Trees & Urban Streets: Research on Traffic Safety & Livable Communities

Kathleen Wolf, Ph.D.,
Social Science & Urban Greening

University of Washington, Seattle
USDA Forest Service, PNW Research Station

November 2009
DANGER AHEAD
FASTEN SAFETY BELTS
AND REMOVE DENTURES

GEVAAR VOOR
MAAK GORDELS VAS
EN VERWYDER KUNSTANDE
roadside trees = bad trees?
Presentation Outline

- City Trees & DOTs – traditions/standards
- Trees, Livability & Value
- City Trees and Safety
- Design Opportunities
Clear Zone (U.S. policy): Class 1- Least Risk

Solution to run-off-the-road crashes auto damage & driver injury

forgiving roadside
Class 3 Risk

Class 5 Risk
Class 7: Highest Risk
Thanks to Mark Wilkes, Savannah GA Metro Planning Commission
Presentation Outline

- City Trees & DOTs – traditions/standards
- Trees, Livability & Value
- City Trees and Safety
- Design Solutions
trees make cities pretty . . . .

More than beauty . . .

environment, economics, social benefits
Ecosystem / Environmental Services

- Stormwater Absorption & Quality
- Air pollutants reduction
- Nitrogen, phosphorus and sediment interception
- Carbon emission reduction, storage and sequestration
- Urban heat-island cooling
- Reduced “bad” ozone
- Wildlife habitat creation
Human Well-Being Benefits

- Stress reduction in urban lifestyles
- Higher job satisfaction and reduced absenteeism
- Reduced violence and more constructive conflict resolution in domestic conflict
- Improved surgery and illness recovery
- Greater creativity and modeling behavior in children’s play
- Reduced ADHD symptoms
Roadside Landscape & Traffic Stress Response

- **Roadside Features - Driving Simulations**
  - Forest, golf course, strip mall

- **Physiological Response**
  - E.g. heart beat, blood pressure

- **Results**
  - Nature scenes - return to baseline faster, less response to new stressors
  - Immunization effect

Americans travel 2.3 billion miles per day on urban freeways & highways
Physical Inactivity & Obesity

majority of Americans not active enough
goal-30 minutes per day of moderate activity
to reduce risk factors for chronic diseases
(heart, stroke, cancer, diabetes)
significant costs to national health services

310-580,000 deaths per year
$100 billion medical costs (1995)
9.4% of all U.S. medical costs
* There are now more overweight than malnourished people in the world!
parks, open spaces & trails
need access & facilities
A brisk walk in the park keeps Mary II in shape because dog owners, like everyone, need exercise. Mary’s owner, Carol Smith, gets up early to give her 3-year-old cocker spaniel his regular exercise. They typically jog 1 mile in Harlaxne Park.
Make Room for Pedestrians
Walkable Neighborhoods
Streets Focused on Vehicles

need people space, and multi-modal mobility
Community Economics

• Improved consumer environments in business districts: + 9-12% product spending
• Residential real estate values:
  + 3-7% with trees in yard
  + 5-20% proximity to natural open space
  + 9% when adjacent to street tree plantings
• Commercial property rental rates: + 7%
• Air pollution mitigation
• Heating and cooling cost reductions
City Trees & Retail Behavior
Willing to pay 9-12% more
Wolf, J Forestry 2006, J Arb 2005
Image Categories (sorted by ratings) (cities of 10-20 K population)

Full Canopy
mean 3.63

No Trees
mean 1.65 (lowest)

Scale: 1 = not at all, 5 = like very much, 26 images
1. Place Perceptions
   - Interaction with Merchants
   - Quality of Products
   - Maintenance and Upkeep

2. Patronage Behavior
   - travel time, travel distance
   - duration & frequency of visits
   - willingness to pay for parking

3. Product Pricing
   - higher willingness to pay for all types of goods
   - higher in districts with trees - 9-12%

multiple studies, funded by US Forest Service & NUCFAC
Tree Values & Benefits

- Ecosystem / Environmental Services
- Community Economic Development
- Human Dimensions & Social Benefits

so much more than aesthetics!
Presentation Outline

- City Trees & DOTs – traditions/standards
- Trees, Livability & Value
- City Trees and Safety
- Design Opportunities
Problem!

 Hunters run off the road and crash into trees

 national crash data analysis for 2002

 research funding: USDA Forest Service; NUCFAC
Total 2002 motor vehicle crashes: 6,316,000

Collisions with trees - 1.9% (120,000 per year)
Injury Comparison

**All accidents**

- No injury: 61%
- Possible injury: 12%
- Non-incapacitating injury: 12%
- Incapacitating injury: 12%
- Fatality: 1%

**Trees only**

- No injury: 29%
- Possible injury: 10%
- Non-incapacitating injury: 15%
- Incapacitating injury: 40%
- Fatality: 6%
Speed Comparison

- All crashes
- Trees only
### U.S. traffic accident rates in 2002

<table>
<thead>
<tr>
<th>Category</th>
<th>U.S. Total</th>
<th>Tree Accidents</th>
<th>Urban Accidents</th>
<th>Urban Tree Accidents</th>
</tr>
</thead>
<tbody>
<tr>
<td>All Accidents</td>
<td>*6,316,000 (100%)</td>
<td>1.9%</td>
<td>37%</td>
<td>0.7%</td>
</tr>
<tr>
<td>Incapacitating Injury and Fatality</td>
<td>13%</td>
<td>0.9%</td>
<td>4.1%</td>
<td>0.04%</td>
</tr>
<tr>
<td>Fatality</td>
<td>*43,005 (0.6%)</td>
<td>1.2%</td>
<td>*141,000 (2.2%)</td>
<td></td>
</tr>
</tbody>
</table>

* NHTSA (2004) - %s may differ due to sampling and analysis procedures

Bratton and Wolf, Trans Research Board, 2005
## Annual Fatality Risks:

M. Norris, Australia ISA, 2005

<table>
<thead>
<tr>
<th>Risk</th>
<th>Individual risk per person per year</th>
</tr>
</thead>
<tbody>
<tr>
<td>Smoking (20 cigarettes a day)</td>
<td>1:200</td>
</tr>
<tr>
<td>Cancers from all causes</td>
<td>1:500</td>
</tr>
<tr>
<td>Drinking alcohol</td>
<td>1:2,500</td>
</tr>
<tr>
<td>Travelling by Motor vehicle</td>
<td>1:7,000</td>
</tr>
<tr>
<td>Travelling by Train</td>
<td>1:33,000</td>
</tr>
<tr>
<td>Travelling by Aeroplane</td>
<td>1:100,000</td>
</tr>
<tr>
<td>Fires and accidental burns</td>
<td>1:100,000</td>
</tr>
<tr>
<td>Cataclysmic storms and storm flood</td>
<td>1:5,000,000</td>
</tr>
<tr>
<td>Lightning strike</td>
<td>1:10,000,000</td>
</tr>
<tr>
<td>Meteorite</td>
<td>1:1,000,000,000</td>
</tr>
</tbody>
</table>

fatal urban tree crash 1: 100,000
research on risk management
perceived versus actual risk

city trees crashes risk?
Urban/Rural Crash Rates

2001 Traffic Data

- Miles Traveled
- Crashes

Percent

Rural
Urban

Location
Injury Comparison

**All accidents**

- No injury: 61%
- Possible injury: 12%
- Non-incapacitating injury: 12%
- Incapacitating injury: 12%
- Fatality: 29%

**Trees only**

- No injury: 6%
- Possible injury: 14%
- Non-incapacitating injury: 29%
- Incapacitating injury: 15%
- Fatality: 40%
Injury, Urban and Rural Differences
No sir, I was not talking on my cell phone....
I was watching a T.V. show on my iPod....
Behavior & Safe Driving!

- Crashes occur on weekends, late evening hours
- Winding rural roads, vehicle leaves road on outside of curves
- Male traffic fatalities outnumber female 2 to 1
- Drunk driving - about 50% of all traffic fatalities
- Seat belt use reduces risk of death by 42%
- Travel speed exceeds posted speed - about 30% of fatalities

Psychology division in transportation agencies?
Presentation Outline

- City Trees & DOTs – perception/reality
- Trees, Livability & Value
- City Trees and Safety
- Design Opportunities
the
“green book”

AASHTO: policy vs standards

professional interpretation
Streets Focus on High-Speed

poor livability
Alternative!

Psychological Traffic Calming

“body language of the street”
“mental speedbumps” D. Engwicht

- complete streets
- home zones
Narrower Lanes?

- almost 4 lanes . . . . . . .

Topp, 1990, Germany
Home Zones (Dutch “woonerf”)  
Integrating the Street into Everyday Life
Home Zones
Traffic Calming
Green Streets
Festival Planning
Play Spaces
Multi-modal Transport
Let’s Complete America’s Streets!

The streets of our cities and towns ought to be for everyone, whether young or old, motorist or bicyclist, walker or wheelchair user, bus rider or shopkeeper. But too many of our streets are designed only for speeding cars, or worse, creeping traffic jams. They’re unsafe for people on foot or bike — and unpleasant for everybody.

Now, in communities across the country, a movement is growing to complete the streets. States, cities and towns are asking their planners, engineers and designers to build road networks that welcome all citizens.

COMPLETE STREETS are designed and operated to enable access for all.
Complete the Streets!
cars/pedestrians/bikes

multi-modal systems
Context Sensitive Solutions
national & state policy – U.S.

8th Street Barracks Row, a 3/4 mile, 6 block stretch between Pennsylvania Avenue and M Street SE, is one of the District’s oldest commercial corridors. 8th Street’s turn of the century buildings give the street charm and character, but over the years the commercial strip had experienced economic decline. Vacant storefronts and loitering added to the perception that 8th Street was an unsafe place to be and shop after dark. Merchants complained that there was inadequate public parking. And time...
Context Sensitive Solutions
Mississippi

Mannsdale Road, Mississippi Route 463

Mannsdale Road is located west of the city of Madison northwest of Jackson, Mississippi. The road is about 8 mi long and is currently two lanes wide. Land use varies significantly along the short project length. Light commercial is prevalent at the beginning near the Interstate and shifts to existing and developing suburban areas along the middle of the corridor. The end of the project is primarily rural with very low density residential and agricultural uses. Most of the project area is rich in history with two early town areas, a former plantation, and two 150-year-old church congregations. To date, the local residents have been successful in influencing the character of the growth in the culturally rich area. Realizing the cultural significance of the area, the Mississippi Department of Transportation (MDOT) and the FHWA determined that the project should be developed following the principles of CSD. MDOT has chosen to implement and develop context sensitive solutions by utilizing the NEPA process. A multidisciplined project team was assembled to see the project from initial concept through the NEPA phase. Currently, the design team and the public have reached general consensus and are advancing two build alternatives through the NEPA process. Early in the project a Citizen’s Advisory Team (CAT) was assembled to represent the citizens in the corridor and work with the project development team to see that the project addressed citizens’ concerns.

Mannsdale Road is located west of the city of Madison northwest of Jackson, Mississippi. The road is about 8 mi long and is currently two lanes wide. Land use varies significantly along the short project length. Light commercial is prevalent at the beginning near the Interstate and shifts to existing and developing suburban areas along the middle of the
Context Sensitive Solutions

Case study: Barracks Row, WA DC
Context Sensitive Solutions

case study: Barracks Row, WA DC
Goals for Roadside Trees?

- Common Transportation Perception: trees & landscape enhance beauty
- Evolving Understanding: green streets offer environmental, economic, and social benefits
- Do not compromise Safety! Reasonable Risk?
- Engineering, landscape, and tree professionals working together
Urban Streets Guidelines - 2008 –
crash stats best practices (what is, not what could be)
still has a “clear zone” bias
Context Sensitive Solutions

U.S. national & state policy
e.g. Institute of Transportation Engineers

- Acknowledge & integrate community values
- Documentation of public process limits liability
Goals for Roadside Trees?

- Common Transportation Perception: trees & landscape enhance beauty
- Evolving Understanding: green streets offer environmental, economic, and social benefits
- Do not compromise Safety! Reasonable Risk?
- Engineering, landscape, and tree professionals working together