



Main Street Square – Rapid City, South Dakota
Methodology for Landscape Performance Benefits
South Dakota State University *Case Study Investigation* 2015

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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/main-street-square>

Environmental Benefits

Environmental Benefit 1

Manages 50% of annual rainfall on-site with rain gardens and infiltration basins.

Methodology

The EPA National Stormwater Calculator was used to analyze the amount of stormwater retained and infiltrated on site.

The following selections were made to run the analysis.

Soil Type: Option to view soil survey data was selected; Moderately Low potential

Soil Drainage: Option to view soil survey data was selected

Topography: Flat (2% Slope)

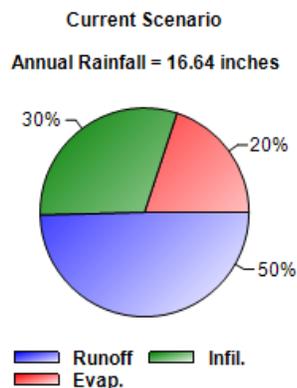
Precipitation: Rapid City WFO

Evaporation: Rapid City WFO

Climate Change: No Change; Near Term (2020-2049)

Land Cover: 20% Lawn; 80% Impervious

LID Controls: 4% Rain Gardens (10 in. Ponding Height, 18 in. Soil Media Thickness, 5% Capture Ratio); 16% Infiltration Basins (6 in. Basin Depth, 20% Capture Ratio)



Statistic	Current Scenario
Average Annual Rainfall (inches)	16.64
Average Annual Runoff (inches)	8.32
Days per Year With Rainfall	40.00
Days per Year with Runoff	23.00
Percent of Wet Days Retained	42.50
Smallest Rainfall w/ Runoff (inches)	0.22
Largest Rainfall w/o Runoff (inches)	0.22
Max. Rainfall Retained (inches)	0.54

Figure 2. 30% of stormwater infiltrates soil on site and 20% evaporates = 50% managed on-site.

Source: EPA National Stormwater Calculator

Environmental Benefit 2

Prevents 58,080 gallons of materials from entering landfills annually by providing 4 recycling bins.

Methodology

To determine the total amount of recycled material, the total amount of material collected during the tourist season and off-season was calculated.

Recycling:

- Site has 4 220-gallon containers.
- 4 containers X 220 gallons = 880 gallons of recycled material
- Tourist season (May-September) the containers are emptied twice a week.
- 22 weeks of tourist season
- 22 weeks X 880 gallons of recycled material X 2 (twice per week) = **38,720 gallons**
- October – April recycled once per week.
- 30 weeks of off-season
- 30 weeks X 880 gallons of recycled material = **19,360 gallons**

Total Recycled Material

- 38,720 gallons (tourist season) + 19,360 gallons (off-season) = **58,080 gallons per year**

Limitations of Methodology

Calculations only include the daily visitation recyclable bins. These calculations do not include the recyclables collected during special events. Calculations assume that the bins are completely full each time they are regularly emptied.

Source: Dan Seftner, Destination Rapid City

Environmental Benefit 3

Reduces ground-level air temperatures in the sun by 2°-6° F compared to a nearby parking lot which resembles the square prior to redevelopment.

Methodology

Urban heat islands can greatly affect cities due to their contribution to extreme temperatures. Urban areas tend to have a higher amount of impermeable surfaces. These exposed surfaces are the cause of the urban heat island effect. Evening temperatures in heat islands can be 22 degrees higher than the surrounding areas. This drastic difference is known to cause increased air pollution as well as heat-related illness and mortality. Through the addition of trees and a

large fescue lawn at Main Street Square, the air and surface temperature of the area are greatly reduced.

To determine the difference in air temperature of Main Street Square before and after construction, the temperature of the square was compared to the temperature of a nearby parking lot which is similar to the square's preconstruction state. Temperature readings were taken for both the square and the paved lot, at 5pm and 5:30pm on July 10, 2015. Weather conditions were sunny and breezy. A thermometer with an accuracy of $\pm 2^\circ \text{F}$ was used to take readings approximately 12 in above each surface in multiple locations. The average temperature of the square was always cooler than the average temperature of the paved parking lot.



Figure 1: Locations sampled on July 9, 2015. Source: Google Maps

- 1 – Air temperature above pavers near granite sculpture in shade (Main Street Square)
- 2 – Air temperature on bench near edge in shade (Parking lot)
- 3 – Air temperature above sidewalk in sun (Main Street Square)
- 4 - Sidewalk near parking in sun (Parking lot)
- 5 - Center of synthetic turf in sun (Main Street Square)
- 6 - Center of parking lot in sun (Parking lot)

Temperature read (°F) Thursday, 7/9/2015			
Time of Day	Main Street Square Near granite sculpture in shade	Parking Area Bench near edge in shade	Difference in temperature (°F)
5:00 PM	80	80	0
5:30 PM	80	80	0
Averages	80	80	0

Temperature read (°F) Thursday, 7/9/2015			
Time of Day	Main Street Square Sidewalk near square in sun	Parking Area Sidewalk near parking in sun	Difference in temperature (°F)
5:00 PM	80	82	2
5:30 PM	80	86	6
Averages	80	84	4

Temperature read (°F) Thursday, 7/19/2015			
Time of Day	Main Street Square Center of synthetic turf in sun	Parking Area Center of parking lot in sun	Difference in temperature (°F)
5:00 PM	86	91	5
5:30 PM	90	96	6
Averages	88	93.5	5.5

Table 1. Temperatures measured at 5:00 PM and 5:30 PM on July 9, 2015.

Limitations of Methodology

Due to the short length of time for gathering data, the temperature was only recorded on 1 day. If taken over a longer period of time it may show a more diverse comparison.

Source:

"Basic Information | Heat Island Effect | U.S. EPA." EPA. Environmental Protection Agency, n.d. Web. 08 July 2015. <<http://www.epa.gov/heatisland/about/index.htm>>.

"Heat Island Effect | U.S. EPA." EPA. Environmental Protection Agency, n.d. Web. 08 July 2015. <<http://www.epa.gov/heatisland/>>.

Social Benefits

Social Benefit 1

Attracts over 600,000 annual visitors through programs and events, including over 17,000 ice skaters in the winter and over 10,000 concertgoers every Thursday night in the summer.

Methodology

It is estimated that 500-800 people visit the site daily during the summer. These numbers are based on estimates of the amount of trash removed from the site on a daily basis. At least 1 tour bus stops at the square once per day during the summer, bringing 46 visitors. At times, there are 4 tour bus visits to the square per day. For 16 weeks during the summer, the square hosts the Summer Nights and Autumn Nights concert series, bringing 10,000 to 12,000 visitors every Thursday night. Many other events are held in the square including the Art and Wine Festival, which brings an additional 2,500 people, and the Beerfest, which attracts 3,500 visitors. During the winter, from the week before Thanksgiving to February, 17,000 ice skaters are ticketed per year. It is estimated that 2.5 additional people are with the ticketed ice skater.

Scheduled reoccurring events

Summer Nights

10,000-12,000 visitors per night (11,000 average)

May-August = 14 events

11,000 (visitor average) x 14 (events) = **154,000** visitors

Autumn Nights

10,000-12,000 visitors per night (11,000 average)

September = 2 events

11,000 (visitor average) x 2 (events) = **22,000** visitors

Movie in the Square

400 visitors per night

June-August = 12 events

400 (visitors) x 12 (events) = **4,800** visitors

Ice skating Tickets

17,000 skaters annually

2.5 average visitors with a ticketed skater

17,000 (skaters) + [17,000 (skaters) x 2.5 (average visitors with skater)] = **59,500**

visitors

Total Scheduled Reoccurring Event Visitation = 240,300 visitors

One-time events

The square hosts a variety of events year-round totaling nearly 200. The square hosts mostly public events but can be rented to host private events. Some examples of public events include: Eggstravaganza, Frühlingsfest, Kids' Carnival, Art and Wine Festival, Independence Day Celebration, Cruiser Car Show, [Love]² Bridal Fair, Rally Week in the Square, Strider World Championship, Great Downtown Pumpkin Festival, Bierbörse, Made in South Dakota, Scare in the Square, and Holiday Celebration.

Total One-Time Event Visitation = 180,750 visitors

Daily visitation

Summer

500-800 visitors per day (650 average)

May-September = 31+30+31+31+30= 153

650 (visitors) x 153 (days) = **99,450** visitors during the summer

Off-Season

375 average visitors per day

October- April = 31+30+31+31+28+31+30= 212

375 (visitors) x 212 (days) = **79,500** visitors during off-season

Total Daily visitation = 99,450 + 79,500 = **178,950** daily visitors

180,750 one-time event visitors + **240,300** reoccurring event visitors + **178,950** daily visitors = **600,000** annual visitors

Limitations of Methodology

The estimate is calculated using averages for event visitation and ticket sale numbers on ice skaters as well as wristbands handed out during events. Many of these are likely repeat visits.

Source: Dan Seftner, Destination Rapid City

Social Benefit 2

Provides opportunities for socializing according to 74% of 39 survey respondents. 80% of respondents enjoyed the overall character of the site.

Methodology

To measure the social performance benefits of Main Street Scare, the research fellow developed a voluntary, on-site survey for individuals 18 and older. The survey included Likert scale, multiple choice, and checkbox questions. The surveys were conducted on site and on social media on July 9, 2015. A total of 39 adults participated in the survey.

Survey Questions

Spending time in this place influences my satisfaction with quality of life in this city.

Strongly Agree Agree Neither Agree nor Disagree Disagree Strongly Disagree



Figure 3. 87.2% of respondents agree that spending time in this place influences their satisfaction with the quality of life in the city.

The features I enjoy most in the space are (check all that apply):

- a. Views
- b. Overall character of the place
- c. Plants, (trees, lawn, flowers)
- d. Fountain feature
- e. Fresh air, sunshine, breezes
- f. Play area
- g. Café
- h. Games and active recreation
- i. Other: _____

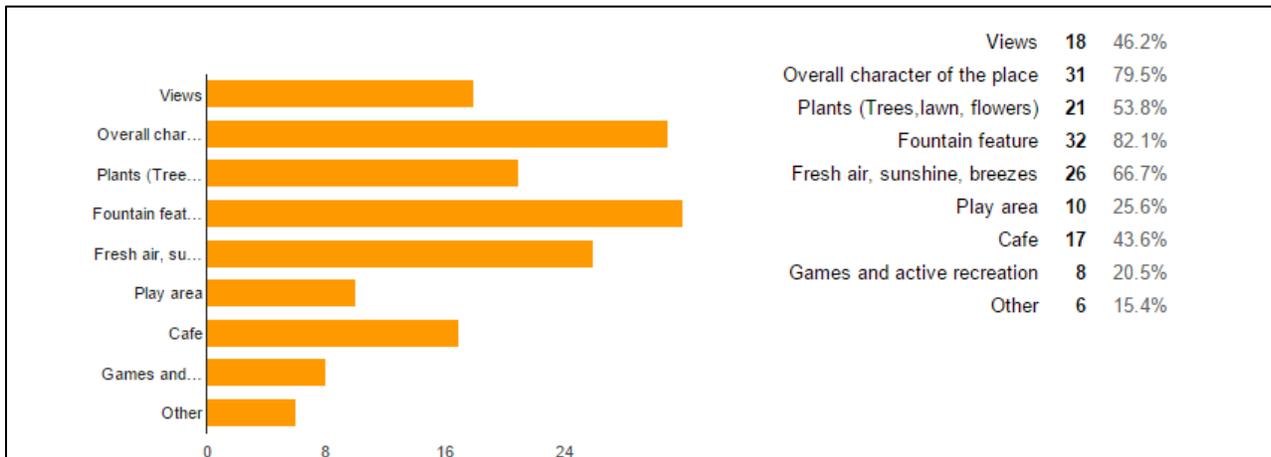


Figure 4. 82.1% enjoy the fountain feature, 79.5% enjoy the overall character of the place, and 66.7% enjoy the fresh air, sunshine, and breezes the site has to offer.

Main Street Square _____ (check all with which you agree based on your experience/use at the park).

- a. Improves my quality of life
- b. Influences my perspective of Rapid City
- c. Promotes a healthy lifestyle
- d. Provides a safe and secure environment
- e. Increases my outdoor activity
- f. Enhances my understanding of the site’s cultural history
- g. Promotes art
- h. Promotes schedules outdoor events

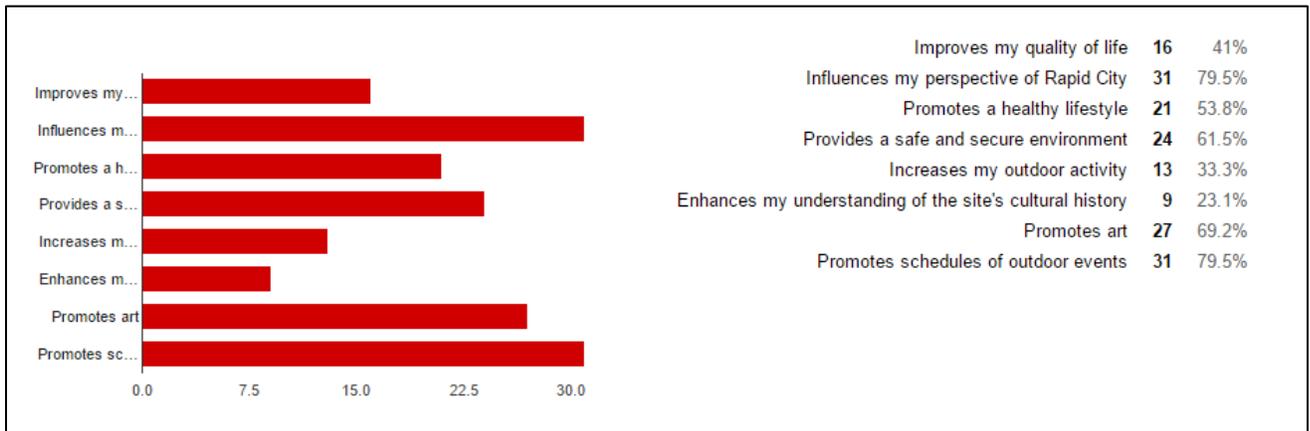


Figure 5. 79.5% responded that Main Street Square promotes outdoor events as well as influences their perspective of Rapid City.

Spending time in this place influences my perception of the city

Strongly Agree Agree Neither Agree nor Disagree Disagree Strongly Disagree

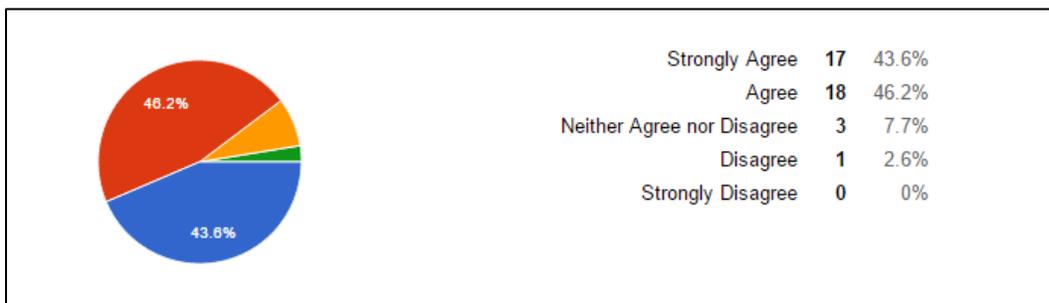


Figure 6. 89.8% of respondents agree that spending time in this place influences their perception of the city.

What are the reasons that you use or visit this place? (check all that apply):

- a. For relaxing/stress reduction
- b. For recreating/letting kids play
- c. For reading
- d. I walk through it to get where I am going
- e. To enjoy nature
- f. To people watch
- g. To meet people
- h. To socialize with friends and family
- i. Other (Please explain)

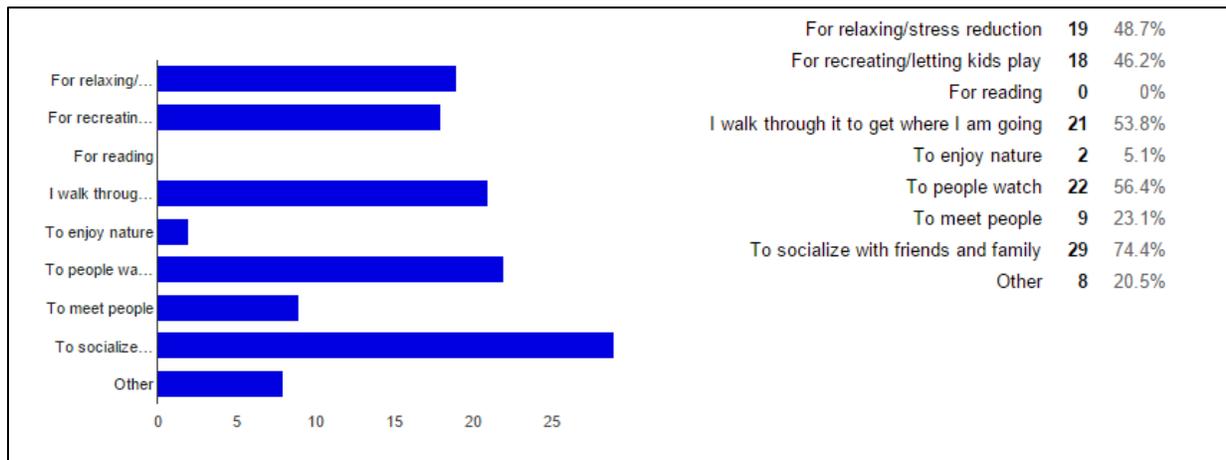


Figure 7. 74.4% responded that they use the space to socialize with friends and family, 56.4% responded that they use the site to people watch, and 53.8% walk through the space on their way elsewhere.

Economic Benefits

Economic Benefit 1

Contributed to a 250% increase in assessed value for properties surrounding the square from 2010 to 2015.

Methodology

Assessed Value Calculations					
Address	2010	2015	Calculations		% Increase
512 Main Street	\$2,248,600	\$4,220,100	(4220100-2248600)/2248600	.87676777	87.7
510 Main Street	\$137,300	\$455,200	(455200-137300)/137300	3.31536781	231.5
508 Main Street	\$1,031,900	\$132,700	(132700-1031900)/	-.87618689	-87.1

			1031900		
502 Main Street	\$376,000	\$1,993,600	(1993600-376000)/ 376000	4.30212766	430.2
				Calculations	749.4/3
				Average % Increase	249.8%

Source: Data courtesy of Pennington County Equalization Department

Additionally, the Tire & Automotive Shop located 1.5 blocks from the site was listed on the market in 2008 for \$300,000. In 2015, the property is listed on the market for \$800,000.

Calculations:

$$(\$800,000 - \$300,000) / 300,000 = \mathbf{166\%}$$

Limitations of Methodology

Due to dramatic renovations on the 508 Main Street building, it was placed as an outlier and not used in the calculations. Half of the building was demolished and replaced by overflow patio space diminishing the square footage and greatly reducing the property value.

Only one sample was listed for market value assessment before and after the development of Main Street Square. Using multiple sites within the 2-block radius would give a better understanding of the increase in market value. No other known samples listed the before and after development of Main Street Square real estate values.

Source: Dan Seftner, Destination Rapid City

Economic Benefit 2

Created 15 full-time and 50 part-time jobs with Destination Rapid City, the nonprofit created to program and maintain the square.

Methodology

Before the creation of Main Street Square, a long-term downtown parking lot occupied the area. Destination Rapid City, the nonprofit organization created to run and maintain the square, created 15 full-time jobs. 50 part-time jobs were created to serve the maintenance and daily needs of the square. These jobs change seasonally with the different needs of the square. An additional 100 jobs were created through the renovation of the Sears Building into the Main Street Square Shopping Center that lies adjacent to the square. The shopping center holds 15 different stores on 3 different floors.

Source: Dan Seftner, Destination Rapid City

Cost Comparison

The installation of synthetic turf provides a cost savings of \$51,307.50 over a 10-year time frame as compared to natural turf. The decision between synthetic or natural turf came up multiple times during the design process. The high level of traffic impact as well as the location under the seasonal ice skating rink required that sod be replaced every year. This added \$9,000 to annual operational costs and also raised maintenance needs. The texture and feel of natural turf was desirable for users of the oval lawn; however, tens of thousands used the space every month and a durable sod was pushed to the limit in terms of high impact. Synthetic turf was added in 2015 due to the repeated replacement of natural turf. The synthetic turf had a one-time cost of \$50,000 with a 10-year warranty.

During the design process, the choice between natural and synthetic turf arose multiple times. The intense level of traffic as well as the location under the ice skating rink greatly impacted the lawn. Initially the design called for natural turf for its texture and feel, as it was a benefit to the users of the oval lawn. However, tens of thousands used the space every month and the durable sod was pushed to its limit. The replacement of the sod every year added an additional \$9,000 to operational costs and raised the maintenance needs of the square. Irrigation within the square for the natural turf added an additional cost of \$1508.64 per year. Synthetic turf was added in 2015 due to the repeated replacement of the natural turf. The synthetic turf had a one-time cost of \$50,000 with a 10-year warranty. As a result, there will be a savings of \$51,307.50 in maintenance and irrigation costs over a 10-year period.

To determine the cost of natural turf over a 10 year time frame we used the previous installation costs and calculated the cost of irrigation for 10 years.

Sod Installation:

- \$9,000 per sod installation
- Sod installed every year from high impact.
- \$9,000 x 10 years = \$90,000 over 10 years

Water Usage:

- .6 in of water coverage takes 0.3738 gallons per sf
- 7,000 sf area would take 2,616.6 gallons each irrigation day
- Irrigation should cover about 120 days each year (May – August). Irrigating every other day is fairly standard, so 60 days of the 120, the sprinklers would turn on.
- 60 days x 2,616.6 gallons = 156,996 gallons over the course of the season (or 39,249 per month).

Billing (per month):

- 100 cubic ft = 1 unit of water
- 100 cubic ft of water is equal to 748 gallons
- 39,249 gallons = 5,247 cu ft (52.47 units)
- \$4.31 per unit
- 52.47 x \$4.31 = \$226.1457 per month
- \$226.15 x 5 months = \$1,130.75 annually
- \$1,130.75 x 10 years = \$11,307.50 per 10 years

Natural Turf Total over 10 years:

- \$90,000 (sod) + \$11,307.50 (irrigation) = \$101,307.50

Synthetic Turf Total over 10 years:

- \$50,000 one-time installation with 10-year warranty

Appendix

Survey Questions

DEMOGRAPHIC QUESTIONS

I am: male____; female____; I do not wish to disclose this information____

My age range is: 18-25____; 26-35____; 36-45____; 46-55____; 56-65____; 66-75____; 76-85____; above 85____; I do not wish to disclose this information

Please select the response below that most accurately describes your geographic relationship to this place.

- I live in Rapid City.
- I live in the Black Hills outside Rapid City
- I am a South Dakota resident from outside the Black Hills.
- I am a visitor from another state.

How long have you been visiting this place?

- Less than one year
- One year
- More than one year
- More than five years
- More than ten years

I visit this place:

- Very infrequently (once per year, or less)
- Infrequently (2-3 times per year)
- Somewhat frequently (1 time per month)
- Frequently (1-2 times per week)
- Very frequently (More than 3 times per week)
- Every day

I am satisfied with the overall quality of my life in Rapid City

Strongly Agree Agree Neither Agree nor Disagree Disagree Strongly Disagree

Spending time in this space helps me to cope with the demands of work, family and other stressful situations.

Strongly Agree Agree Neither Agree nor Disagree Disagree Strongly Disagree

I feel this is a family friendly space as compared to its previous history.

Strongly Agree Agree Neither Agree nor Disagree Disagree Strongly Disagree

I feel safe and secure in the Main Street Square.

Strongly Agree Agree Neither Agree nor Disagree Disagree Strongly Disagree

What features make you feel safe and secure in this space?

- a. Presence of people
- b. Adequate lighting at night
- c. Presence of security personnel
- d. Change of perception of the district
- e. Presence of exposed and open space
- f. Lack of vehicular presence.