City Trees & Traffic Safety: What is the Risk?

Ohio Tree Care Conference
February 2009

Kathleen Wolf, Ph.D., Social Science, Forest Resources, University of Washington
DANGER AHEAD
FASTEN SAFETY BELTS
AND REMOVE DENTURES

GEVAAR VOOR
MAAK GORDELS VAS
EN VERWYDER KUNSTANDER
CAUTION
TREE IN CENTRE
OF ROAD

NO PARKING
ABOVE
THIS SIGN
roadside trees = bad trees?
Presentation Outline

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

AASHTO: policy vs standards

professional interpretation
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
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
Why Roadside Trees?

- Transportation Perception: Primary Benefit of Landscaping is to Enhance Beauty

- Evolving Understanding: Street Trees offer Environmental, Economic, and Social Benefits

*Recommendation:* Do not compromise Safety, but Engineering & Landscape professionals need to work together to Identify Strategies to Safely Incorporate Street Trees
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
   - Amenity and Comfort
   - 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*
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

100,000 direct deaths per year (2006, CDC)
$90 billion medical costs
9.4% of all U.S. medical costs
missed work, $4 billion cost to employers
Obesity Trends* Among U.S. Adults

1990, 1995, 2005

(*BMI ≥30, or about 30 lbs overweight for 5’4” person)

No Data          <10%           10%–14%           15%–19%           20%–24%          25%–29%          ≥30%

Source: Behavioral Risk Factor Surveillance System, CDC.
Walkable Neighborhoods
Make Room for Pedestrians
Walking and Bicycling: International Comparisons

Percent of trips by walking and biking, 1995

<table>
<thead>
<tr>
<th>Country</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>USA</td>
<td>7</td>
</tr>
<tr>
<td>Germany</td>
<td>34</td>
</tr>
<tr>
<td>Netherlands</td>
<td>46</td>
</tr>
</tbody>
</table>

Pedestrian fatalities per 100 million trips, 2000

<table>
<thead>
<tr>
<th>Country</th>
<th>Fatalities</th>
</tr>
</thead>
<tbody>
<tr>
<td>USA</td>
<td>17</td>
</tr>
<tr>
<td>Germany</td>
<td>5.2</td>
</tr>
<tr>
<td>Netherlands</td>
<td>1.1</td>
</tr>
</tbody>
</table>

Pucher, AJPH 93:1509, 2003
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)
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: 40%
- Fatality: 6%
## 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>*6,316,000 (100%)</td>
<td>1.9%</td>
<td>37%</td>
<td>0.7%</td>
</tr>
<tr>
<td></td>
<td>*141,000 (2.2%)</td>
<td></td>
<td></td>
<td></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% *43,005 (0.6%)</td>
<td>0.1% *3,258 (&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 2 Every Day Risks
Source ANSTO (Higson 1989)

<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>
Urban/Rural Crash Rates

![Graph showing Urban vs. Rural Crash Rates]

2001 Traffic Data

- **Miles Traveled**
- **Crashes**

<table>
<thead>
<tr>
<th>Percent</th>
<th>Rural</th>
<th>Urban</th>
</tr>
</thead>
<tbody>
<tr>
<td>80</td>
<td></td>
<td></td>
</tr>
<tr>
<td>70</td>
<td></td>
<td></td>
</tr>
<tr>
<td>60</td>
<td></td>
<td></td>
</tr>
<tr>
<td>50</td>
<td></td>
<td></td>
</tr>
<tr>
<td>40</td>
<td></td>
<td></td>
</tr>
<tr>
<td>30</td>
<td></td>
<td></td>
</tr>
<tr>
<td>20</td>
<td></td>
<td></td>
</tr>
<tr>
<td>10</td>
<td></td>
<td></td>
</tr>
<tr>
<td>0</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Location**

- Rural
- Urban
Injury, Urban and Rural Differences

![Bar graph showing the frequency of different injury severities in rural and urban areas.](image-url)
No sir, I was not talking on my cell phone....
I was watching a TV 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
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
Recent Urban Research

- Consider vehicle speed & compatibility with other transportation modes
- Operating speed modeling, GPS recorded:
  - higher speed - 2 lane per direction vs. one lane (most significant factor)
  - reduced speed - on-street parking and sidewalks
  - reduced speed - increase in density of trees or utility poles, or decrease in their offsets
  - reduced speed - increase in density of driveways, T intersections

Wang, Dixon, Li, Hunter; 2006, Trans Research Record
Presentation Outline

- City Trees & DOTs – perception/reality
- Trees, Livability & Value
- City Trees and Safety
- Design Opportunities
Urban Streets Guidelines - 2008 –

crash stats
best practices
(what is,
not what could be)

still has a
“clear zone” bias
Psychological Traffic Calming

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

- complete streets
- home zones
Let's Complete America's Streets!

THE LATEST

Congress shows support for complete streets
The energy bill that was recently signed by President Bush includes a "Sense of Congress" supporting 'complete streets,' basically representing a statement of support for the concept. Read more on Smart Growth America's blog.

Praise for the Coalition
Read what syndicated columnist Neal Peirce has to say about the National Complete Streets Coalition.

Complete Streets Bill passed in Illinois!
The Complete Streets law requires that bicycle and pedestrian ways be established in the planning and construction of all state transportation projects.

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.

Cut the latest Complete Streets News!
Overview article from On Common Ground Magazine
Elements of Complete Streets Policies
Frequently Asked Questions
Thunderhead Alliance's Complete Streets Page
Groups Working for Complete Streets
Complete Streets brochure pdf or html
Join the Coalition!
Donate!

Click here to view a short slide show on why we need complete streets.

COMPLETE STREETS are designed and expected to provide safe access for all.
Streets Focus on High-Speed

poor livability
Streets Focused on Vehicles

no room for people – utilities are more important
Complete the Streets!
cars/pedestrians/bikes

multi-modal systems
Home Zones (Dutch “woonerf”)  
Integrating the Street into Everyday Life
Home Zones
Traffic Calming
Green Streets
Festival Planning
Play Spaces
Multi-modal
Transport
Closing Thoughts

- 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
Closing Thoughts

- Community benefits of vegetation are extensive and evidence-based
- Safety on urban streets is very important
- Pursue collaboration of transportation and urban forest professionals
- AASHTO Green Book offers flexible guidelines
Human Dimensions of Urban Forestry and Urban Greening

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

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.