Bio Retention in an Urban Environment

Shaw Nature Reserve

Landscape Series

June 19, 2012

Saint Louis Great Streets INITIATIVE

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EAST-WEST GATEWAY

Council of Governments

Creating Solutions Across Jurisdictional Boundaries

SOUTH GRAND GREAT STREETS INITIATIVE
BIO-RETENTION PROJECT

Great Streets

- Are representative of their places (context sensitive)
- Allow people to walk comfortably and safely
- Contribute to economic vitality of the area
- Are functionally complete (accommodate all modes)
- Provide mobility (travel, local circulation, and access)
- Facilitate place making (identity, space, art, activity)
- Are green (ecological & attractive)

"To design a street according to its probable use is a reasonable but uncommon practice."
…1917 - City of St. Louis Plan

SOUTH GRAND GREAT STREETS INITIATIVE

1. South Grand Boulevard
2. Tower Grove Park
3. Gravois Avenue
4. Interstate 44
5. Master Plan Study Area
6. Phase One Project Area


Typical Sidewalk Condition

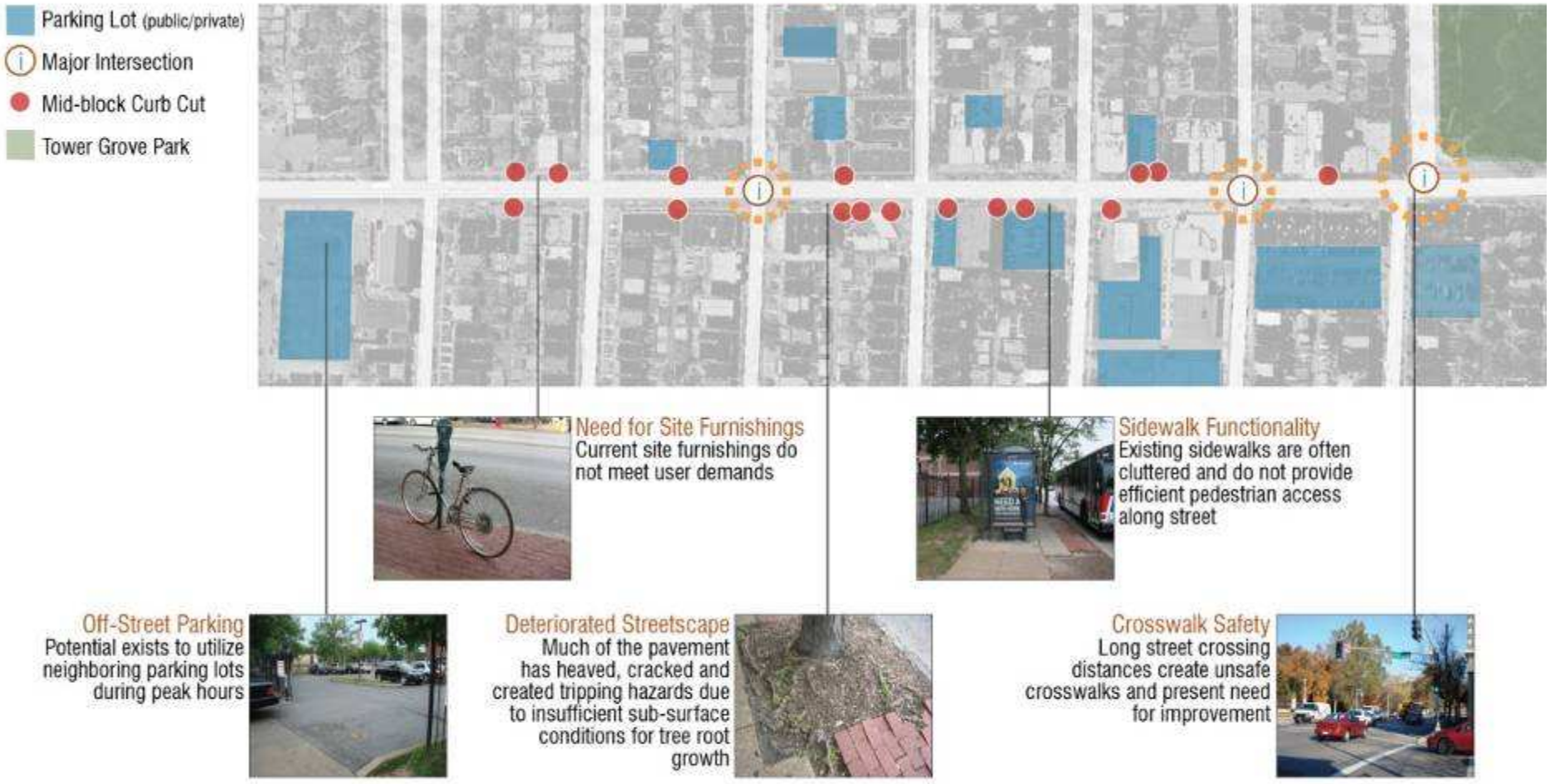

Typical Side Street Character


TowerGrove Park Entrance


Typical Dining Experience

City of St. Louis and South Grand Community Improvement District

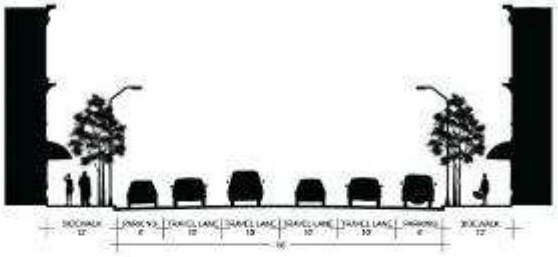
PROBLEM AREAS



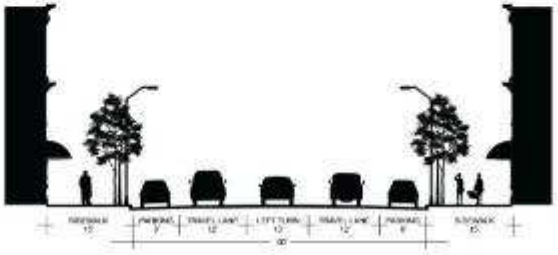
Ecological Issues Addressed:

- Education – establish expectations, priorities, and tools
- Plantings – hardiness / maintenance intensity
- Storm Water – quantity and cleanliness of piped water
- Heat Island effect – thermal battery of materials used
- Light Pollution – aesthetics and practicality
- Quantity of Motorized Travel – amenity for bike / ped / transit
- Carbon Footprint – materials selected & ongoing maintenance
- Waste Management – construction practices
- Wildlife – birds, small animals, flora
- Air Quality – reduced carbon emissions & improve absorption
- Sound – reduced ambient and peak noise levels

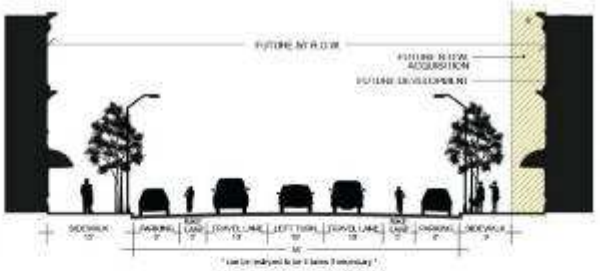
SOUTH GRAND GREAT STREETS INITIATIVE



4 Lane Basic Enhancement

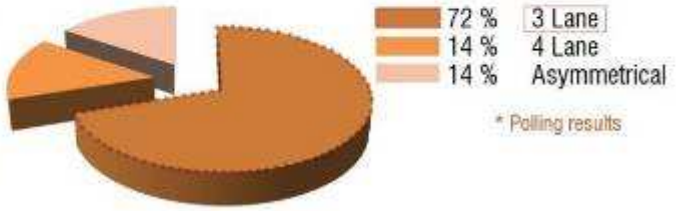


3 Lane Enhancement Plus



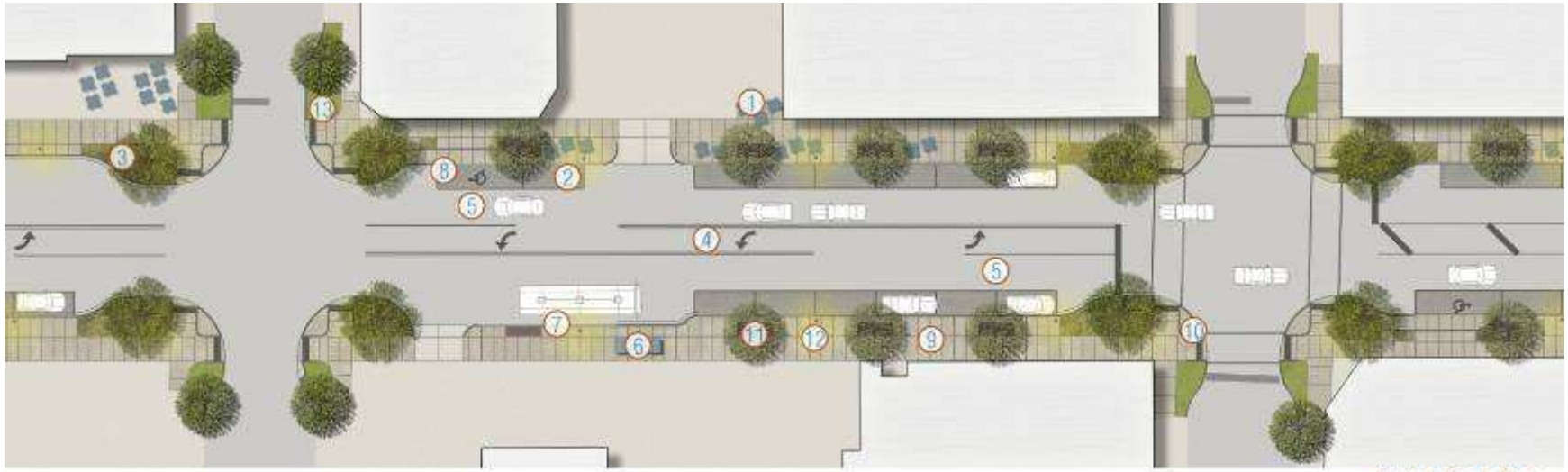
3-4 Asymmetrical (contingent upon ROW acquisition, may be re-striped for 4 lanes)

I prefer the following future street?



* Polling results

PLAN VIEW OF THREE LANE STREET



Typical Block Plan

1. Outdoor Dining
2. Pervious Parking Lane
3. Rain Garden
4. Left-Turn Lane
5. Travel Lane/Bike Sharrow
6. Bus Shelter
7. Bus Stop
8. Accessible Parking Space
9. Pervious Concrete Sidewalk
10. Intersection Bulbout
11. Proposed Street Tree
12. Street Lamp
13. Planting Area

Typical Block Cross Section

Concept Design for Bulb-out & Raingarden

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South Grand

Green Stormwater Design Overview:

Utah Street to Arsenal Street

The ultimate green stormwater design goal of the Great Streets Initiative for South Grand is for 50 percent of the street cross-section, from the right-of-way to the centerline of South Grand Boulevard, to be pervious. The design team is proposing the following as amenities to help achieve the goal:
1. pervious concrete paving for pedestrian walking and gathering surfaces,
2. permeable pavers for all parking spaces,
3. rain gardens at bulb-outs,
4. planting areas.

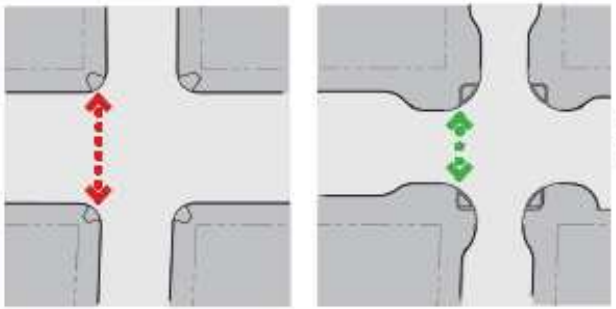
Proposed Design

(by Design Workshop)

Classic Bulbout

City Garden

Crosswalk Distance



Existing Crossing Distance = 56'
Proposed Crossing Distance = 37'

DW LEGACY DESIGN METRICS

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Green Stormwater Design Overview:

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Pervious Concrete

Locations: All pedestrian sidewalks
Quantity: 42,412 Square Feet

Permeable Pavers

Locations: All parking spots
Quantity: 15,694 Square Feet

Rain Gardens

Locations: Bulb-outs along S. Grand and side streets
Quantity: 14,132 Square Feet

Planting Areas

Locations: tree pits
Quantity: 2,803 Square Feet

South Grand Bulbouts Today

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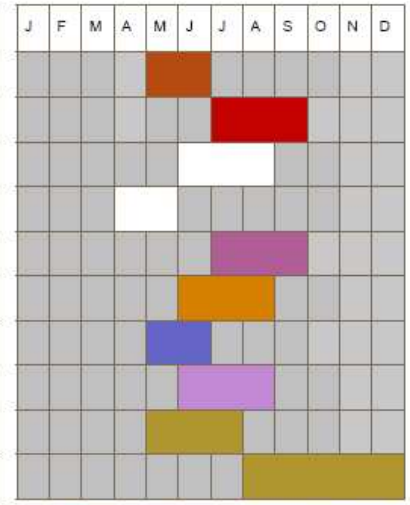
Rain Gardens: Plant List

Rain gardens are designed to filter and absorb stormwater run-off from impervious surfaces such as the roadway and parking lots to reduce the amout of water flowing into storm drains, and reduce erosion, water pollution and flooding from surface run-off.

The following plant list was selected based on recommendations from the *Landscape Guide for Stormwater Best Management Practice Design, St. Louis Missouri*, and resources from the Missouri Botanical Gardens. These native plant species were selected due to their ability to thrive in wet conditions and tolerance of frequent flooding and salt, their ability to thrive in full or partial sun, their ability to attract birds and butterflies, as well as their availability in the local nursery trade. All of these plants are native and part of Missouri's natural heritage, providing a high aesthetic value.

Latin Name	Common Name	Seasonal Interest Color	Months
Iris fulva	Copper Iris	Copper	May-June
Lobelia cardinalis	Cardinal Flower	Red	July-September
Cephalanthus occidentalis	Buttonbush	White	June-August
Penstemon digitalis	Smooth Beard-tounge	White	April-May
Phlox paniculata	Meadow Phlox	Purple/Pink	July-September
Asclepias tuberosa	Butterfly Milkweed	Orange	June-August
Baptisia australis	Wild Blue Indigo	Blue	May-June
Echinacea purpurea	Purple Coneflower	Purple	June-August
Carex vulpinoidea	Fox Sedge	Tan	May-July
Sporobolus heterolepis	Prairie Dropseed	Tan	August-Dec




Iris fulva


Lobelia cardinalis


Cephalanthus occidentalis


Penstemon digitalis


Carex vulpinoidea


Phlox paniculata


Asclepias tuberosa


Baptisia australis

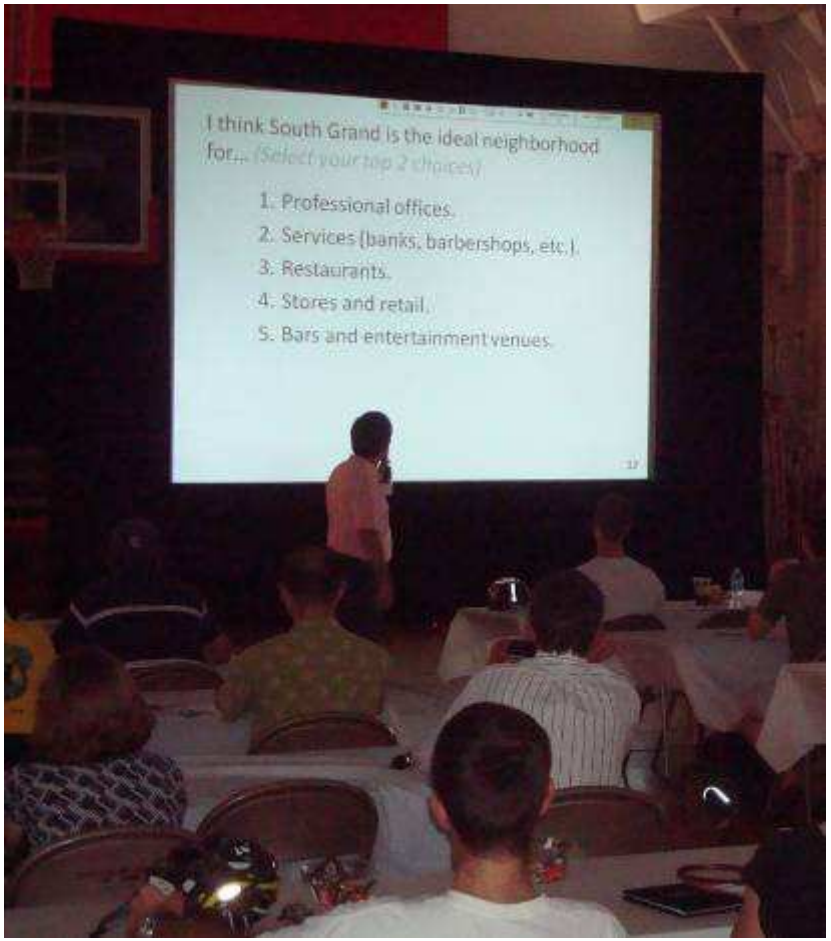

Echinacea purpurea


Sporobolus heterolepis

Species Selection

(by Design Workshop)

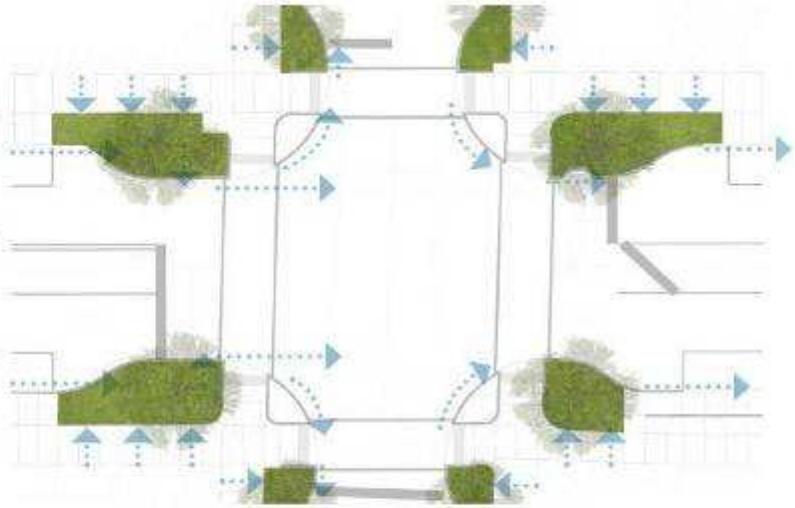
ENVIRONMENT | PERMEABILITY

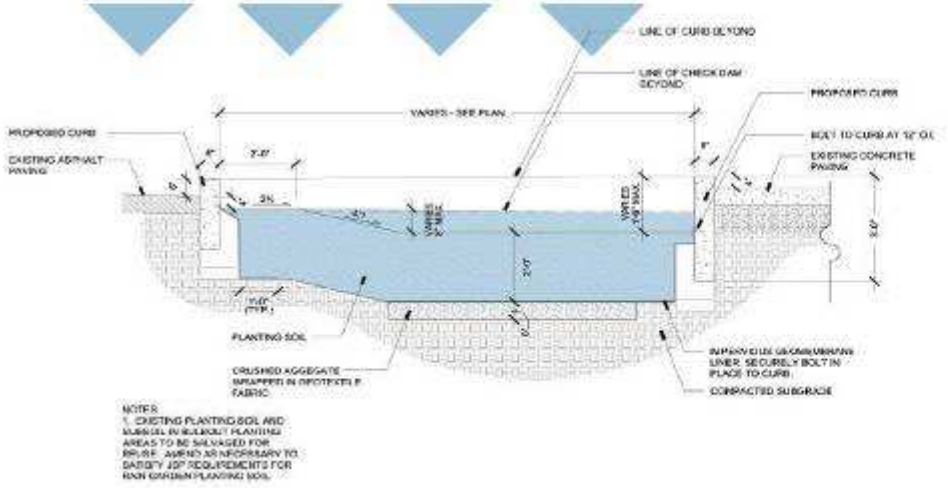


Engaging the public in prioritizing metrics

Demonstrating porous pavement to the public

ENVIRONMENT | PERMEABILITY





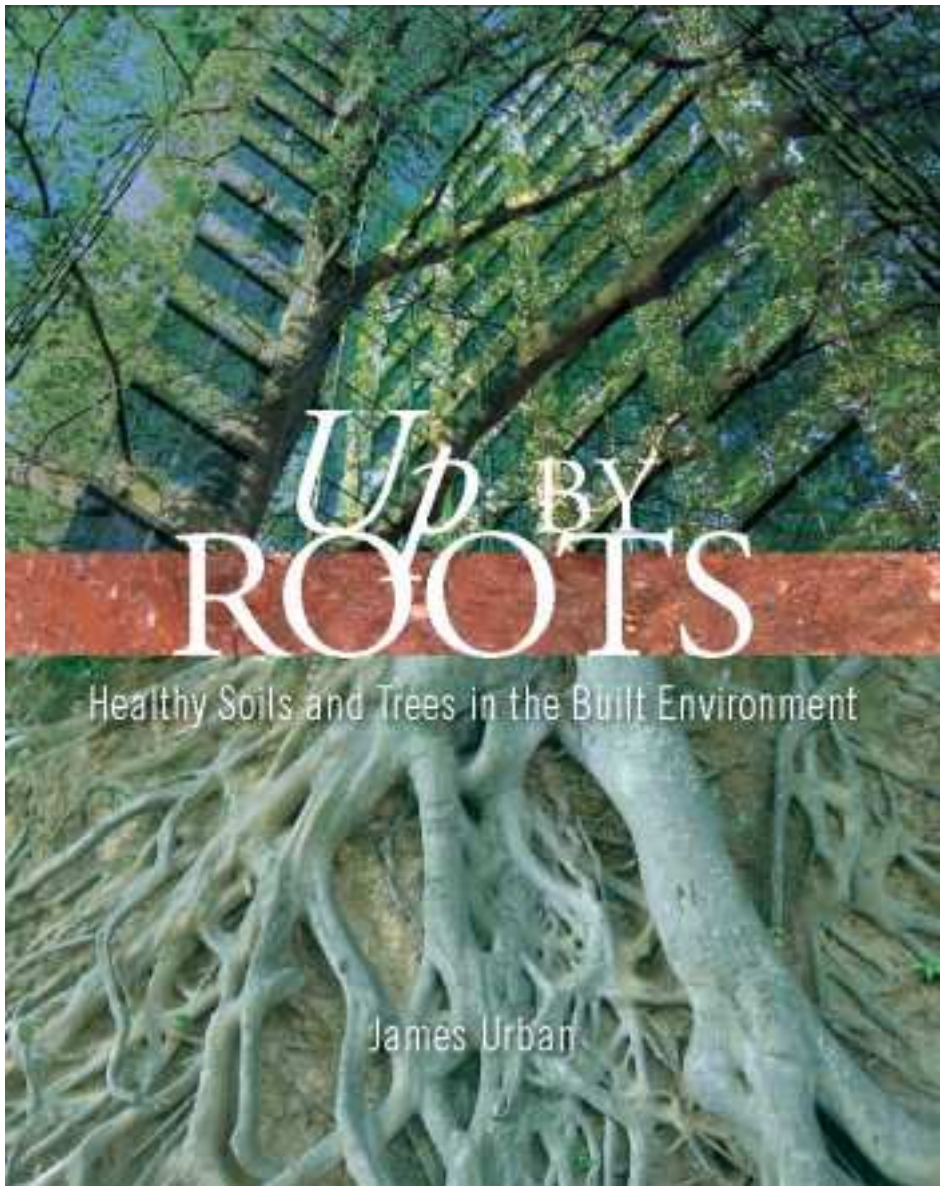
Strategy: To gain buy-in for rain gardens and permeable paving as strategies to reduce runoff and stress to the combined sewer system.

ENVIRONMENT | PERMEABILITY

Existing permeability	**2%**
Proposed permeability (planted areas, rain gardens, pervious concrete, permeable pavers)	**23%**

Proposed Permeable Materials:	**square feet**
Pervious concrete	13,516
Softscape (planted areas and rain gardens)	23,112
Permeable pavers (proposed)	13,422
Total Permeable Area:	*50,050*
Project Site Area	222,343
Total Pervious (Permeable Pavers removed from project) =	16.4%

ENVIRONMENT | TREE SOIL VOLUMES

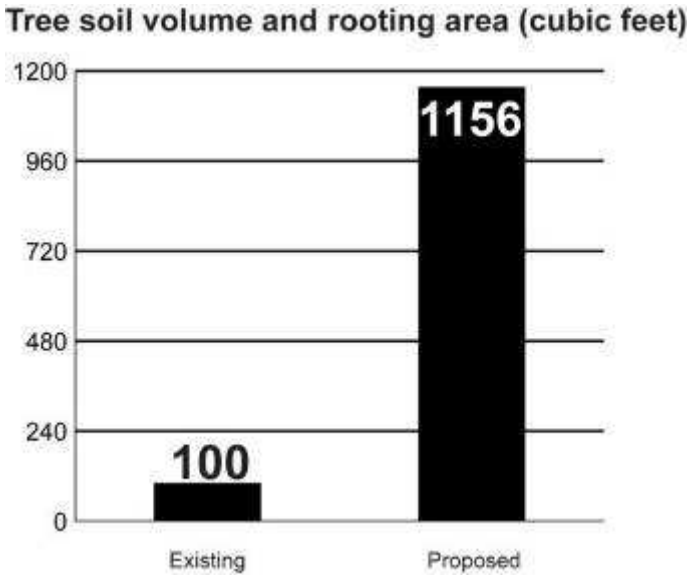


: James Urban: *Up By Roots*

ENVIRONMENT | TREE SOIL VOLUMES

Strategy: To generate support for replacing existing trees by demonstrating the poor health of existing trees due to compaction and lack of rooting area, air, soil moisture and drainage.

Evidence : By providing larger tree pits for root volume and water storage, healthy street trees will decrease the urban heat island effect, improve air quality and decrease flooding.



Target rooting area is 1,000CF - 1500CF per street tree.

The **Master Plan defines a planter area** of **1156 cubic feet (CF) per street tree**. **The existing trees currently have between 60-100 CF per tree**. Goals is to increase tree lifespan to 50 years.

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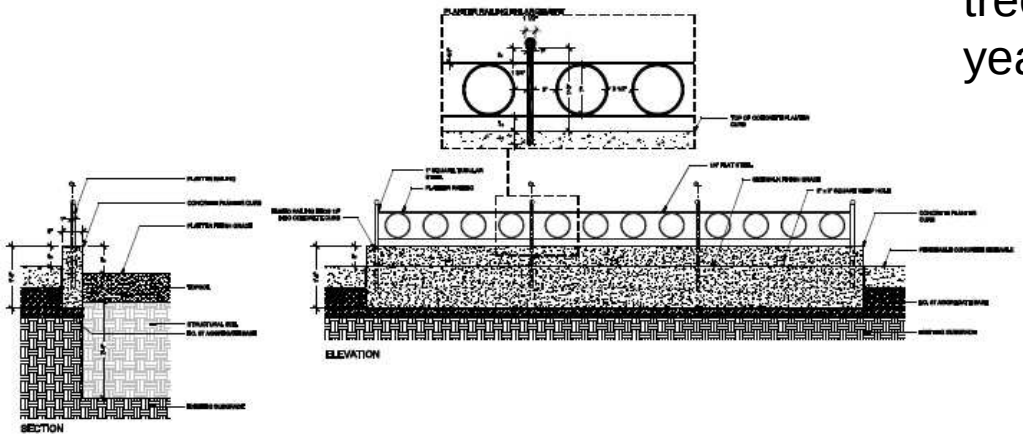
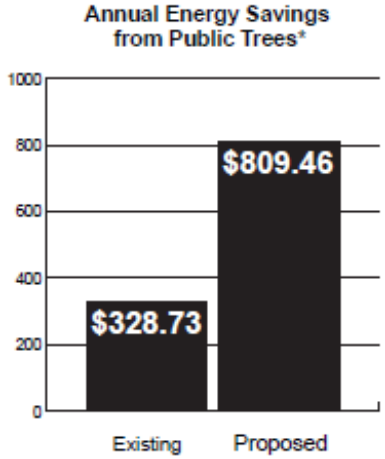
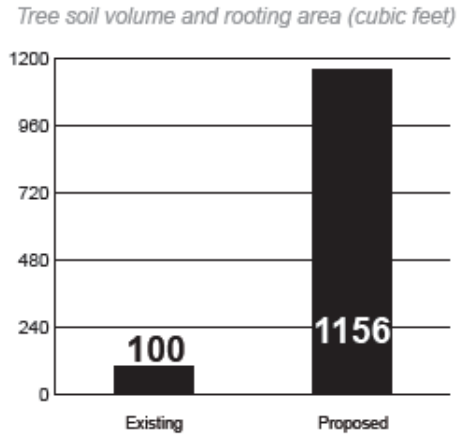
Street Trees



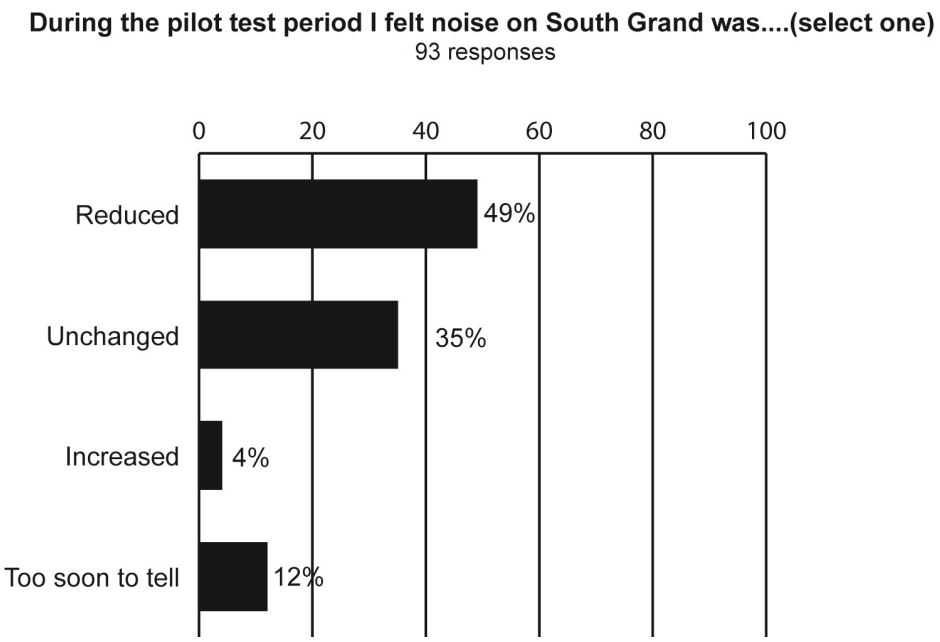




Tree wells designed to increase street tree life from average of 7 years to 50+ years

- **minimum soil volume** approx. 1000 – 1200 cubic feet
- edge treatments **discourage soil compaction** - results in healthier trees and less root heave damage
- corner trees different from mid block – **avoid monoculture**
- **species selection** informed by the 2009 Davey Resource Group "City of St. Louis, Missouri Street Tree Resource Analysis" to maximize benefit to the district.
- adjacent pervious pavement structures **increase hydration**

COMMUNITY | NOISE

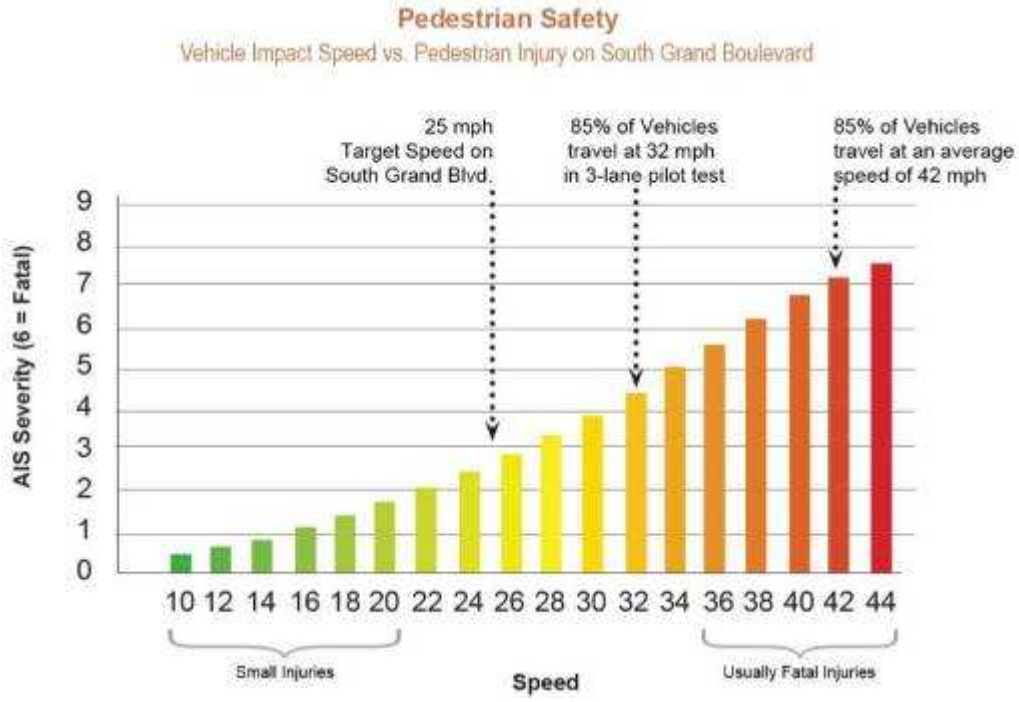


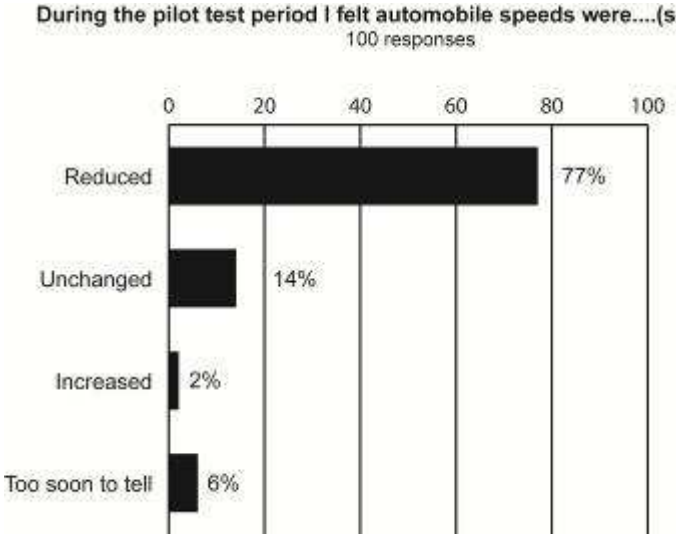
Evidence : By implementing a pilot test of the proposed lane reduction and bulb-outs, **the average peak noise levels fell by 17db, meeting the target noise level of 60db.** The street is about 1/3 as loud as it was previously, therefore providing a more comfortable shopping and dining experience.

COMMUNITY | TRAFFIC SPEEDS

Strategy: To demonstrate the danger of existing traffic speeds and build a case for a “road diet.”

Evidence : By implementing a pilot test of the proposed lane reduction, pedestrian bulb-outs, and synchronizing traffic lights, traffic speeds were reduced to the target 25mph.





In addition:

56 percent of participants felt that pedestrian safety was improved or greatly improved.

64 percent of participants felt that crossing the street by foot was easier and safer.

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1. Pervious Concrete Sidewalk
2. Seatwall Faced with Recycled Brick
3. Ornamental Planter Fence
4. Parking Lane with Pervious Paving
5. Willow Oak Street Trees
6. 3-Lane Traffic Plan
7. Rain Garden
8. Identity Banner
9. Reused Street Lamp with High Efficiency Bulb

Streetscape Rain Garden and Seating Area

Benefits

- Stormwater management
- Air Quality improvement
- Sound/noise reduction
- Safety enhancement
- Heat island mitigation

Rain Garden Project Evaluation

- Pre and Post installation – volume and pollutants measured
  - Partnership with Metropolitan St. Louis Sewer District and University of Illinois-Edwardsville
  - N,P, K, metals and E-coli
  - Pre-sampling complete May 2012
    - Four Storm drains
  - Post installation sampling in 2014

Education

- Six large signs in Rain Gardens
  - One at each intersection
- Community Improvement District Brochure
- Bio-Blitz in Tower Grove Park and environs
- Partnership with
  - South Grand Community Improvement District
  - Academy of Science
  - Missouri Department of Conservation
  - Other 319 Projects in the vicinity
    - Operation Brightside – Rain Garden & Pervious Pavement
    - City of St. Louis – Pervious Alleyways

Alley Projects

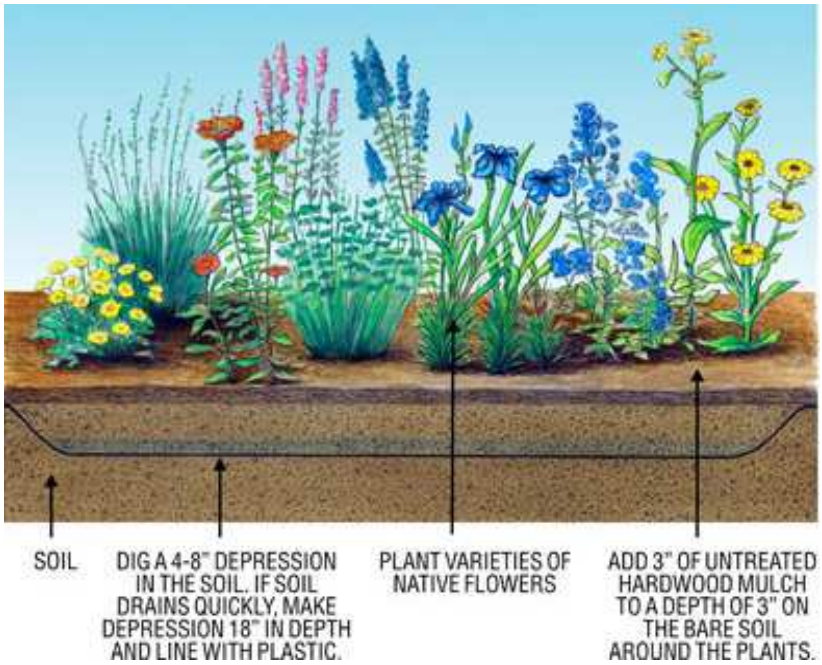
Inspire Residential Rain Gardens

- A landscaped area planted with wildflowers or native vegetation that captures stormwater from impervious surfaces.
- Rain gardens treat stormwater as a resource rather than waste p

First year

After three years

How does it work?



- A shallow depression or catchment structure.
- Filled with soil and mulch that absorb and infiltrate storm water runoff.
- Captures runoff from adjacent impervious surfaces.

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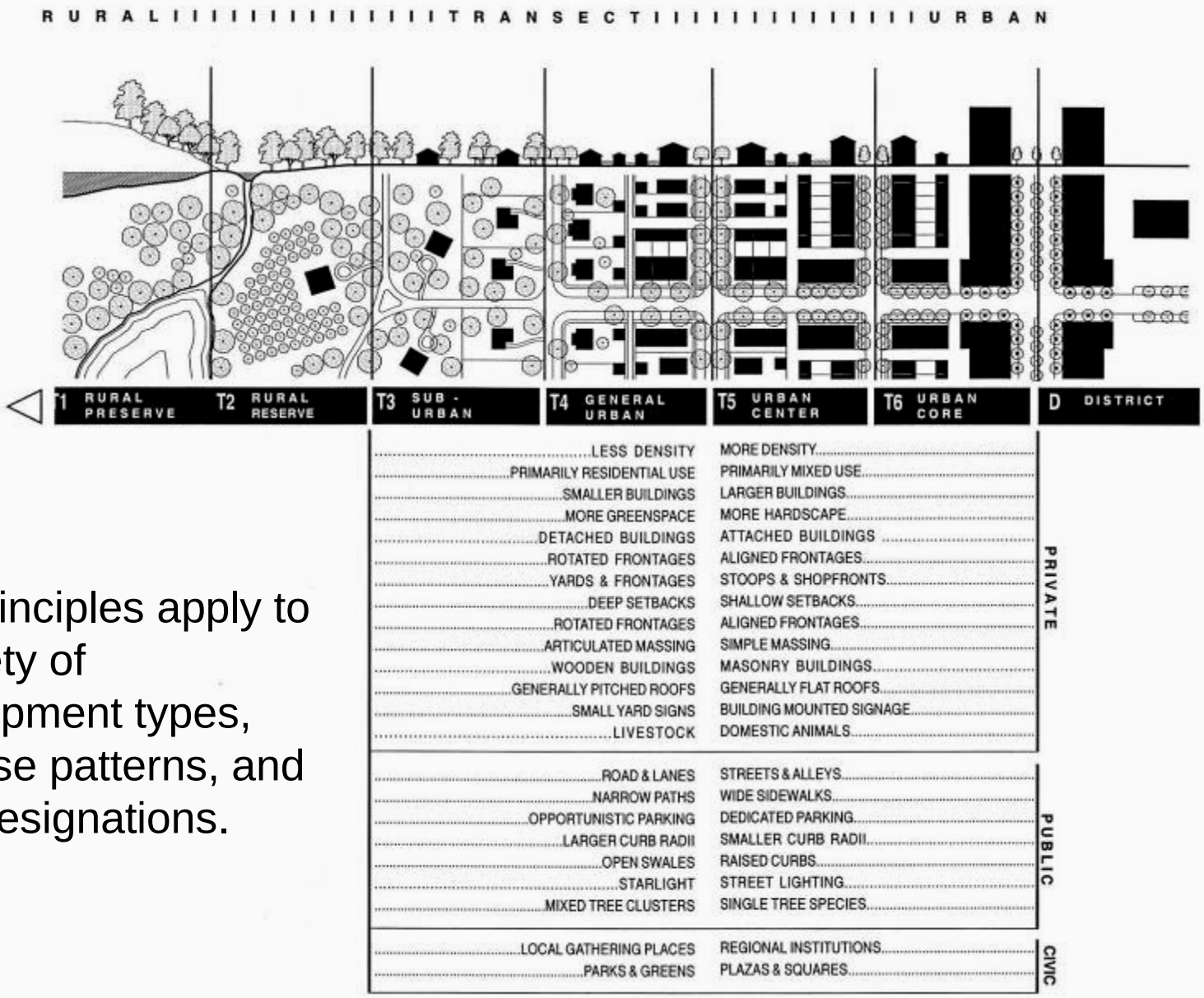

The principles apply to a variety of development types, land use patterns, and road designations.

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1. Environment Principles

- Responsible stormwater management can reduce runoff and erosion and maintain water quality.
- Reducing heat island effects and noise levels creates a more comfortable pedestrian environment.
- Mixed use districts and the availability of alternative transportation and local employment opportunities reduce traffic and air pollution.
- Utilizing efficient and/or alternative energy sources, reducing waste and promoting alternative transportation reduces the areas' energy and carbon 'footprint.'

Environment Metrics	Preliminary Goal	Baseline	Benchmark	SMART GOAL	Strategies
Planting Design	Use native plant materials to reduce water usage			Minimize the use of irrigation.	1) Specify native plant materials for street trees,rain gardens and street planting areas.
	Improve the health of street trees	Existing tree pits of 4'x4' 82% of trees in Ward 8 are in good condition. 88% of trees in Ward 15 are in good condition.	Davey Resource Group	Increase soil volume to 1,000 c.f. to provide healthier street trees	1) Provide tree pits of 5.5'x 15' to increase soil area 2) Utilize structural soil, specified soil mix 3) Choose tree species with a Relative Performance Index of 1.0 or higher (Davey Resource Group: City of St. Louis Street Tree Resource Analysis)
Heat Island Effect	Protect against and reduce urban heat island	Existing temps: Grass 74.9-90 degrees, Brick 77.5-112.6, Grey Concrete 82.7-112.6, Aggregate Concrete 84.2-110.4, Painted/ Colored Concrete 85.7-116, Asphalt 88.2-122		No net increase of ambient air temperatures post development, 50 percent paved area within the ROW is porous	1) Plant trees to shade hardscapes, 2) Replace paved areas with either planted area or pervious materials, 3) Use hardscape paving materials that are high albedo.
Noise Pollution Reduction	Reduce noise levels	Existing noise levels: Bus Traffic-75-81dB, General Traffic-64-74dB, Stopped Traffic-57dB	60dB - target noise level at posted speed limit of 25 mph	Reduce impacts to 60dB or less	1) Reduce vehicular speed through lane reduction, traffic calming techniques and increasing walkability of sidewalks.
Light Pollution Reduction	Improve night sky visibility	Fluctuating light levels from very dark to extremely bright with all non-cut-off fixtures/luminaires		Minimize obtrusive light so that no light escapes above a horizontal plane	1) Provide even distribution of light along the corridor and meet city standards of 1 fc on sidewalks and 2fc at intersections, 2) Provide cut-off fixtures/luminaires to reduce light pollution
Non-motorized Alternatives	Maintain the percentage of residents within walking distance to alternative transportation	Metro ridership on South Grand - average of 334 daily boardings		Increase alternative transportation ridership.	1) Increase the number of bike racks, 2) provide shared bike lanes on South Grand to encourage more bicycle riding, 3) provide shelters at transit stops.
Stormwater Management	Contain and collect stormwater on-site and increase the quality of any runoff	Currently 99 percent impervious		50 percent porous pavement within the ROW	1) Direct stormwater to rain gardens, 2) Utilize porous pavement on 50 percent of the street cross section, 3) Maximize incorporation of planting areas and rain gardens.
Landscape Materials	Incorporate locally extracted and manufactured materials	Limestone quarried locally along Mississippi River	LEED	Average distance of materials not to exceed 500 miles	1) Incorporate locally quarried limestone, 2) Recycle materials (see waste management) for wall caps, pavers, or specialty architectural features
Waste management	Reduce the amount of landfill waste generated by construction	Existing concrete, curbing, asphalt, brick and subbases can be recycled for re-use	LEED	Recycle 100% of materials removed during construction	1) Recycle existing concrete, brick and asphalt. Re-use existing site furnishings, granite curbing and brick. Utilize recycled materials for sub bases and trenching fill. Chip demoed street trees and reuse for mulch.
	Support recycling programs				1) Provide recycle inserts for 50 percent of salvaged and re-used trash cans
Wildlife	Provide habitat for urban wildlife	existing % canopy cover in Ward 8 is 7.7%; existing % canopy cover in Ward 15 is 8.9%. Bio Blitz Data	Davey Resource Group: American Forests (2002) suggests canopy cover in a business district should be 15% of total land area.	Increase tree canopy to 15% Increase urban wildlife habitat	1) Provide healthy and adequately-spaced street trees with ample (1,000 SF min.) planting pits, 2) Encourage green roofs in new development, 3) Provide plantings and rain gardens with plants that provide for the needs of birds, insects, etc. 3) Increase the amount of tree canopy on the street.
Energy and Carbon	Minimize energy use	Total annual benefit of existing honey locust trees = $2,451	Davey Resource Group	Increase the total annual benefit of street trees by 35$ ($7,034 annually)	1) Provide efficient street lighting, 2) Utilize materials with a long life cycle, 3) Promote solar as an energy source, 4) Promote alternative transportation options, 5) Ensure proper synchronization of traffic lights
Air Quality	Improve air quality	Current Emissions: HC Emissions: 112 (g), CO Emissions: 3,050 (g), NOx Emissions: 364 (g)		Reduce Emissions: HC Emissions: at least 50% CO Emissions: at least 50% NOx Emissions: at least 50%	1) Reduce heat island effect, 2) Use low-volatile paints, 2) Run Synchro and Sim Traffic Emissions analysis, 3) Ensure proper synchronization of traffic lights

Environmental Matrix

(by Design Workshop)

Need for Public Education

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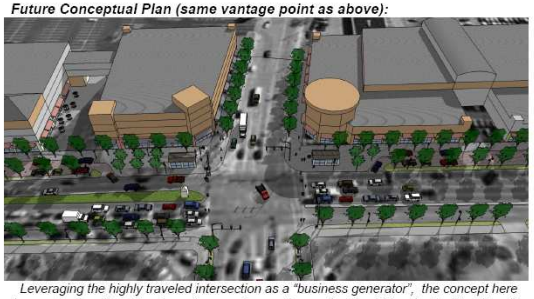
Manchester

"Pulse Node" at Clarkson and Manchester

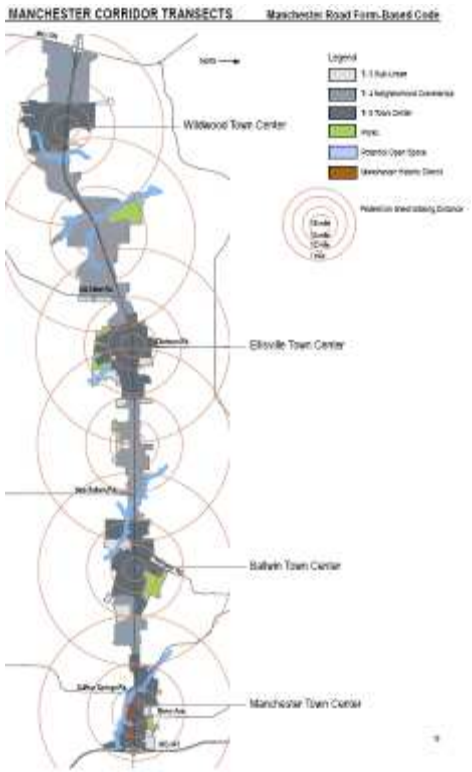
Existing Condition Today (looking south from Clarkson Road):

Massive parking lots and auto-oriented development dominate the existing intersection of Manchester and Clarkson. particularly on the south side of the node.

Future Conceptual Plan (same vantage point as above):



Leveraging the highly traveled intersection as a "business generator", the concept here shows a half multi-way boulevard conversion on the south side of Manchester Road to allow patrons to easily access the hot new businesses via the access and parking lane separated from the through traffic by a median and street trees. Future development would be primarily commercial/retail around the node itself, with mixed residential and office on the edges.



Questions?

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Project partners include:
City of St. Louis, South Grand Community Improvement District, Academy of Science of St. Louis, Metropolitan St. Louis Sewer District, Missouri Department of Conservation, Southern Illinois University-Edwardsville

The U.S. Environmental Protection Agency Region 7, through the Missouri Department of Natural Resources, has provided partial funding for this project under Section 319 of the Clean Water Act.

MISSOURI DEPARTMENT OF NATURAL RESOURCES

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