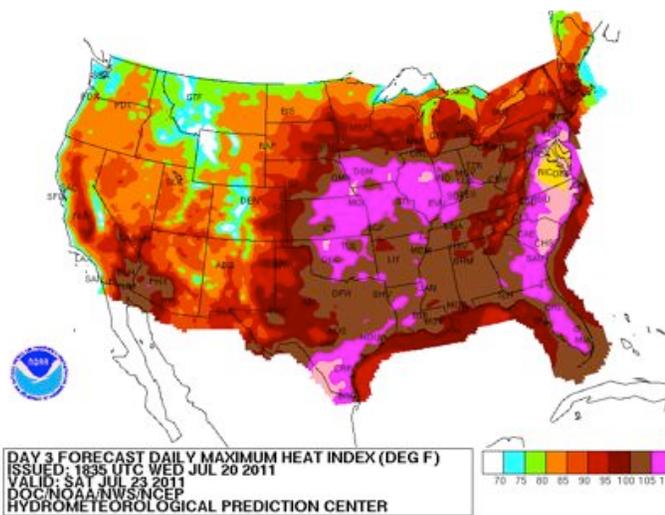
WHO NEEDS COOL PAVEMENT?

According to NASA's Earth Orbiting Satellite, asphalt creates heat sinks in the cities that can be seen as thermal images, and drilled down on Google as the following types of asphalt properties:

Airports:	Tarmac, aprons, and super size parking lots (<i>every major city</i>)
Retail Developments:	Fashion Shopping Malls with super size parking lots (<i>every major city</i>)
Amusement Parks:	Pedestrian ways and Super parking lots (<i>Disney, County Fairgrounds-etc.</i>)
Sports Events Venues	Giant parking lots (<i>Nascar, Indy, Datona –Sports Colliseums</i>)
Corporations:	Large parking lots and cement/asphalt roofs (<i>nationwide</i>)
Casinos:	Large parking lots (<i>Las Vegas, Atlantic City, Indian Reservations</i>)
Strip malls:	Large parking lots (<i>Industrial & neighborhoods</i>)
Car Dealers:	Large parking lots (<i>numerous in every city</i>)
Hotels Chains:	Large asphalt parking lots (<i>every city, often near airports</i>)
Cities:	Roads, bike lanes and crosswalks
School:	Play yards and parking lots (<i>in every city every few miles</i>)
Home Owners:	Asphalt roofs and driveways (<i>located in every city square mile</i>)
All Automobile Owners:	Idling in hot traffic jams, burning fuel and overloading A/C
All Taxpayers:	The cost of continually replacing roads is costing taxpayers money
All Property Owners:	Deteriorating unrepaired roads drive property value down

COOL PAVEMENT FOR “SMART PARKING LOTS”

The term “Cool Pavement” was coined by the EPA, and has mainly referred to reflective pavements that lower surface temperatures and reduce heat absorbed into the pavement. Cool pavements include light colored materials such as chip seal, cements, or cool coatings that go over existing black asphalt. Permeable pavements which hold water causing cooling through evaporation are also included. With today's science of how hot pavements affect urban climates, many new and advanced materials have emerged which can reduce the heat and also offset the toxic effects of CO₂, and other pollutants in smog associated with this heat. Overall, “Cool Pavement” lowers asphalt surface temperatures, reduces AC energy cost, reduces carbon emissions and smog, is safer for the environment, improves pedestrian comfort, and parking lot safety. Last but not least, the addition of solar reflective color can transform ordinary the hot asphalt parking lots into a design project and an architectural hardscape.



2012 Heat Domes Cool Pavement Solutions: 2011 was the hottest year in recorded history with solar flares forming “heat domes” over major cities. In 2012, this 11-year cycle called “solar maximum,” will bring more frequent higher levels of solar flares and more heat. The cost of air conditioning will spike during these months, especially for shopping malls, airports businesses near large “black” parking lots which will intensify as city heat sinks. NASA anticipates heat and electromagnetic activity could also affect the power grid because a 1°(F) temperature rise increases power demand on the grid by 2%. Retailers who implement cool pavement materials, trees and other “smart parking lot” solutions will save on power costs and also help reduce the load on the grid. The importance of retail chains in helping to reduce this load is evident by the following illustrations:



Walmart Chains Stores US



McDonalds Chain Stores US



Toys R' US Chain Stores US

RE-INVENTING AMERICA'S SHOPPING CENTERS

Before his appointment to the White House, Stephen Chu, (former Director of DOE Lawrence Berkeley National Labs) made the following statement about the relationship between environmental protection and color:

"Changing surface colors in 100 of the world's largest cities could save the equivalent of 44 billion tones of carbon dioxide — about as much as global carbon emissions are expected to rise over the next decade." Today he confirms that American's can **"dramatically reduce our carbon emissions and reinvigorate our economy at the same time"** stating that **"This is not only our opportunity; it is our responsibility to future generations."**

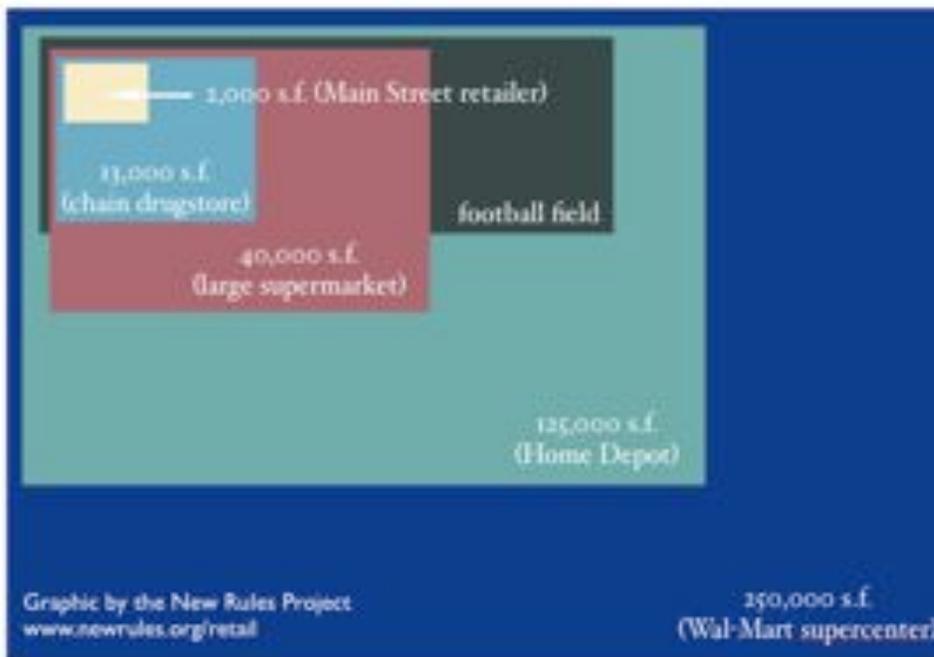
Changing the colors of America's Parking Lots does not require an Act of Congress, only that mall management understand the savings on monthly electric bills, increased parking lot safety, reduced carbon footprint, and enhanced customer appeal they can create by changing the color of the pavement. This approach to sustainable parking lot design can cool the property by 20[°](F), reduce the carbon footprint, and will also attract more business because the color makes it more inviting. Emerald Cities™ offers design and solar reflective color matching free on its "Cool Pavement" projects to demonstrate the importance of color in the battle against Urban Heat.

Cool & Durable

The key to making a successful change to color will be the selection of strong sustainable materials. Products just now coming onto the market should be viewed for their durability and maintenance features. Then again, almost anything would be better than the alternative of toxic tar slurries.



Retailer Theme Color Design Layout - ©2011 Emerald Cities USA Ltd. (.45 SR)



The Leap of Giants

America's shopping center giants have the power to literally turn around the urban heat problem in our cities. When you look at the size and how many of these chain stores exist each with a hot black parking lot, changing the color of the asphalt as a "simple solution" becomes immediately apparent. A general look at the top 100 retail stores in America combined with their square footage reveals some startling potential for energy savings and carbon offsetting.

Wal-Mart and Target are building "supercenters," typically 180,000 to 250,000 square feet with giant parking lots being larger in size to the square footage of the store itself.

Many other big box retail stores---including Home Depot, Lowe's, Office Depot, Bed Bath & Beyond, etc.---average 60,000 to 140,000 square foot range, again with parking lots. Equal or greater in size. most supermarkets like Safeway, Albertsons, Ralphps, Krogers range from 25,000 to 45,000 square feet; free-standing chain drugstores operated by Walgreens, Rite Aid, and CVS are generally 11,000-15,000 square feet with the parking lot typically 20,000 to 30,000 s/f in size.

COST-BENEFITS OF COOL PAVEMENT:

The following chart provides general minimum calculations for Emerald Cities™ 40% CO₂ offsetting and kWh energy savings on the parking lots of major retail chain stores in America as indicated. Calculations were arrived at based upon scientific information as follows:

- Number of Stores:** Taken from “2011 Top 100 Retailers” <http://www.stores.org>
- Store Sq/Ft of Parking Lot:** Parking lots size have been calculated as a minimum size based upon “average” square footage of store, except where the actual parking lot sizes are published.
- Total Sq/Ft. Store Asphalt:** Number of stores multiplied by the minimum “average” size of the parking lot = the total square footage of asphalt each retailer owns/operates. This calculations is abased on the number of stores (published) and does not deduct for instore operations whereby the company would not have its own parking lot.
- Total Store CO₂ Offset:** Calculation based on US Department of Energy - Lawrence Berkeley National Laboratories calculation of Emerald Cities™ .4 solar reflectance (40%) = 10 tons CO₂ per/1000 sq ft.
- Est. kWh Energy Savings:** According to the US Department of Energy, “direct savings” from installing a cool roof equates to approximately 0.25 kWh per sq. ft. For purposes of this article, Emerald Cities™ has calculated the “indirect savings” upon 20°(F) cooling of asphalt building envelope adjacent to/or surrounding the building @ = 0.05 kWh savings per building sq. foot. Savings applies only to the differential in the heat signature on peak heat days.

Chain Store Name	Number Stores	Store sq/ft Parking Lot	Total sq/ft of Store Asphalt	Total Cool Pavement Offset @ .4 SR	Peak Heat Savings .05 kWh sq/ft
Wal-Mart	4,358	200,000	871,600,000 s/f	8,716,000 tons CO ₂	43,580,000 kWh
Kroger	3,609	40,000	144,360,000 s/f	1,443,600 tons CO ₂	7,218,000 kWh
Target	1,750	150,000	262,500,000 s/f	2,625,000 tons CO ₂	13,125,000 kWh
Walgreen	7,456	15,000	111,840,000 s/f	1,118,400 tons CO ₂	5,592,000 kWh
The Home Depot	1,966	125,000	245,750,000 s/f	2,457,500 tons CO ₂	12,287,500 kWh
Costco	412	150,000	61,800,000 s/f	618,000 tons CO ₂	3,090,000 kWh
CVS Caremark	7,217	15,000	108,255,000 s/f	1,082,550 tons CO ₂	5,412,750 kWh
Lowe's	1,723	100,000	172,300,000 s/f	1,723,000 tons CO ₂	8,615,000 kWh
Best Buy	1,312	37,000	48,544,000 s/f	485,440 tons CO ₂	2,427,200 kWh
Sears Holdings	3,484	130,000	452,920,000 s/f	4,529,200 tons CO ₂	22,646,000 kWh
Safeway	1,475	40,000	59,000,000 s/f	590,000 tons CO ₂	2,950,000 kWh
SUPERVALU	2,436	70,000	170,730,000 s/f	1,707,300 tons CO ₂	8,526,000 kWh
Rite Aid	4,750	15,000	71,250,000 s/f	712,500 tons CO ₂	3,562,500 kWh
Publix	1,173	50,000	58,650,000 s/f	586,500 tons CO ₂	2,932,500 kWh
Macy's	852	120,000	102,240,000 s/f	1,022,400 tons CO ₂	5,112,000 kWh
McDonald's	14,027	10,000	140,270,000 s/f	1,402,700 tons CO ₂	7,013,500 kWh

Kohl's	1,083	80,000	86,640,000 s/f	866,400 tons CO ₂	4,332,000 kWh
J.C. Penney	1,099	60,000	65,940,000 s/f	659,400 tons CO ₂	3,297,000 kWh
Taco Bell	6,446	4,000	25,784,000 s/f	257,840 tons CO ₂	1,289,200 kWh
Kentucky Fried Chx	11,000	10,000	110,000,000 s/f	1,100,000 tons CO ₂	5,500,000 kWh
Pizza Hut	6,000	10,000	60,000,000 s/f	600,000 tons CO ₂	3,000,000 kWh
True Value	4,701	25,000	117,525,000 s/f	1,175,250 tons CO ₂	5,876,250 kWh
ShopRite	273	40,000	10,920,000 s/f	109,200 tons CO ₂	546,000 kWh
Wendy's / Arby's	9,406	10,000	94,060,000 s/f	940,600 tons CO ₂	4,703,000 kWh
Staples	1,575	30,000	47,250,000 s/f	472,500 tons CO ₂	2,362,500 kWh
Ace Hardware	4,047	10,000	40,470,000 s/f	404,700 tons CO ₂	2,023,500 kWh
Toys "R" Us	1,486	100,000	148,600,000 s/f	1,486,000 tons CO ₂	7,430,000 kWh
Whole Foods	288	30,000	8,640,000 s/f	86,400 tons CO ₂	432,000 kWh
Bed Bath & Beyond	1,114	80,000	89,120,000 s/f	891,200 tons CO ₂	4,456,000 kWh
7-Eleven	6,586	4000	26,344,000 s/f	263,440 tons CO ₂	1,317,200 kWh
Burger King	7,258	3000	21,774,000 s/f	217,740 tons CO ₂	1,088,700 kWh
Ross Stores	1,054	150,000	158,100,000 s/f	1,581,000 tons CO ₂	7,905,000 kWh
Office Depot	1,125	30,000	33,750,000 s/f	337,500 tons CO ₂	1,687,500 kWh
Trader Joe's	359	15,000	5,385,000 s/f	53,850 tons CO ₂	269,250 kWh
AutoZone	4,364	10,000	43,640,000 s/f	436,400 tons CO ₂	2,182,000 kWh
Applebee's	3,000	5000	15,000,000 s/f	150,000 tons CO ₂	750,000 kWh
Advance Auto Parts	3,537	6000	21,222,000 s/f	212,220 tons CO ₂	1,061,100 kWh
Barnes & Noble	1,343	40,000	53,720,000 s/f	537,200 tons CO ₂	2,686,000 kWh
OfficeMax	904	8000	7,232,000 s/f	72,320 tons CO ₂	361,600 kWh
O'Reilly Automotive	3,570	20,000	71,400,000 s/f	714,000 tons CO ₂	3,570,000 kWh
Big Lots	1,398	80,000	111,840,000 s/f	1,118,400 tons CO ₂	5,592,000 kWh
Pet Smart	1,118	20,000	22,360,000 s/f	223,600 tons CO ₂	1,118,000 kWh
RadioShack	5,602	6000	33,612,000 s/f	336,120 tons CO ₂	1,680,600 kWh
Albertsons	221	40,000	8,840,000 s/f	88,400 tons CO ₂	442,000 kWh
Sherwin-Williams	3,279	5000	16,395,000 s/f	163,950 tons CO ₂	819,750 kWh
Sports Authority	464	40,000	18,560,000 s/f	185,600 tons CO ₂	928,000 kWh
Outback	968	6000	5,808,000 s/f	58,080 tons CO ₂	290,400 kWh
Chili's Restaurants	1,337	5000	6,685,000 s/f	66,850 tons CO ₂	334,250 kWh

AN EMERALD CITIES™ SOLUTION

"Changing surface colors in 100 of the world's largest cities could save the equivalent of 44 billion tones of carbon dioxide — about as much as global carbon emissions are expected to rise over the next decade."

Secretary of Energy, Stephen Chu --- 2008

The thought of highways in beautiful cool aqua blue or sea foam green colors instead of black was awe inspiring. "Who decided that all roads and parking lots should be black?" The truth that Sheri soon discovered is that "NO ONE DECIDED." It was the unintended consequence of advancement in the transportation industry since the 1800's, minus an understanding of how color impacts the environment. "I guess we just didn't know," She says. But more importantly is the next question. Now that we know **"hot black asphalt is contributing to urban heat and climate change"**...can we as a society afford to ignore it? Sheri thinks not. "The scientific facts supporting the disastrous future consequences are overwhelming if we don't do something soon."

ABOUT THE AUTHOR



Sheri Roesse is a colorist and 35 year veteran in the Architectural Surface Design Field. She is known for her textile designs and architectural surface treatments in which have had application in projects all over the world through International Design Firms. She was honored with the International Woman in Design Award with showrooms across America, and featured in Harrods London, and Lafayette's in Paris. Designer installations utilizing her textiles and surface design treatments have featured her the installations in Architectural Digest, House & Garden, Designers West, Elle, Vogue and many other international publications. *Specific client projects include the following:*

King Faad Royal Termal- Riyahd (Bechtel)
Marriot Hotel – Saudi Arabia
Al Sabah Royal Family –Kuwait Reconstruction
Architectural Digest Corporate Headquarters
Sheraton Hotels – Worldwide
American Museum of Art – NY
Dallas Gold Exchange

Presidential Palace – Mexico
Presidential Suite – Embassy Hotel D.C.
Xerox Corporation Headquarters
Hilton Hotels – Worldwide
St. Frances Hotel – San Francisco
Music Center – Los Angeles
CBS & NBC Studio Projects

Sheri has background in physics and chemistry, and also studied Boolean logic and its application in corporate intelligent work. "I was on the information highway when it was a dirt road" she chuckles. It was the up and coming new career at the end of the cold war. America's defense companies were fighting to get into international markets, and laying off staff while hiring corporate intelligence consultants to do the market research. Her list of clients included Martin Marietta, ITT, Loral, Rockwell International, Motorola Defense, McDonald Douglas (Offset Programs) and many small high tech firms. Following the invasion of Kuwait, she also worked directly for the Al Sabah Royal Family Attorney out of London, helping to bring engineering, construction and technology companies back into Kuwait to assist with reconstruction projects.

Sheri also founded Nations Trust Ltd. to assist her smaller clients to access the Lloyds and London financial markets for project financing alternatives and political risk underwriting. The company has been business for over 15 years, and takes on only selected projects which meet specific criteria. In 2008, Nations Trust Ltd. formed Emerald Cities™ International Ltd. specifically to foster master planning of sustainable green communities. In 2009 Emerald Cities™ USA Ltd. was set up to manufacture the Cool Pavement Products as part of that master plan. Nations Trust Ltd. will act as offsetting agent/originator for CO₂ generated by Emerald Cities™ cool pavement products. VER Transactions will be conducted through CCX London with trading scheduled to begin in 2013.

"As woman and entrepreneur, I am concerned about how urban heat would affect the future world of our children." Sheri Roesse, founder of Emerald Cities™ International Ltd. explained. "When I read the words of Stephan Chu, it was like the light bulb went on in my head." Sheri goes on to say "its was so logical...why aren't we doing this? With all the talk about cool roofs, there are a thousand times more roads, crosswalks, bike lanes, and big black parking lots belonging to shopping malls, hospitals, sports arenas, amusement parks, hotels and corporations. In the battle against urban heat and rising cost of power, Sheri says "Cool Pavement is simplest most cost effective solution that can do the greatest amount of good to slow the effects of climate change in the shortest amount of time....and...we are running out of time."