

Neighborhood Design & Life Safety

Issues & Trade-offs

Patrick Siegman
Nelson\Nygaard
Consulting Associates

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Agenda

1. Neighborhood Design – Questions to Consider
2. Some trade-offs
 - Advantages of wide streets
 - Advantage of narrow streets
3. Additional issues & trade-offs
4. Codes that require connectivity & allow narrow streets

Neighborhood Design – Questions to Consider

1. What are the dangers? (fire safety, traffic safety, medical emergencies, etc.)

One goal: improve life safety

United States, 1999		
	Fatalities	Injuries
Fire	3,671	21,875
Traffic	41,611	3,236,000
Emergency medical response – ??? lives saved		

My background

- 14 years as a transportation planner
- No formal training in fire safety or emergency response

Neighborhood Design – Questions to Consider

2. What is the existing context for the proposed project?



**Carson City,
Nevada**



24 feet

Southgate Neighborhood, Palo Alto



Post-World War II
neighborhoods



Pre-World War II
neighborhoods

Existing context – Two Examples

1. The proposed project would be added to a community where all existing streets are wide, and the community's existing equipment & staffing levels were chosen on the assumption that all streets would be wide.
2. The proposed project will add one more block to an existing community that has many narrow streets. The community's fire department already has the staff, training & equipment needed for operating on these streets.

Issue: Mutual Aid Obligations

Fire departments have mutual aid obligations to fight fires & respond to disasters in many communities

Many earthquake zones have old neighborhoods with narrow streets (San Francisco, Berkeley, Palo Alto, etc.)

24 feet



Southgate Neighborhood, Palo Alto

Many high fire hazard areas (Lake Arrowhead, CA; Oakland Hills, CA; Paradise, CA; Santa Cruz County, CA, San Diego County, CA) have narrow streets in mountainous, forested terrain

Mutual Aid Obligations: How can departments respond if their apparatus cannot fit (at least, not easily) on existing narrow streets?

Neighborhood Design – Questions to Consider

2. Costs & Benefits: What do things cost and who has to pay for them? (fire department budget, public works dept. budget, home prices & rents, etc.)

Costs & Benefits - Examples

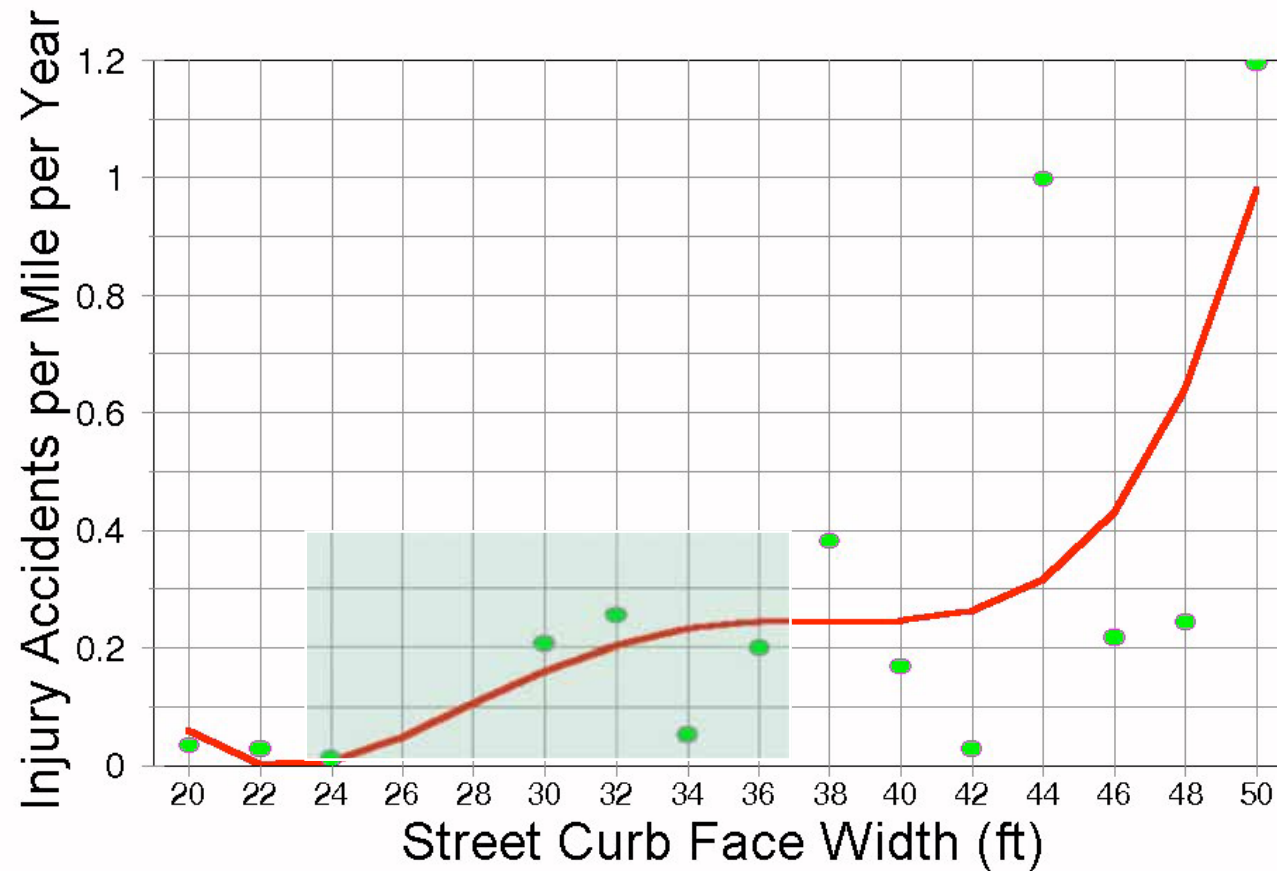
1. What does it cost to build, equip, staff and maintain a firehouse?
2. What does it cost to purchase a new ladder truck?
3. What does it cost to build & maintain one linear mile of street at 36' width, instead of 26' width (including land value)?

Advantages of narrow streets

Advantages of narrow streets

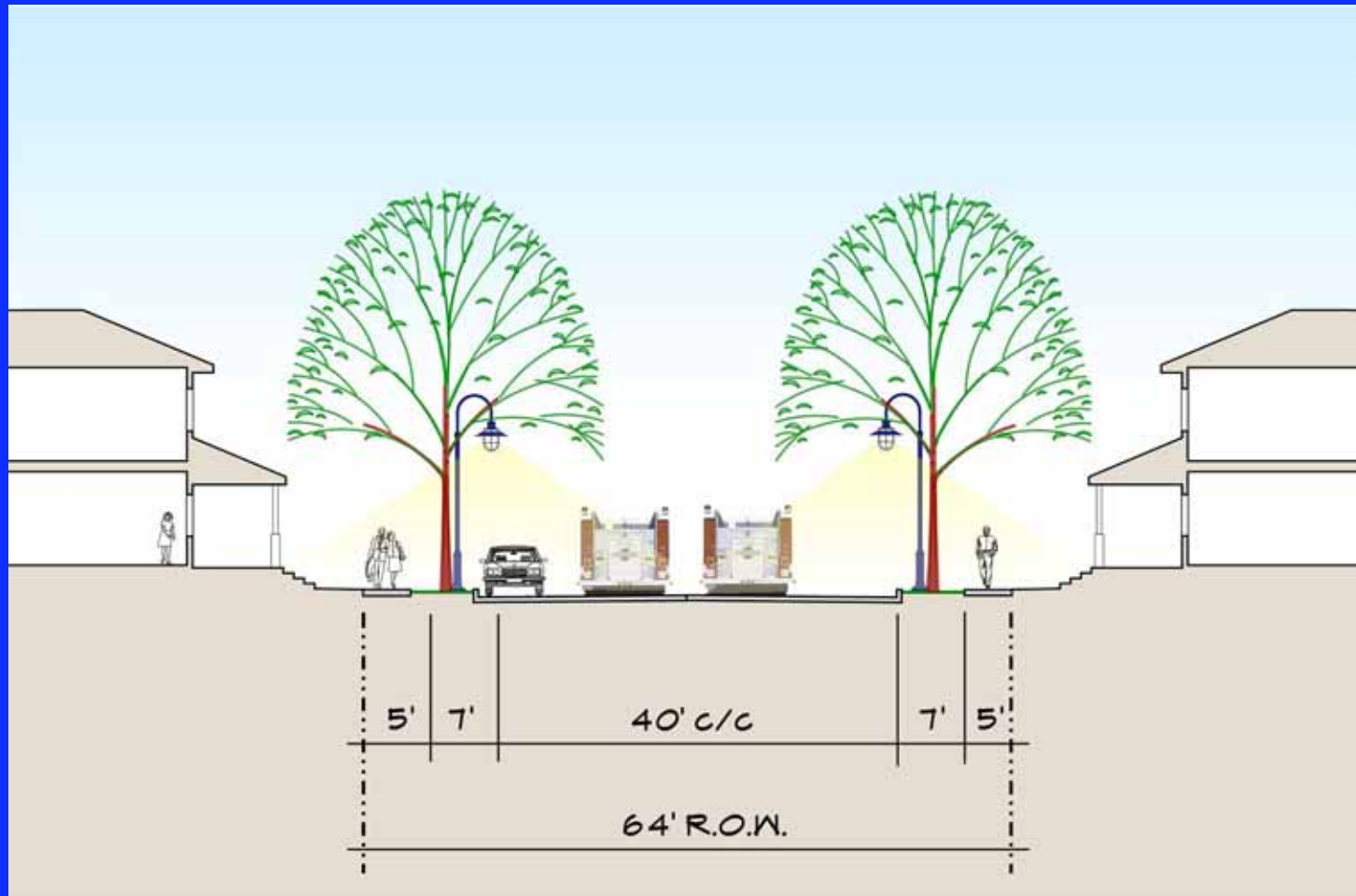
Street Width and Injury Accident Rate

4th Order Polynomial ($R^2 = 0.52$)



Advantages of Wide Streets

1. Wide streets allow one fire vehicle to pass another



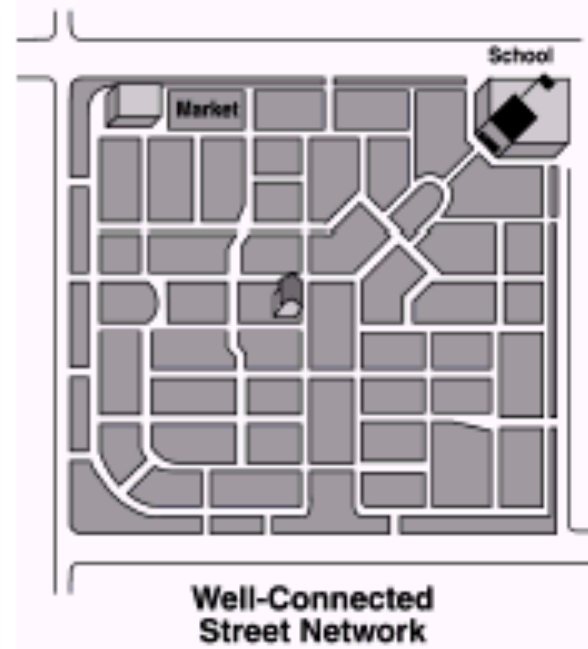


Two Basic Approaches

1. Design streets to accommodate existing fire apparatus & staffing
2. Alter fire apparatus & staffing to accommodate smaller streets

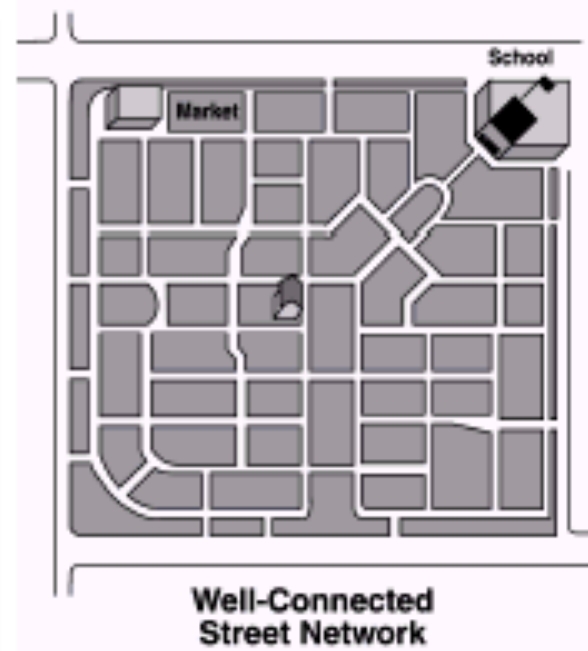
Alternate approach: go around the block

✓ **Connected Street Networks.** Connected street networks provide multiple ways for emergency response vehicles to access a particular location and multiple evacuation routes. In addition, a connected street system encourages slow, cautious driving since drivers encounter cross traffic at frequent intervals.



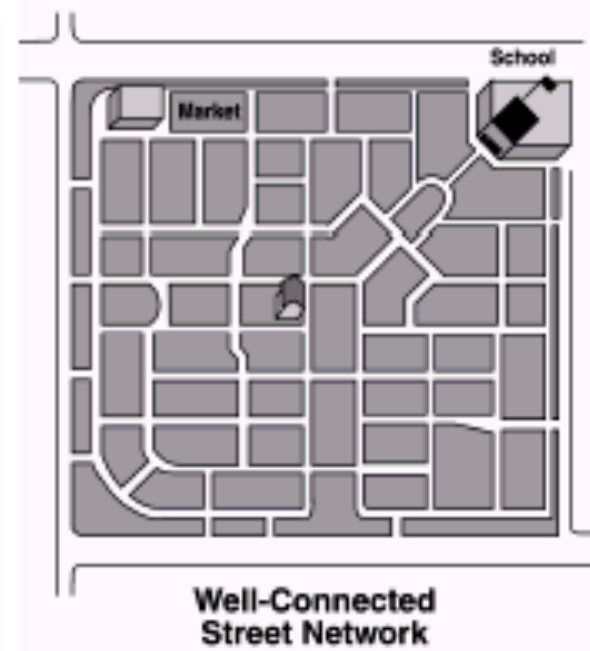
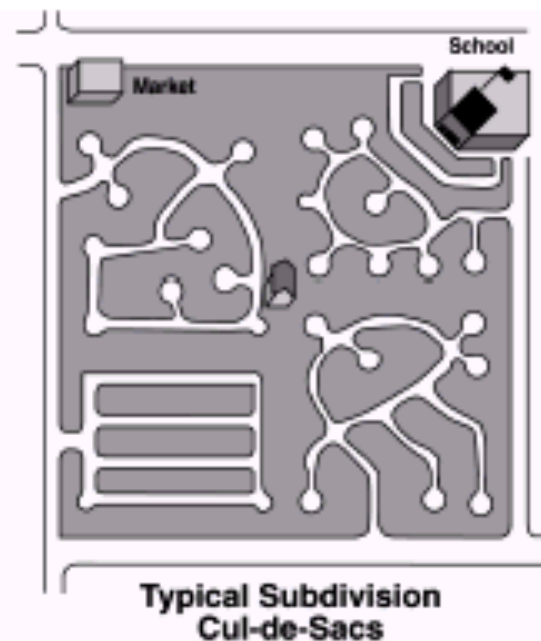
Potential solution: limit block length

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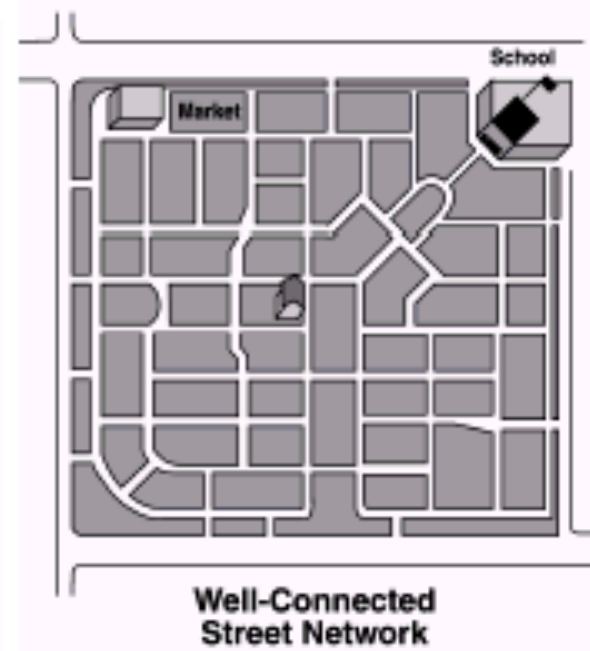
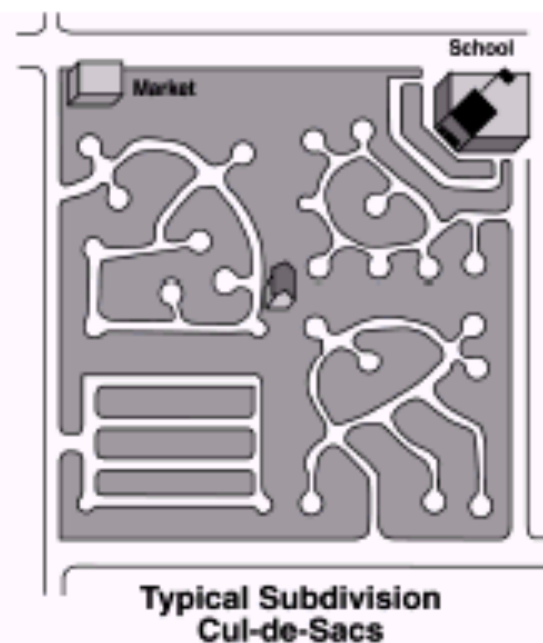
Potential solution: limit block perimeter

✓ **Connected Street Networks.** Connected street networks provide multiple ways for emergency response vehicles to access a particular location and multiple evacuation routes. In addition, a connected street system encourages slow, cautious driving since drivers encounter cross traffic at frequent intervals.



Potential solution: Limit cul-de-sac length

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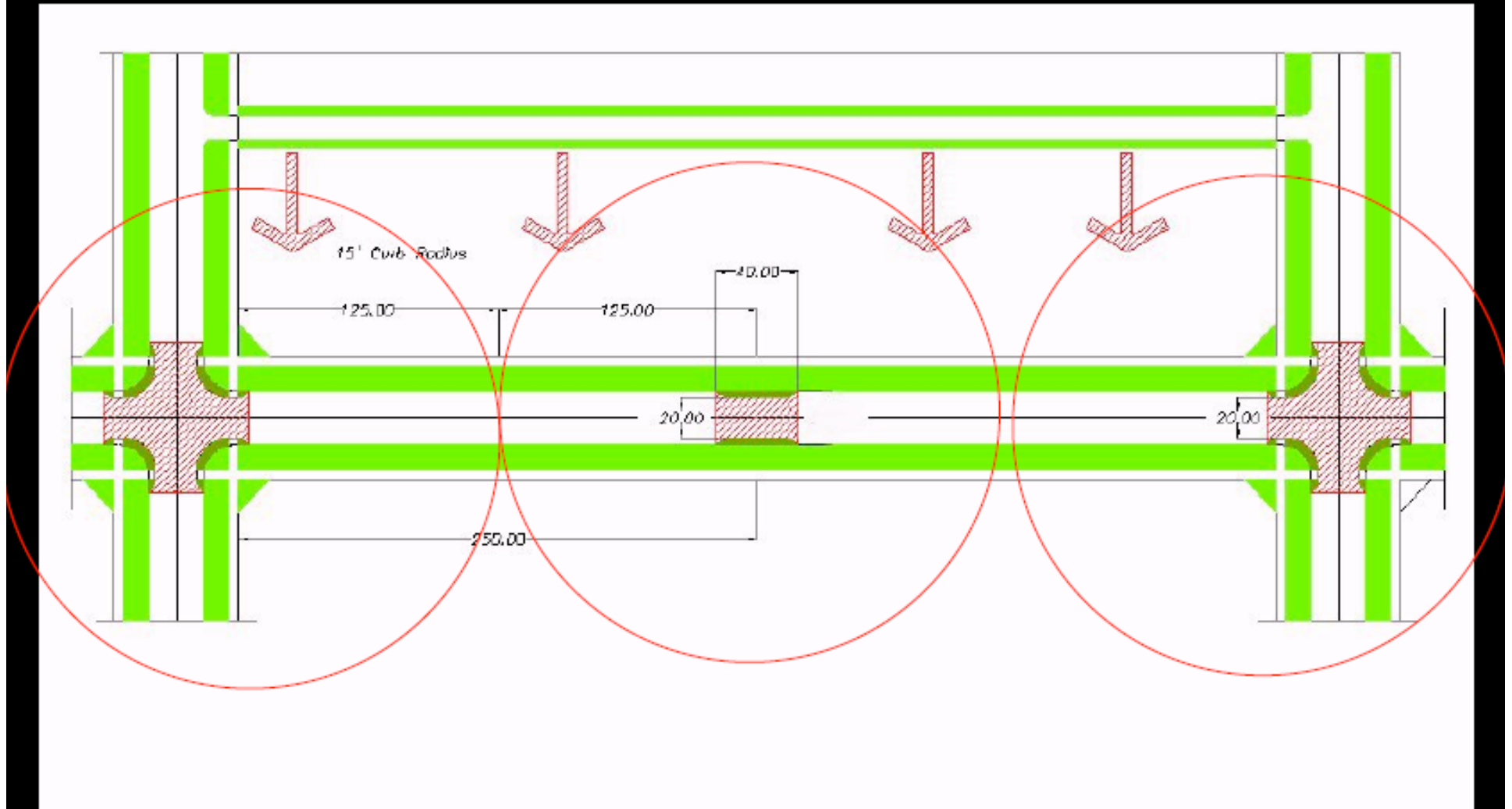
2. Wide streets provide room to connect hoses to pumps on the side of an engine & room to work around them



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Potential solution: provide 20' clear width at set-up zones



Potential solution: provide 20' clear width
at set-up zones

- Provide mid-block bulb-outs with red curbs at least every 150'
- Provide bulb-outs at intersections to allow staging
- Provide paired driveways, which creates clear zones





Alternate approach: connect hoses to pumps on the rear of an engine



Alternate approach: connect hoses to pumps on the rear of an engine

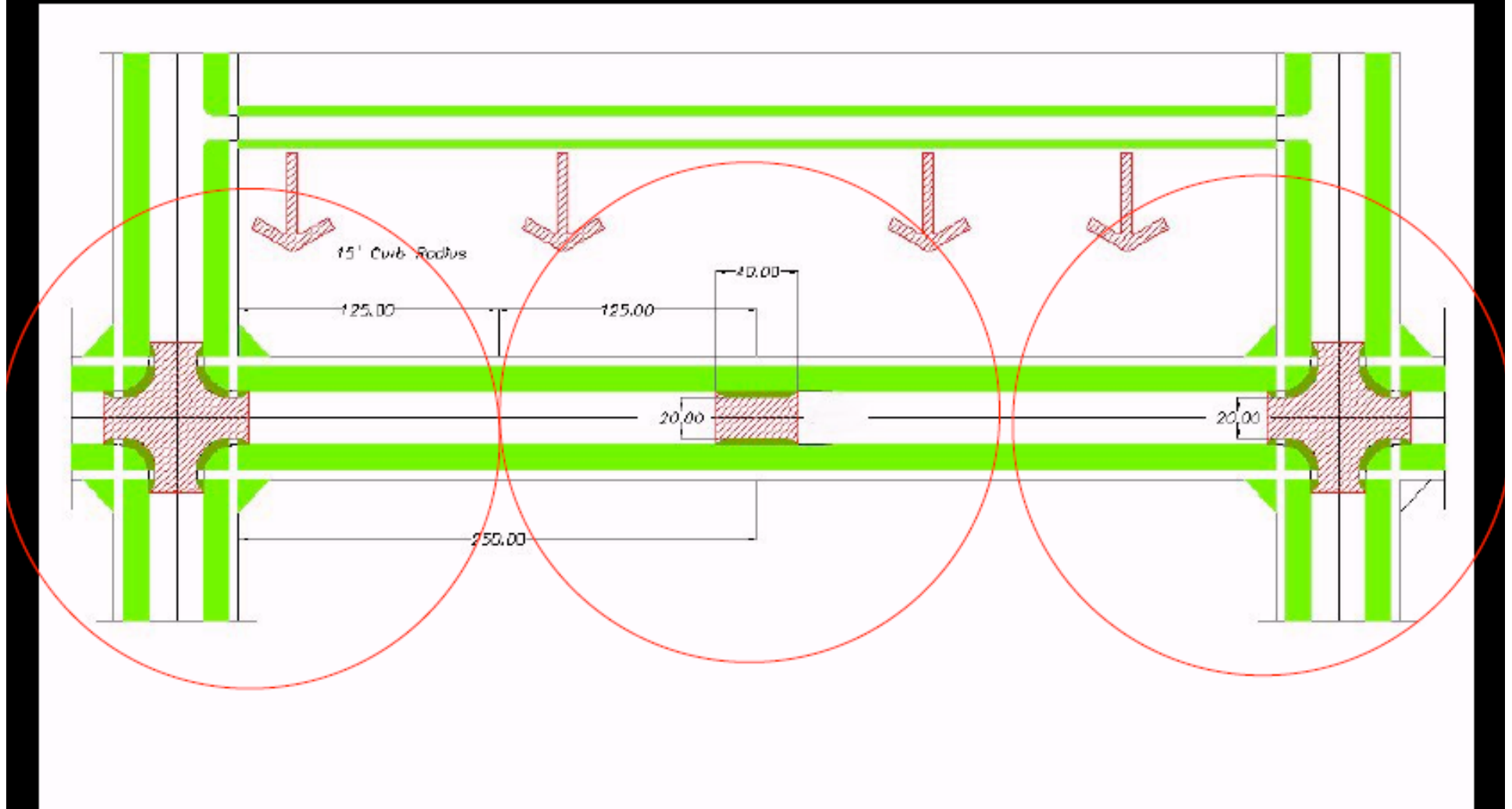


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3. Wide streets provide room to open swing-out doors on equipment cabinets & work around them (while wearing air packs)



Potential solution: provide 20' clear width at set-up zones



Alternate approach: Use roll-up doors on equipment cabinets



Scania Rescue Pump

<http://www.bucksfire.gov.uk/BucksFire/Fire+Stations/Meet+the+fleet/BEA1-KX57TWL.htm>

Alternate approach: Use roll-up doors on equipment cabinets



<http://www.bucksfire.gov.uk/BucksFire/Fire+Stations/Meet+the+fleet/BLE1-KX55PMO.htm>

4. Wide streets provide room to deploy ladder racks to sides of fire engines



Alternate approach: use manual ladder racks



Alternate approach: use ladder racks that deploy to the rear



5. Wide streets provide room to deploy stabilizers on aerial ladder trucks



Potential solution: require wide streets only where aerial ladder will need to be deployed (i.e. buildings taller than X feet)



Alternate approach: use aerial ladder trucks (Metz, etc.) with outriggers that require less width

Rosenbauer Raptor brochure:
"Over 100' reach but drives like a pumper. The Raptor's short wheelbase allows this rescue-platform to maneuver in tight or congested street where others simply cannot. For this reason, the Raptor was a natural fit in the narrow streets of tourist communities such as Nantucket Island, Mass."



Alternate approach: use aerial ladder trucks (Metz, etc.) with outriggers that require less width

- The Out-and-Down Jacking System
- All four METZ Out-and-Down Outriggers can be extended to their maximum spread of 14 ft. 9 in. within 20 seconds. No jack pins are required so that the aerial can be raised as soon as the electronic ground pressure sensors have detected ground contact. Even short jacked at 8 ft. 3 in. the ladder can still be rotated 360 degrees and extended to its full height. The maximum horizontal reach, though, is then automatically limited by the METZ Operating System

Metz



When seconds count, Metz delivers!

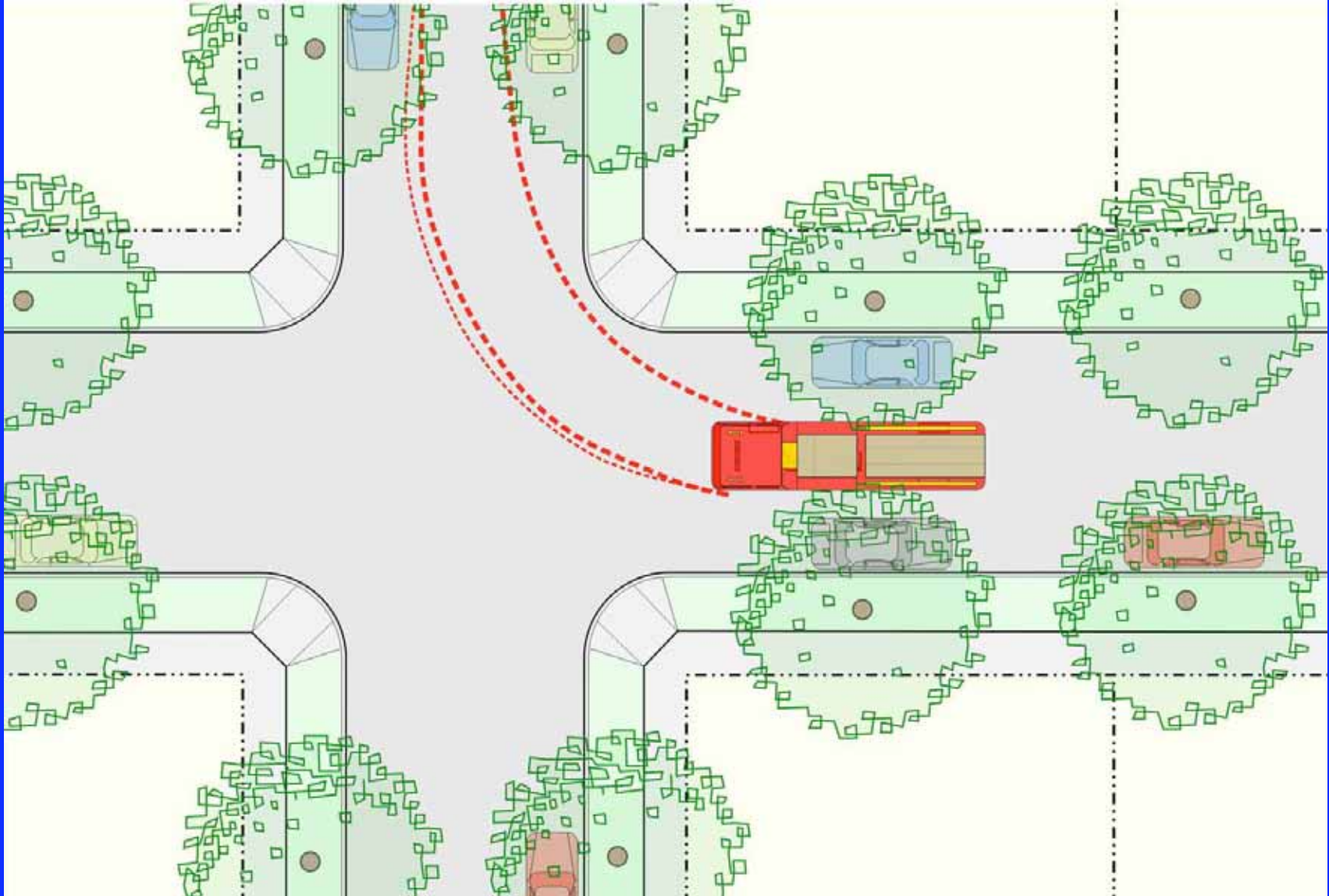


Alternate approach: use aerial ladder trucks (Metz, etc.) with outriggers that require less width



<http://www.bucksfire.gov.uk/BucksFire/Fire+Stations/Meet+the+fleet/TurntableLadder.htm>

6. Wide streets provide adequate turning radii at corners & curves



Potential solution: test street designs using turning templates for the fire apparatus that will need to use those streets; provide extra width only where needed



Alternate approach: use fire apparatus with better turning radii ('Milwaukee Engine' from Pierce, etc.)



7. Wide streets provide room for high-speed driving, meaning faster response times

Potential solution: reduce response *distance*,
since
response time = speed * distance

- Require connectivity
- Require compact neighborhoods

Response time = average speed * response distance

To improve response times

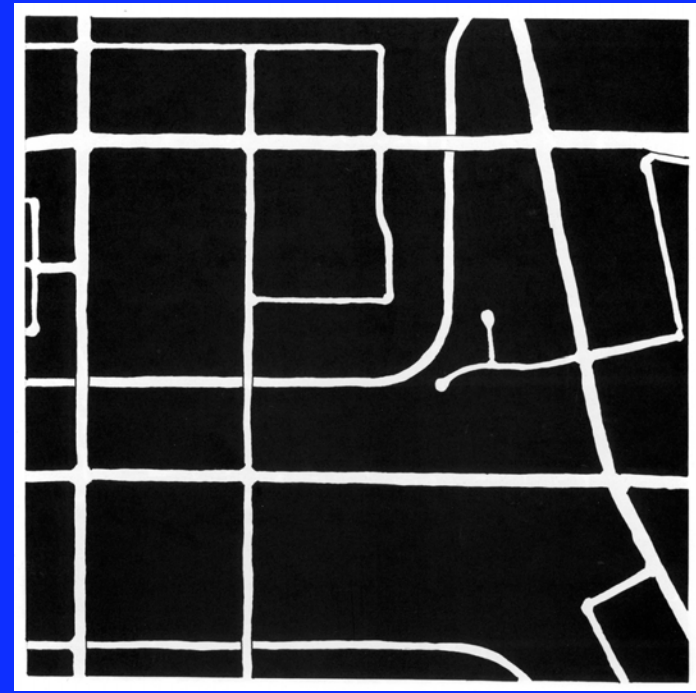
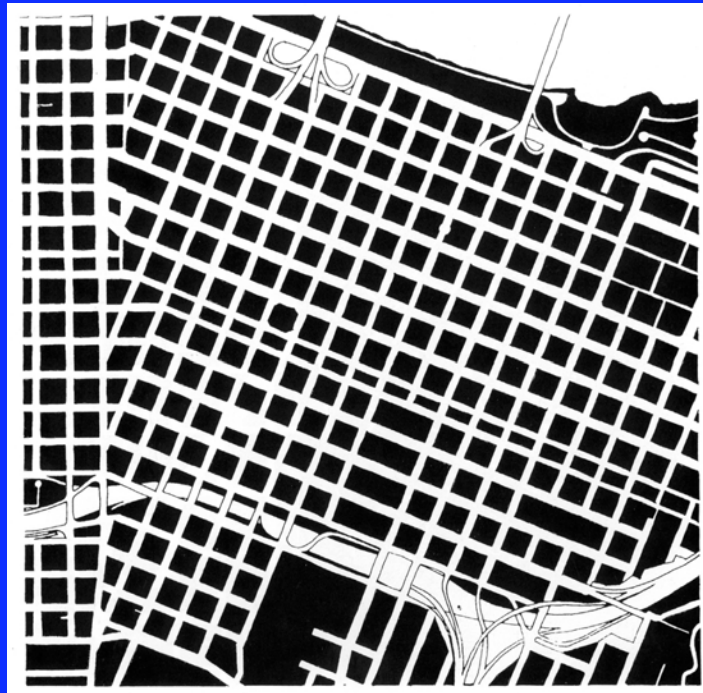
Option 1: Increase speeds

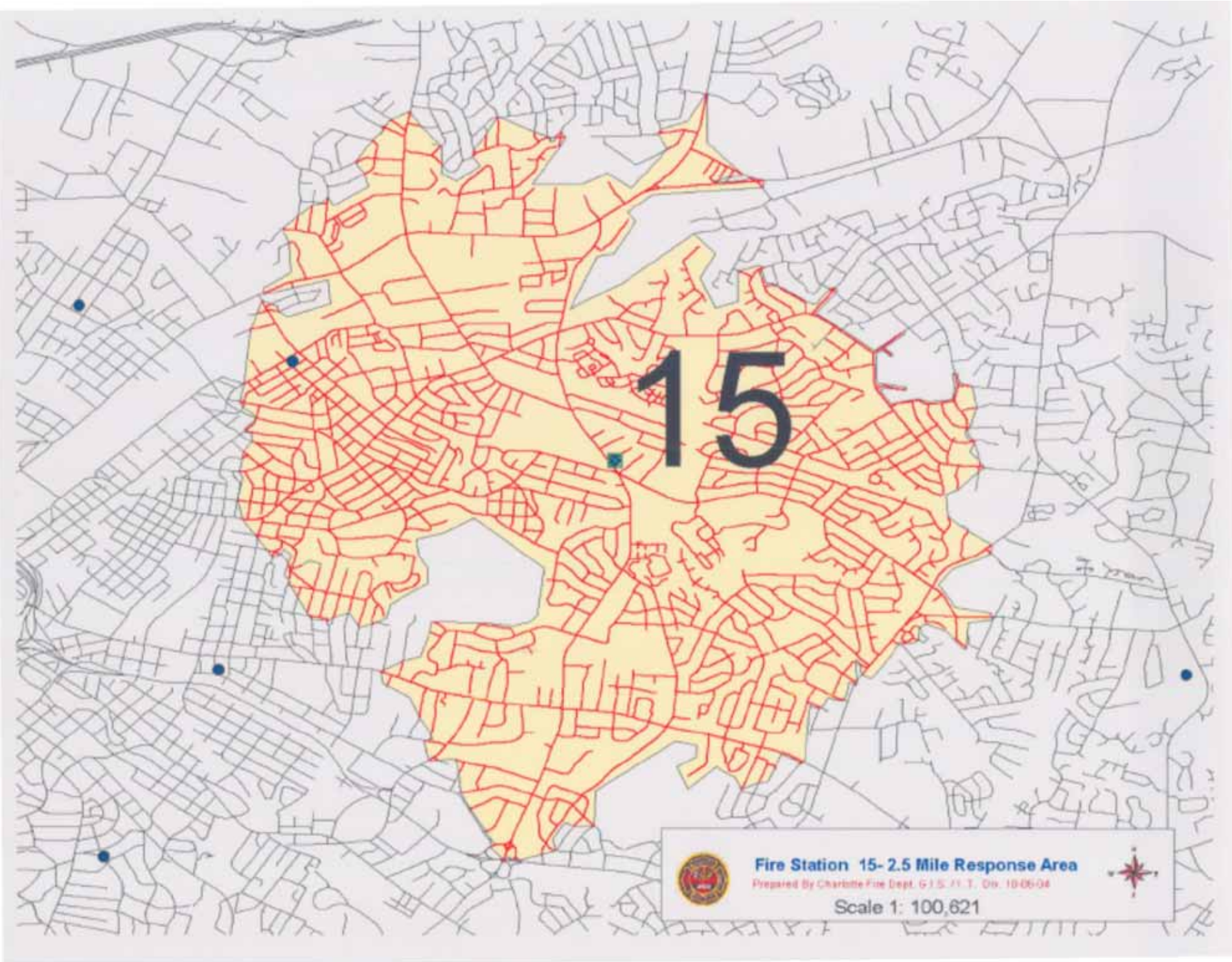
Option 2: Reduce response distances


- Design shorter routes from firehouse to homes
- Keep homes closer to existing firehouses

Benefits of Street Connectivity

1. More trips stay on local streets => less congestion on arterial streets
2. More direct routes => Shorter response distances





 **Fire Station 15- 2.5 Mile Response Area**
Prepared By Charlotte Fire Dept. GIS / T. Div. 10-06-04 

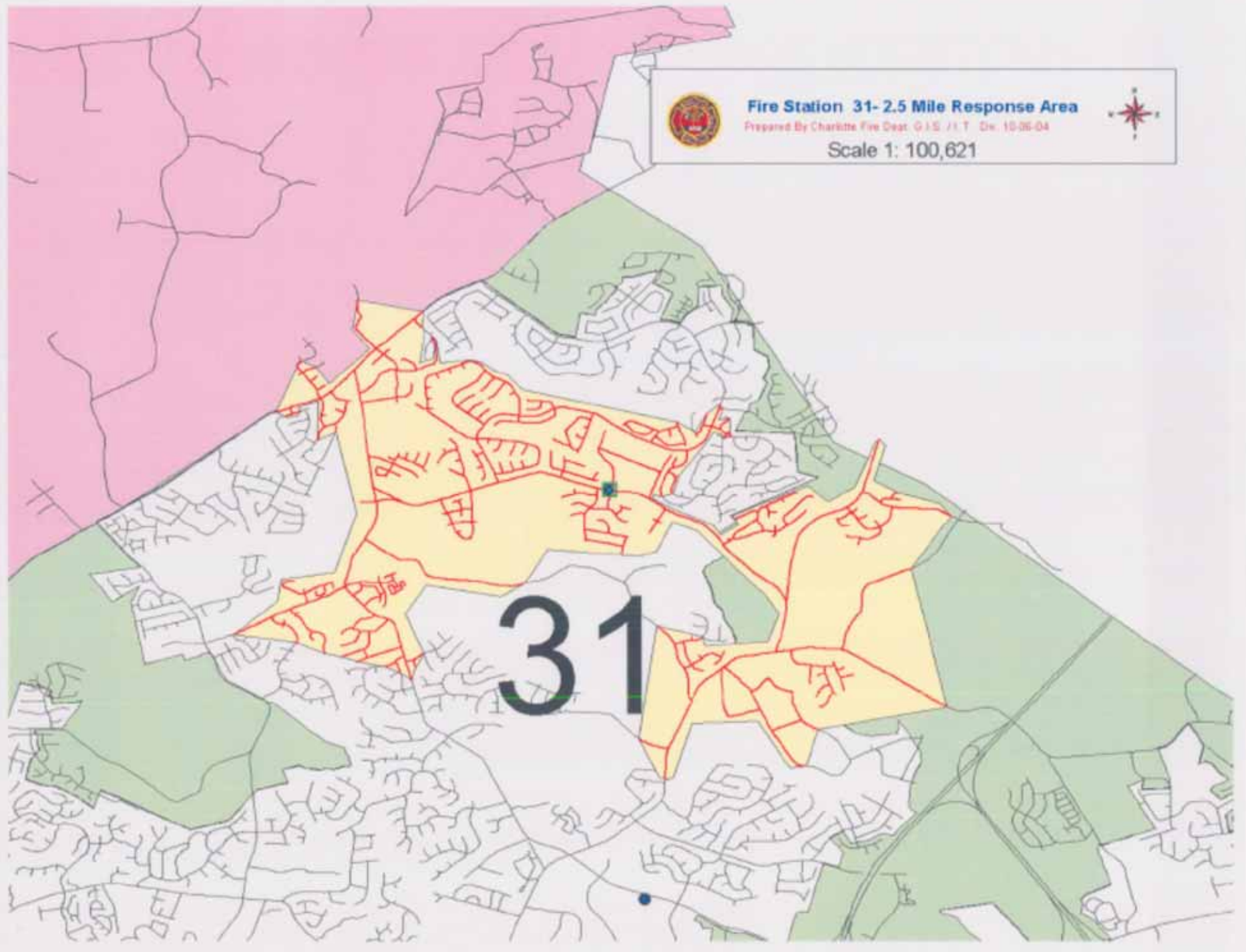
Scale 1: 100,621



Fire Station 31- 2.5 Mile Response Area

Prepared By Charlotte Fire Dept. GIS / J.T. Dr. 10-06-04

Scale 1: 100,621

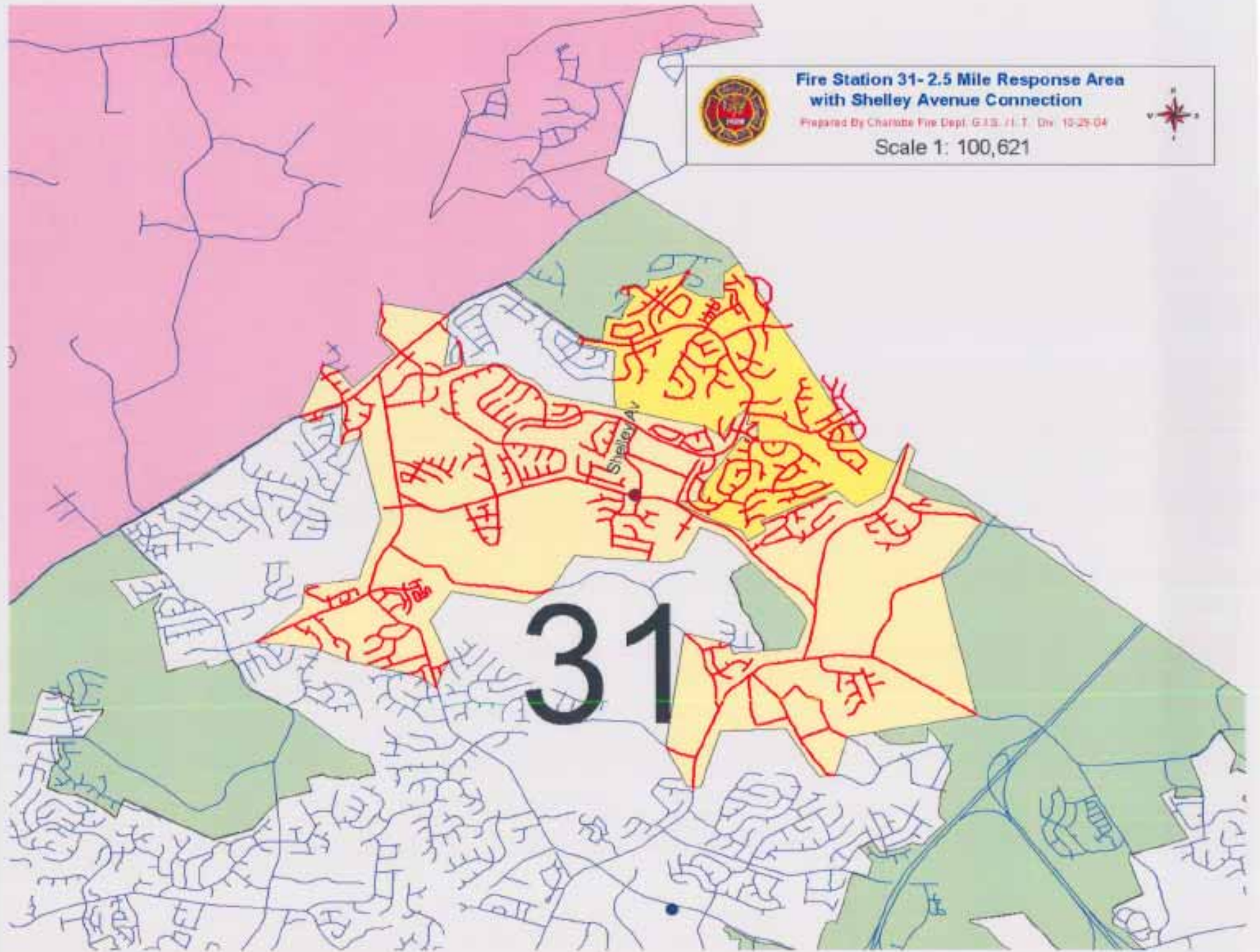




**Fire Station 31-2.5 Mile Response Area
with Shelley Avenue Connection**

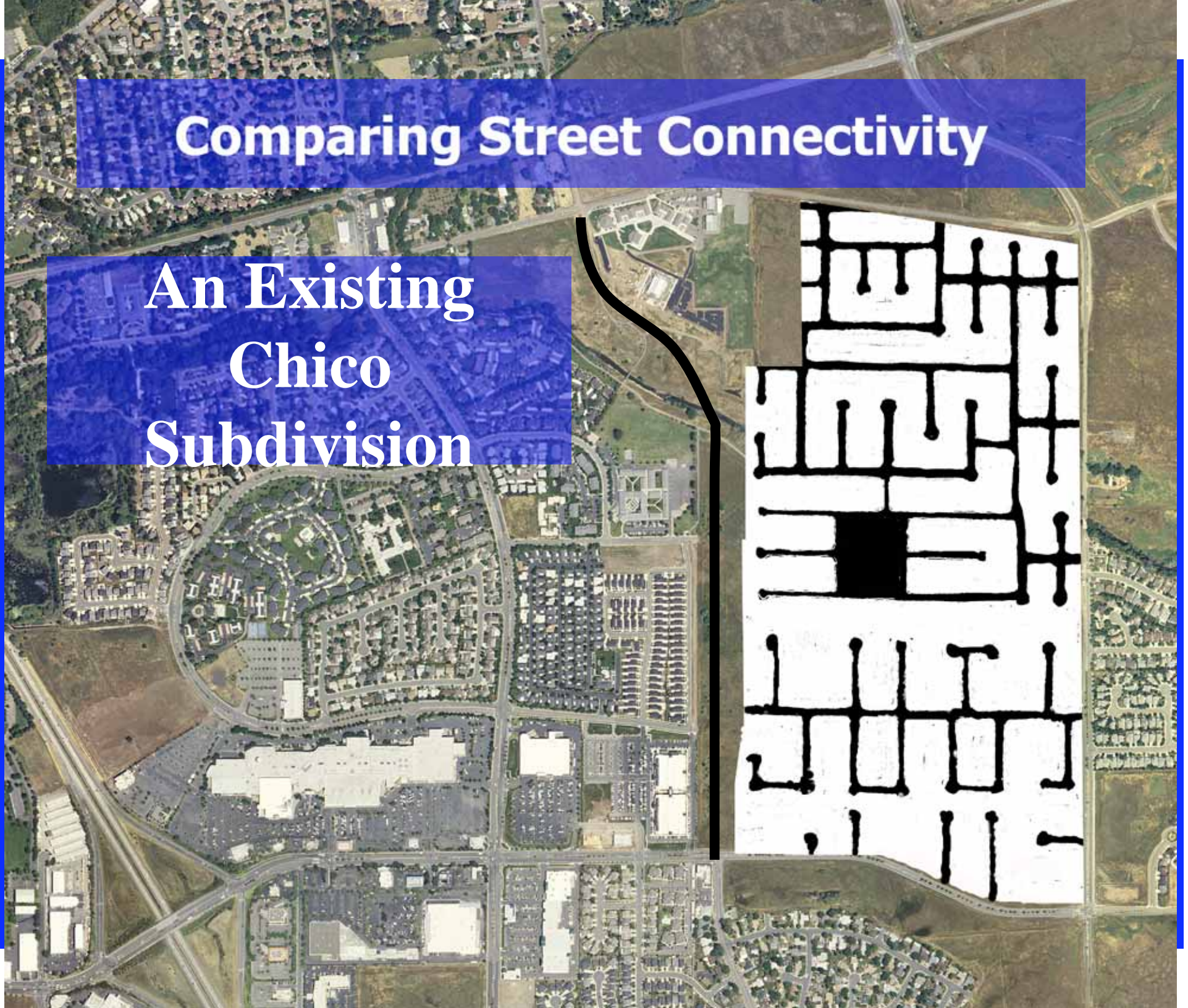
Prepared By Charlotte Fire Dept. GIS / I.T. Div. 10-29-04

Scale 1: 100,621



Comparing Street Connectivity

An Existing
Chico
Subdivision

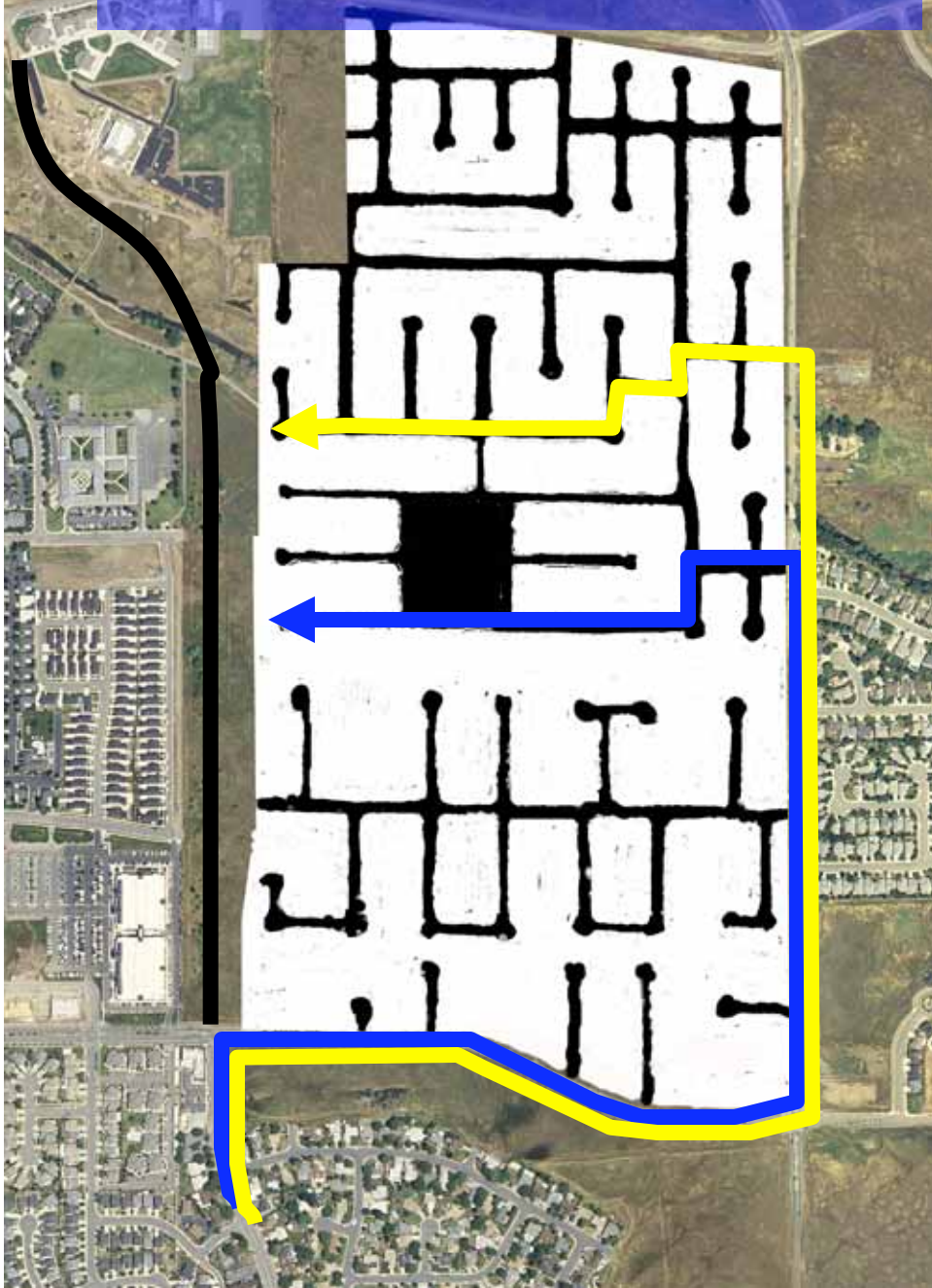


Comparing Street Connectivity

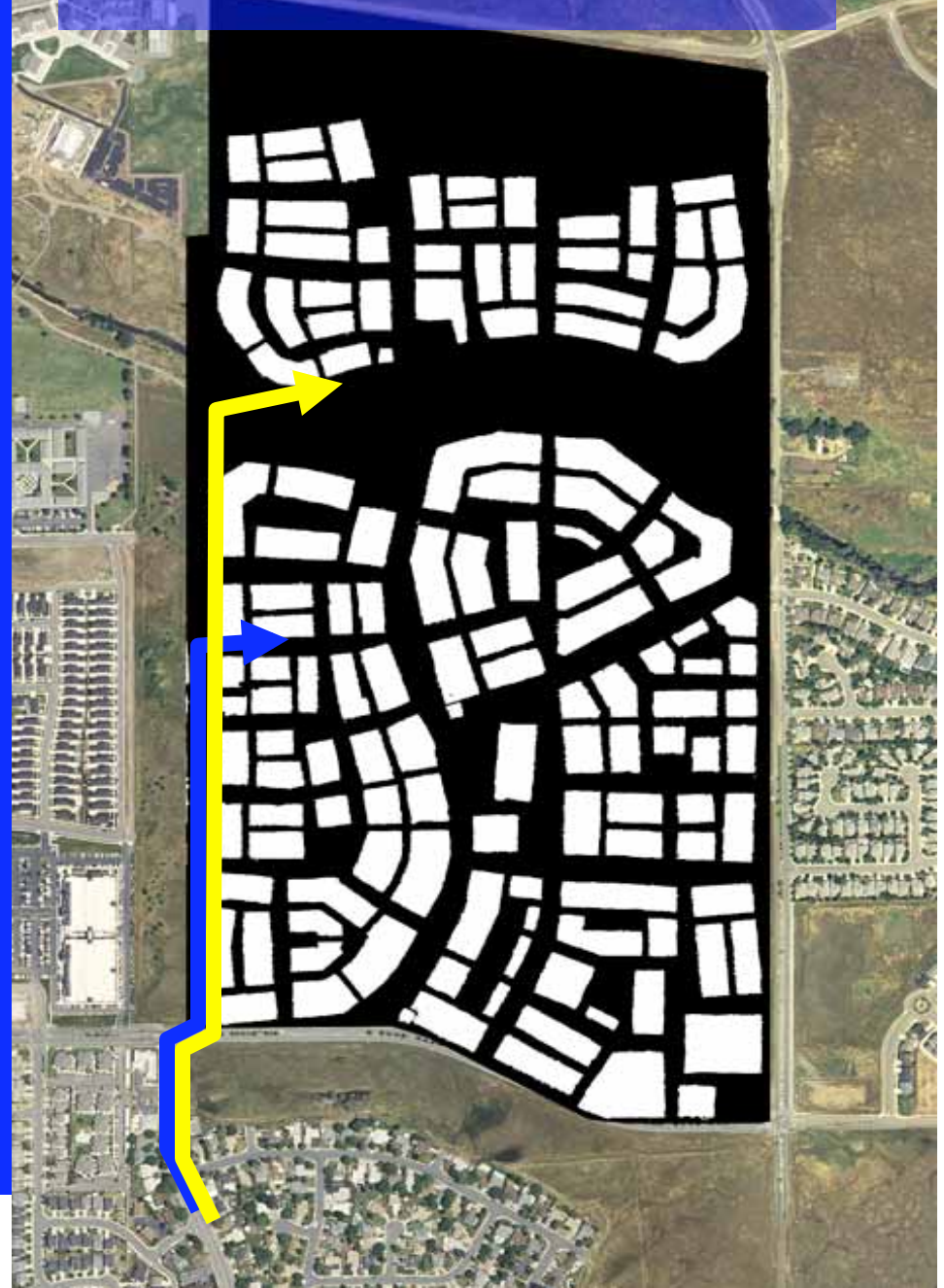
Proposed Plan



Long, slow routes



Short, direct routes



Response time = average speed * response distance

To improve response times

Option 1: Increase speeds

Option 2: Reduce response distances

- Design shorter routes from firehouse to homes
- Keep homes closer to existing firehouses

Doe Mill in Chico, CA: 8 units/acre



Sierra Nevada: < 1 unit/acre
an example of "ex-urban sprawl"



Response time
= average speed * response distance

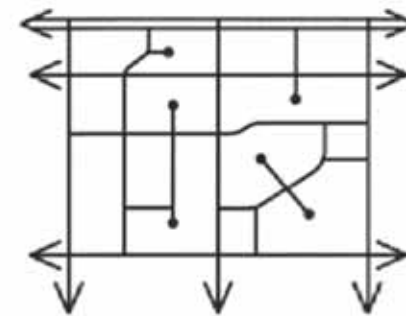


Codes that require connectivity & allow
narrow streets

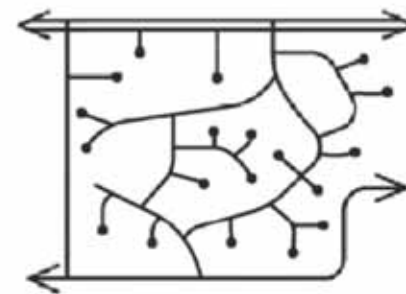
Communities with street connectivity ordinances

Portland, OR
Beaverton, OR
Eugene, OR
Fort Collins, CO
Boulder, CO
Cary, NC
Huntersville, NC
Cornelius, NC
Conover, NC
Middleton, DE
Orlando, FL
Etc.

Figure 6-1 Example Local Street Circulation Patterns



Preferred



Discouraged

Original Source: Tri-County Metropolitan Transportation District of Oregon (Tri-Met), *Planning and Design for Transit*, 1993. (Modified by City of Salem)

Two Basic Approaches

1. Design streets to accommodate existing fire apparatus & staffing
2. Alter fire apparatus & staffing to accommodate smaller streets

9. Wide streets provide room to maneuver around illegally parked cars

Potential solution: use bulb-outs, other design measures to discourage illegal parking

Potential solution: require connected streets, so one can go around the block

10. Wide streets allow aerial ladder trucks to deploy ladders to intermediate stories

Potential solution: define space required to deploy aerial ladders to each building

11. Wide streets allow firefighters and apparatus to stay out of the collapse zone for buildings

Potential solution: define the collapse zone for each building, provide space to keep apparatus out of it

12. On major routes, wide streets provide room to maneuver around traffic congestion

Potential solution: provide bicycle lanes to
provide space to pull over

Potential solution: provide bus-only lanes
to create uncongested lanes

Potential solution: provide spaces to pass
over medians

Potential solution: pass over centerline

Potential solution: require connected streets to provide (a) alternate routes and (b) reduce congestion on major routes

Potential solution: use congestion pricing,
maximum parking requirements, etc. to
eliminate congestion

Other Advantages of narrow streets

Lower Maintenance Costs



Phoenix, AZ: 4-foot narrower streets save \$70,000 a mile in repaving costs

Greater Housing Affordability



“each 10 feet of required street width reduces the supply of homes by 3 to 4 percentage points.”

- University of Wisconsin-Madison Center for Urban Land Economics Research

Greater energy efficiency



Visalia, CA: Reducing street width by 8 feet lowered ambient temperatures 10 degrees to 15 degrees Fahrenheit.



Reduced pavement
= reduced stormwater
runoff
= reduced pollutant
loadings

