Emergency Response and the Role of Street Networks

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Thanks to US EPA and CNU

DAVIS: Fire Incidents

Station 31

Station 32

Station 33

0 0.5 1 2 3 4
Miles
Street Network affect Emergency Response

This is very preliminary work but it suggests that

**Streets networks affect**

- The population that can be serviced by each station
  
  *Depending on the type of street network the station can server upwards of six times more people*

- The response times
  
  *In a connected network the path is much more direct, therefore, actual distances are much shorter*
What Type of Street Networks Are Best?

The preliminary analysis suggests that the best street network for efficient emergency response are denser and more grid like.
Why is this Important?

Current street design codes (including fire codes) make it more difficult to design smart growth street networks.
Danger of Focusing on Speed

*The advent of the automobile has altered
not simply the time it takes to get to point 𝑏,
but where point 𝑎 and point 𝑏 are in the first place,
our reasons for going there,
what we see along the way and,
ultimately, the structure of the society
within which 𝑎 and 𝑏 become destinations*

- Justin Good
California Cities Study of Street Networks

*Does the Street Network Matters?*

Twenty-four Cities
Davis, CA
14% of people ride to work
Davis, CA
Road Fatality Rate: 1 per 100,000
Road Fatality Rate for All 157 California Cities Over 40,000

*number per 100,000 population*
Road Fatality Rate for All 157 California Cities Over 40,000

*number per 100,000 population*
Road Fatalities per 100,000

*California Cities of 40,000 to 120,000*

Pre-1950: 5.6
Post-1950: 6.3
Risk of Fatality

(Fatalities as % of Injuries)

*California Cities of 40,000 to 120,000*

- **Pedestrians**: Pre-1950: 3.8, Post-1950: 5.4
- **Bicycle Riders**: Pre-1950: 0.72, Post-1950: 1.01
- **People in Vehicles**: Pre-1950: 0.55, Post-1950: 0.75

**Legend**
- Green: Pre-1950
- Orange: Post-1950
Chance of Pedestrian Fatality vs. Impact Speed

Evolution of the Street Network

Pre-1950’s

Post-1950’s

Adapted from Stephen Marshall
How Did This Drastic Change Occur?

One important agency in getting rid of the grid network was the Federal Housing Authority.

FHA Technical Bulletin No. 7 (1938)
Planning Profitable Neighborhoods
According to the FHA the grid layout was

- Monotonous
- Had Little Character
- Uneconomical
- Posed Safety Concerns
Evolution of the Street Network
Characterizing the Street Network

- Shape and Configuration
- Street Network Scale
- Street Network Connectivity
### Citywide Street Network

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<th>Linear</th>
<th>Tree</th>
<th>Grid</th>
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Adapted from Stephen Marshall, *Streets & Patterns*
Network Scale

550 Intersections per Square Mile
Network Scale

110 Intersections per Square Mile
45 Intersections per Square Mile
Network Connectivity

Link-to-Node Ratio = 1.61

Link-to-Node Ratio = 1.13

Link-to-Node Ratio = 1.16
Variables included in Our Safety and Travel Choice Models

Street Network Properties

Street Design Properties
  - Average Total Number of Lanes
  - Average Outside Shoulder Width
  - Raised Median
  - Painted Median
  - On-Street Parking
  - Bike Lanes
  - Raised Curbs

Travel and Activity Level

Distance from City Center

Income

Mix of Land Use
Safety Analysis Based on Geo-coding 230,000 Accident Records in 24 California Cities
Safety and Travel Choice Analysis done for 1040 Census Block Groups

24 California Cities
versus
Risk of Severe Injury or Fatality*

versus

Chance of being Severely Injured
30% Higher

Chance of being Killed
50% Higher

*Given that an injury occurred
Odds of Dying in a Road Accident based on Intersection Density*

*Given that an injury occurred
Percentage of People Walking, Biking or Taking Transit

- Walking: 9%
- Biking: 2%
- Taking Transit: 1%
Percentage of People **Walking**, **Biking** or **Taking Transit**
Percentage of People Walking, Biking or Taking Transit

Effect of Intersection Density for Cul-de-sac Network

10%

5%

0%

< 81  81-144  144-225  225+
Percentage of People Walking, Biking or Taking Transit

Effect of Intersection Density for Gridded Network

10%

5%

0%

< 81 81-144 144-225 225+
What About Emergency Response?

As discussed earlier, the results suggest that the best street network for emergency response would be

1. Dense
2. Well connected
Smart Growth and Street Networks

We need a holistic approach to design

We need to focus on designing whole communities not the individual components

Street networks are the basic building blocks for communities
Residents of Washington’s outer suburbs struggled Wednesday night with horrendous traffic on the city’s commuter routes.

At the same time, many D.C. residents were enjoying happy hours, snowball fights and otherwise carrying on with their lives. By the time people in the central city were fast asleep, many suburbanites were still fighting to get home.

- Erik Webber