DANGER AHEAD
FASTEN SAFETY BELTS
AND REMOVE DENTURES

GEVAAR VOOR
MAAK GORDELS VAS
EN VERWYDER KUNSTANDE
Why Urban Street Trees Aren’t the Hazard the Traffic Engineer Thinks They Are.

Eric Dumbaugh, Ph.D.
Assistant Professor
Program Coordinator, Graduate Certificate in Transportation Planning
Texas A&M University
roadside trees = bad trees?
Take Home Messages!

- Research of last decade = new understandings about city trees and traffic safety
- Driving safety is psychological response, not a rational thought process
- Trees are an essential part of livable cities. Must think beyond curb-to-curb!
# Focused Parking Requirements

<table>
<thead>
<tr>
<th>Use</th>
<th>Minimum Parking Requirement</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Office Building</td>
<td>250 s.f.</td>
<td>1.0</td>
</tr>
<tr>
<td>Personal Service Shop</td>
<td>250 s.f.</td>
<td>1.0</td>
</tr>
<tr>
<td>Priv. School or Comm. Studio</td>
<td>100 s.f.</td>
<td>1.0</td>
</tr>
<tr>
<td>Retail Sales &amp; Service: C-1</td>
<td>250 s.f.</td>
<td>1.0</td>
</tr>
<tr>
<td></td>
<td>C-2</td>
<td>350 s.f.</td>
</tr>
<tr>
<td></td>
<td>C-3</td>
<td>250 s.f.</td>
</tr>
<tr>
<td>Restaurant (w/o drive-through)</td>
<td>65 s.f.</td>
<td>1.0</td>
</tr>
<tr>
<td>(w/ drive-through)</td>
<td>100 s.f.</td>
<td>1.0</td>
</tr>
<tr>
<td>Rooming/Boarding House</td>
<td>Person</td>
<td>1.0</td>
</tr>
<tr>
<td>Sales Display</td>
<td>250 s.f.</td>
<td>1.0</td>
</tr>
<tr>
<td>Single-family Dwelling</td>
<td>DU</td>
<td>2.0</td>
</tr>
<tr>
<td>Shopping Center** C-1</td>
<td>250 s.f.</td>
<td>1.0</td>
</tr>
<tr>
<td></td>
<td>C-2</td>
<td>350 s.f.</td>
</tr>
<tr>
<td></td>
<td>C-3</td>
<td>250 s.f.</td>
</tr>
<tr>
<td>Townhouse</td>
<td>DU</td>
<td>2.0</td>
</tr>
</tbody>
</table>

What are the effects on site development?

thanks to Eric Dumbaugh, Texas A&M
Example 1: A Small Urban Building

- 50 sf x 100 sf = 5000 sf footprint
- 5 stories = 25,000 sf
- 1 space per 250 sf = 100 parking spaces
- Stall = 9x20 = 180 sf
- Min area = 18,000 sf
- Aisles and stall reqmts – typically require same area as parking
- Parking area = 36,000 sf
- Area = 0.83 acres.
- Equivalency is the area of 8 of the shown buildings
Example 2: What about the Louvre?

- 3 million sf
- 12,000 parking spaces
- 4.3 million sf parking + aisles
- 100 acres of parking
What if the Louvre met conventional parking standards in the US?
The Mall of Georgia

- 2.2 million square feet of retail...
- ...on 180 acres.
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

giving roadside
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
"Canine constitutional.

A brisk walk in the park keeps Harry III in shape for boss dog above. His owner, Columbus resident Carla Swaine, got up early to give her 3-year-old Dachshund his regular exercise. Photo originally ran 12 miles at Riverside Park.
Make Room for Pedestrians
Walkable Neighborhoods
Streets Focused on Vehicles

need people space, and multi-modal mobility
Walking and Bicycling: International Comparisons

- Percent of trips by walking and biking, 1995
- Pedestrian fatalities per 100 million trips, 2000

<table>
<thead>
<tr>
<th>Country</th>
<th>Walk/Bike (%)</th>
<th>Fatalities</th>
</tr>
</thead>
<tbody>
<tr>
<td>USA</td>
<td>7</td>
<td>17</td>
</tr>
<tr>
<td>Germany</td>
<td>34</td>
<td>5.2</td>
</tr>
<tr>
<td>Netherlands</td>
<td>46</td>
<td>1.1</td>
</tr>
</tbody>
</table>

Pucher, AJPH 93:1509, 2003
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%

most measures higher with trees

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!

Drivers 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: 14%
- Incapacitating injury: 1%
- Fatality: 12%

Trees only

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

- All crashes
- Trees only

![Graph showing speed comparison between all crashes and trees only.](image)
Urban/Rural Crash Rates
Injury, Urban and Rural Differences
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>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>0.1%</td>
<td>0.4%</td>
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* 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>
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<th>Risk</th>
<th>Individual risk per person per year</th>
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<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>
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Fatal urban tree crash: 1:100,000
research on risk management
perceived versus actual risk

city trees crashes risk?
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<td><strong>Fatality</strong></td>
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<td>0.01%</td>
<td>&lt;0.001%</td>
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Bratton and Wolf, Trans Research Board, 2005
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? a driving “mentalist”
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
www.completestreets.org/
Complete the Streets!
cars/pedestrians/bikes

multi-modal systems
Traffic Calming?

- pilot study . . . .
- increased safety perception: urban and suburban
- slower travel speed: suburban

Naderi, Kweon, Maghelal, ITE 2008
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 has 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 corridor.
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
Memorable Messages!

- Research of last decade = new understandings about city trees and traffic safety.
- Driving safety is psychological response, not a rational thought process.
- Trees are an essential part of livable cities. Must think beyond curb-to-curb!
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.