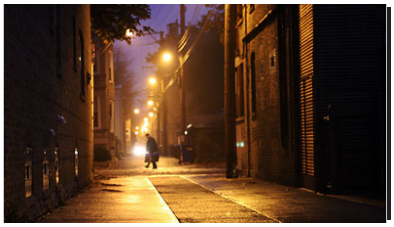
Chicago's Green Alley Program

The Green Alley Handbook - Chicago Illinois, USA

prepared by: Benjamin Engelhard, Seth Geiser, Will Payne



Above: Night image of a "Green Alley" in Chicago using a "central alley filtration system."

Left: A before and after illustration showing the use of pavers in place of a standard non-pervious asphalt.
-The Green Alley Handbook

"With approximately 1,900 miles of public alleys, Chicago has one of the most extensive and important pieces of infrastructure of any city in the world. That's approximately 3,500 acres of paved impermeable surface that provides an opportunity to better manage our resources and improve our environment."
-The Green Alley Handbook

"Stormwater runoff causes two key impacts: (1) excess water volume, or quantity, and (2) degraded water quality." *Guide to Stormwater BMP's - City of Chicago*

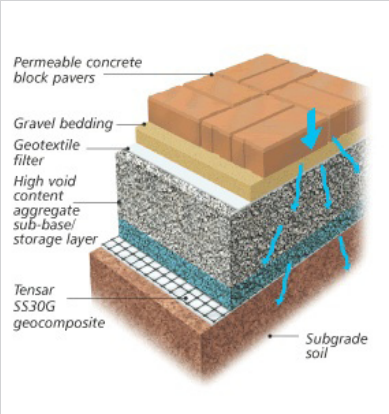


Image 1 egov.cityofchicago.org
Pavers: Concrete, Stone and Brick---Open joints allow water permeability

Image 2 perviouspavement.org
Porous Concrete---A controlled amount of water and cement with little to no sand in mix create voids around the aggregate material.
Porous Asphalt---Small aggregate is removed from the standard mix and laid on a stone sub-base of 18-36 inches deep.

Image 3
perviouspavement.org

1. Stormwater Management

This is perhaps one of the most significant driving factors in what motivated the city to give attention to their alley system. Involving the alley system was a part of a vision that attempts to deal with water in the city in a more holistic manner. Alleys represent a particular piece within Chicago's hydrology, but the cities Green roof program also respresents a very important piece as to how the city is dealing with stormwater. Specific problems associated with runoff include: increased flooding, combined sewer overflows and backflows into Lake Michigan. By adding green roofs in mostly impervious spaces within the city, storm water that is directed into the sewer system has been greatly reduced. Regarding the cities alley system, most alleys had two major problems. First, they were paved in asphalt or concrete that didn't allow for stormwater to filter back into the earth. Second, they typically did not provide points for water to drain into the sewer system so the city frequently saw flooding in alleys. The following looks at how the city has sought to solve the problem of flooding, and how that relates to overflow problems associated with the sewer.

Image 6 Green roof atop City Hall - Guide to Stormwater BMP's

Flooding

This is perhaps one of the most significant driving factors in what motivated the city to give attention to their alley system. Because alleys in Chicago are typically not connected to the combined sewer system the main way the city is seeking to deal with runoff that reaches the road bed is to provide various permeable paving solutions that allow water to drain without adding more water to the combined sewer system.

Water collection & Infiltration

The cities Guide to Stormwater BMP's (best management practices) lays out a hierarchy of dealing with water that is clearly associated with their plan for the alley system. Green roofs. Downspouts, rain barrels and cisterns. Permeable paving. Natural landscaping which includes: filter strips, bioinfiltration (rain gardens), drainage swales and naturalized detention basins. The Green Alley Program most specifically utilizes the idea of using green roofs atop buildings that border an alley, the possibility of collecting roof runoff in cisterns, and finally allowing water that does reach the alley floor to infiltrate to the soil through the various permeable options already listed. Also, Subsurface drain pipes can be used in areas where soil compaction and/or soil type restrict infiltration.

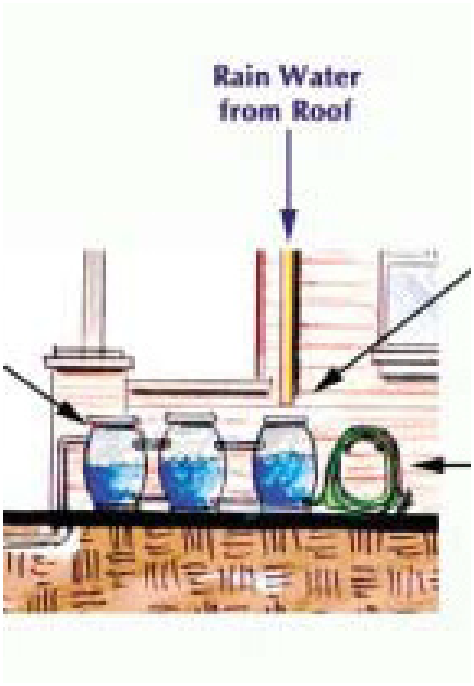


Image 7 Cisterns

Image 8 Permeable Paving

Materials

Permeable paving options are the primary solution the city is using for dealing with runoff and flooding problems associated with alleys. In summary the materials typically used include: Permeable asphalt and concrete (Image 1,2 & 8), Permeable pavers (Image 3), Turf/Grass pavers (Image 4), and less common but possible is a recycled rubber material (Image 5).

Image 4 Turf/Grass Pavers
paversearch.com
Concrete or Recycled Plastic honeycomb grid prevent compaction and allow for infiltration. Best for low traffic applications.

Image 5 Rubber
www.cityofchicago.org
100% recycled tires formed as pavers are currently being tested in experimental sidewalk patches in Chicago. Ground rubber can also be added to porous asphalt mix.

Imagine if all the alleys had a light, reflective surface (high albedo) that reflected heat energy, staying cool on hot days and thereby reducing the "urban heat island effect" *Green Alley handbook - City of Chicago*

2. Heat Reduction

Heat Island Effect

Temperatures in cities tend to be hotter than then nearby rural areas due to heat which is absorbed and radiated from solid surfaces. Tall buildings, narrow streets and vehicle emissions also contribute to increased temperatures in cities.

Image 9 Chicago Heat Wave

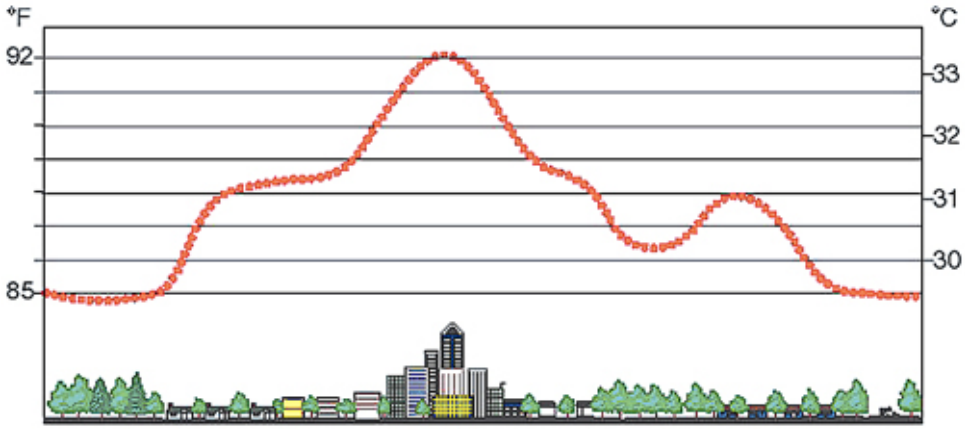


Image 11 Heat Island Effect

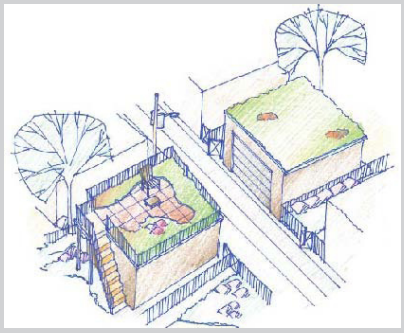


Image 10 City Hall Green Roof & green roof atop garage options from The Green Alley Handbook

Heat Related Deaths

Extreme heat during the summer months can be exacerbated by the heat island effect, leading to increased risk of heat-related fatalities. During the 1995 Chicago heatwave, over 600 people died over a five-day span.

Heat Reduction with Green Roofs

In addition to water-quality benefits, the heat island effect can be diminished through the use of green roofs. Chicago City Hall's green roof has been recorded to be about 25 degrees cooler during summer days than the adjacent building which has a black-tar roof. Estimates show 10% energy reduction for heating and cooling of the building.

Materials

There are two main ways that paving surfaces in alleys can help to reduce the heat island effect: by using high albedo paving surfaces (surfaces that will reflect heat as opposed to absorbing it, see Image 12), and through using porous paving which allows for more air circulation and consequently less absorption and re-radiation of heat.

"The Solar Reflectance Index (SRI)---Combines albedo and emittance (a material's ability to release absorbed heat)." LEED standards require at least a 29 SRI on 50% of the paved areas on a site. (LAM, Feb 2007)

Material surface	Solar Reflectance*	Emittance	SRI*
Black acrylic paint	0.05	0.9	0
New asphalt	0.05	0.9	0
Aged asphalt	0.1	0.9	6
"White" asphalt shingle	0.21	0.91	21
Aged concrete	0.2 to 0.3	0.9	19 to 32
New concrete (ordinary)	0.35 to 0.45	0.9	38 to 52
New white portland cement concrete	0.7 to 0.8	0.9	86 to 100
White acrylic paint	0.8	0.9	100

Image 13 The Solar Reflectance Index - LAM

Sources:

www.concretethinker.com
http://www.asla.org/lamag/lam07/february/ecology.html
http://egov.cityofchicago.org

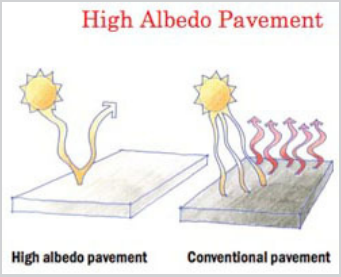


Image 12 High Albedo Surfaces
"Refers to a material's ability to reflect the visible, infrared, and ultraviolet wavelengths of sunlight." (Landscape Architecture Magazine, Feb. 2007) Usually light colors reflect more light and are therefore desireable.

Image 13 Gravel Surfaces
Urban Heat Island Initiative Gravelpave2, a porous gravel structure that contains the gravel even as it provides heavy load bearing support, unlimited traffic volume and parking duration. The new system can handle up to a 3" rainfall per hour, allowing rainwater to soak into the ground and thereby reduce polluted run-off and flooding. The system is suitable for traffic, including residential traffic as well as service vehicles. The new alley has eliminated formerly chronic flooding without using the sewer system and reduced the heat island effect by eliminating dark, heat absorbing surfaces.

"Recycled construction materials can be incorporated in a variety of ways in green alleys." *Green Alley Handbook - City of Chicago*

Image 14 Recycled Rubber Pavers
• They do not crack or crumble
• Water permeable
• Reduce tripping hazards
• Tree roots can be remedied without affecting the tree
• Easier on the feet
• Come in several colors or patterns
• You can even relocate and reuse them
http://claddaghpaving.com/about6.html

3. Material Recycling

Concrete---Old concrete crushed and used as aggregate to strengthen new pavement. Also used as a strong sub-surface base for all porous surfacing materials.

Asphalt---Probably the easiest and most energy/cost effective material to recycle and reuse

Slag---Gravel and stones from ore refinement as aggregate and sub-surface base.

Rubber---Old tires ground in asphalt mix or molded as pavers.

Plastic---Reused in honeycomb grid membrane from grass pavers.

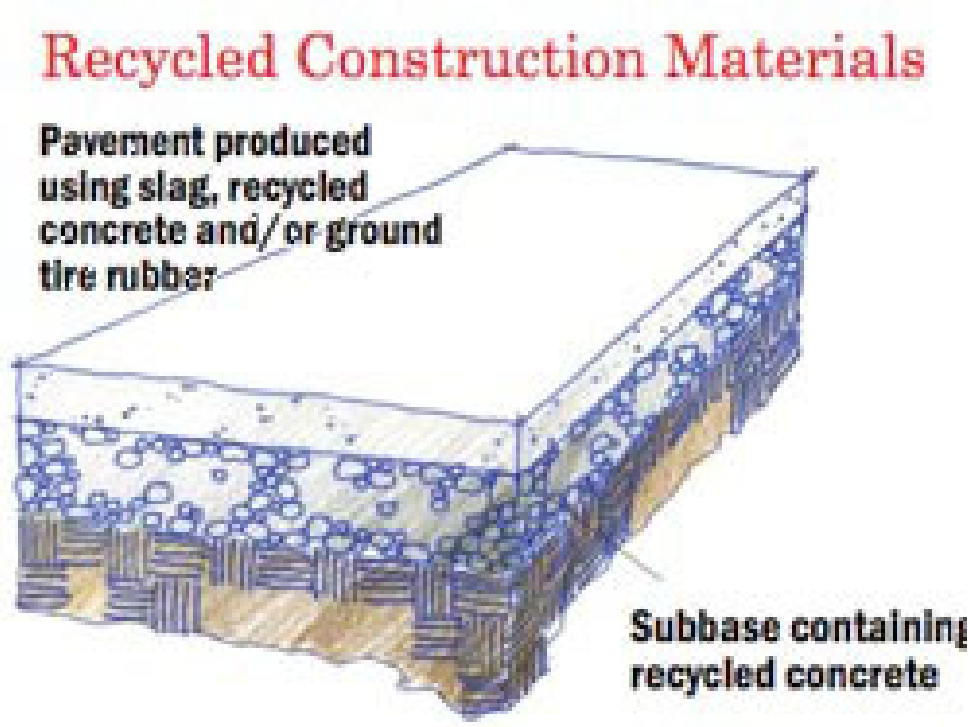


Image 15 Recycled Construction Materials - Green Alley Handbook

"Energy efficient, dark sky compliant light fixtures are specially designed to direct light downward, focusing light where it's needed." *Green Alley Handbook - City of Chicago*

4. Light Pollution

Energy Waste

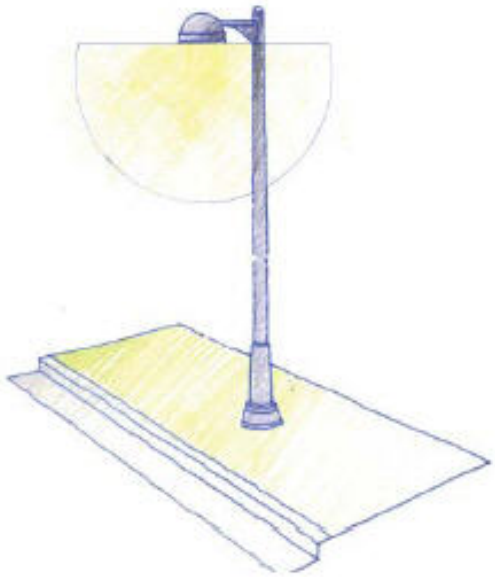
Nationwide, 22% of energy use is for lighting

Light which illuminates the sky instead of surfaces is wasted energy

Glare and Safety

By using metal halide lamps, glare is reduced and whiter light is provided which dramatically increases visibility

Technique 9	Energy Efficient / Dark Sky Lighting					
$200-$5,000+ each	✓	Residential	✓	Commercial	✓	Industrial



Energy efficient/dark sky light fixtures are designed to direct lamp light downward and outward where it is useful rather than upward where it wastes energy and contributes to glare and light pollution.

Potential Benefits

- Reduces energy costs
- Reduces light pollution from site
- Reduces glare and provides better light uniformity

Image 16 Dark Sky Compliant Light Fixtures - Green Alley handbook

Image 17 Metal Halide Lamp
Example of metal halide fixture that focuses light that allows for a broad spectrum at night.

Image 18 Downlighting

"...what goes on here... how should it occur?" *Louise Grassov - Gehl Architects*

Image 19 Post Alley_Seattle
voodooangel - flickr
http://www.flickr.com/photos/voodooangelmg/2808671491/
This image illustrates the possibilities for various social opportunities that need to be explored for the Green Alley Handbook to embrace a more holistic view of sustainability.

5. Critiques and Conclusions

Stormwater Management

- Heavy vehicle traffic can damage some of these high cost paving options
- Dirt, sand, salt, and dust can clog the voids in porous materials over time
- High maintenance costs
- Doesn't go far enough to recommend plantings in alleys
- There are many "green" initiatives going on in Chicago and the programs are disconnected. It would be better to see the programs integrated - at least visually - in order to illustrate a more holistic understanding about how water enters, is used, and eventually leaves the city - This would allow us to see how green alleys work with green roofs, heat Island reduction, etc.. .

Heat Reduction

- Weathering can change the SRI value of materials
- Glare is worse on high albedo surfaces
- Limited design options with light colored surfaces
- Green roofs increase maintenance costs, require quality installation and can't be retrofitted to older buildings with low structural support

Material Recycling

- Not enough emphasis on locality of materials
- Nothing is stated about what to do with material removed from alleys being refinished

Light Pollution

- Metal halide lights aren't as efficient or white as LED lights
- There is not any discussion dealing with lighting for safety and other social concerns

Conclusion

Alongside these critiques it is also important to note that there is not any discussion involving the use of the alleys - specifically thinking about their role socially in the city. The "green" environmental portion is covered quite well overall, but the program thus far has failed to address how alleys in various urban conditions should be treated and used by people. It seems to assume that all alleys should/do function in the same way. This is no longer true in a contemporary city and the Green Alley handbook would benefit greatly by taking social and use factors into account. Other recommendations include: Open surface for urban tough plants to grow (raised beds?) Hardy vines to grow on light posts and other vertical structures, Vertical gardens.