# Modern Network Design (MND) Product

## INTRODUCTION

This draft describes the suggested characteristics and attributes that a modern multimodal transportation network should have. While the network structure is built upon a framework of thoroughfares, those thoroughfares should be configured to optimize the mobility, access, and services that pedestrian, bicycle and transit can provide in addition to roadway systems. This document also presents a set of performance measures that can be used to evaluate the effectiveness of urban transportation networks.

## THE VISION

The Modern Network Design (MND) comprises the full range and arrangement of thoroughfares required to support smart growth and new urban development. The MND includes a range of types of thoroughfares – streets, roads, parkways, avenues, boulevards, alleys, and the like – built and connected in a way that complements compact, mixed-use, pedestrian-friendly land development. The MND intrinsically provides the armature for a built environment that supports walking, cycling, transit, and driving – and living. With this diversity, the MND provides an environment in which diverse housing types can elegantly coexist with businesses, entertainment, cultural, and education institutions of all varieties.

The MND stands in stark contrast to the conventional suburban thoroughfare network, which derived from the same factors that produced single-use, auto-dependent sprawl. In addition to better supporting better land development, the MND provides greater compatibility with its surroundings and more support for alternative modes of travel. The MND outperforms its conventional counterpart over a broad range of transportation and community outcomes.

The MND can be broadly characterized by the ways in which it differs from the conventional, failing suburban network.

| Modern Network Design | Conventional |
|---|---|
| Highly Connected | Partially connected |
| Multimodal | Auto-dependent |
| Accessible destinations | Indirect routes |
| More public streets | Fewer public streets |
| Detailed streetscape | Few streetscape elements |
| Welcoming for pedestrians | Dangerous and unpleasant for pedestrians |
| More route choices / redundant | Fewer route choices / prone to breakdown |
| Smaller (narrower ?) streets | Wider streets |
| Finer grained | Coarser grained |
| Lower speeds but faster trips | Higher speeds but longer trips |
| Focus on quality of place | Focus on flow of vehicles |
| Less delay at intersections | More delay at intersections |
| Simpler turns | More complicated turns |
| Supports activity on sidewalks adjacent to streets | Sidewalk and adjacent activity subservient to traffic flow |

- MND Objectives:
  - characteristics – network should be highly connected, multimodal, and accessible, with smaller and more thoroughfares offering redundancy, people mobility rather than car speed, throughput rather than speed, and simpler nodes, activity and access rather than access alone.
  - performance - better on congestion, VMT, safety, and cost for infrastructure
  - compatibility and mutual support between land use and transportation
  - take advantage of the land use - transportation relationship and opportunities, supporting internalization and linking of trips

**DESIGNING IT**

Modern Network Design (MND) is based on the interaction between land uses, compatibility of transportation facilities with land uses, and network density needed to meet demand. It is the process of configuring transportation facility components into a system that meets the vision of new urbanism/smart growth. MND considers all land based transportation modes in an integrated fashion. These modes include – private vehicles, busses, truck traffic, commuter and light rail, bicycles, and pedestrians.

Appendix A shows how conventional network design differs from the new urbanism/smart growth approach.

Appendix B shows a sketch of an area-wide network that fits the stated vision. Appendix B also contains a sketch of 10 possible street layouts to provide accessibility and mobility to neighborhood, town and urban centers. This appendix also contains a discussion of the applicability of each street layout by area center type, traffic level compatibility, and the advantages and disadvantages of each street layout option.

The following are some key components of Modern Network Design:

1. Connectivity

There should be connectivity generally between all adjacent urban areas especially for the following conditions:

- Within and between neighborhoods and from neighborhoods to neighborhood centers.
- From one neighborhood center to another and from neighborhood centers to town centers.
- From one town center to another and from town centers to urban centers
- From one urban center to another and from urban centers to regional transportation facilities

2. Continuity

There should be opportunities for continuous movement:

- Within neighborhoods (neighborhoods can be residential or part of a mixed use development)
- Between the various centers (neighborhood centers, town centers, and urban centers)
- Between major facilities (inter regional)

3. Circulation patterns

Circulation should be ubiquitous and multimodal providing:

- Connections should be as direct as possible to prevent circuitous travel within and neighborhoods and centers
- Block lengths should be fairly short (preferably less than 600 feet)
- The transportation system should be focused on the various centers
- The transportation system should be designed as an integrated multimodal system

4. Street density

Street density should be function of activity intensity and street types. Higher activity intensity results in high traffic demand, which requires more street capacity. Each street type has a maximum recommended number of lanes ***(See Appendix D – Street Matrix by others, CNU work group)***. In high intensity areas the spacing between higher classes of streets should be less to maintain the required capacity and stay within the maximum lane requirements.

5. Accessibility versus mobility

High capacity streets such as freeways and expressways should be designed and used for high levels of mobility, whereas connectors and local streets should be designed to provide access and local mobility. The remaining street types (major thoroughfares) should be designed to provide the balance between accessibility and mobility.

6. Street types

The functional classification of streets for new urbanism/smart growth is addressed in a matrix currently prepared by the CNU work group led by Fred Dock (See Appendix D).

7. Land use compatibility

Street types should be compatible with and supportive of the intended activities and environment associated with the adjacent area types and land uses. Appendix C contains a table that shows the compatibility of the various street types and the various land use categories.

A well designed MND will have surround groups of (mostly mixed use) neighborhood with a framework of connecting thoroughfares (connectors and higher types) that are spaced in accordance with estimated demand. The thoroughfares will all accommodate multiple modes; major thoroughfares will be able to handle significant transit service or regional transit routes. Freeway/expressways will be reserved for longer distance, through trips where demand will be too high for major thoroughfares to handle.

**ASSESSING IT**

The performance of transportation networks is typically measured along very few dimensions, few of which are meaningful in urban contexts. Vehicle congestion, “level of service,” and average speeds dominate most performance studies. Urban networks require performance for all users over a wide range of conditions. A broad range of research is underway to compare the performance of alternative networks, including conventional dendritic systems, traditional grids, and some networks approximating MND. The research ranges from neighborhood to regional scale, from theoretical to empirical, and evaluates alternative networks including traditional connected urban, conventional dendritic suburban, and new urban or MND. Early results indicate that urban and modern network designs provide equal or superior performance on a number of conventional and broader performance measures.

Clearly, the comparison of alternative networks requires the ability to distinguish among the characteristics of networks as built. However, as indicated in Designing It above, the range of design criteria in use has conventionally been quite limited. A more robust range, including criteria other than minimum speed, supports the design of the MND. Specifically, multimodal connectivity, continuity, circulation, and accessibility measures can contribute to the design of more effective and more beneficial networks.

We have examined a large number of specific measures in current practice and research, with the goal of selecting a small number to carry forward as (1) capable of differentiating between network designs, (2) operational and measurable, and (3) proven or potentially meaningful in predicting performance. These measures include:

1. Network grain – measured as intersection density or average block size. The former, intersection density, offers the most examples in practice. It should be calculated without including "intersections" with dead-end facilities in the calculation, as they do not contribute to route choice.

2. **(Need specific measure)** Pedestrian route directness – includes both vehicle thoroughfares with sidewalks and ped/bike-only thoroughfares.

3. Pedestrian environmental quality – operationalized in many ways, but it is critical to include a measure of the quality of the pedestrian experience and not just its "quantity" as reflected in route directness. Would include measures of street-frontage quality and not just sidewalks. This does not need to incoporporate crossing if a measure like (4) below is included, but some efforts have combined ped quality and crossing quality into a single measure.

4. Width of thoroughfares – operationalized in different ways, including average pavement width, percentage of major thoroughfares with more than four lanes, etc. Can indicate both ease of pedestrian crossing, and complexity of intersections/signals for vehicles.

5. Accessibility – combines multimodal transportation with land use, most promisingly in measures like "% of jobs within 45 minutes by 3 or more travel modes" and the like, although these are origin or point-specific.

With a set of measures incorporating all five of these key areas, we can begin to distinguish between the prospective effectiveness on values of alternative transportation networks. As the land use/thoroughfares compatibility sections are more fully developed, it may be possible to measure the share of thoroughfares with designs that accompany appropriate land uses and designs.

**NEXT STEPS**

1. The CNU Transportation Taskforce should review the following products:
   - Modern Network Design Design Concept (this document)

- Street Design Matrix (prepared by the committee led by Fred Dock)
2. Refine this draft based on feedback from the CNU Transportation Taskforce
3. Feed the product into the ITE/CNU/FHWA/EPA project for Context Sensitive Design for Major Urban Thoroughfares
4. Restructure the system for funding eligibility by thoroughfare type.
   - Freeways remain freeways
   - Arterial can be classified as throughways, boulevards, and avenues

# Appendices

**Appendix A**
Appendix A shows a comparison of the AASHTO Green Book network design characteristics and those of Modern Network Design (MND)

**Appendix B**
Appendix B shows a sketch of the area wide network as well as a sketch of 10 possible street layouts to provide accessibility and mobility to the centers. This appendix also contains a discussion of the applicability of each street layout by area center type, traffic level compatibility, and the advantages and disadvantages of each street layout option.

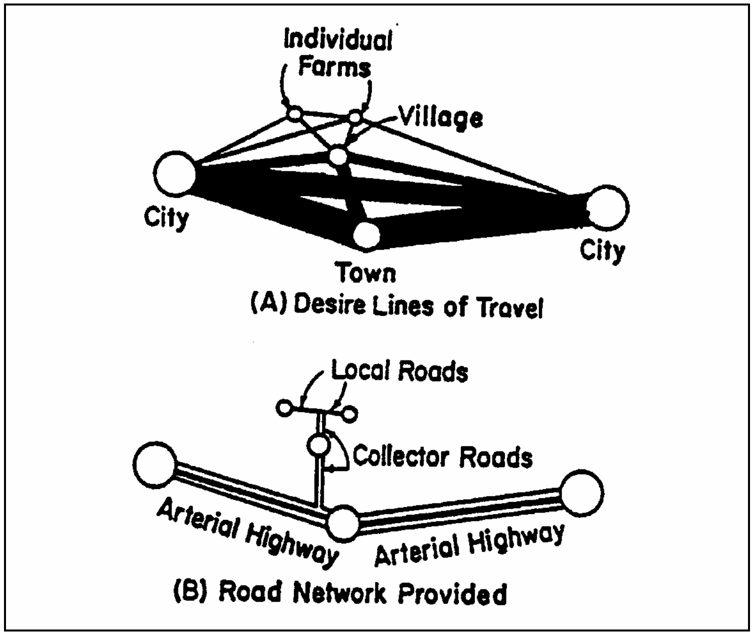
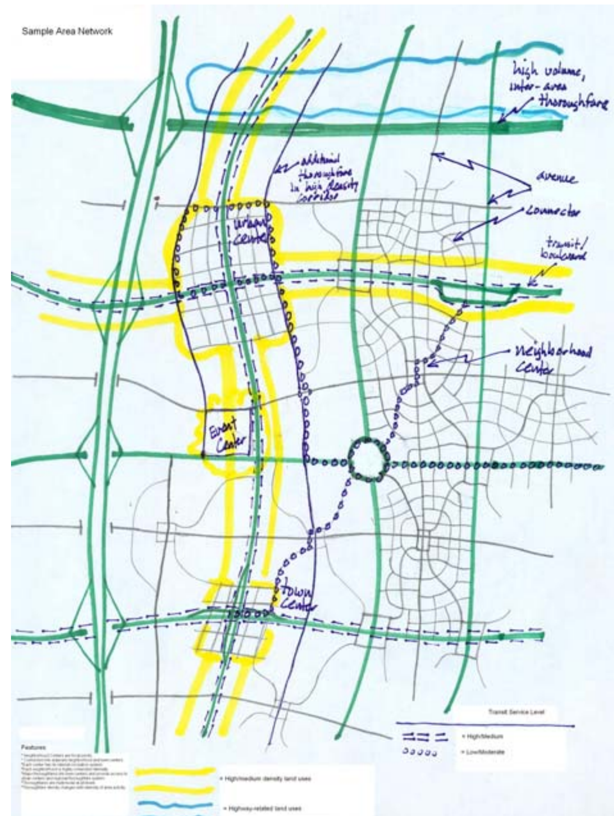
**Appendix C**
Appendix C contains a table that shows the compatibility of the various street types and the various land use categories.

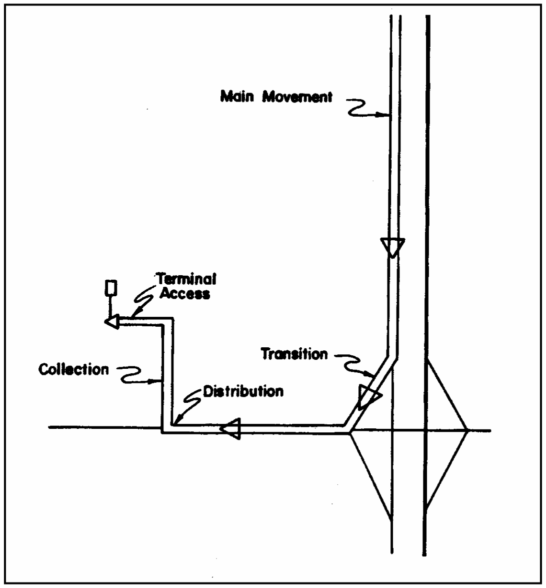
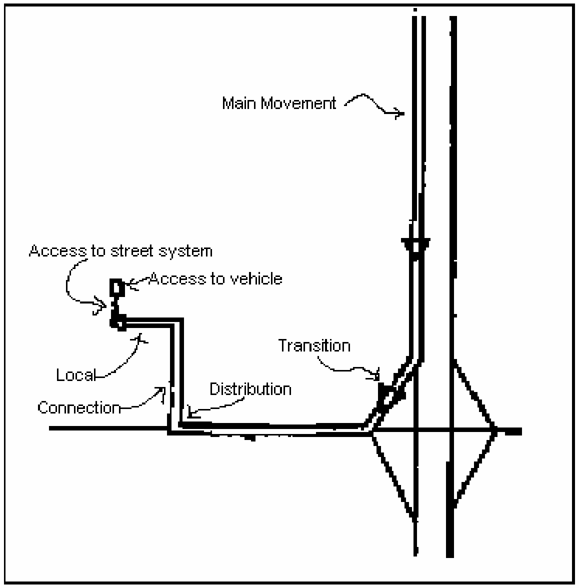
**Appendix D (from other CNU work group led by Fred Dock)**
Appendix D contains a matrix of thoroughfare types that shows key design criteria for each. This matrix is intended for use in designing urban thoroughfares within each context zone.

# Appendix A

**AASHTO Chapter 1**

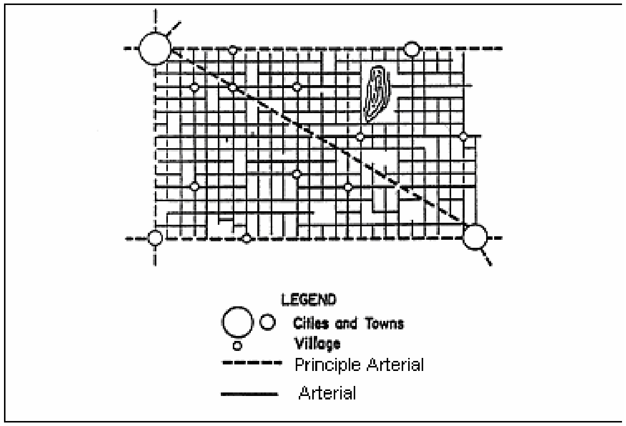
*What AASTHO says about networks, and how the New Urban Network will address these issues.*

<table>
<tr><th>AASHTO</th><th>New Urban Network</th></tr>
<tr><td colspan="2">Systems and Classifications</td></tr>
<tr><td>Describes different types of highway classification systems, describes functional classification system as one of “character of service”.<br><br></td><td>Classifies roads/streets in terms of both function and area context.<br><br></td></tr>
</table>

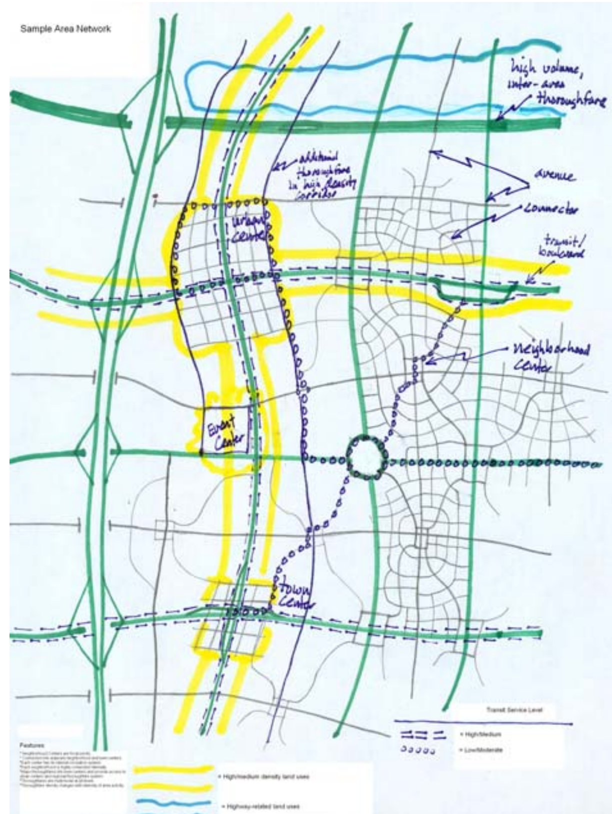
| Hierarchy of Movements | |
|---|---|
| ▪ Describes "5 stages of a trip" (which only describes half the stages of the trip).<br>▪ Long highway trips use all stages; local trips may use only some stages.<br>▪ AASHTO presumes that every trip includes high speed travel on a major road.<br> | ▪ There are up to 7 steps of a trip made by driving and each needs to be consistent in designing both the street system and the street. Not all stages are required for short trips. Stages 1-4 differ in roles from AASHTO's Terminal and Connection stages. Stages are as follows:<br>o 1. Access to vehicle<br>o 2. Access to street system<br>o 3. Local<br>o 4. Connection<br>o 5. Distribution<br>o 6. Transition<br>o 7. Main Movement<br>▪ Urban areas generally allow for a much shorter average trip length.<br>▪ More trips will be made by other modes.<br>▪ Urban areas have less VMT per capita, due to use of other modes, higher mixed use density, and higher connectivity and direct routing allowed by street network.<br> |

**_Functional Relationships_**

Describes and illustrates typical rural and suburban network, is more vague on urban networks. Continuity and connectivity is provided by a 1-mile grid of arterials supplemented by direct routes between major destinations. Networking is note addressed at the collector or local street level sot it is not complete. Additional capacity is provided by widening or upgrading higher class roads.



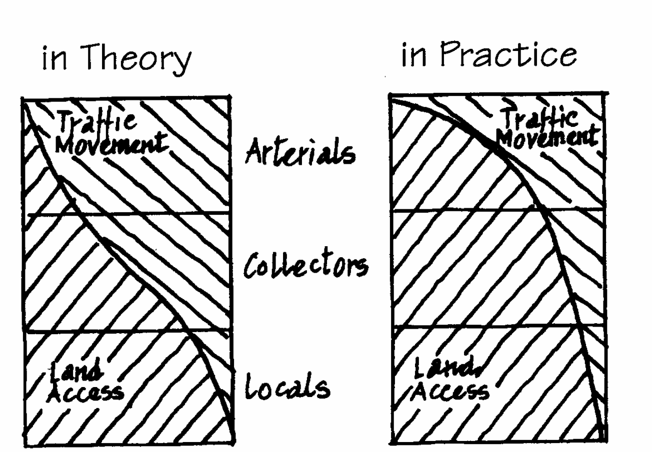

Networking extends down to the minor street system. Connectivity is high at all street classification levels. Network density may increase at higher




classifications to accommodate higher demand levels; increasing density of major thoroughfares is preferable to having fewer but wider thoroughfares.

## ***Access/Mobility Relationship***

Access is only "incidental", on urban arterials. Arterials will provide "major traffic circulation movements". AASHTO defines the relationship of access/mobility (left). However, the graph on the right better represents how the system actually works (right).

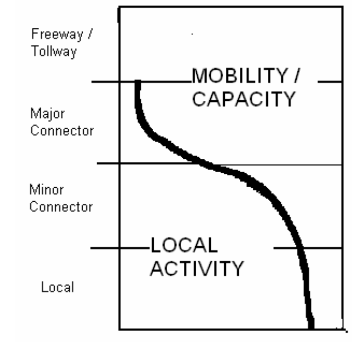



Source: Reid Ewing, Transportation and Land Use Innovations, APA, 1997

In general, access should be related to both area type, and road type.

- Access should be correlated with street type and area type. T6 will have a high degree of access, and T1 would have low access.
- Access will be inversely related to desired travel speed. High Speed/low access in rural T1, low speed/high access in T6.
- Consider access by all modes of transportation.
- Develop design tools such as boulevards to combine high degree of access with through-trip mobility in cases where there is conflict and a need to provide both access and mobility.

Option 1 -Graphic




Option 2 – Tabular

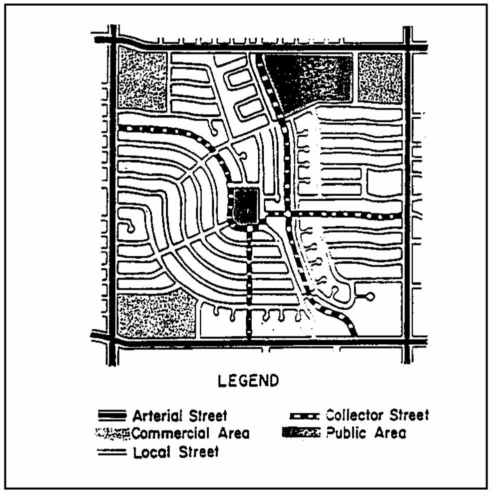
| | Rural | Suburban | General Urban | Neighbhd / Town Center | Regional Center |
|---|---|---|---|---|---|
| Freeway/ Tollway | 0 | 10 | 10 | 10 | 25 |
| Major (Ave., Blvd.) | 25 | 25 | 25 | 50 | 60 |
| Connector | 80 | 80 | 80 | 80 | 80 |
| Local/ Special | 100 | 100 | 100 | 100 | 100 |

<u>Scale</u>

Mobility = 0

Local Activity = 100

Is this what we want?

<table>
<tr><th colspan="2">Place Type</th></tr>
<tr><td>AASHTO considers 2 or 3 place types. Sometimes there are just two: urban and rural. Other places there are 3 place types, include suburban. Urban is defined based on the US census places of over 5,000 persons. Suburban is never specifically defined, although the example to the right shows what they consider to be a suburban network.<br><br>Source: AASHTO<br><br>
</td>
<td>Defines 6 place types (T1- T6) formally.  May also need some subcategories within some transects defined by predominant land use, if not fully mixed use.<br>T1 – Natural<br>T2 – Rural<br>T3 – Sub-urban (Neighborhoods) (OK?)<br>T4 – General Urban (Neighborhoods with Multiple and Mixed Use)<br>T5 – Urban Center (mixed use)<br>T6 – Urban Core (mixed use)<br>
<br>Source: DPZ Architects and Planners</td></tr>
<tr><th colspan="2">Characteristics of Urban Arterials</th></tr>
<tr><td>Spacing of about 1 mile in urban areas to 5 miles in fringe areas. May have more density in urban cores.Spacing is generally consistent, with capacity being adjusted by number of lanes or degree of access control (i.e. surface or grade separation). Collectors average ½ mile spacing but less regular and vary in layout per development plan.</td>
<td>Walters/Calthorpe Urban Network Study:<br>Majors (Avenues or Blvds.) generally on basic 1-mile spacing, but may be closer in high intensity corridors.  Maximum lanes held at 4 lanes (6 lanes for Blvds.) Same with lower classifications. Define spacing as:<br>Local Streets: 400 ft<br>Connectors: 1,200 ft<br>Avenues: 5,200 ft<br>NOTE: Urban Network does not require more frequent major routes (Avenues), since the local and connectors are designed to serve transportation needs, also. This statement conflicts with others on this side of the comparison matrix.</td></tr>
</table>

<table>
<tr>
<td>
<ul>
<li>Assumes all traffic/trips will gravitate to arterials for almost every trip.</li>
<li>The system is designed to encourage drivers to use the highest order road available for their trip, and transition up and down the hierarchy in the course of their trip.</li>
<li>Collector and local street connectivity and continuity is limited, so shorter trips must use arterials. It also concentrates turns at fewer intersections, increasing the number of potential congested intersections.</li>
<li>Limited collector/local continuity and connectivity also makes it more difficult to provide transit convenient to ultimate trip ends, leading to more driving trips. Same for pedestrian connectivity unless supplemental connectors are made.</li>
</ul>
</td>
<td>
<ul>
<li>Greater connectivity accommodates short trips on connector/minor streets. Does not encourage the use of arterials for short trips.</li>
<li>Greater connectivity also facilitates convenient transit, walking and bicycling.</li>
<li>Connectivity of local streets will make them more useful for short to medium length trips, especially during peak hours when arterials are congested.</li>
</ul>
</td>
</tr>
<tr>
<td>Assumes all arterials will provide “high speed” travel, does not acknowledge conflicts when arterials pass through urban areas, village downtown areas, or others where high speeds are not possible or appropriate</td>
<td>Design guidelines for major urban arterials will include context-appropriate design speeds, and balance of mobility with access and context.</td>
</tr>
<tr>
<td>Hierarchy in terms of travel vs. mileage as follows:
<table>
<tr><td></td><td colspan="2">Range</td></tr>
<tr><td>Systems</td><td>Travel Volume (%)</td><td>Length (%)</td></tr>
<tr><td>Principal Arterial</td><td>40-65</td><td>5-10</td></tr>
<tr><td>Principal + Minor Arterials</td><td>65-80</td><td>12-25</td></tr>
<tr><td>Collectors</td><td>5-10</td><td>5-10</td></tr>
<tr><td>Local Road System</td><td>10-30</td><td>65-80</td></tr>
</table>
</td>
<td>Based on Walters/Calthorpe modeling comparison, we can try to establish ranges in our network. Key findings from examples examined by Walters/Calthorpe:
<ul>
<li>20% fewer vehicle trips in Modern Design Network (all streets or just connectors and above?)</li>
<li>30% fewerVMT in Modern Design Network</li>
<li>30% fewer streets with more than 30,000 ADT</li>
<li>Reduced 6 lane streets from 26% to 13% (is this by length?)</li>
<li>Increase 2 lane avenues to 13% of network (was it 0% in conventional suburban?)</li>
<li>Reduces typical travel time by 5 to 15%</li>
<li>Increases route directness by 10 to 25%</li>
</ul>
</td>
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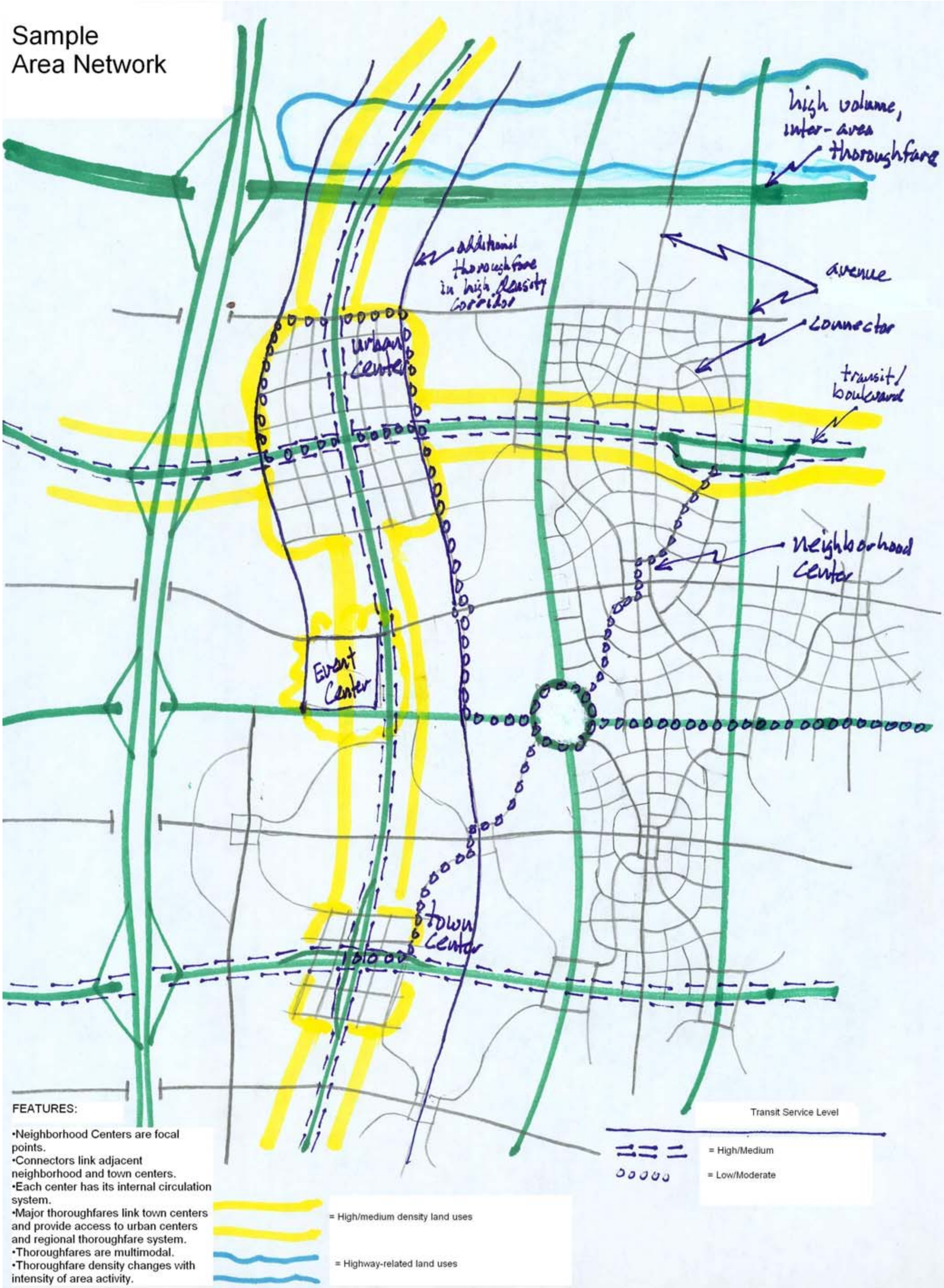
</table>

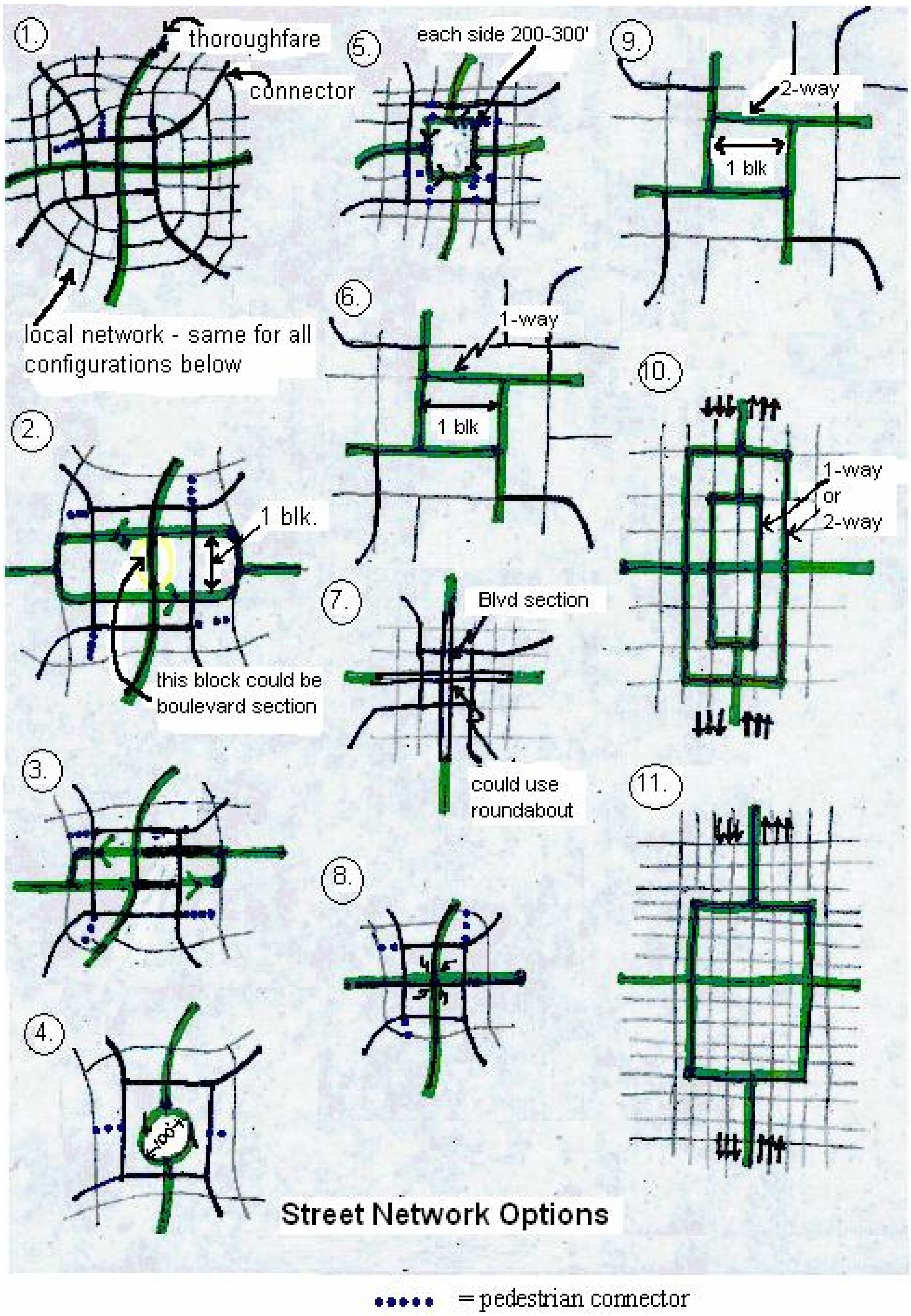
**VMT?**

**From Centerline?**

# Appendix B


Sample
Area Network
high volume,
inter-area
thoroughfare
additional
thoroughfare
in high density
corridor
avenue
connector
transit/
boulevard
urban
center
neighborhood
center
Event
Center
town
center
FEATURES:
•Neighborhood Centers are focal points.
•Connectors link adjacent neighborhood and town centers.
•Each center has its internal circulation system.
•Major thoroughfares link town centers and provide access to urban centers and regional thoroughfare system.
•Thoroughfares are multimodal.
•Thoroughfare density changes with intensity of area activity.
Transit Service Level
= High/Medium
= Low/Moderate
= High/medium density land uses
= Highway-related land uses

# Street Network Options




**Note: See following discussion for explanation.**

## Basic Street Concepts at Area Centers

The following eleven optional street layouts are proposed to provide accessibility and mobility for urban, town, and neighborhood centers:

- Simple avenue intersection
- Avenue split to couplet through area center
- Large (4-block) roundabout in area center
- Small roundabout in area center
- Squareabout in area center
- Wide avenue boulevard (60 feet or more) through area center
- No left turns at central intersections
- Avenue offset at central square
- Avenue split to three or more streets through area center
- Through traffic bypass of area center

These options are presented as examples. Other configurations may be devised that also fit specific contexts and needs.

The following sections discuss general issues related to the street network design options, the applicability of each street layout by area center type, traffic level compatibility and the advantages and disadvantages of each street layout option.

### I. General Issues

What are the land use implications of each scheme?

- Center size and applicability (maybe density/ activity intensity)
  - Neighborhood
  - Town
  - Urban/Regional
- Abutting land uses
- Central intersection and center focus

What is result re: walkability?

- Crossing distance
- Block length (Circumference less than …. and each side less than ….)
- Pedestrian friendliness
- Traffic volumes
- Safety

What are multimodal/movement and operational viability and efficiency?

- Walk
- Bike
- Transit

- Traffic

## II. Street Layout Options

**Option #1 - Simple avenue intersection**
*Applicability*
- Town or Neighborhood center
- More applicable for low-moderate volume thoroughfares

*Traffic Level Compatibility*
- Low or Medium

*Advantages*
- Simple block style network allows for more prominent corner frontage for retail
- Grid network is easier for pedestrians to navigate; more comprehensible
- Grid network is easier for vehicles to navigate; more comprehensible
- High "exposure" to passing traffic for Center business, but possible accessibility limitations (due to medians, left turn limits and other aspects of "access management" needed to preserve capacity.

*Disadvantages*
- Thoroughfare intersecting in the core area could produce large and congested intersections (unnecessarily channels high volumes of traffic through Centers).
- No deterrent to arterial speeds

**Options #2 and #3 - Avenue split to couplet through area center**
*2 – One-sided offset*
*3 – Two-sided offset*

*Applicability*
- Most applicable for moderate to high volume thoroughfares or those with intersections with high volumes of left turns.
- Any sized center acceptable.

*Traffic Level Compatibility*
- Medium or High

*Advantages*
- Reduce traffic volumes and congestion potential by splitting traffic volume onto at least two 1-way separate streets
- Improved safety because pedestrians can view traffic approaching from one direction rather than two
- Thoroughfare street width can be narrower allowing for easier pedestrian crossings
- Central area is large enough for land use activity

- Grid network is easier for pedestrians to navigate
- Smaller intersections
- Shorter crossings, less exposure
- Reduce barrier effects
- Less confusion at intersections, driveways
- On-street parking more likely possible on segments with limited right-of-way
- Narrower pavement handles buses and trucks
- More traffic capacity
- Good route for trucks and buses due to improved maneuverability at intersections and better signal coordination.
- More likely to allow front-door deliveries for business
- Better speed management if block lengths short and intersections signalized.

*Disadvantages*

- Depending on the destination and spacing between one-way elements, could involve circuitous travel
- Higher traffic speeds if not controlled with closely spaced, carefully timed traffic signals.
- In retrofit situations, may be opposed by businesses.
- Bicycle routing issues
- Worse speed management if signal spacing too great
- Reduced driver attentiveness?
- Loss of street median as landscape opportunity
- Less focus on central intersection

**Option #4 - Small roundabout in area center**

*Applicability*

- Town or Neighborhood Center
- Most applicable for low to moderate volume thoroughfares

*Traffic Level Compatibility*

- Low or Medium

*Advantages*

- Provides a grand entrance and central point to core area
- Potentially fewer conflict points – improved safety
- Reduced idling if traffic signals can be avoided
- Layout/design may have a traffic calming effect
- No opposing left turns

*Disadvantages*

- Depending on the destination, could involve circuitous travel
- Pedestrians may be confused, feel unsafe regarding crossing points
- More difficult for people with disabilities to cross
- Layout may adversely affect parcel shape
- No traffic platoons, which will reduce capacity at nearby signalized intersections
- A roundabout occupies more land than a simple intersection

- Potential driver confusion on how the system operates

**Option #5 - Squareabout in area center**

*Applicability*

- Town Center

*Traffic Level Compatibility*

- Low or Medium

*Advantages*

- Provides a grand entrance and central point to core area
- Improved safety because pedestrians can view traffic approaching from one direction rather than two
- Simple block style network allows for more prominent corner frontage for retail
- Grid network is easier for pedestrians to navigate; more comprehensible
- Central area is large enough for land use activity
- Potentially fewer conflict points – improved safety
- Layout/design may have a traffic calming effect
- Reduced idling if traffic signals can be avoided
- Configuration could slow traffic down
- No opposing left turns
- More businesses have exposure to through traffic

*Disadvantages*

- Potentially difficult access to central core
- Depending on the destination, could involve circuitous travel
- No traffic platoons, which will reduce capacity at nearby signalized intersections

**Option #6 - Central Square one-way only**

*Applicability*

- Town or urban center

*Traffic Level Compatibility*

- High

*Advantages*

- Improved safety because pedestrians can view traffic approaching from one direction rather than two
- Central area is large enough for land use activity
- Potentially fewer conflict points – improved safety
- Reduced idling if traffic signals can be avoided
- Configuration could slow traffic down.
- No opposing left turns
- Layout/design may have a traffic calming effect
- More businesses have exposure to through traffic

*Disadvantages*

- Depending on the destination, could involve circuitous travel and higher traffic volumes on next parallel streets.
- Potentially difficult access for pedestrians to central core blocks
- May consume more land than simple intersection
- High level of driver confusion
- Forces highest volume of traffic to undertake higher number of turn movements, reducing capacity and increasing pedestrian conflict
- Creates T intersections, which can reduce pedestrian perception of safety.

**Option #7 - Wide avenue boulevard (60 feet or more) through area center**
*Applicability*
- Town or urban center

*Traffic Level Compatibility*
- Medium or High

*Advantages*
- Grid network is easier for vehicles to navigate; more comprehensible
- Grid network is easier for pedestrians to navigate; more comprehensible
- Thoroughfare street width can be narrower allowing for easier pedestrian crossings
- Median provides pedestrians a refuge at midpoint in road.
- Layout/design may have a traffic calming effect

*Disadvantages*
- Thoroughfare intersecting in the core area could produce large and congested intersections
- No deterrent to arterial speeds
- Layout may adversely affect parcel shape
- More complicated intersection with additional traffic signal phasing

**Option #8 - No left turns at central intersection**
*Applicability*
- Neighborhood or Town Center
- Most applicable for intersections that would have low to moderate left turn volumes

*Traffic Level Compatibility*
- Low or Medium

*Advantages*
- Simple block style network allows for more prominent corner frontage for retail
- Prohibiting left turns makes the intersection less complicated for pedestrians and provides a higher percentage of “green time” for pedestrians
- Potentially fewer conflict points – improved safety
- Fewer signal phases improve vehicle and pedestrian flows at intersection
- No opposing left turns

- Simpler signal phasing allows improved signal coordination, increasing platooning and possibly further reducing street and intersection width requirements.
- Allows wider median pedestrian refuge and/or wider sidewalks on streets with constrained right-of-way.

*Disadvantages*

- Potential driver confusion at intersection due to required alteration in left turn path
- Depending on the destination, could involve circuitous travel
- No deterrent to arterial speeds
- Potentially reduced capacity
- In retrofit situations, often opposed by businesses.

**Option #9 - Avenue offset at central square – two-way traffic**

*Applicability*

- Town or Neighborhood center
- Most applicable for low to moderate volume thoroughfares

*Traffic Level Compatibility*

- Low or Medium

*Advantages*

- Central area is large enough for land use activity
- Layout/design may have a traffic calming effect
- More businesses have exposure to through traffic

*Disadvantages*

- Potentially difficult access for pedestrians to central core blocks
- May consume more land than simple intersection
- Higher level of driver confusion

**Option #10 - Avenue split to three or more streets through area center**

*Applicability*

- Town or Neighborhood Center
- More applicable for high volume thoroughfares or those with high volumes of left turns

*Traffic Level Compatibility*

- High

*Advantages*

- Deviates non-local traffic to roadways external to core
- More businesses have exposure to through traffic
- Reduce congestion by splitting the volume of traffic onto at least two separate streets
- Thoroughfare width can be narrower allowing for easier pedestrian crossings

*Disadvantages*
- Potential driver confusion at intersections where split occurs
- Difficult to distribute traffic evenly
- Could be confusing for through traffic
- Could encourage development on periphery of core

**Option #11 - Through traffic bypass of area center**

*Applicability*
- Town or Urban Center
- Most applicable for high volume thoroughfares with high portion of through traffic

*Traffic Level Compatibility*
- Low, Medium or High

*Advantages*
- Deviates non-local traffic to roadways external to core
- More businesses have exposure to through traffic
- Reduce congestion by splitting the volume of traffic onto at least two separate streets
- Thoroughfare street width can be narrower allowing for easier pedestrian crossings

*Disadvantages*
- Could encourage development on periphery of core
- Places higher traffic volumes on more central streets
- Traffic trying to travel at higher speeds on more streets
- Could produce more intersections of moderate turn volumes rather than low volumes

# Appendix C

## Thoroughfare Appropriateness for Context-Based Street Design

***NETWORK AND LAND USE COMPATIBILITY***

*1st Draft*

Design Sequence:

1. Appropriate Range of Thoroughfares selected based on Context
2. Network framework is determined/selected
3. Thoroughfares and Network configuration are fine-tuned to match Context and Network Function.

| | | ADJACENT LAND USE | | | | | | | | | | Notes |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| THOROUGHFARE TYPE | | Natural/Rural (T1,T2) | Rural Residential (T2,T3) | Context Zone 3: Suburban | Context Zone 4: General Urban | Context Zone 5: Urban Center | | | | Context Zone 6: Urban Core | Districts (D) | |
| | | | | | | Neighborhood Centers; Town Centers; Urban Centers | | | | | | |
| | | | | | | Retail Focus | Employment Focus | Civic/ Institutional Focus | Mixed Use | | | |
| | **Relative Densities:** | | | **L M H** | **L M H** | **N T U** | **N T U** | **N T U** | **N T U** | **L M H** | | |
| **THROUGHWAYS** | | | | | | | | | | | | |
| FREEWAY | | Y | Y | P* | E | X | X | X | X | X | P | |
| EXPRESSWAY | | Y | Y | Y* | E | X | X | X | X | E | P | *-With Frontage Road |
| PARKWAY | | Y | Y | Y | Y | X | X | X | X | E | Y | |
| **MAJOR THOROUGHFARES** | | | | | | | | | | | | |
| HIGHWAY | | Y | Y | P P X | E | X | X | X | X | E | P | |
| MULTIWAY BOULEVARD | Boulevard with Local Access Lane, Transit Boulevard | X | X | X X P | Y | N | Y | Y | Y | Y | Y | |
| AVENUE | | X | X | Y | Y | Y | Y | Y | Y | Y | Y | |
| LARGE STREET | ***what is difference w/ Avenue? **** | X | X | X X P | P P Y | Y | Y | Y | Y | Y | Y | |
| **MINOR THOROUGHFARES/CONNECTORS** | | | | | | | | | | | | |
| CONNECTOR | | X | X | Y | Y | Y | Y | Y | Y | Y | Y | |
| ROAD | | Y | Y | Y P P | X | X | X | X | X | X | P | |
| STREET | Standard Street | X | X | Y | Y | Y | Y | Y | Y | Y | Y | |
| | Yield Street | X | Y | Y | Y | X | P | X | P | P X X | P | |
| MEWS/COURT | Woonerf | X | X | P | Y | Y | X | Y | Y | Y | P | |
| ALLEY | Alley | X | X | Y | P Y Y | Y | Y | Y | Y | Y | P | |
| **SPECIALTY THOROUGHFARES** | | | | | | | | | | | | |
| PATH/PASSAGE | | Y | Y | Y | Y | Y | Y | Y | Y | Y | Y | |
| PEDESTRIAN MALL | | X | X | X | X | P | P | P | P | P | P | |
| TRANSIT MALL | Transit Street | X | X | X | X | P | P | P | P | Y | P | |
| SERVICE ROAD | Frontage Road | Y | Y | Y | Y | X | X | X | X | Y | Y | |

| KEY | |
|---|---|
| Y | Yes, best fit |
| P | Provisional, special treatments required |
| X | Prohibited |
| E | Along the Edge of |

# Appendix D

**Appendix D (from other CNU work group led by Fred Dock)**
Appendix D contains a matrix of thoroughfare types that shows key design criteria for each. This matrix is intended for use in designing urban thoroughfares within each context zone.