Development patterns & budgets:
Assessing the cost of sprawl

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Tulsa, Oklahoma
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Since the ‘70s, studies have confirmed:
Low-density sprawl costs municipalities more than compact development
A scenario analysis tool

A fiscal impact model focused on the relative effects of sprawl versus compact development
Communities for which the model has been applied

- Madison, Wisconsin
- West Des Moines, Iowa
- Doña Ana County, New Mexico
- Macon, Georgia
- Indianapolis, Indiana
- Battle Creek, Michigan
- Kalamazoo, Michigan
- Rifle, Colorado
- Brookings, South Dakota
- Pittsburg, Kansas
- Chattanooga, Tennessee
- St. James Parish, Louisiana
- Pagosa Springs, Colorado
- Collier Co., Florida (pending)
- Tulsa, Oklahoma
Development affects costs

Compact development offers efficiencies in delivering services.

– Police and fire departments have less area to cover.
– Fewer miles of road to cover for trash pickup, school buses.
– Fewer miles of water and sewer pipes to maintain.

.. etc.
Typical average cost fiscal impact model

- Costs are assumed to be proportional to residents and employees.
- Same number of residents = same additional costs regardless of density.
OUR MODEL – COSTS VARY BY DENSITY

Expenditures for infrastructure and services are more efficient in denser, better connected areas.
What cost categories might vary by density?

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<thead>
<tr>
<th>Services &amp; Infrastructure</th>
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<tbody>
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<td>Fire</td>
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<td>Solid Waste</td>
<td>Yes (collection)</td>
</tr>
<tr>
<td>Schools</td>
<td>Yes (bus transportation)</td>
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<td>No</td>
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</table>
ROAD LENGTH AND AREA PER CAPITA DECREASES AS DENSITY INCREASES – ARLINGTON, VA

\[ R^2 = 0.9774 \]
LOW DENSITY DEVELOPMENT REQUIRES MORE PIPE – MEANING HIGHER MAINTENANCE COSTS

Water and Sanitary Costs per Capita (Illustrative Only)

Revenue per Capita

- Low Density
- Average Density
- High Density

Other Costs per Capita
Pipe Maintenance Costs per Capita
INFRASTRUCTURE COST METHODOLOGY
THE 60-ACRE GRID OVERLAY
ROAD LENGTH AND AREA PER CAPITA DECREASES AS DENSITY INCREASES

NOTE: Chart shows road length only. Road area per capita has a similar relationship to density.

**Suburban Residential**
- Residents: 120
- Employees: 12
- Total: 132
- Total Res. & Emp Per Acre: 2.2
- Total Road Length: 7,401 ft
- Road Length per Capita: 56 ft

**Downtown Urban**
- Residents: 348
- Employees: 2,839
- Total: 3,187
- Total Res. & Emp Per Acre: 53
- Total Road Length: 17,616 ft
- Road Length per Capita: 5.5 ft
SCHOOL TRANSPORTATION COSTS DECLINE AS DENSITY INCREASES

R² = 0.8179

SOURCE: Wisconsin Dept. of Public Instruction
FIRE PROTECTION COSTS INCREASE DRAMATICALLY AT VERY LOW DENSITIES

Projected Fire Costs per Capita in Macon-Bibb

Determinants of Operating Efficiency
- Response Shed Size
- Population Density
- Rate of Calls per Population
- Capacity per Fire Engine
SOLID WASTE PICKUP – HIGHER DENSITY SHOULD SAVE TIME, FUEL AND VEHICLE COSTS

- Lower densities imply larger distances between homes.
- Higher distances between pickups mean more time and fuel expense per home.
- Over large areas, small time and fuel savings can add up to significant sums.
- So far, data limitations have prevented application of this part of the model.
Macon model projects that moving from 1 unit per acre (net) to 16 reduces per capita county costs by 25%.

Hypothetical residential programs in Macon-Bibb:

- 0.9 units per acre
- 11.7 units per acre
- 21.8 units per acre

NOTE: Does not include potential density-related savings associated with solid waste or use of existing infrastructure.
Macon model projects that moving from 1 unit per acre (net) to 16 reduces per capita county costs by 25%.

Hypothetical residential programs in Macon-Bibb:

- 0.9 units per acre
- 11.7 units per acre
- 21.8 units per acre

Other roads, fire, water, sewer.

Note: Does not include potential density-related savings associated with solid waste or use of existing infrastructure.
Density can affect property value and property tax revenue per acre in 2 ways:

\[\downarrow\] By simply allowing for more occupiable space – 2 houses are worth more than 1, all else equal

\[\leftarrow\] By creating economies of agglomeration, and enabling conditions for the “walkable” urban premium to emerge, making each square foot more valuable
BIBB COUNTY POPULATION DISTRIBUTION 1980

Bibb County: 150,526
Macon: 116,896
BIBB COUNTY POPULATION DISTRIBUTION 2010

Bibb County: 155,635
Macon: 91,408
SCENARIOS EVALUATED:

LOW DENSITY GREENFIELD
• 300,000 SF of Office
• 200,000 SF of Retail
• 1,000 Single-Family Detached Units
• $200,000 Avg. Value per Unit
• Density of 2 per Acre (Net)
• Greenfield development requiring all new infrastructure

HIGH DENSITY GREENFIELD
• 300,000 SF of Office
• 200,000 SF of Retail
• 200 Townhouses
• $110,000 Avg. Value per Unit
• 800 Multifamily Units
• Avg. Value of $68,000 per Unit
• Overall Density of 16 per acre (net)

DOWNTOWN IN-FILL
• 300,000 SF of Office
• 200,000 SF of Retail
• 200 Townhouses
• $110,000 Avg. Value per Unit
• 800 Multifamily Units
• Avg. Value of $68,000 per Unit
• Only marginal additions to existing infrastructure

DOWNTOWN IN-FILL WITH PREMIUMS
• Same as above but assumes 20% higher assessed value for all property types
SUMMARY OF RESULTS BY SCENARIO

Total Annual Budgetary Impact
Macon-Bibb County and Schools Combined

- **Low Density Greenfield**
- **High Density Greenfield**
- **Downtown Infill**
- **Downtown Infill Premium**

- $800,000
- $600,000
- $400,000
- $200,000
- $0
- ($200,000)
- ($400,000)
- ($600,000)
- ($800,000)
- ($1,000,000)
Indianapolis

Projected annual net fiscal impact at build-out
City of Indianapolis and Indianapolis school transportation budget combined

- Low Density Sub-urban
- Medium Density Sub-urban
- TOD Urban
- TOD Urban Plus
TO SUM UP

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<th>Development Density</th>
<th>Development Location</th>
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<tr>
<td>Low-density</td>
<td>Greenfield: Low or negative</td>
</tr>
<tr>
<td>High-density</td>
<td>Greenfield: Moderate</td>
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TO SUM UP

Certain public costs vary by density.

- All else being equal, more compact development imposes a **smaller cost burden** on municipalities, and the savings can be significant.
- Compact development uses land more efficiently and **maximizes the revenue yield** per acre.
- With the right design and “critical mass”, compact development can foster **walkable urban environments**, which often **command a “value premium.”**
- The combination of lower costs and higher values results in an **improved net fiscal impact** for the locality.
Low-density suburban development rarely pays for itself

Costs for:
- infrastructure
- ongoing operations and maintenance

Burden ultimately falls on local governments – and its taxpayers
Fiscal Impact Model
Tulsa, Oklahoma

SUMMARY OF RESULTS
Fiscal Impact Model
Tulsa, Oklahoma

Population & employment forecast
Population Forecast

2017 estimates

Residents: 401,324
Employment: 251,551

• 20-year forecast
• Assuming .2% to .3% annual gain vs 0% to .4% last 10 years.
• 22,966 more people (5.7% increase)
• 22,640 additional jobs (9% increase)

Fiscal Impact Model
Tulsa, Oklahoma

Scenarios
Scenario 1: Trends Continue

Scattered, Low Density Suburbs

• Total area of potential development: 
  ~ 8,500 Acres

• Developed by 2037: 
  ~ 3,315 (39%)
Scenario 2: Comp. Plan Focus Areas

Targeted Focus Areas

• More Dense Land Use

• Total area of potential development:
  ~ 4,000 Acres

• Developed by 2037:
  ~ 1,040 (26%)
Scenario 3: Focus Areas w/ Increased Density

Same as Scenario 2 but w/ higher density targets

- Total area of potential development: 
  ~ 4,000 Acres

- Developed by 2037: 
  ~ 840 (21%)
Density Options – Density Levels

- Methodology: Divide the City into 40 acre squares to use as unit of measurement.
- Average density ~ 5.92 persons + jobs per acre
- Maximum density ~ 257 persons & jobs per acre
City Costs Considered

- Roads
- Sidewalks
- Water Lines
- Sewer
Fiscal Model Theory

• Denser development
  – distributes costs over more households.
  – requires less infrastructure per housing unit
  – requires less infrastructure, overall

• How might Tulsa accommodate 45,606 additional jobs and people in 20 years?

• Choose to build more or less infrastructure?
  – Density matters
City of Tulsa Budget 2017

Total Budget
Incl. non-general fund

$764 Million Total

= $2,933 per Household

The Total Budget ($764 M) is the basis for comparison, in particular because of the role of infrastructure items.

Roads, sidewalks, water lines, and sewer are paid for by combination of general fund, as well as other sources.
### Results

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<th>Focus Areas</th>
<th>Focus Areas + Density</th>
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<tr>
<td>Capital Costs – 20 years</td>
<td>$695.9 M</td>
<td>$377.2 M</td>
<td>$287.6 M</td>
</tr>
<tr>
<td>Amortized Costs (20 years at 2.2% rate)</td>
<td>$867.6 M</td>
<td>$470.3 M</td>
<td>$358.6 M</td>
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<tr>
<td>Maintenance Costs – 20 years</td>
<td>$34.8 M</td>
<td>$18.9 M</td>
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<td>Total Costs – 20 year</td>
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<td>Fiscal Cost per year</td>
<td>$33.6 M (+4.5% of budget)</td>
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Study costs to accommodate 45,606 additional people and jobs.
### Net Fiscal Impact

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Study costs to accommodate 45,606 additional people and jobs.
Net Fiscal Impact – 20 Years

-391.4

Trends Cont.  Focus Areas  Focus Areas +

21.9

138.1

($ Millions)
Remember

This is all very conservative.

• Only includes some costs.

• Doesn’t account for revenue effects (almost certainly positive) of denser scenarios.

Let’s look at revenues.
Value by Total Parcel
City of Tulsa

Total Value of Each Parcel

- $0 - $500,000
- $500,001 - $1,500,000
- $1,500,001 - $3,000,000
- $3,000,001 - $8,000,000
- $8,000,001 - $21,900,000
Parcel Value by Acre
City of Tulsa

Parcel Value by $ per Acre

- $0 - $250,000
- $250,001 - $500,000
- $500,001 - $750,000
- $750,001 - $1,000,000
- $1,000,001 - $1,639,964
Half of the Total Land Value
City of Tulsa

Parcels that make up 50% of the entire land value of Tulsa when prioritized by Value per Acre

- 11,117 Acres Total
- 6.7% of the total area of the City
Hot Spot Analysis

Definition - A hot spot analysis visualizes geographically where a higher density or cluster of activity occurs. When looking at the value of land in a community, a hot spot analysis is another way of describing the relationship a development pattern has upon the land value around it.

Hot/Cold: Indicates a statistical significance between the various development areas. (i.e. - If one area is higher in value (hot) those around it are likely to be higher as well.)

Not Significant: Indicates there is not a statistical relationship between the value of a parcel, and the value of its neighbors.
Hot Spot Analysis
City of Tulsa

Share of Total Land Area Per Hotspot Category

- Cold: 16%
- Hot: 5%
- Not Significant: 79%

Share of Total Value Per Hotspot Category

- Cold: 6%
- Hot: 35%
- Not Significant: 59%

(Property Values Normalized by Using Value per Acre)
Hot Spot Analysis
City of Tulsa

(Property Values Normalized by Using Value per Acre)
Land consumed by 2037 under each scenario (acres)

- Trends Cont.: 3,315 acres
- Focus Areas: 1,040 acres
- Focus Areas +: 840 acres
Comparing Parcel Value Downtown vs Focus Areas

Downtown Tulsa

950 Acres
Value: $1.7 Billion
5% of the City’s total value

Focus Areas

4,024 Acres
Value: $3.6 Billion
11% of the City’s total value
Why does this matter?

Return on investment

• Infrastructure investments
• Locating government facilities
• Incentivizing development
Questions?
Thank you!

John Robert Smith
Chris Zimmerman

Tulsa, Oklahoma
July 19, 2017