Trees & Urban Streets:
Perceptions, Research & Safety

Kathleen Wolf, Ph.D.,
Social Science & Urban Greening
University of Washington
Seattle, USA
March 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 – perception/reality
- 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
Class 7: Highest Risk
Research on risk management: perceived versus actual risk.
Presentation Outline

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

Not just 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 people 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

$1.5 billion annual direct costs - AUS

Indirect costs?!

Missed work, $4 billion cost to employers
* There are now more overweight than malnourished people in the world!
parks, open spaces & trails

need access & facilities
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
Tree Values & Benefits

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

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

Drivers run off the road and crash into trees
Distribution of Crashes

Total 2002 motor vehicle crashes: 6,316,000 collisions with trees - 1.9% (120,000 per year)
U.S. vs. Australia?

<table>
<thead>
<tr>
<th>Country</th>
<th>no.</th>
<th>People killed per 100,000 persons</th>
<th>People killed per 10,000 registered vehicles</th>
<th>People killed per 100 mill. vehicle-km travelled</th>
<th>Total population mill.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Australia</td>
<td>627</td>
<td>8.0</td>
<td>1.2</td>
<td></td>
<td>0.8</td>
</tr>
<tr>
<td>France</td>
<td>318</td>
<td>8.8</td>
<td>1.4</td>
<td></td>
<td>1.0</td>
</tr>
<tr>
<td>Germany</td>
<td>361</td>
<td>6.5</td>
<td>1.0</td>
<td></td>
<td>0.8</td>
</tr>
<tr>
<td>Japan</td>
<td>931</td>
<td>6.2</td>
<td>1.0</td>
<td></td>
<td>1.0</td>
</tr>
<tr>
<td>Korea, Republic of (South)</td>
<td>8</td>
<td>13.2</td>
<td>3.4</td>
<td></td>
<td>1.9</td>
</tr>
<tr>
<td>New Zealand</td>
<td>406</td>
<td>9.9</td>
<td>1.3</td>
<td></td>
<td>na</td>
</tr>
<tr>
<td>Poland</td>
<td>444</td>
<td>14.3</td>
<td>3.2</td>
<td></td>
<td>38.2</td>
</tr>
<tr>
<td>Portugal</td>
<td>247</td>
<td>11.8</td>
<td>2.3</td>
<td></td>
<td>na</td>
</tr>
<tr>
<td>Spain</td>
<td>442</td>
<td>10.2</td>
<td>1.6</td>
<td></td>
<td>43.5</td>
</tr>
<tr>
<td>Sweden</td>
<td>440</td>
<td>4.9</td>
<td>0.9</td>
<td></td>
<td>0.6</td>
</tr>
<tr>
<td>Switzerland</td>
<td>409</td>
<td>5.5</td>
<td>0.8</td>
<td></td>
<td>0.7</td>
</tr>
<tr>
<td>United Kingdom</td>
<td>201</td>
<td>5.5</td>
<td>1.0</td>
<td></td>
<td>58.5</td>
</tr>
<tr>
<td>United States of America</td>
<td>43</td>
<td>14.7</td>
<td>1.8</td>
<td></td>
<td>na</td>
</tr>
<tr>
<td>OECD median</td>
<td>443</td>
<td>9.5</td>
<td>1.4</td>
<td></td>
<td>0.9</td>
</tr>
</tbody>
</table>

Source: Australian Transport Safety Bureau.
Injury Comparison

All accidents

- No injury: 61%
- Possible injury: 14%
- Non-incapacitating injury: 12%
- Incapacitating injury: 12%
- Fatality: 1%

Trees only

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

- All crashes
- Trees only
# Roadside Trees & Safety

**U.S. traffic accident rates in 2002**

<table>
<thead>
<tr>
<th></th>
<th>U.S. Total</th>
<th>Tree Accidents</th>
<th>Urban Accidents</th>
<th>Urban Tree Accidents</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>All Accidents</strong></td>
<td><em>6,316,000</em>&lt;br&gt;(100%)</td>
<td>1.9%&lt;br&gt;<em>141,000</em>&lt;br&gt;(2.2%)</td>
<td>37%</td>
<td>0.7%</td>
</tr>
<tr>
<td><strong>Incapacitating Injury and Fatality</strong></td>
<td>13%</td>
<td>0.9%</td>
<td>4.1%</td>
<td>0.04%</td>
</tr>
<tr>
<td><strong>Fatality</strong></td>
<td>1.2%&lt;br&gt;<em>43,005</em>&lt;br&gt;(0.6%)</td>
<td>0.1%&lt;br&gt;<em>3,258</em>&lt;br&gt;(&lt;0.001%)</td>
<td>0.4%</td>
<td>&lt;0.001%</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>

Source: ANSTO (Higson 1989)
Urban/Rural Crash Rates

2001 Traffic Data

- Miles Traveled
- Crashes

Percent

Rural

Location

Urban
Injury Comparison

All accidents

Trees only

- No injury
- Possible injury
- Non-incapacitating injury
- Incapacitating injury
- Fatality

<table>
<thead>
<tr>
<th>Injury Type</th>
<th>All Accidents</th>
<th>Trees Only</th>
</tr>
</thead>
<tbody>
<tr>
<td>No injury</td>
<td>61%</td>
<td>29%</td>
</tr>
<tr>
<td>Possible injury</td>
<td>14%</td>
<td>10%</td>
</tr>
<tr>
<td>Non-incapacitating</td>
<td>12%</td>
<td>15%</td>
</tr>
<tr>
<td>Incapacitating injury</td>
<td>12%</td>
<td>40%</td>
</tr>
<tr>
<td>Fatality</td>
<td>1%</td>
<td>6%</td>
</tr>
</tbody>
</table>
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?
Reported factors of crashes
(first mention of any factor)

Australian Road Safety Report, 2008
Presentation Outline

- City Trees & DOTs – perception/reality
- Trees, Livability & Value
- City Trees and Safety
- Design Opportunities
Psychological Traffic Calming

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

- complete streets
- home zones
Streets Focus on High-Speed

poor livability
Recent Urban Research

- Safety effects of three urban roadside design strategies:
  - widening paved shoulders
  - widening fixed-object offsets
  - livable (pedestrian oriented) street treatments

- Only livable streets variable was consistently, negatively associated with reduced roadside and midblock crashes

E. Dumbaugh, 2006, Trans Research Record
www.completestreets.org/
Complete the Streets!
cars/pedestrians/bikes

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

Barracks Row

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

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

- Acknowledge & integrate community values
- Documentation of public process limits liability
Context Sensitive Solutions

case study: Barracks Row, WA DC
Context Sensitive Solutions
case study: Barracks Row, WA DC
Street Alternatives & Safety

- Street features and geometry as driver feedback system
  - design speed versus operating speed
  - perception and behavior
  - role of roadside in speed modulation
  - attain mobility & livability
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
Human Dimensions of Urban Forestry and Urban Greening

featuring research on peoples’ perceptions and behaviors regarding nature in cities

What's New?
Nature and Consumer Environments
Research about how the urban forest influences business district visitors.

Trees and Transportation
Studies on the value of having quality landscapes in urban roadsides.

Civic Ecology
Studies of human behaviors and benefits when people are active in the environment.

Policy and Planning
Integrating urban greening science with community change.

Urban Forestry and Human Benefits
More resources, studies and links . . .

Research Director
Kathleen L. Wolf, Ph.D.

Sponsors