Trees and Urban Streets:
Traffic Safety & Livable Communities

_Idaho Horticulture Expo_
_“Where the Winners Meet”_

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roadside trees = bad trees?
Presentation Outline

- City Trees & DOTs – perception/reality
- Trees, Livability & Value
- City Trees and Safety
- Design Solutions

research on risk management
perceived versus actual risk
Clear Zone:
Class 1- Least Risk

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

Class 3 Risk

Class 5 Risk
Class 7: Highest Risk

the “green book”

AASHTO: policy vs standards

professional interpretation
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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

Research Question:
What is the response of consumers/shoppers to trees in CBD streetscapes?

Measures:
Visual preference
Place perceptions
Patronage behavior
Product pricing

research program, U of Washington
Wolf & collaborators, funded by US Forest Service
Image Categories (sorted by ratings) (cities of 10-20 K population)

Pocket Parks
mean 3.72
(highest)

Scale: 1=not at all, 5=like very much, 26 images

Full Canopy
mean 3.63

Enclosed Sidewalk
3.32

Intermittent Trees
2.78
No Trees
mean 1.65
(lowest)
(high - 3.72)

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%

most measures
higher with
trees
Physical Activity & Obesity

- Majority of Americans Not Active Enough
- Goal: 30 minutes per day of Moderate Activity
- Risk Factor for Chronic Diseases (Heart, Stroke, Cancer, Diabetes)
- Significant Costs to National Health Services

- 310-580,000 deaths per year
- $100 annual billion medical costs (1995)
- 9.4% of all U.S. medical costs

Obesity Trends* Among U.S. Adults 2004

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

Doubling of adult obesity rate since 1980.
parks, open spaces & trails

Provide Continuous Pedestrian Facilities
Walking and Bicycling: International Comparisons

![Bar charts showing percent of trips by walking and biking in 1995 and pedestrian fatalities per 100 million trips in 2000 for the USA, Germany, and the Netherlands.]

- Percent of trips by walking and biking, 1995:
  - USA: 7%
  - Germany: 34%
  - Netherlands: 46%

- Pedestrian fatalities per 100 million trips, 2000:
  - USA: 17 fatalities
  - Germany: 5.2 fatalities
  - Netherlands: 1.1 fatalities

Pucher, AJPH 93:1509, 2003
Walkable Neighborhoods

Make Room for Pedestrians
Tree Values & Benefits

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

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Problem!

- Drivers run off the road and crash into trees

Distribution of Crashes

- Noncollision: 5%
- Non-fixed object collision: 10%
- Collision with fixed object: 85%

Total 2002 motor vehicle crashes: 6,316,000 collisions with trees - 1.9% (120,000 per year)
Injury Comparison

- All accidents
- 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>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>*141,000 (2.2%)</td>
<td>0.9%</td>
<td>4.1%</td>
</tr>
<tr>
<td>Fatality</td>
<td>1.2%</td>
<td>*43,005 (0.6%)</td>
<td>0.1%</td>
<td>0.4%</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 (Bigson 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>

fatal urban tree crash 1: 100,000

Urban/Rural Crash Rates

2001 Traffic Data
Injury, Urban and Rural Differences

Frequency

No injury  Possible injury  Non-incapacitating injury  Incapacitating injury  Fatality

Injury Severity

Rural  Urban

No sir, I was not talking on my cell phone.... I was watching a TV show on my iPod....

No 5 R. 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

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Urban Streets Guidelines - 2008 –

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

still a clear zone bias
Psychological Traffic Calming
“body language of the street”
“mental speedbumps” D. Engwicht

- complete streets
- home zones

www.completestreets.org/
Streets Focus on High-Speed

Poor Livability Factor

Streets Focused on Vehicles

No room for people – Utility Encroachments
Complete the Streets!
cars/pedestrians/bikes

Home Zones (Dutch “woonerf”)
Integrating the Street into Everyday Life
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
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

www.cfr.washington.edu/research.envmind