Analyzing the Relationship between Density and Public Costs
The Traditional Fiscal Impact Model Cost Paradigm

• Costs are assumed to be proportional to residents and employees

• Same number of residents = same additional costs regardless of layout
<table>
<thead>
<tr>
<th>Services &amp; Infrastructure Cost Categories with Potential to Vary by Density</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fire</td>
</tr>
<tr>
<td>Police</td>
</tr>
<tr>
<td>Schools</td>
</tr>
<tr>
<td>Libraries</td>
</tr>
<tr>
<td>Hospitals</td>
</tr>
<tr>
<td>Parks</td>
</tr>
<tr>
<td>Waste</td>
</tr>
<tr>
<td>Roads</td>
</tr>
<tr>
<td>Stormwater</td>
</tr>
<tr>
<td>Sewer and Water</td>
</tr>
</tbody>
</table>
Infrastructure Costs: Roads and Pipes
The Raw Data – Each Dot is One Grid Cell

R² = 0.55948
Road Area per Capita Declines as Density Increases – Madison, WI

Suburban Residential
- Residents: 178
- Employees: 5
- Total: 183
- Total Res. & Emp Per Acre: 4.6
- Total Road Area: 227,408
- Road Area per Capita: 1,242 ft.

Downtown Urban
- Residents: 2236
- Employees: 633
- Total: 2,869
- Total Res. & Emp Per Acre: 71
- Total Road Area: 306,303
- Road Area per Capita: 107 SF

\[ R^2 = 0.82918 \]
Road Area per Capita Declines as Density Increases – West Des Moines, IA

R² = 0.91728

Road Area per Capita

Population and Employees per Acre

[Graph showing the relationship between road area per capita and population and employees per acre, with an R² value of 0.91728.]
Road Area per Capita Declines as Density Increases – Arlington, VA

R² = 0.97742
Road Length per Capita Declines as Density Increases – Dona Ana County, NM

- Linear Feet of Road per Capita
- Population and Employees per Acre

$R^2 = 0.91606$
## Lane Miles per Capita as Density Increases – Even Across Entire Jurisdictions

### Lane Miles per Capita by Jurisdiction

<table>
<thead>
<tr>
<th>City</th>
<th>Lane Miles</th>
<th>Total Population and Employees</th>
<th>Acres</th>
<th>Pop. And Emp. Density</th>
<th>Lane Miles per Capita</th>
</tr>
</thead>
<tbody>
<tr>
<td>Arlington</td>
<td>916</td>
<td>365,000</td>
<td>16,600</td>
<td>22</td>
<td>0.0025</td>
</tr>
<tr>
<td>Madison</td>
<td>1,742</td>
<td>437,000</td>
<td>49,100</td>
<td>9</td>
<td>0.0040</td>
</tr>
<tr>
<td>West Des Moines</td>
<td>774</td>
<td>108,892</td>
<td>25,267</td>
<td>4</td>
<td>0.0071</td>
</tr>
</tbody>
</table>
All Else Being Equal, That Translates to Lower Costs per Capita for Areas with Higher Population Density

Hypothetical Road Maintenance Costs per Capita
Assuming $15,000 per Lane Mile

Arlington
Madison
West Des Moines
Water and Sewer Pipes

- Tend to follow length of road – meaning water and sewer pipe length per capita will decrease as density increases.

- Usually governed by a utility that sets rates based on usage (gallons), ignoring length of pipe to maintain.

- But, all else being equal, there will be more pipe to maintain relative to revenue generated in less dense areas.

- SGA/RCLCO model works by comparing the ratio of rate revenues to the anticipated pipe maintenance costs in the scenario development to that of the city as a whole.
School Transportation Costs are Clearly Correlated with Density

R² = 0.8179
The SGA Model is Based on the Anticipated Quantity of Students in the “Walk Zone”

- Not specific to existing school situation
- Key determinants are size of the schools and radius of the walk zone
- Chart assumes 1-mile walk zone and school sizes of 400, 600, and 1,600
Preliminary Analysis of Fire Shows Less Relationship to Density than Hypothesized

- Determinants of Operating Efficiency
  - Response Shed Size
  - Population Density
  - Rate of Calls per Population
  - Capacity per Fire Engine
PuIng it All Together – Preliminary Results Show Costs per Capita Can Fall by 7% to 12% as Density Increases

Estimated Costs per Capita in Madison by Scenario

- **Low Density**: $620
- **Base Density**: $580
- **Compact**: $540

Net Residential Density Ranges from 4.1 per Acre to 16.1

Estimated Costs per Capita in West Des Moines by Scenario

- **Low Density**: $740
- **Base Density**: $700
- **Walkable Urban**: $660

Net Residential Density Ranges from 5.5 per Acre to 22.4
Not Counting the Opportunity Cost of Land Consumption in Low Density Scenarios

<table>
<thead>
<tr>
<th>Density Type</th>
<th>Consumed</th>
<th>Preserved</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lower Density</td>
<td>2,500</td>
<td>500</td>
</tr>
<tr>
<td>Base Density</td>
<td>2,000</td>
<td>1,000</td>
</tr>
<tr>
<td>Higher Density</td>
<td>1,500</td>
<td>1,500</td>
</tr>
<tr>
<td>Walkable Urban</td>
<td>1,000</td>
<td>2,000</td>
</tr>
</tbody>
</table>

- Smart Growth America
  - Making Neighborhoods Great Together
The New Paradigm

Option A Public Costs

Option B Public Costs

>
Areas in Progress/Need for Improvement

• Infrastructure costs: How do usage and quality requirements affect maintenance costs?
• Disaggregating roads associated with employees from residents
• Better data and/or economic model behind solid waste
• Better understanding of school transportation costs with regard to busing for integration/magnet schools, etc.
• Police – is there a connection to density and how to model it?