Church Street Socially Sustainable Behavior
TEAM 3

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ARCH 5550  LA 5405 Optimizing the Building/Landscape Interface
ENVISIONING THE SUSTAINABLE CAMPUS
Integrating carbon, energy, and water management strategies toward zero- and net-positive design
Instructors: Loren Abraham & Barry Lehrman
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89 Church Street SE
Minneapolis, Minnesota  55455
Table of Contents

site inventory

Site Plan
Context
  Cultural
  Ecological
Climate
  Precipitation
  Wind
  Sun
Infrastructure
  Buildings
  Utilities
  Circulation
Vegetation
  Existing Greenspace

case studies

Ryneck Glowney - Poland
Plaza Hidalgo - Mexico
Plazza Navona - Italy
Plaza Santa Ana - Spain
Bryant Park - USA

design strategies

Manifesto
Mission Statement

performance metrics

Simulation of Baseline Conditions
Design & Performance Parameters
Benefits & Limitations

sources

Bibliography
Data sources
Begin one way vehicle traffic with the exception of parking ramp entrance. This area could mark the beginning of the pedestrian mall with changes in paving materials, curb separation, vegetation, signage and lighting.

Waste water biology pond treatment demonstration area with collected rainwater from proposed green roof.

Bike pasture: using under utilized space for public services such as bicycle parking and public gathering that also demonstrates site water management.

Off grid Street lighting for pedestrian and bicycle traffic increasing safety. Offer spaces for interactive learning of site strategies for utilizing solar energy and water. Begin to characterize this area as innovation boulevard countering the traditional aesthetic of the Northrop.
site inventory

Our scope of investigation focuses on the northern portion of Church St. serving as both a gateway and a transition zone between pedestrian mall and automotive right of way. Currently the landscape between buildings is unplanned and as a result many of the spaces are not meeting their potential as public space.

Context

Bike racks east side of Church Street
Possible bike pasture zone
Bike racks west side of Church Street

Where pedestrian zone meets vehicular zone
Material differentiation
Only sign differentiating vehicular and pedestrian zones
Example of driver confusion

Church St. looking North
Northrop Mall looking North
Seating area SW of Rapson Hall
Seating area on the crossing between Church St + Scholars Walk
site inventory

Climate

+ Sun, wind and precipitation
+ Amount of daylight per year
+ Shade studies and micro climate
+ Average yearly rainfall: 26”
+ Average yearly temperature: 45.4 °F
site inventory

+ Current lighting locations.
+ The circulation of traffic.
+ Capacities and boundaries.
+ System descriptions.
+ Utilities on the site and buildings
case studies

Rynek Glowney – Main Square, Krakow, Poland

Access + Linkages:
• Located in the middle of the city
• Accessible from 11 different streets
• Main tourist attraction
• Accessible by foot

Comfort + Image:
• Benches to sit in throughout
• Patios outside of cafés (located on the perimeter of the square)
• Regular policing
• Regular Maintenance
• No access to vehicles

Uses + Activities:
• Diversity of social groups
• Shopping facilities
• Cafés and restaurants
• Within walking distance of museums, university facilities, churches, etc.

Sociability:
• Meeting point for diverse social groups
• Multiplicity of activity

case studies

Plaza Hidalgo, Coyoacan, Mexico City, Mexico

Access + Linkages:
• Center of Plaza is only accessible by foot
• Streets lead to it but divert cars
• Sidewalks lead directly to it

Comfort + Image:
• People presence makes it feel safe
• Maintained

Uses + Activities:
• Market on the weekends
• Street vendors throughout
• Diversity of social groups

Sociability:
• Propensity of chance encounters
• Comfortable interaction
• Strong sense of local pride
• Attachment to the community

case studies

Piazza Navona, Rome, Italy

Access + Linkages:
• Accessible by foot
• Streets lead to it but divert cars

Comfort + Image:
• Seating available throughout
• Well maintained
• Policing
• No vehicular traffic

Uses + Activities:
• Bernini’s Fountain
• Markets
• Cafés
• Street performers

Sociability:
• Comfortable interaction
• Diversity of social groups
case studies

Plaza Santa Ana, Madrid, Spain

Access + Linkages:
• Near center of the city
• Narrow channels of traffic
• Accessible by foot

Comfort + Image:
• Calmed streets (vehicular traffic)
• Oasis in the city
• Tree lined promenade

Uses + Activities:
• Copious amenities
• Restaurants
• Playgrounds

Sociability:
• Comfortable interaction
• Diversity of social groups from old to young

case studies  Bryant Park, NYC. Olin Studio.

+ City park that supports individual and group activities with movable furniture and variety of seating areas.

+ People go to people watch, play bocce ball or ping pong and find respite from street noise.

+ Simple movable furniture, accommodates individuals and groups.

+ Surrounding vegetation and raised elevation of park allow for noise buffering.

+ Once an unsafe park, it was transformed into a cultural icon and beloved city park.
design strategies  Manifesto

Planet Earth is comprised of people, wildlife and natural resources
Industry is supported by people and natural resources
The build environment is comprised of people and industry, but wildlife and natural resources aren’t really added into the equation.
Profit is made by people, industry and natural resources
CURRENT ECONOMIC MODEL: Infinite profit is dependent on infinite natural resources
Strained natural resources are brought on by large population growth, diminishing wildlife and diminishing natural resources.
Earth doesn’t have an infinite amount of natural resources
Current Economic Model is worth more than the world’s resources vs. An economic model that values the world’s resources more than risky
mission statement

Enhancing wellness, productivity and interaction within campus life by addressing mobility and accessibility, built conditions and ambient conditions. Technology is the built environment in which people work and live. It came out of an economic investment for greater productivity, however research has taught us that technological investment and implementation are dependent on changes in behavior modification. In this project we address the social sustainability and it’s social return on investment.
Aligning outdoor space with University values by designing for wellness, productivity and interaction.

**Metrics**

**Social Investigations**
- Accessibility/Mobility
- Built Conditions
- Ambient Conditions

**Metrics**
- Level of daily and seasonal occupancy
- Seating availability (Number, size, distance, type)
- Access to nature (Existing and potential greenspace)
- Decibel level/sound (Affects on attention span and decision making)
- Material Use
- Amenities
- Impact of biodiversity (Global effects, local economy, environmental impact)
- Modes of transportation (Bicycles, service deliveries, waste collection)
- Public/Private (Perceived/Real)
- Safety (Perceived/Real)
- Spatial necessities and access for wellness and productivity
- Types of nature, interaction of nature and impact on attention span, wellness and productivity

**Outcomes**

metrics
accessibility and mobility

Is it worth the effort?
<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Weight of bike, rider,</td>
<td>650 lbs</td>
</tr>
<tr>
<td>and cargo</td>
<td></td>
</tr>
<tr>
<td>Average speed of trip</td>
<td>5 mph</td>
</tr>
<tr>
<td>Power in watts</td>
<td>151.23</td>
</tr>
<tr>
<td>Calories per mile</td>
<td>26</td>
</tr>
<tr>
<td>Approximate MPG</td>
<td>1191 MPG</td>
</tr>
<tr>
<td>Approximate MPG of truck (city)</td>
<td>15 MPG</td>
</tr>
<tr>
<td>One Gallon of gasoline</td>
<td>31,000 Cal.</td>
</tr>
<tr>
<td>15 mile trip cost</td>
<td>$3.80</td>
</tr>
<tr>
<td>15 mile trip “cost”</td>
<td>($1.19 -</td>
</tr>
<tr>
<td></td>
<td>McDonald’s</td>
</tr>
<tr>
<td></td>
<td>McDouble)</td>
</tr>
</tbody>
</table>


Buildings share dumpsters for trash and recycling collection.

Morrill Hall
Tate Lab of Physics
recycling ~300 lbs per day per type
Vincent and Murphy Hall
Ford Hall
recycling ~300 lbs per day per type

Grounds - campus wide
recycling 180 lbs. 6 cubic yds

From bin to recycling center: amounts and scope

Buildings (FM)
Collection every Monday, Wednesday
FM staff empty bins into collection room, consolidated into dumpster and picked up by packer truck bound for recycling center.

Grounds (Landcare)
Collection daily
Landcare collects trash and deposits it in building dumpster, recycling is consolidated on truck bound for recycling center.

2 mile route from Church St. to 3009 Como Ave.
Truck route performs 80 stops campus wide- 17,000 lbs a day.
Buildings share dumpsters for trash and recycling collection.

Morrill Hall
Tate Lab of Physics
recycling ~300 lbs per day per type

Vincent and Murphy Hall
Ford Hall
recycling ~300 lbs per day per type

Grounds - campus wide
recycling 180 lbs. 6 cubic yds
organics unknown weight

FM staff empty bins into collection room, recycling is picked up by bike hauler for each building then bound for recycling center.

Landcare bikes with haulers, in teams of two (one for trash and one for recycling), collect waste around campus and part ways.

2 mile route from Church St. to 3009 Como Ave.
Truck route performs 80 stops campus wide- 17,000 lbs a day.
### Cost Comparison

<table>
<thead>
<tr>
<th>Cost of Recycling Collection in 2010</th>
<th>$145 per ton</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total Recovered Recycling in 2009</td>
<td>3666.59 tons</td>
</tr>
<tr>
<td>Total Cost of Recycling Collection in 2009 (estimate based on 2010 rate)</td>
<td>$531,655.55</td>
</tr>
<tr>
<td>Cost per Month</td>
<td>~$44,304.63</td>
</tr>
<tr>
<td>Cost per Month for 2 Collection Zones on Church St.</td>
<td>~2000 lbs. per day, ~730,000 lbs (365 tons annual)</td>
</tr>
<tr>
<td>Estimated Cost of Recycling Collection for Church St.</td>
<td>$52,925 (annually), $4410 (monthly), $145 (daily)</td>
</tr>
</tbody>
</table>

### For Recycling in 5 Buildings near Church Street

<table>
<thead>
<tr>
<th>Trucks</th>
<th>Bikes</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Initial Cost</strong></td>
<td>Initial cost of bike</td>
</tr>
<tr>
<td>~$20,000 pick-up truck</td>
<td>~$600 bike, helmet</td>
</tr>
<tr>
<td>Additional Costs</td>
<td>~$1200 cargo hauler</td>
</tr>
<tr>
<td>Fuel</td>
<td>~4 miles round trip (2 per wk)</td>
</tr>
<tr>
<td>~35 miles a month (6.5 gal)</td>
<td>~34 miles a month</td>
</tr>
<tr>
<td>~$8.62 a month in gasoline.</td>
<td>~844 calories</td>
</tr>
<tr>
<td>Maintenance</td>
<td>Maintenance</td>
</tr>
<tr>
<td>~$40 oil change (3,000 miles)</td>
<td>~$50 tune up (annually)</td>
</tr>
<tr>
<td><strong>Number of Employees Needed</strong></td>
<td>Number of employees needed</td>
</tr>
<tr>
<td>~1 (salary, insurance unknown)</td>
<td>~2 (salary, insurance unknown)</td>
</tr>
<tr>
<td><strong>Operational Cost</strong></td>
<td><strong>Operational Cost</strong></td>
</tr>
<tr>
<td>(8 month fuel, maintenance)</td>
<td>(8 month fuel, maintenance)</td>
</tr>
<tr>
<td>$69, $4 = $73</td>
<td>$nominal,$50 = $50</td>
</tr>
</tbody>
</table>

Bike collection from April - March. With the possibility for year round operations expansion. 
$35,280 spent during 8 month period. Potential savings after initial investment is $23 annually.

### Environmental and Social Benefits

- Emissions savings
- Carbon savings
- Health benefits
- Sustainable awareness
- Minimal intrusion on site
- Additional uses such as Landcare or campus deliveries
- Waste pick-up daily - potential for organics pick-up

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Donatucci, Dana. Interview by author. Minneapolis, MN., June 8th, 2011


Why should I go there?
"Where Town meets Gown"

What makes a public space successful on campus?

1. They bring people and ideas together
2. They are places not just facilities
3. Successful campuses balance concerns about flexibility and control
4. Successful campuses improve the town/grown relationship
5. Campuses can sow the seeds of sustainability
6. Well Designed campuses can solve traffic and parking woes

built conditions

Concrete is the most used material behind water

26 billion tons of CO2/ year

5% of which comes from concrete

12.5 billion tons of concrete/ year

3rd largest source of anthropogenic CO2
Carbon Footprint = (Amount of CO2 embodied in each ingredient lb/yards) X (Mass)

Ordinary Concrete:
Portland Cement + Water + Fine Aggregate + Coarse Aggregate = 537 lb CO2/yard

High Volume Fly Ash (50/%) 
Portland Cement + Water + Fine Aggregate + Coarse Aggregate + Fly Ash = 302 lb CO2/yard

Calera Cement:
Carbonate Mineral Concrete:
Portland Cement (80%) + Carbonate Mineral Supplementary Cementitious Material “CM-CSM” (20%) + Fly Ash (20%) = 293 lb CO2/yard

Carbon Neutral Concrete:
Portland Cement + Water + Fine Aggregate + Fly Ash + CM-CSM + Fine Synthetic Aggregates “SA” = 0.9 lb CO2/yard
Being less bad is not good enough...
- William McDonough
Carbon Footprint = (Amount of CO2 embodied in each ingredient lb/yards) X (Mass)

“Negative-Carbon” Concrete:
Portland Cement + Water + Fly Ash + Fine SA + Coarse SA = -1,146 lb CO2/yard
~336.11 Cubic Yards assuming the pour is of 4 inches deep. Church street would require 672 Tons of concrete.

Ordinary Concrete:
= 549.42 Tons CO2

High Volume Fly Ash (50/%)  
= 308.18 Tons CO2

Carbonate Mineral Concrete:
= 299.78 Tons CO2

Calera Cement:

Carbon Neutral Concrete:
= 0.92 Tons CO2
built conditions

World View: Concrete is the most widely used building material in the world...

Current:

Future???

Developing World

CO2

1,175

28 Billion tons/ year

CO2
how can we change?

People's propensity to engage in environmentally sustainable behavior is primarily determined by whether or not it is in their financial interest to do so.

- “Social Dilemma” is used to describe the situation in which private interest are at odds with collective interests.

Individuals require “Persuasive communication.” That is, not only does one need to make conservation a more economically viable act, one must also convince individuals that economic benefits exist and that they warrant changes in behavior.

- “Tragedy of the commons” is used to describe the situation in which choices made for personal gain are deterrent to the collective interest which rely on shared resources.
how can we change?

Environmentally Sustainable Behavior (ESB)

+ Motivators of environmentally responsible behavior are more effective when they have a direct impact on people’s needs and concerns.

+ Community based social marketing indicates that initiatives to promote behavior change are most often effective when they are carried out at the community level and involve direct contact with people.
Wellness is a journey towards optimal health that can only be realized through the integration of various dimensions; wellness is characterized by a balance of the physical, emotional, social, spiritual, occupational and intellectual dimensions.

**Physical:**
- Riding a bicycle
- Running

**Social:**
- Two people talking
- A tree

**Occupational:**
- Carrying a briefcase

**Emotional:**
- Holding a heart
- Holding a tree

**Spiritual:**
- Sitting in meditation

**Intellectual:**
- Reading a book
built conditions

Trees
Existing Open Green Space
Potential Active Green Space

Access to Nature
built conditions

Public vs. Private Space

Low
Medium
High
(proposed) built conditions

Amenities

- Bike Racks
- Bike Repair Center
- Seating
- Water Fountains
- Access to WiFi
- Food (Seasonal)
- Artificial Light
- Power Outlets
- Trash/Recycle Bins
Impact of Biodiversity

ambient conditions

Ecological process attracts human ->

Human becomes attached to ecological process ->

Ecological process becomes part of human identity ->

Human acts on “new” identity.
ambient conditions

How does Church Street feel?
ambient conditions

Impact of biodiversity

Surface Temperature (Day)
Air Temperature (Day)
Surface Temperature (Night)
Air Temperature (Night)
ambient conditions

Existing and Possible Tree Canopy as Percent of Land Area for Neighborhoods. Proposed tree plantings will increase canopy cover by 10% and could effect temperature by up to 3°F. The National Wildlife Federation states that a 3°F rise of overall temperature in Minnesota could triple heat related deaths.

Bauer, Kilberg, Martin. “Classification and Mapping of Urban Tree Cover: City of Minneapolis.” 2011.
ambient conditions

Impact of biodiversity

RED OAK
≈ 534 species

PIN OAK
≈ 534 species

LITTLE LEAF LIDEN
≈ 150 species

Wind rustling through trees is approximately 50 decibels, the equivalent to the decibel level of a car.

The proposed 11 new trees will reduce surrounding air temperature by up to 3°F.

Little leaf lindens flower attract bees with pollen with they flower

Number of species that each tree could provide habitat for. (These are not regionally specific).

ambient conditions

Proposed Canopy Rainwater Capture

LITTLE
LEAF
LIDEN

RED
OAK

PIN
OAK

3" DBH

Small Industrial Site

Large Industrial Site

18" DBH

18501
19697

18" DBH

3232
3232

18" DBH

3774
3774
ambient conditions

In 2006, more than 4 million people spent more than $3.6 billion on hunting, fishing and wildlife viewing in Minnesota and the industry in turn supported 67,764 jobs in the state.

15% of Minnesotans hunt

52% of Minnesotans watch wildlife (the highest participation rate in the country).

When investing in our surrounding environment, whether planting more trees, capturing stormwater or planting with natives, we are also in the economies of the state and the world.

Desperate bird exploits itself to bird watchers in exchange for food. Habitat overtaken by invasive species and development.

One sick fish caught in the hypoxic zone. Guess that fisherman can’t sell this fish.

After viewing a frightening movie and were then shown a video of either a natural or built environment. The results indicate that participants perceived the natural environments as more beautiful than built environments. In addition, viewing natural environments elicited greater improvement in mood and marginally better concentration than viewing built environments. Affective restoration accounted for a substantial proportion of the preference for the natural over the built environments. Conclusion: views of natural environments calm stress more than built environments.
ambient conditions
Types of Nature and Effect on Wellness

Patients with a view of the urban environment with trees recovered faster, needed less pain medication and had a smaller hospital bill.


Patients with a view of urban scenes without trees took longer to recover, needed more pain medication and had a larger hospital bill.
ambient conditions

Impact of nature on productivity

Access to nature can increase productivity by up to 18%. Those with a view of the built environment are generally found to be less productive than those with a view of the built environment with trees.

ambient conditions

Building attributes that matter the most...if it matters inside, it matters outside.

Clean Air
Ergonomics
Access to Nature
Lighting
Privacy
Land Use
Thermal Comfort
Social Interaction
Mobility
Noise

ambient conditions
How noise, temperature and light affect us

Other studies also reveal that people may be less likely to help strangers in noisy environments and are more likely to try to escape by walking faster and gazing straight ahead, thus avoiding other people.

Unpleasantly noisy environments are linked with higher arrest rates, aggression, decreased care for the environment.

More errors made with simple tasks in the presence of noise.

Comfort levels and mood are highly dependent on temperature.

Lighting effects perceived safety, real safety, mood and productivity level.
ambient conditions

With approximately 430 Annual Average Daily Trips, vehicular circulation on Church Street.

Motorists, services vehicles, pedestrians and bicyclists merge together just outside of Rapon Hall and the Scholar's Walk.
in conclusion... An under-utilized outdoor space is the equivalent to a classroom without students or teachers.
a look to the future...of socially sustainable behavior
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