LANDSCAPE PERFORMANCE SERIES
presented by the Landscape Architecture Foundation

2015 LAF CSI Program Landscape Performance Series: The Bagby Street Reconstruction, Houston, TX

Research Title: The University of Texas at Austin Case Study Investigation 2015: The Bagby Street Reconstruction in Midtown Houston, TX

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Sponsor/Research Partner: Landscape Architecture Foundation

This Methods Document accompanies a *Landscape Performance Series* Case Study Brief. It was produced through the 2015 Landscape Architecture Foundation's *Case Study Investigation* (CSI) program, a unique research collaboration that matches LAF-funded faculty-student research teams with leading practitioners to document the benefits of exemplary high-performing landscape projects.

The full case study can be found at:
https://landscapeperformance.org/case-study-briefs/bagby-street-reconstruction

Figure 1: Bagby Street Reconstruction Site Plan by Design Workshop

Landscape Performance Benefits

<u>Environmental Benefits</u>

> ***Captures and treats 100% of a 2-year storm, up to 437,600 gallons, in rain gardens.***

Background
Before the Bagby reconstruction project, the drainage system consisted of a curb and gutter system. Water drained into the Smith-Crosby Drainage system and eventually to the Buffalo Bayou. According to the PATE Engineer study, the drainage system in this area was installed in the early 1900s and is inadequate for the current level of development. There was an unacceptable level of ponding in the area which did not meet the current City of Houston design standards (Bagby Stormwater Management Report).

Methods
Data and Calculations are sourced from the Midtown Bagby Street Reconstruction Stormwater Management Report prepared by the engineering group Walter P. Moore & Associates.

Data

- Rain gardens designed to treat a 2-year storm event from the 4.7-acre watershed.
- 2-year storm = 437,000 gallons

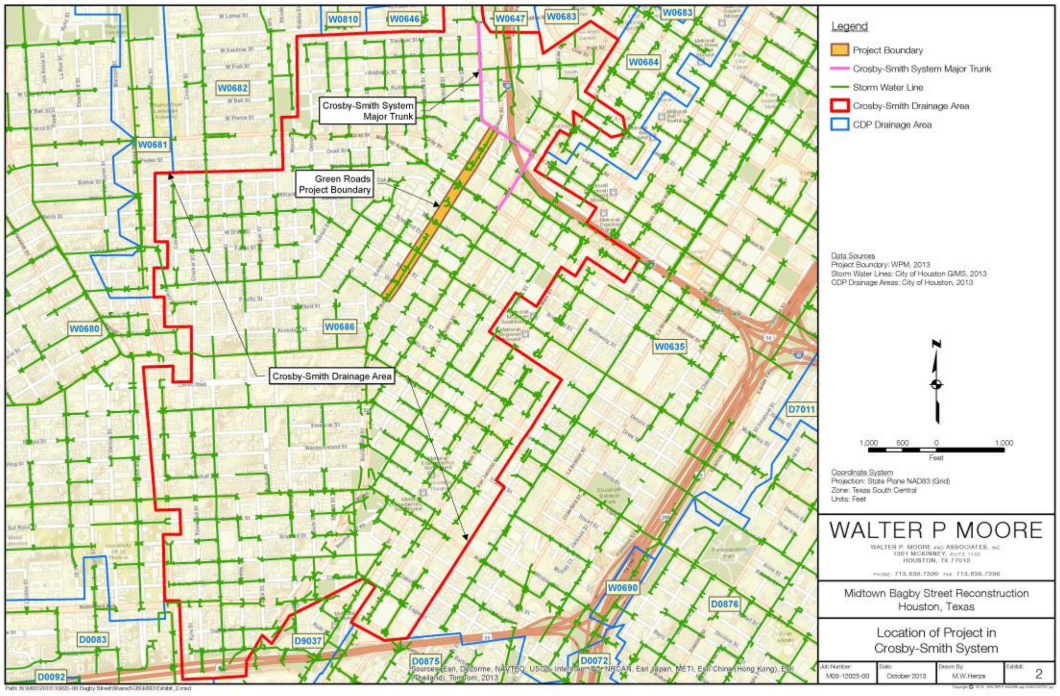

Figure 2: Bagby Street Drainage Map from "Midtown Bagby Street Reconstruction Stormwater Management Report," Walter P. Moore

Rain garden volume

Station	Length (ft)	Width (ft)	Depth (ft)	Volume(cf)
4+40, RT	57	9	2	1,026
6+18, RT	86	9	2	1,548
6+65, RT	43	9	2	774
8+50, RT	59	9	2	1,062
9+67, LT	138	7	2	1,932
21+08, LT	160	9	2	2,880
23+20, LT (1)	89	5	2	890
23+20, LT (2)	7	9.25	2	30
23+20, LT (3)	8	13.5	2	216
23+25, RT	74	8	2	1,184
24+90, RT	43	8	2	688
29+63, RT	98	11.5	2	2,254
TOTAL				**14,584**

Limitations

The Rational Method assumes that there is uniform sheet flow across similar surface materials with the same slope. It also does not account for changes in storm patterns but instead accepts uniform rain intensity for the entire site (up to 200 acres).

References

- Strom, Steven, Kurt Nathan, and Jake Woland. *Site Engineering for Landscape Architects*. 6th ed. Hoboken, NJ: John Wiley & Sons, 2013. Print.
- Walter P. Moore and Associates, Inc. (2013). Midtown Bagby Street Reconstruction Stormwater Management Report. Presented in support of Greenroads Certification. October 2013.

Removes 85% of suspended solids, 75% of bacteria, 73% of phosphorous, and 93% of oil and grease from 437,700 gallons of stormwater treated by the rain gardens.

Background

Sheet flow from the street runs into the rain gardens from curb cuts along the parallel parking areas. The water collects in the depressed rain garden and is slowed by vegetation. As the water slowly soaks into the soil, suspended solids are filtered out by plants and engineered soils. At the end of the each rain garden water is filtered through engineered soil media.

Methods

Levels of pollutants removed are estimates provided by Constructions EcoServices.
Suspended Solids: 85% removal
Bacteria: 75% removal
Phosphorous 73% removal
Oil and grease 93% removal

Data

Infiltration Water Quality Calculations

Block to Block	Side of Street	Media Depth (m)	Media width (m)	Media Surface Area (m^2)	Drainage Area (Hec)	Volume Treated (m^3)
Drew to Tuam	East	2.7	4.0	10.9	0.109	94.8
Dennis to Drew	East	2.7	4.3	11.7	0.210	182.5
Dennis to Drew	East	2.7	3.0	8.4	0.113	98.3
McGowen to Dennis	East	2.7	4.6	12.5	0.417	361.5
McGowen to Dennis	West	2.1	4.6	9.8	0.243	210.6
Webster to Hadley	West	2.7	2.4	6.7	0.388	336.9
Gray to Webster	West	1.5	4.0	6.0	0.202	175.5
Gray to Webster	East	2.4	4.6	11.1	0.053	45.6
Gray to Webster	East	2.4	3.4	8.2	0.045	38.6
St. Joseph to Pierce	East	3.5	3.4	11.8	0.129	112.3
				TOTAL	1.910	1,657

Calculations from “Bagby Street Reconstruction. How Low Impact Development Can be Integrated into Vibrant Urban Environment,” Andres A. Salazar, Ph.D., P.E.

1 m3 = 264.17 gallons

1,657 m3 x 264.17 = 437,729.69 gallons

Focal Point Water Quality Calculations

Block to Block	Side of Street	Focal Point Depth (FT)	Focal Point Width (FT)	Focal Point Surface Area (SF)	Drainage Area (AC)	Volume Treated (CF)	Volume Treated (Gal)
Drew to Tuam	East	9	13	117	0.27	3,347	25,036
Dennis to Drew	East	9	14	126	0.52	6,446	48,216
Dennis to Drew	East	9	10	90	0.28	3,471	25,963
McGowen to Dennis	East	9	15	135	1.03	12,767	95,497
McGowen to Dennis	West	7	15	105	0.6	7,437	55,629
Webster to Hadley	West	9	8	72	0.96	11,900	89,012
Gray to Webster	West	5	13	65	0.5	6,198	43,361
Gray to Webster	East	8	15	120	0.13	1,611	12,050
Gray to Webster	East	8	11	88	0.11	1,364	10,203
St. Joseph to Pierce	East	11.5	11	126.5	0.03	3,967	29,673
				TOTAL	4.72		437,640

Calculations from “Midtown Bagby Street Stormwater Management Report” Walter P. Moore Engineers

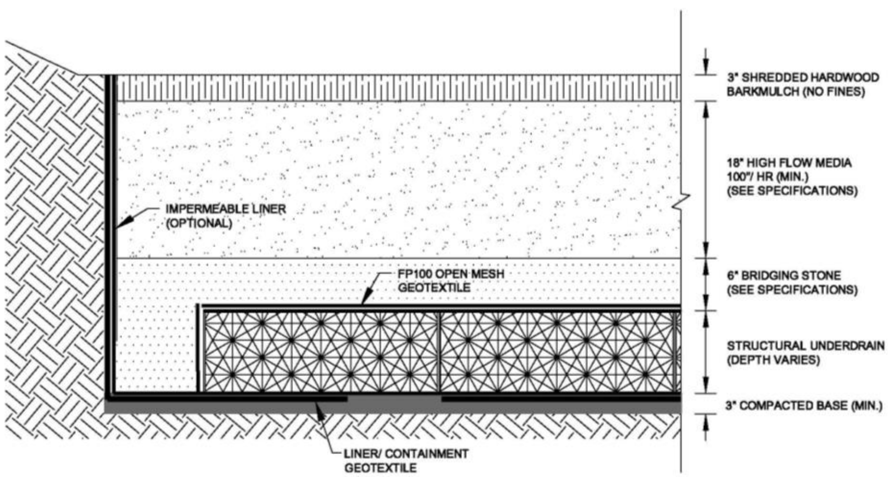

Figure 3: Typical engineered soil cross section (FocalPoint, distributed by Construction EcoServices)

Limitations

The levels of pollutants removed are an estimate for this project. These values were collected from testing on another project outfitted with the same filtering material and similar stormwater management circumstance.

References

- Salazar, Andrés A., Ph.D. P.E. Bagby Street Reconstruction. *How Low Impact Development Can Be Integrated into a Vibrant Urban Environment*. Walter P. Moore and Associates, Inc., Houston, Texas., n.d. Web.
- Walter P. Moore and Associates, Inc. (2013). Midtown Bagby Street Reconstruction Stormwater Management Report. Presented in support of Greenroads Certification. October 2013.

Reduces pavement temperatures by an average of 21.6 °F on a June day as a result of street tree shading, which is projected to cover 70% of the street.

Background

In Houston, TX, creating a walkable street means providing shade for people to walk under, especially in the summer months. It was important to the designers to cultivate a climatically comfortable environment for visitors to spend time outside.

Methods

Surface temperatures were taken along the corridor in areas of shade and sun using a thermal gun. Additional infrared photographs were shot of the same transects to provide a visual representation of the heat differences.

Tree shade area calculations were conducted by Design Workshop. The calculations are projections based on expected size of all new trees combined with shade from existing trees.

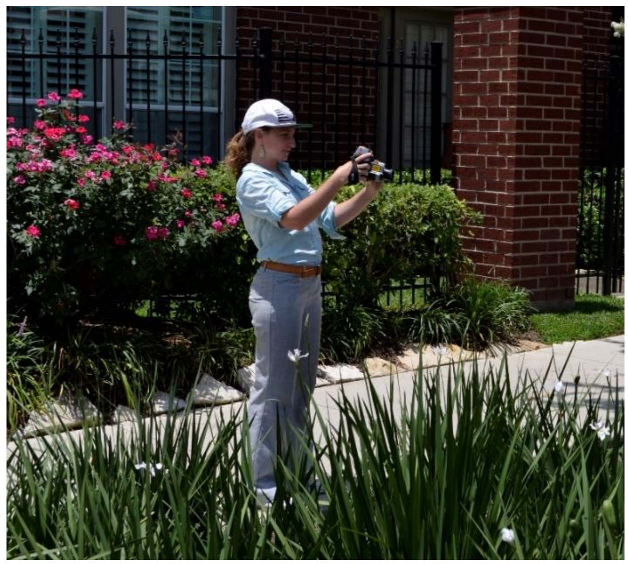

Figure 4: Research Assistant taking an infrared photo on June 25, 2015

Data

Location	Ambient Tempurature	Pavement SHADE	Pavement SUN	Vegetation SHADE	Vegetation SUN	Asphault SUN	Asphault SHADE	Bench SUN	Bench SHADE
Between Mcilhenny St and Bremond St.	98.2	96.2		91.9	103.8				
Between Hadley St and McIlheniny St (1)	98.4		121.2	93.3	121.8				
Between Hadley St and McIlheniny St (2)	98.4	93.2		102		132.4	104.5		
Between Hadley St and McIlheniny St (3)	98.4		123.9	107					
Between Hadley and Webster (1)	96.2	104.3	136.7			131		97.7	
Between Webster and Gary (1)	93	106	127	97					
Between Webster and Gary (2)	88.3	105	125.4						

Average difference between surface temperature in sun and shade: **21.56 °F**

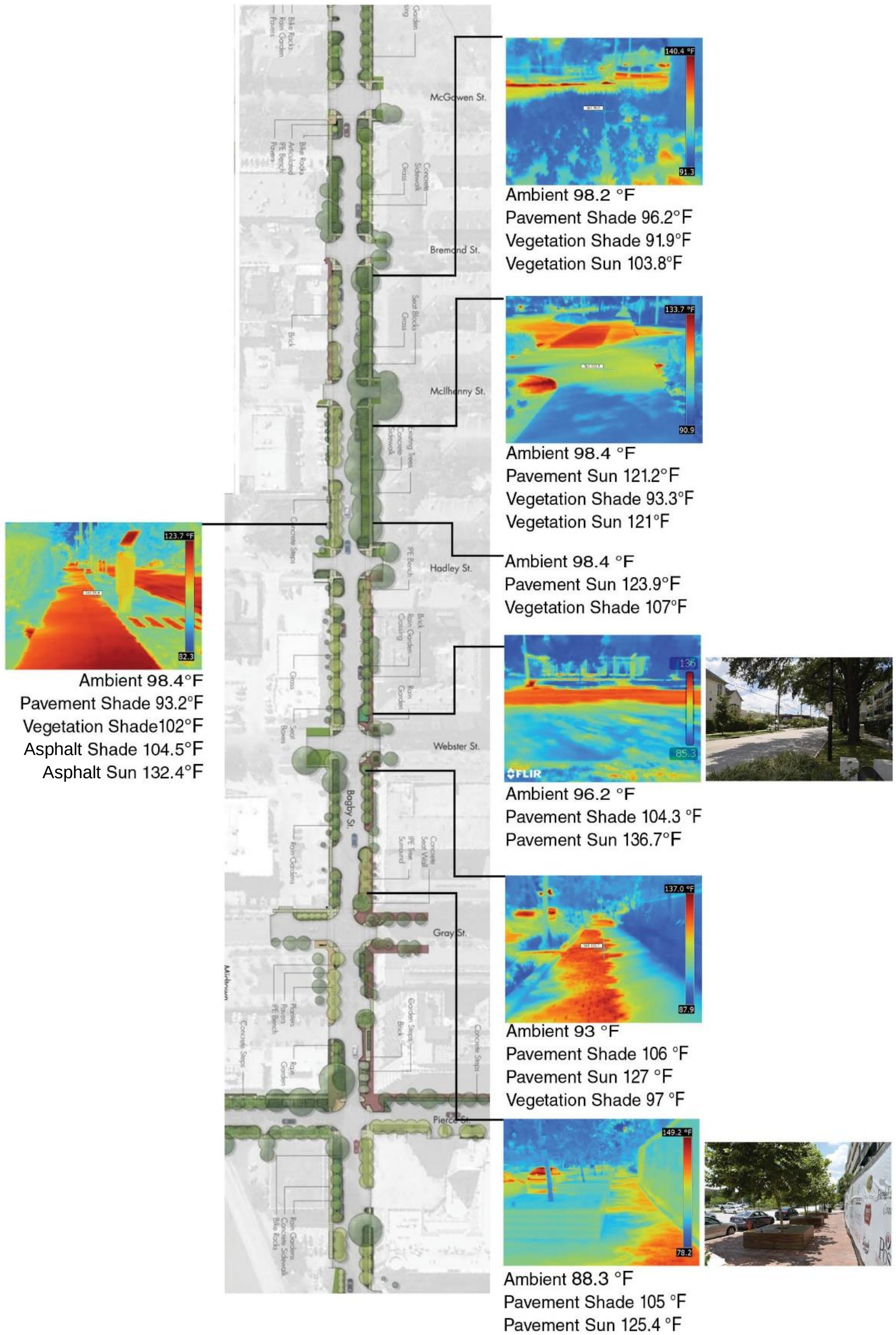

Figure 5: Thermal study conducted on June 6, 2015

Limitations
The thermal testing was only conducted one day in the summer. Shade calculations are based on projected tree sizes. This does not account for possible tree fatalities or poor growth.

References

- Thermal Study conducted on June 6, 2015

Avoided 300 tons of carbon emissions by sourcing concrete made with 25% fly ash.

Background
The world's cement production accounts for 7% of the global carbon load. This number is expected to grow exponentially in the next 50 years as concrete construction becomes commonly used worldwide.

Fly ash is a byproduct of burning coal. It is included in cement to substitute some of the required Portland cement which is very energy intensive to produce. It requires 1 ton of carbon to create 1 ton of Portland cement. Fly ash is a recycled material and therefore does not require any energy to produce. By incorporating fly ash into the concrete mix, concrete production uses less energy and concrete is made stronger and lasts longer than without fly ash.

EPA: Components of the Fly Ash Recycling Emission Factor ($MTCO_2E$/Short Ton)

Material/Product (a)	Process Energy (b)	Transportation Energy (c)	Process Non-Energy (d)	Net Emissions (e) (e = b + c +d)
Cement (Virgin Production)	0.42	0.01	0.45	0.88
Fly Ash	-	0.01	-	0.01

EPA: Difference in Emissions between Virgin Cement Production and recycled Fly Ash Used ($MTCO_2E$/Short Ton)

	Virgin Cement Production ($MTCO_2E$/Short Ton)			Recycled Fly Ash Use ($MTCO_2E$/Short Ton)			Difference Between Virgin Cement Production and Recycled Fly Ash Use ($MTCO_2E$/Short Ton)		
Material/ Product	Process Energy	Transpor-tation Energy	Process Non-Energy	Process Energy	Transpor-tation Energy	Process Non-Energy	Process Energy	Transpor-tation Energy	Process Non-Energy
Fly Ash/ Cement	0.42	0.01	0.45	–	0.01	–	-0.42	–	-0.45

– = Zero emissions.

Methods
Design Workshop did the calculations for this benefit but unfortunately do not have records of their methods.

Data
25% Fly ash content concrete
300 tons of carbon reduced compared to standard concrete without fly ash

Limitations
Without the original data source analysis on the particular amount of carbon saved on this project is not possible. Research shows that the use of fly ash in concrete does provide significant carbon reduction in concrete production.

References

- Data source, Design Workshop 2015
- EPA. (2003). *Background Document for Lif-Cycle Greenhouse Gas Emission Factors for Fly Ash Used as a Cement Replacement in Concrete.* Washington, DC: U.S. Environmental Protection Agency, November 7, 2003
- http://epa.gov/climatechange/wycd/waste/downloads/fly-ash-chapter10-28-10.pdf
- Lohita, R C, Joshi R P. "Fly Ash in Concrete: Production, Properties and Uses." *Fuel and Energy Abstract*s 39.1 (1998): 26. Web. 01 Aug. 2015.
- Mehta, P. Kumar. "Reducing the Environmental Impact of Concrete." *Concrete International* (2011): 61-66. Web. 01 Aug. 2015.

Sequesters 7,872 lbs of atmospheric carbon and intercepts 38,564 gallons of stormwater annually in 175 newly-planted trees.

Background
The Bagby Street Reconstruction protected many live oak trees which would have been removed under the original stormwater management plan. In addition to protecting many existing tress, the planting plan adds 175 new trees to the street. The trees added are all native or climate appropriate.

Methods
The online *National Tree Benefit Calculator* was used to generate carbon sequestration and stormwater reduction numbers associated with averages in Houston, TX. Only new trees were included in the calculation. Tree calipers are an estimate based on the gallon size container of the tree at time of planting.

Data

Actual Tree Species	Caliper	quantitiy	Gallon container	Carbon Sequestration for one tree (pounds/year)	Carbon Sequestration of specie (pounds/year)	Stormwater reduction for one tree (gallons/year)	Stormwater reduction of specie (gallons/year)	
White Orchid Tree	2	4	30	12	48	96	384	
Vitex	2	5	30	12	60	96	480	
Chinese Pistache	2	9	30	20	180	79	711	
Montezuma Cypress	2	49	30	11	539	53	2597	
Mexican Sycamore	4	27	65	59	1593	339	9153	
Mexican Oak	4	46	65	56	2576	264	12144	
Live Oak	4	18	65	105	1890	481	8658	
River Birch	4	17	65	58	986	261	4437	
		175			**7,872**	**pounds**	**38,564**	**gallons**

Limitations

The *National Tree Benefits Calculator* results are an approximation. Though it is necessary to include location of the site and the tree sizes, there are many variables not included such as shade, tree health, and nutrient availability of soils. The calculator tool only includes common tree species. Some of the trees found at Bagby Street were not listed on the website. With recommendations from the University of Texas at Austin Facilities Department landscape architect and arborist, the following substitutions were made.

Actual Tree	**Substitution**
White Orchid Tree	Other broad leaf deciduous
Vitex	Chaste Tree
Montezuma Cypress	Bald Cypress
Mexican Sycamore	American Sycamore
Mexican Oak	White Oak

References

- "National Tree Benefit Calculator." National Tree Benefit Calculator. Casey Trees and Davey Tree Expert Co., n.d. Web. 02 July 2015.
- "What Is i-Tree?" i-Tree. Forest Service, Davey Tree Expert Company, National Arbor Day Foundation, Society of Municipal Arborists, International Society of Arboriculture, and Casey Trees, n.d. Web. 02 July 2015.

Social Benefits

Better accommodates pedestrian needs according to 83% of 345 surveyed visitors. Improves pedestrian safety for 80% of 480 surveyed visitors compared to the street before reconstruction.

Background

Design Workshop conducted a post-occupancy study to analyze the public's opinion on the Bagby Street Reconstruction project and to receive public opinion for the firm's next project on neighboring Brazos Street.

Methods

The surveys were dispersed by the Midtown Redevelopment Authority to its entire email list serve. Of the 593 people who answered the question "My connection to Midtown is…" the responses were:

Live in Midtown: 61.38% (364 people)
Work in Midtown: 19.22% (114 people)
Own a home in Midtown: 29.34% (174 people)
Own a business in Midtown: 7.42% (44 people)
Commute through Midtown: 33.39% (198 people)
Attend events in Midtown: 55.65% (330 people)
Volunteer with or represent a community organization in Midtown: 5.56% (33 people)

Data

Question 4:
"After improvements, does Bagby Street better accommodate your pedestrian needs?"
Answers:
Yes: 82.61% (285 people)
Somewhat: 12.75% (44 people)
No: 4.46% (16 people)

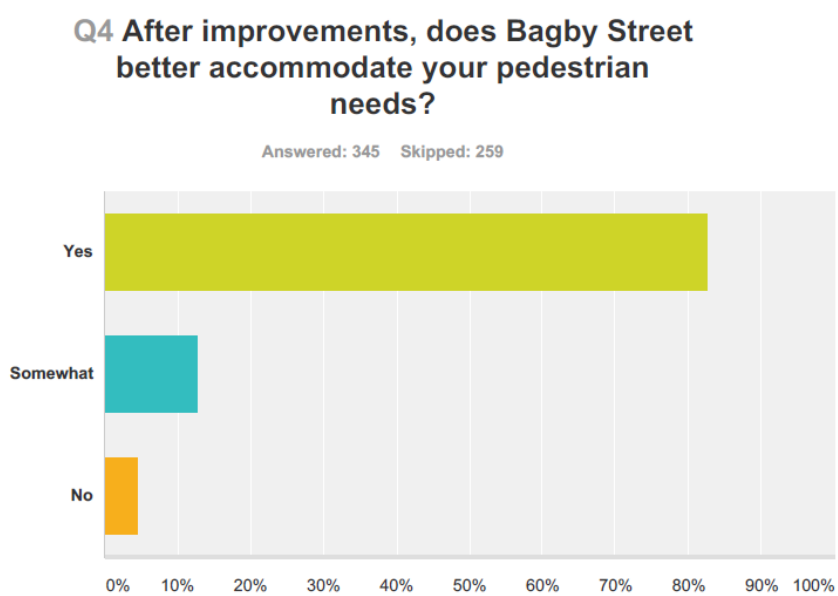

Figure 6: Graph from Design Workshop's Post-Occupancy Study

Question 6:
"To what level, in your opinion, have the improvements changed your perception of pedestrian safety on Bagby Street?"
Answers:
Significantly decreased: 1.88% (9 people)
Moderately decreased: 1.88% (9 people)
Slightly decreased: 3.75% (18 people)
Stayed the same: 12.71% (61 people)
Slightly increased: 18.33% (88 people)
Moderately increased: 31.67% (152 people)
Significantly increased: 29.79% (143 people)

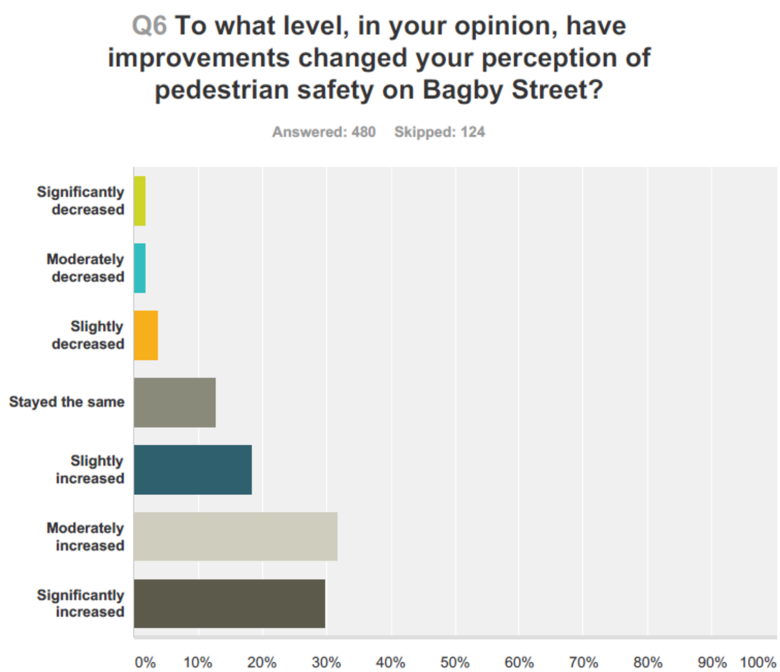

Figure 7: Graph from Design Workshop's Post Occupancy Study

Limitations

The survey may not reflect all the stakeholders of Bagby Street or the casual visitor of the street.

References

- "Post Occupancy Report" from Design Workshop

Economic Benefits

Stimulated a $53 million or 26% increase in the property values of surrounding buildings between 2013 and 2015.

Background

The goal of the client, The Midtown Redevelopment Authority, was that the Bagby Street Reconstruction would grow the tax base of the district. The client views the project as successful and believes there is a direct correlation between the recent economic growth of the district and the street improvements.

Methods

Property tax data from the Bagby Street corridor was analyzed from 2012 to 2015. Dollar amounts are adjusted for inflation using the United States Department of Labor CPI Inflation Calculator.

Data

Year	Total Appraised Value	CPI inflation adjustment	Total Appraised Value (adjusted for inflation)	Annual dollar Increase	Annual percent Increase
2012	$ 183,484,219	1.0357	$ 190,034,605.62		
2013	$ 200,542,699	1.0208	$ 204,713,987.14	$ 14,679,381.52	8%
2014	$ 234,990,155	1.0045	$ 236,047,610.70	$ 31,333,623.56	15%
2015	$ 258,691,154	1	$ 258,691,154.00	$ 22,643,543.30	10%
	**** Project finished in October 2013**				
	Before Reconstruction				
	After Reconstruction				
2013	$ 204,713,987.14				
2015	$ 258,691,154.00				
	$ 53,977,166.86	increase in annual appraisal value between 2013 and 2015			

$53,977,166.86 / $204,713,987.14 = 0.2636 = 26%

Limitations

This approach does not factor in market forces on property value outside of street improvements.

References

- "Property Tax Values BAGBY CORRIDOR SUMMARY 2012 thru 2015" from Midtown Redevelopment Authority

- http://www.bls.gov/data/inflation_calculator.htm

Cost Comparison

Background

One of the primary goals of the Bagby Street Reconstruction project was to create an aesthetic to help establish a brand for all future Midtown Redevelopment projects. The designers achieved this result by incorporating artistic accents into the Bagby Street design. Custom elements such as the benches, rain garden signage, pavers, bike racks and an information kiosk were designed with the industrial history of Midtown in mind. The design of these features is now proprietary to the Midtown Redevelopment Authority.

While typical city improvement projects dedicate 1% of their construction budget to artistic elements of the project, Design Workshop and the client chose to devote 4% of the construction budget to aesthetic improvements. The additional investment was seen as an important expenditure to distinguish Bagby Street from other urban improvements and to provide Midtown with a unique look which cannot be found anywhere else in Houston.

As part of the Greenroads certification process, Design Workshop compiled the construction costs and outlined which items were “artistic, specialty, or aesthetic elements” to the receive credit AE-9. The goal of the Greenroads credit AE-9 is to “promote cultural awareness, community connectivity and art” (Greenroads Manual v1.5).

Method

Data was collected from the project’s Construction Bid Form. Only details flagged as “==”

Data

Bagby Street Budget

Percent of budget dedicated to art: **4%**

Total Construction Costs: **$9,598,220.20**
Artistic, specialty, aesthetic elements Construction Costs: **$408,291.60**

Typical City Budget (estimate for comparison)
Percent of budget dedicated to art: **1%**
Total Construction Costs: **$9,598,220.20**
Artistic, specialty, aesthetic elements Construction Costs: **$95,982.20**

Construction Cost of Aesthetic Elements- Bagby Street's bid form

Detail	Unit of Measure	Estimated Quantity	Unit Price	Total in Figures	Comments
PAVER TYPE 1- BANDED PATTERN	SF	450	$12.60	$5,670.00	Custom paving
PAVER TYPE 7- SQUARE PATTERN	SF	768	$12.70	$9,753.60	Custom paving
PAVER TYPE 8- LINEAR PATTERN	SF	465	$12.70	$5,905.50	Custom paving
CONCRETE PADS (1' X 4')	EA	208	$66.00	$13,728.00	Custom concrete stepping stones
CONCRETE PADS (1' X 8')	EA	6	$167.00	$1,002.00	Custom concrete stepping stones
CONCRETE PADS ON SLOPE	EA	109	$127.50	$13,897.50	Custom concrete stepping stones
GARDEN STEPS	EA	3	$800.00	$2,400.00	Custom concrete steps through garden
CONCRETE LANDINGS WITH SEAT BOXES	EA	6	$700.00	$4,200.00	Custom concrete stepping stones with cast in place concrete seat blocks
THEMATIC CONCRETE WALLS	LF	176	$221.00	$38,896.00	Custom curvilinear cast in place concrete seat wall with rub finish, recessed lighting
CIP PLATFORM AT KIOSK	EA	1	$6,100.00	$6,100.00	Custom cast in place concrete base for kiosk
CIP SEAT BLOCK	EA	15	$185.00	$2,775.00	Custom cast in place concrete seat blocks (set of 3) with rub finish and recessed LED lighting
CIP SEAT BLOCK, SIMILAR TO 4.3 (SINGLE BLOCK)	EA	2	$1,000.00	$2,000.00	Custom cast in place concrete seat block (single) with rub finish and recessed LED lighting
RAIN GARDEN SEAT WALL	EA	4	$4,000.00	$16,000.00	Custom cast in place seat wall with rub finish and artistic form liner patterning, ipe slat top and recessed LED lighting,
CIP CONCRETE WALL	LF	66	$1,100.00	$72,600.00	Custom cast in place concrete seat wall with rub finish
BENCH TYPE 1 - 8' IPE	EA	4	$3,950.00	$15,800.00	Custom cast in place concrete bench with rub finish and ipe slat top and recessed LED lighting
BENCH TYPE 2 - 12' IPE	EA	3	$3,900.00	$11,700.00	Custom cast in place concrete bench with rub finish and ipe slat top and recessed LED lighting
BENCH TYPE 3 - ARTICULATED IPE	EA	2	$5,700.00	$11,400.00	Custom "L" shaped cast in place concrete bench with rub finish and ipe slat top and recessed LED lighting
IPE TREE SURROUND	EA	5	$3,260.00	$16,300.00	Custom ipe tree surround with seating area and interior LED lighting
CUSTOM BOLLARD	EA	11	$2,700.00	$29,700.00	Custom steel bollards
RAIN GARDEN CROSSING	EA	12	$2,700.00	$32,400.00	Custom welded steel grating with lighting below walking surface
RAIN GARDEN PLATFORM	EA	2	$6,300.00	$12,600.00	Custom welded steel grating with lighting below walking surface
SIGN TYPE A- INFORMATION KIOSK	EA	1	$16,000.00	$16,000.00	See signage package
SIGN TYPE AA- MIDTOWN LOGO SANDBLASTED	EA	1	$2,000.00	$2,000.00	See signage package
SIGN TYPE B- WAYFINDING	EA	4	$5,700.00	$22,800.00	See signage package
SIGN TYPE E- RAIN GARDEN INTERPRETIVE	EA	11	$1,000.00	$11,000.00	See signage package
SIGN TYPE F- DISTRICT BANNERS	EA	71	$384.00	$27,264.00	See signage package
SIGN TYPE G- STREET NAMES SANDBLASTED	EA	4	$1,100.00	$4,400.00	See signage package

Landscape Architecture Costs: Designing Aesthetic Elements
$15,000 (or 135 hours) in preparing various concepts, studies, models, etc.
$5,250 (or 45 hours) in presenting to Midtown staff and the board of various design ideas.
$39,250 (or 430 hours) in prototyping, detailing and writing specifications for these elements
$3,000 (or 45 hours) in reviewing contractor shop drawings, responding to RFIs, providing ASIs, and providing construction observation for the specific elements listed above.
Total Billed: **$62,500**
Total Cost of additional aesthetic elements: $408,291.60 + $62,500 = **$479,791.60**

Limitations

Extrapolating the costs of a project which devotes 1% of its total construction costs to art is an estimation. The overall construction costs may decrease or solely a decrease in the percentage of total costs on aesthetic elements.

References

- Data source, Design Workshop, Construction Bid Form for Bagby Reconstruction
- Greenroads Manual v1.5, Credit AE-9

Appendix: Biomass Density Index

> ***Creates a 0.5 Biomass Density Index, increasing available habitat and supporting ecosystem services such as nutrient cycling.***

Background

Biomass density index (BDI) is a measure of vegetation development appropriate to the specific regional climate.

> "Environmental, economic, and social benefits emerge from all general characteristics of living vegetation, such as shading of structures or recreational spaces, atmospheric and building cooling, building protection from cold or otherwise damaging winds, reduced soil water evaporation (hence reducing irrigation), improved air quality (absorption of particulate PM10 and PM20 and low level ozone), noise reduction, storm run-off reduction (from improved soil permeability and vegetation canopy interception and transpiration), and improved water quality (as runoff or sub-soil recharge)." (Sites V2 Reference Guide, p.135)

Methods

The Biomass Density Index is calculated using the methods described in the Sites V2 Reference Guide.

1. Draw a map of the zones of land cover or vegetation types on site. Determine the percent of total area for each distinct zone.
2. Decide on a vegetated area or land cover zone categorized in the Sites reference book, areas should not overlap
3. Exclude areas of open water or invasive species.

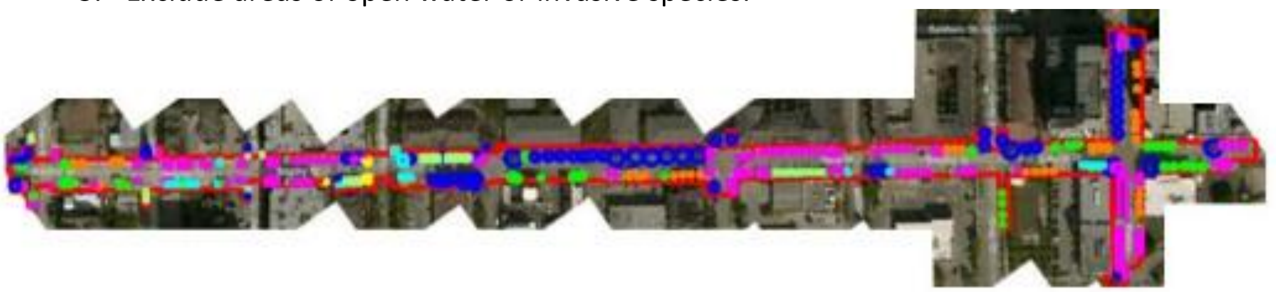

Figure 8 Bagby Street Biomass Density Index study

Data

Land cover/vegetation type zone	**Biomass density value***	**Percent of total site area**	**Biomass density value x percent total site area (column B x column C)**
A	**B**	**C**	**D**
Tree understory	6	4.2%	0.2519
Shrubs	3	5.42%	0.1626
Desert plants	1.5	0.10%	0.0015
Managed turf <3”	2	0.8%	0.0161
Unmanaged grass layer (prairie/pasture) >9”	2	0.81%	0.0161
Tree with no understory	4	1.15%	0.046
Impervious cover (includes building footprint)	0	87.52%	0
Site BDI	n/a	100%	0.494

References

- "Google Maps." Google Maps. N.p., n.d. Web. 20 June 2015.
- SITES V2 Reference Guide: For Sustainable Land Design and Development. Austin, TX: Sustainable Sites Initiative, n.d. Print. 2014
- The Bagby Street Reconstruction Project Planting Plan from Design Workshop’s Construction Documents