Fulford City Center
Geomtric Roadway Design

April, 2003

Glatting Jackson Kercher Anglin Lopez Rinehart

Table of Contents

1. Purpose of Street Guidelines 1

2. Project Continuity 1

3. Cross-Section Guidance/Starting Point 1

4. Encroachment Guidelines 2

5. Roundabout Option 2

6. Waterfront Guidance 3

7. Discussion of Specific Guidelines 3

7.1 Bus Accommodation 3
7.2 Bus Stops 3
7.3 Driveways and Alleys 3
7.4 Alley Accessibility to Larger Vehicles 4
7.5 Textured Median Turn Lane 5
7.6 Parking 7
7.7 Bulbouts 7
7.8 Accessibility Ramps and Pedestrian Crossings 7
7.9 Intersections 8

8. Background Research and Inventory 8

9. Glossary Of Terms 9

Exhibits

Geometric Roadway Design Power Point Presentation

North Miami Beach
Fulford City Center
Geomtric Roadway Design

1. Purpose of Street Guidelines

The City of North Miami Beach desires a town center environment in the area called "Fulford City Center" with a mainstreet known as Hanford Boulevard (NE 164th Street) as its focus. Part of this effort involves rebuilding many of the streets to help achieve town center-related goals and objectives (e.g.; walkability, access, beauty, safety, etc). Over a year ago, the City opened a demonstration block of Hanford Blvd. between NE 18th and NE 19th Avenues. The project was a success. However, the design does not accommodate larger vehicles. Minor modifications were made to the design and bus routes were changed to adjust to the new block. As a result of the approval of the transit tax, the adoption of FCC zoning and the positive response of the community to the demonstration block, the City will be constructing the entire length of Hanford Boulevard. The primary intent of this geometric roadway design project is to provide related design guidance so that bus routes will operate efficiently, access will be provided for other large vehicles (e.g. fire trucks, service vehicles, etc.) and visitors to the district will find parking and access accommodating all while the district thrives as a pedestrian friendly, cohesive and successful commerce and entertainment village.

2. Project Continuity

These design guidelines were tailored to maximize the utility to the City in terms of functionally and aesthetics for any future bus routes in the area and for the area's streets in general. For Hanford Boulevard specifically, the objective was to build on the direction already set by the first reconstructed block (e.g. left turn lanes, parallel parking, valley gutters, mid-block pedestrian refuges, bulb outs, etc.) so that the street would read cohesively in the future as subsequent blocks are rebuilt. The guidance focuses on the area's streets' main design weaknesses and the design weaknesses of the already rebuilt block of Hanford Boulevard.

3. Cross-Section Guidance/Starting Point

Obviously, bus access in the area primarily involves the ability of buses to turn corners at intersections without significant encroachment into oncoming traffic or riding over curbs. Bus cornering without significant encroachment depends mostly on two factors, the cross-sections of the intersecting streets and the corner radii around which the buses must turn. In general the streets in the area were originally built too wide and were poorly designed (i.e. poor aesthetics, long pedestrian crossing distances, and undefined edges). Therefore, they will need rebuilding. Consequently, basing the design guidance on these current cross-sections would not be worthwhile. Hence, two new cross-sections were developed. A new cross-section for Hanford Boulevard was developed showing the full 80' right-of-way with three lanes and parallel parking (*see "Typical Street Detail" illustration - Exhibit 1: Geometric Roadway Design Power Point Presentation, slide #61*). This section was developed to be consistent with the portion of the roadway that is already reconstructed (between N.E. 19th and N.E. 20th Streets). It also provided the ability to retrofit the ends of the already built section for bus access if that is desired in the future. A two-lane cross-section was also developed for the north-south City streets, N.E. 16th, N.E. 17th, N.E. N.E. 18th, N.E. 20th, and N.E. 21st. This cross section is similar to that proposed for Hanford Boulevard but without the textured flush median. These new cross-sections provided a foundation for the corner radii and other guidelines.

These guidelines do not apply to roadways where County or Florida Department of Transportation standards prevail, where the streets in the study area intersect with 163rd Street (FDOT) and the intersection of N.E. 165, 167, 168 and 169 and N.E. 15th Avenue (County).

4. ENCROACHMENT GUIDELINES

While the main focus of these guidelines is to ensure that buses can be accommodated on the streets within the study area, the analysis also allows for WB-40's and any vehicle with a smaller swept path (i.e. garbage trucks, typical service vehicles, school buses). This range of analysis was necessary to address conditions where buses turn (which other big vehicles can use with the same result); where buses do not turn but other big trucks likely will (e.g. Hanford Blvd and NE 17 Ave); and alleys (delivery and garbage trucks) If the general design guidelines are followed, then the streets will accommodate large vehicles (e.g.; buses, delivery trucks, garbage trucks, emergency vehicles etc.) For this area it was determined that it is normal and acceptable that large vehicles can encroach into oncoming travel lanes of City streets while cornering, if they were not following bus routes.

Special bus route guidelines were provided to minimize bus encroachment due to reasons of scheduling and frequency. In other words, the design of the streets will minimize delays to buses that would otherwise be caused by encroachment (i.e. waiting for oncoming vehicles to clear to allow passage). These guidelines affected the corner radii, cross-section, and the stop bar location for bus routes. The stop bar locations are relatively flexible in that they can be easily altered as bus routes change. However, there is less flexibility in determining corner radii at the intersections. Consequently, it is recommended that the City decide, prior to each rebuild project, which routing options/corners to apply the bus route guidelines.

Specifically, corner radii at NE. 15th Avenue, N.E. 19th Avenue and N.E. 22nd Avenue govern the use of Hanford Boulevard for bus routes (*see "Recommended Turning Radii" diagram - Exhibit 1: Geometric Roadway Design Power Point Presentation, Slide #17*). If the City were to decide that only a portion of the potential routing options were necessary, then the corner radii that were not affected by the bus route guidelines could be built to the general curb radius of 25 feet. This would allow for shorter pedestrian crossing distances at the intersections, reduced speeding and more sidewalk space.

5. ROUNDABOUT OPTION

Modern roundabouts should be considered at all of the intersections of Hanford Boulevard and other City streets. Fortunately, the existing rights-of-way are adequately sized for roundabouts so that no private property acquisition would be needed. With roundabouts, these intersections could accommodate larger vehicles on every approach. At the same time, roundabouts avoid left turn lanes, signals, and stop signs. They also save fuel, reduce noise, increase aesthetics, provide more greenery, reduce collisions, and simplify pedestrian travel (i.e. pedestrians only have to look in one direction when crossing from the sidewalk to the splitter island and then in the opposite direction to cross from the splitter island to the destination sidewalk).

6. WATERFRONT GUIDANCE

The area's frontage along the canal has huge potential. In time, it could be developed into wonderful parkway and scenic resource with plenty of economic, recreational, and quality of life benefits. The City should establish setback requirements in the near term so that, as redevelopment occurs, adequate space is provided/set aside along the waterfront for at least a sidewalk; a two-way, narrow, street (e.g. 20-feet wide, face of curb to face of curb); and a separate recreational path; all in a linear park configuration. This planning effort and eventual project should extend at least from N.E. Dixie Highway to N.E. 16th Avenue (i.e. connecting to the Amphitheatre). Obviously, this would require a sustained effort over a long time. The key is for the City to make land use planning changes in the prior to significant redevelopment so that over time the necessary space is established (e.g. using setbacks, easements, site plan provisions, etc.)

7. DISCUSSION OF SPECIFIC GUIDELINES[1]

The specific guidelines are represented in the drawings, figures, and pictures that accompany this report narrative. However, some explanation was considered necessary to clarify some aspects of the guidelines. The following descriptions are sequenced in the same order as the drawings, figures, and pictures. It should be noted that the recommended speed limit for all streets within the study area should be 25 mph.

7.1 Bus Accommodation

Bus routes can be accommodated by following the attached guidance on cross-sections, corner radii, and stop bar locations. However, following these guidelines is unnecessary on possible bus routes that have little likelihood of being used in the future. Consequently, the City should decide on which routes are necessary and unnecessary and follow the more pedestrian-friendly general guidelines for corner radii and stop bars on the unnecessary routes.

7.2 Bus Stops

Bus stops should be located on elongated bulbouts so that the busses stop in the travel lane to pick up and drop of passengers. It is highly recommended that "bus pull over areas" be prohibited due to their negative effect on the sidewalk and bus stop environment and the reduction of the on-street parking supply (when bus bays are used they take up space that could otherwise be used for parking). Furthermore, bus drivers often avoid pulling completely into pull over areas in order to avoid getting delayed by car drivers not allowing them back into the travel lane.

7.3 Driveways and Alleys

In general, driveways and alleys should not look like streets and streets should not look like driveways and alleys. Specifically:

> Each sidewalk along with its material, pattern, and width should continue uninterrupted for the entire length of the block (i.e., across the ends of driveways, parking lots, alleys, etc.).
>
> Sidewalks should cross alleys and driveways in a level fashion. Any difference in elevation between the driveway/alley and the street should be addressed by

[1] Please refer to the **Glossary of Terms**, Section 9 for definition of terminology used throughout this report

sloping the driveway/alley (i.e., not the sidewalk) between the outside edge of the sidewalk and the street.

The dimension of the corner radii of the end of the driveway or alley should be no larger than the dimension separating the sidewalk and the curb-line or ten feet (whichever is less). The corners at the end of a driveway or alley should be finished with a vertical curb. That curb's height should match the height of the street's vertical curb at the street and then taper to a height of zero inches at, or prior to, the sidewalk.

The line of the street's vertical curb should extend across the end of the driveway or alley in the form of a flush header curb. This provides a good edge and separation between the lane and the driveway or alley.

The surface material for the end of the driveway or alley, between the sidewalk and the header curb, should contrast with the material of the adjacent lane (parking or travel lane) (see Driveway Detail Intersecting Parking Lane Illustration). Concrete is recommended and asphalt should be discouraged.

7.4 Alley Accessibility to Larger Vehicles

A semi-trailer (WB40), bus (B40), and/or a single unit truck (SU30) can turn in and out and turn left or right at the intersections of N.E. 164th Street and the public alleys. These maneuvers require:

i. encroachment;

ii. that the design guidance for street widths and corner radii described in this report be followed;

iii. that the on-street, parallel, parking stalls are located and marked at a sufficient distance from the alley; and

iv. that the alley's 20-foot width is unobstructed.

In summary, the alleys are accessible to and from N.E. 164th Street to larger vehicles. Fire trucks and garbage trucks can fit into the alleys as well because they require less space than the design vehicles.

If a raised median is constructed through an intersection of N.E. 164th Street and an alley it would create an obstruction preventing the design vehicles from turning in or out or turn left or right. Consequently, a raised median in the vicinity of an alley would prevent access to the alleys for larger vehicles.

At the intersections of the public alleys and N.E. 17th Avenue, N.E 18th Avenue, N.E. 20th Avenue and N.E 21st Avenue, the three design vehicles noted above can be accommodated for turning in and out, left and right. Similarly, these maneuvers require:

i. encroachment;

ii. that the design guidance for street widths and corner radii described in this report be followed;

iii. that the on-street, parallel, parking stalls (e.g., either parallel or back-in angled parking) are located and marked at a sufficient distance from the alley; and

iv. that the alley's 20-foot width is unobstructed.

7.5 Textured Median Turn Lane

The reconstructed block of Hanford Boulevard is a divided, two-lane, street. A median was included in the design for aesthetic reasons, to create a “boulevard look.” An alternative “textured median turn lane” is the recommended for the remainder of Hanford Boulevard in response to several disadvantages of medians on two lane streets. A textured median turn lane shares much of the aesthetic and pedestrian refuge advantages of the raised median without the disadvantages. This subject will receive an expanded explanation due to the controversial nature of denying access to property in city centers and the degree of debate that this design issue raises.

Over time the Hanford Boulevard area will experience redevelopment and driveways will gradually be eliminated. However, simultaneous with this transition, access to alleys will become increasingly important. The proposed design allows access to existing driveways and alleys while they still exist and allows alley access in the future. It also allows left-turn storage capacity for the intersections at the ends of the blocks and at some point in the future; when all driveways are eliminated a short landscaped median can be installed within the textured left-turn median. But a continuous median is not recommended because of other problems (i.e. access to alleys and blockage).

The main disadvantage of a raised median is that it prevents left turns into and out of adjacent property and alleys. To better grasp the significance of this disadvantage, let’s begin with the basic question, “Why do cities exist?” Generally speaking, cities exist for efficient exchange, to bring people together to exchange of goods, services, social contact, entertainment, labor, ideas, etc. efficiently. In other words, cities exist to minimize travel and maximize exchange. Of all the parts of the city (i.e. neighborhoods, districts, corridors, etc.), the main street and city center should be the heart of such exchange.

There are two basic types of exchanges; planned exchanges and unplanned exchanges. An example of planned exchange would be a car trip to the drug store to pick up a bottle of sunscreen. One gets in the car, drives to the drug store, picks up the sunscreen, meets the cashier, and returns home, achieving one planned exchange. Examples of unplanned exchanges would be a walking trip to the drug store to pick up the same bottle of sunscreen, but along the way to the store and back, one may meet and chat with a neighbor, make eye contact with someone new and say, “Hello,” pause at the park and watch some children play soccer, wave a greeting to the butcher across the street who is taking a break outside his shop, pop into another shop and buy one’s sweetheart a present, and ponder a piece of public art on the corner, achieving one planned exchange and six unplanned exchanges. The quality of a city, a city center, and a main street can somewhat be measured by the sum of the unplanned exchanges.

In order to maximize exchange, maximum access and maximum communication are required. Raised medians physically deny and reduce cross-street access and communication and, thus, they deny and reduce exchange. They reduce unplanned exchanges by optically separating the two sides of the street, preventing impulse entries into driveways, alleys and parking lots, and increasing the physical distance between sidewalks. They reduce/discourage planned exchanges by creating circuitous routing to driveways and alleys, increasing the difficulty of way-finding and providing directions to others, and reducing the visibility of shop windows, displays, signs, and other people.

The circuitous routing increases the average trip length and cause, the affected drivers to drive through more intersections.

Two-lane divided streets are susceptible to blockage problems. If the single travel lane in one direction was blocked for a street repair, collision, protracted parking maneuver, delivery, double park, taxi drop-off/payment, etc., then the whole face of the block is affected. There is no ability to pass around the constricted spot. This is particularly serious for emergency service providers whose response times are considered very important. Normally, cities desire or require an unobstructed width of about twenty feet in case of such blockages. Exceptions are usually made for short sections but not for whole blocks. Usually streets with raised medians have four lanes or more and, thus, don't suffer from this shortcoming. There is the option of widening the single lane on each side of the raised median, but then the result would basically be a four lane divided road and the purpose would be defeated. It is usually best to simply not build divided two-lane streets.

The idea of a divided two-lane main street in a city center also raises questions of aesthetics and appropriateness. The row of trees in the rebuilt block is purported to provide a "boulevard look." However, the word "boulevard" connotes a wide, multi-lane, street that has otherwise poor communication and pedestrian connectedness across the street. Providing a wide landscaped median or public green space on such a street can help mitigate the barrier, help visually split the expanse of asphalt, and help provide the otherwise missing connectedness through the pedestrian refuge function. However, the normal expectation is that a two-lane street in an urban context has inherently fine communication and connectedness by virtue of being a two-lane urban street. There is nothing to mitigate. Trees and the allocation of right of way are normally better used on the sides of two-lane streets rather than in the middle because the trees provide shade to pedestrians and wider sidewalks have a myriad of benefits.

One has to acknowledge that the private property on the sides of Hanford Boulevard is currently not aesthetically pleasing because extensive redevelopment has not taken place. Consequently, the trees in the median of the rebuilt block look very nice. However, should the landscaping resources be placed into the bulb-outs and the sidewalk edge zone of future rebuilt blocks, those blocks will look very nice as well. Furthermore, they will look very nice in a more urban/city/access-friendly way when complemented in the future by buildings on both sides of the street, which will further "hold the street," somewhat like an outdoor room.

Some of the reasons that a three-lane section was developed as the general guidance for the remainder of Hanford Boulevard was that it provides design continuity with the already built block, but it will be slightly narrower than the two-lane divided section (improving communication), it will provide better access, it will provide a mid-block pedestrian refuge through a short raised and landscaped median, it will provide a median feel with the surface texture and color change, it will meet the normal requirements for emergency service providers, and it will likely result in higher car carrying capacities throughout the area (more opportunities to turn left, more opportunities to share gaps in approaching traffic, shorter queues at intersections, fewer blockages, shorter trip lengths, etc.). Had the City not rebuilt the first block and not set the design direction for mid-block crossings with a pedestrian refuge, straight travel lanes, etc., then the design recommendation would have been to use a network of

simple two-lane, urban, city streets with no medians, and no mid-block pedestrian refuges.

A discussion of medians would not be complete without mentioning the “splitter” at each the end of median on the rebuilt block. It is recommended that the City never use a splitter on any City street in the area for future projects. The splitter has no aesthetic value, it provides no significant refuge for pedestrians, it lengthens pedestrian crossing distances, it can interfere with turning movements of larger vehicles, it uses up right of way width which usually causes the sidewalks to be narrower, and it denies access to driveways (until they are eliminated) and alleys. If the splitter was not installed, the median could be narrower and the sidewalks could be wider. However, the splitter issue does not exist with the textured median turn lane (see Glossary for definition).

A pedestrian refuge area on a short raised median (i.e. used in conjunction with the textured median turn lane) and a pedestrian refuge on a conventional raised median should be designed the same way. The path through the refuge should be at street level (i.e. no ramps) and it should have a detectable strip at each end. It should also angle from left to right so that pedestrians are encouraged to look (and look the correct way) into the eyes of the oncoming drivers.

7.6 Parking

In the study area there is parallel parking, various degrees of head-in angle parking, and 90-degree angled parking. We recommend parallel parking along Hanford Boulevard, to allow for wider sidewalks, and back-in angle parking or parallel parking along all the other streets within the study area. The popularity of back-in angle parking is growing in America due to its safety benefits for motor vehicle users and cyclists (see “On-street Parking” illustration). Head-in angle parking and 90-degree parking is not recommended.

7.7 Bulbouts

Bulbouts are very beneficial to self-enforce the no-parking areas near corners, to reduce pedestrian crossing distances, and to improve the aesthetics of the streets. They do their best when they are designed to accommodate trees. The trees help to optically narrow the street by affectively bringing the trees closer together across the street. The rebuilt block missed a huge aesthetic opportunity by not landscaping the bulbouts.

7.8 Accessibility Ramps and Pedestrian Crossings

The ramps that connect the sidewalks to the streets should be as wide as the sidewalk that they service. They should lead directly across the street at intersections and not 45-degrees towards the center of the intersection. There should be a three-foot wide detectable strip at the base of each ramp.

The sides of the ramps should be vertical curbs, beginning at the same height as the street’s vertical curb and tapering to nothing at or prior to the intersecting sidewalk. The sidewalk height should remain level and not be sloped for accessibility purposes. The only exception to this should be if the separation between the street’s vertical curb and the sidewalk is so small that ramp’s slope intersects the sidewalk. In these cases, the sidewalk needs to slope to meet the ramp. However, this condition should be rare in the area.

Pedestrian crossings should be provided across every approach at every intersection.

Unwarranted traffic signals should be removed. Pedestrian phases should be provided without push buttons (i.e., not pedestrian actuated) and provided with countdown timers.

Black and white stripes (pavement markings), perpendicular to the direction of the pedestrian crossing should be used to mark pedestrian crossings. The red colored asphalt used in the rebuilt block does not provide adequate contrast for visibility.

7.9 Intersections

The typical intersection approach for the typical three-lane street is shown with the various design guidelines applied. The two-lane section is the same as the three-lane section except that the center lane is removed and the approach is 11 feet narrower (i.e. 23 feet face of curb to face of curb). Also, on the two lane section the City has the option to use parallel or back-in angle parking. If a three-lane section intersects a two-lane section, then the textured left turn median can be carried through the intersection. If two-three lane sections meet, then the textured left turn median should end when it reaches the stop bar (when not affected by bus routes) or the pedestrian crossing (when the stop bar is affected by bus routes).

8. Background Research and Inventory

In order to develop these design guidelines the project team conducted extensive site inventories. Team members spent two full days collecting field measurements of typical characteristics for every condition evaluated in the analysis including travel lane widths, parking configurations, roadway conditions, driveway widths, alley widths, driveway/alleyway configurations, corner radii, posted speed limits, roadway jurisdiction, right-of-way widths, bus travel routes, roadway lane travel direction, roadway traffic controls and roadway intersection characteristics. The Institute of Traffic Engineers' "Turning Vehicle Templates" (version 2000) was used as the technical reference for recommended turning radii.

Examples of locations where design concepts are currently being applied include:

Textured Median Turn Lane/Mid Block Crossing Detail ..... Raleigh, NC
..... Charlotte, NC (accepted design)
..... 17/92 – Orlando, FL (accepted design)
..... Broad Street, Philadelphia, PA
.....Young Boulevard, Toronto

Head in Parking.....Seattle, WA

23' Side Street with Valley Gutter..... W. Flagler Drive, West Palm Beach, FL
..... Rosemary Avenue, West Palm Beach, FL

Accessibility Ramps .....S. Olive Street, West Palm Beach, FL
..... Clematis Street, West Palm Beach, FL

9. Glossary Of Terms

Bicycle Lane or Bike Lane:	a five to six-foot lane along the street reserved for cycling and in-line skating
Bulb out:	a curbed protrusion into the parking lane at a corner, mid-block pedestrian crossing, street tree location, bus-stop, or at other locations where on-street parking is undesirable
Block:	1) a rectangular-shaped land area in a city that is bordered on four sides by streets, 2) a section of street that extends for a length of one block
Corner/Curb Radius:	the radius of the vertical curb at a corner
Divided Street:	a street that has a raised median that prevents left turns into or out of driveways, parking lots, and alleys (median breaks are usually provided at streets or major driveways).
Five-Lane Street:	a street with four lanes (two in each direction) plus a dedicated lane in the center for left turns along the majority of the length of the block
Four-Lane Street:	a street with four lanes at the mid-block (two in each direction)
Left Turn Lane:	a lane dedicated for left turns at an intersection or driveway
Parking Lane:	the part of the street used for motor vehicle parking
Raised Median:	a curbed divider between opposing travel lanes that prevents left turns (wide medians are often landscaped)
Right of Way:	publicly owned land used for street purposes
Right Turn Lane:	a lane dedicated for right turns at an intersection or driveway
Sidewalk:	the path/facility provided primarily for pedestrians along a street
Sidewalk Edge Zone (SEZ):	the part of the street between the sidewalk and the vertical curb that is used for landscaping, street furniture, street signs, parking meters, fire hydrants, lights, etc.
Street (urban):	the space between city blocks from building face to building face including the travel lanes, sidewalks, etc. (unless a street is specified as a “one-way street,” then two-way travel is assumed)

Textured Median Turn Lane:	a flush divider between opposing travel lanes that allows left turns (typically used intermittently with short raised medians and mid-block pedestrian crossing refuges)
Three-Lane Street:	a street with two lanes (one in each direction) plus a dedicated lane in the center for left turns along the majority of the length of the block
Through Lane:	a travel lane that goes through an intersection or past driveways
Travel Lane:	typically a nine to 12-foot wide lane in the street intended for vehicle travel and turns
Two-Lane Street:	a street with two lanes (one in each direction) at the mid-block
Valley Gutter:	typically a two-foot wide, concrete, shallow channel on the edge of the travel lane or parking lane that allows for storm water to flow along it and vehicles and pedestrians to cross it
Vertical Curb:	a four to six-inch high linear barrier (for storm water and vehicle tires) between the sidewalk/SEZ and the outermost lane

Fulford City Center
Geomtric Roadway Design

Exhibits

Geometric Roadway Design
Power Point Presentation

North Miami Beach

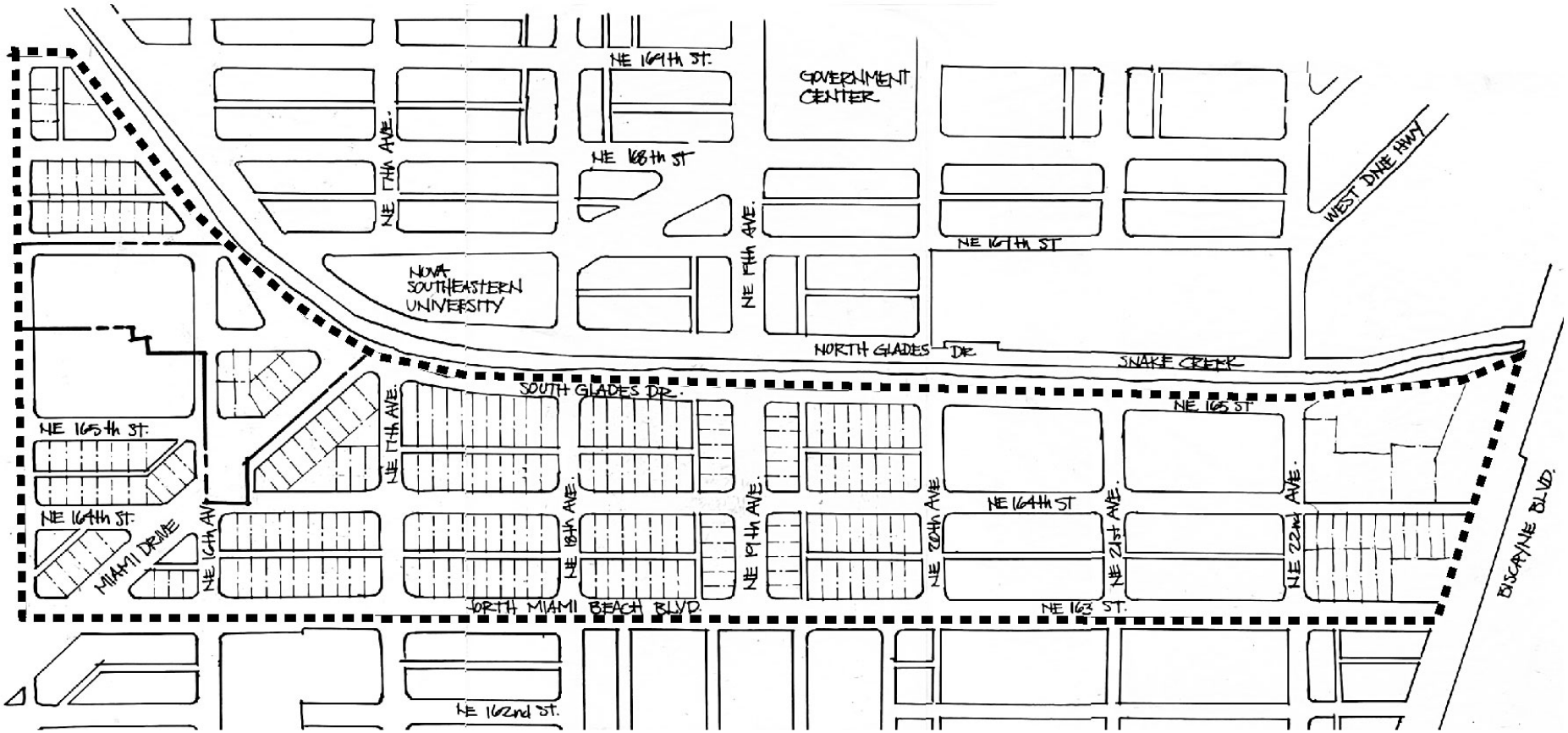
Fulford City Center

Conceptual Geometric Roadway Design

GLATTING JACKSON KERCHER ANGLIN LOPEZ RINEHART, INC.

Community Planning

Context



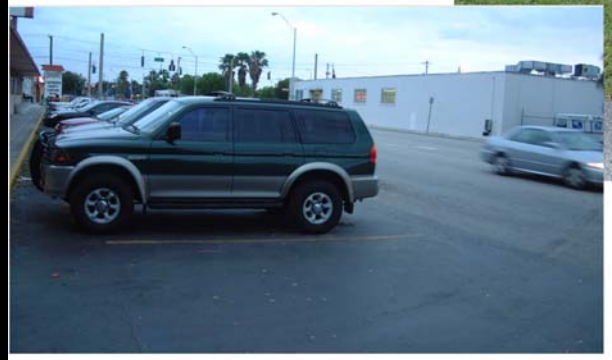
CITY OF NORTH MIAMI BEACH - 164TH STREET

N

Alleys and Driveway Ends

Streets

On-Street and Street Edge Parking

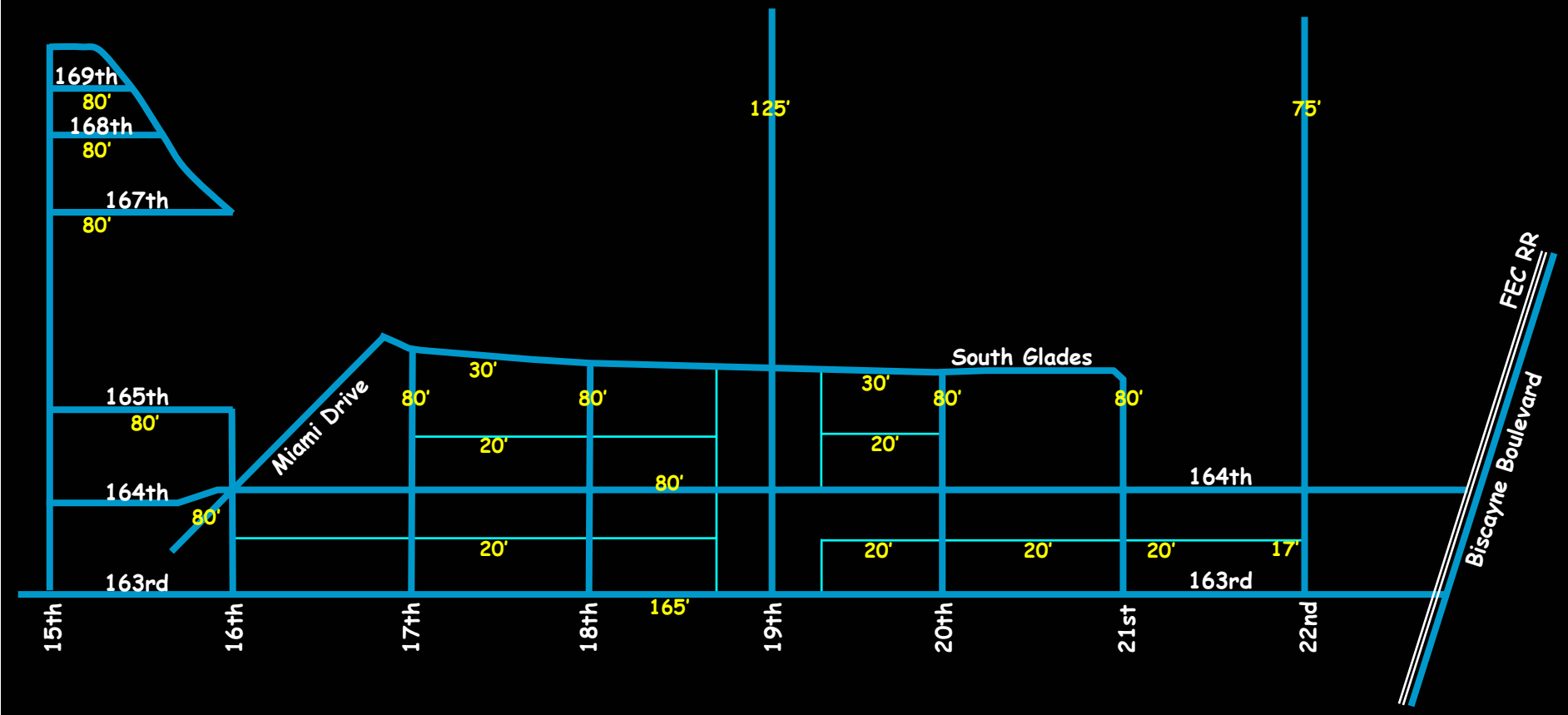


Intersections

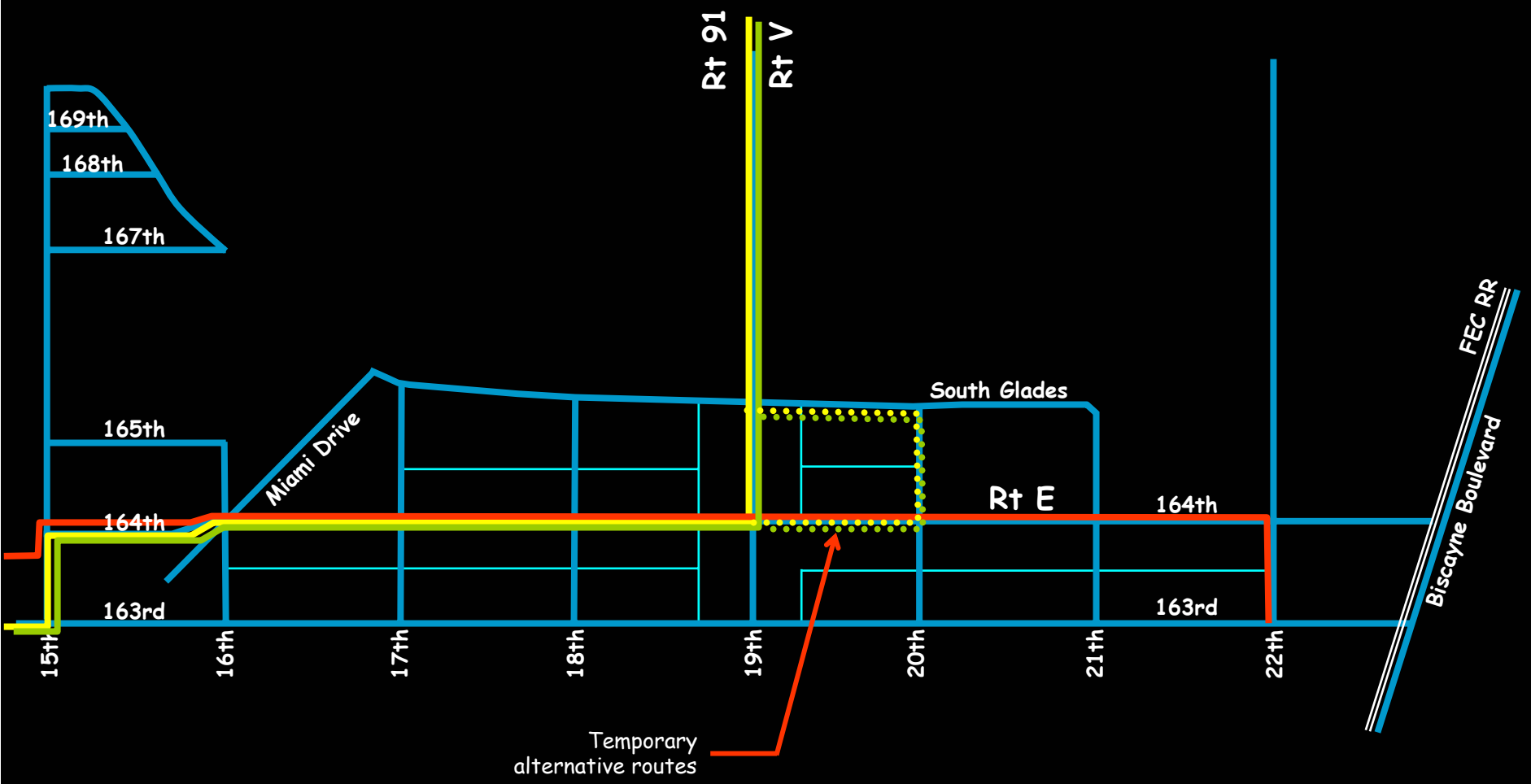
Alleys

Roadway Jurisdiction

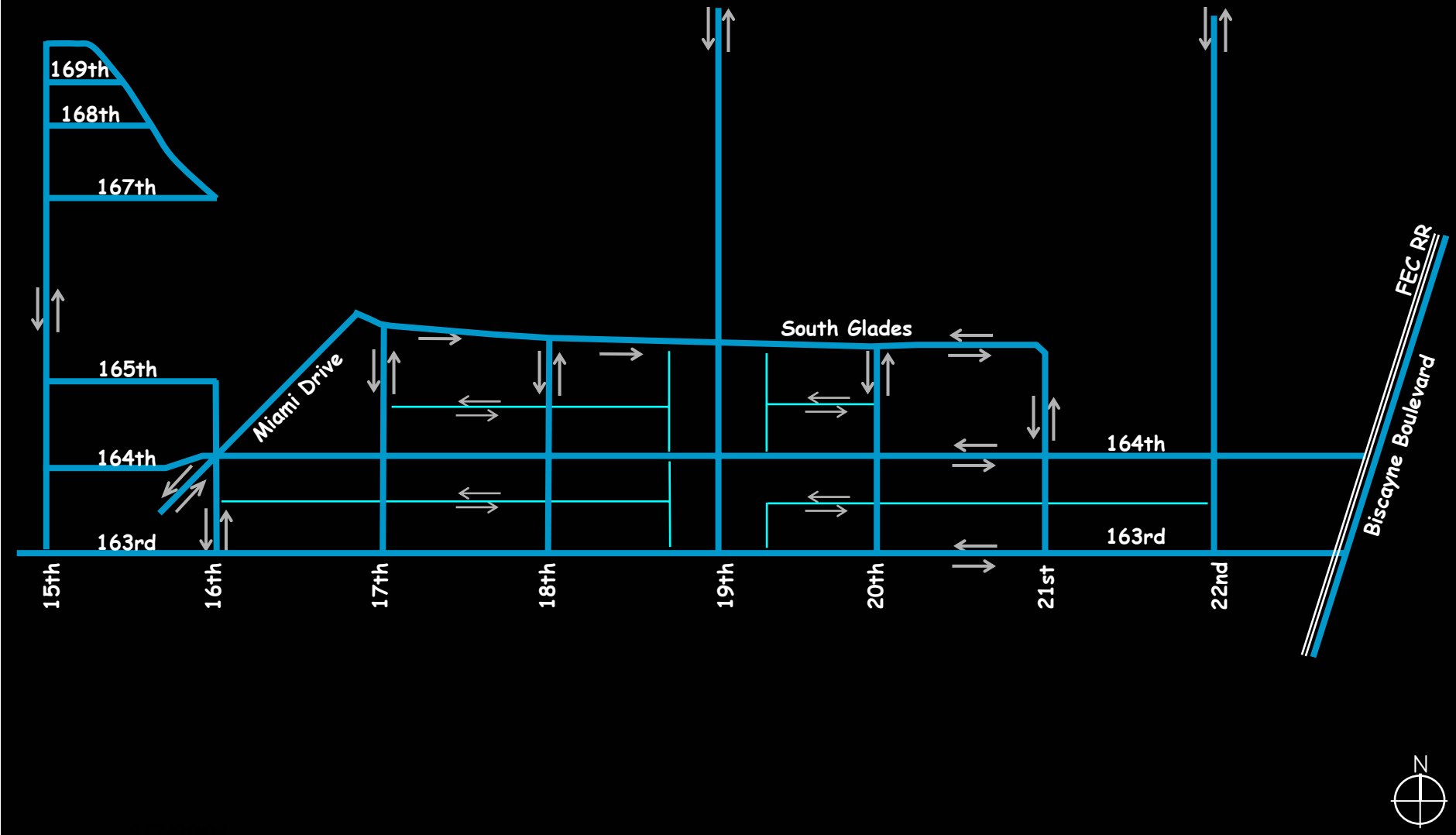
Existing ROW Widths



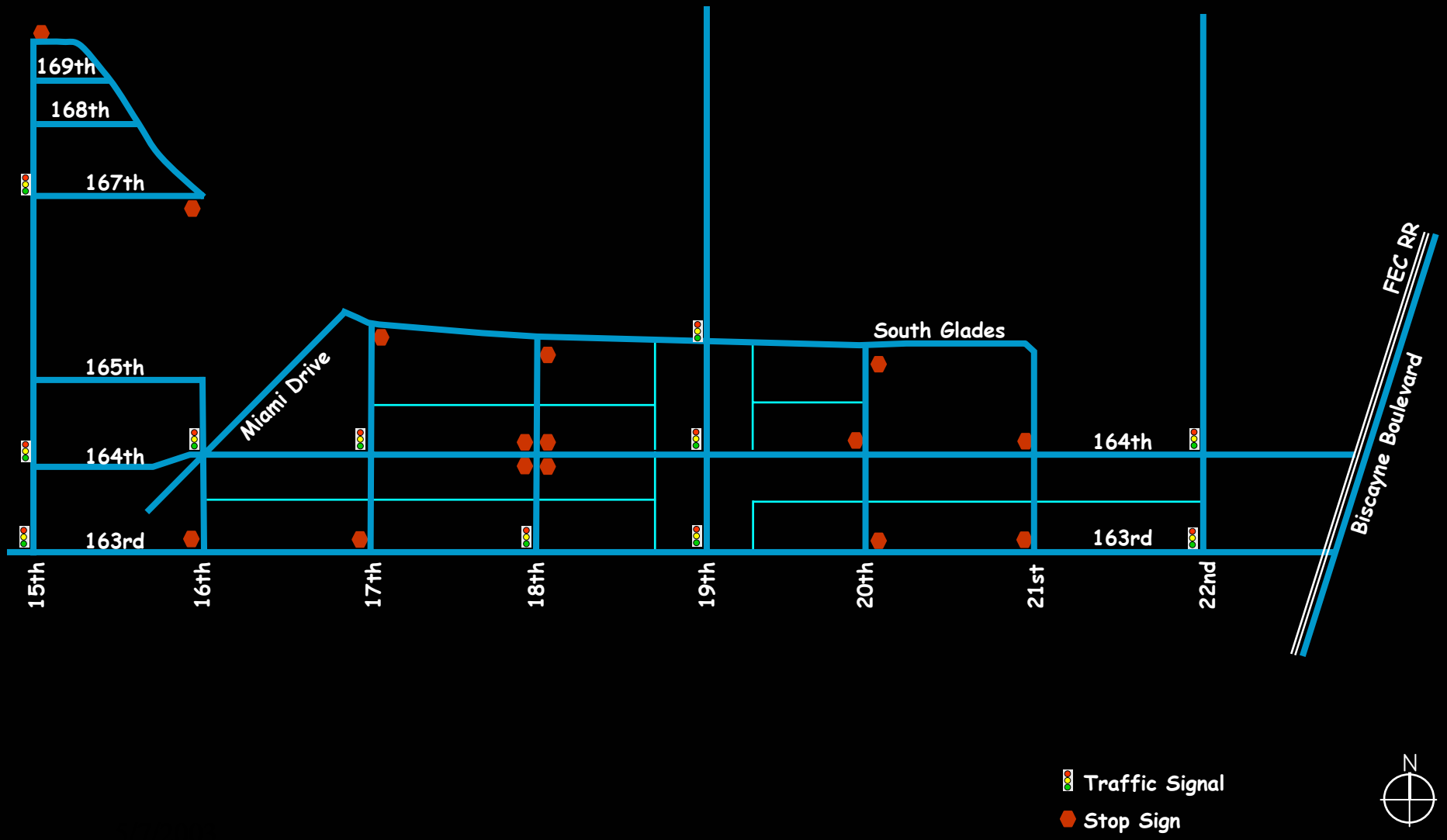
Bus Routes


Rt 91
Rt V
169th
168th
167th
165th
164th
163rd
Miami Drive
South Glades
Rt E
164th
163rd
FEC RR
Biscayne Boulevard
15th
16th
17th
18th
19th
20th
21th
22th
Temporary
alternative routes
N

Direction of Travel



Traffic Controls



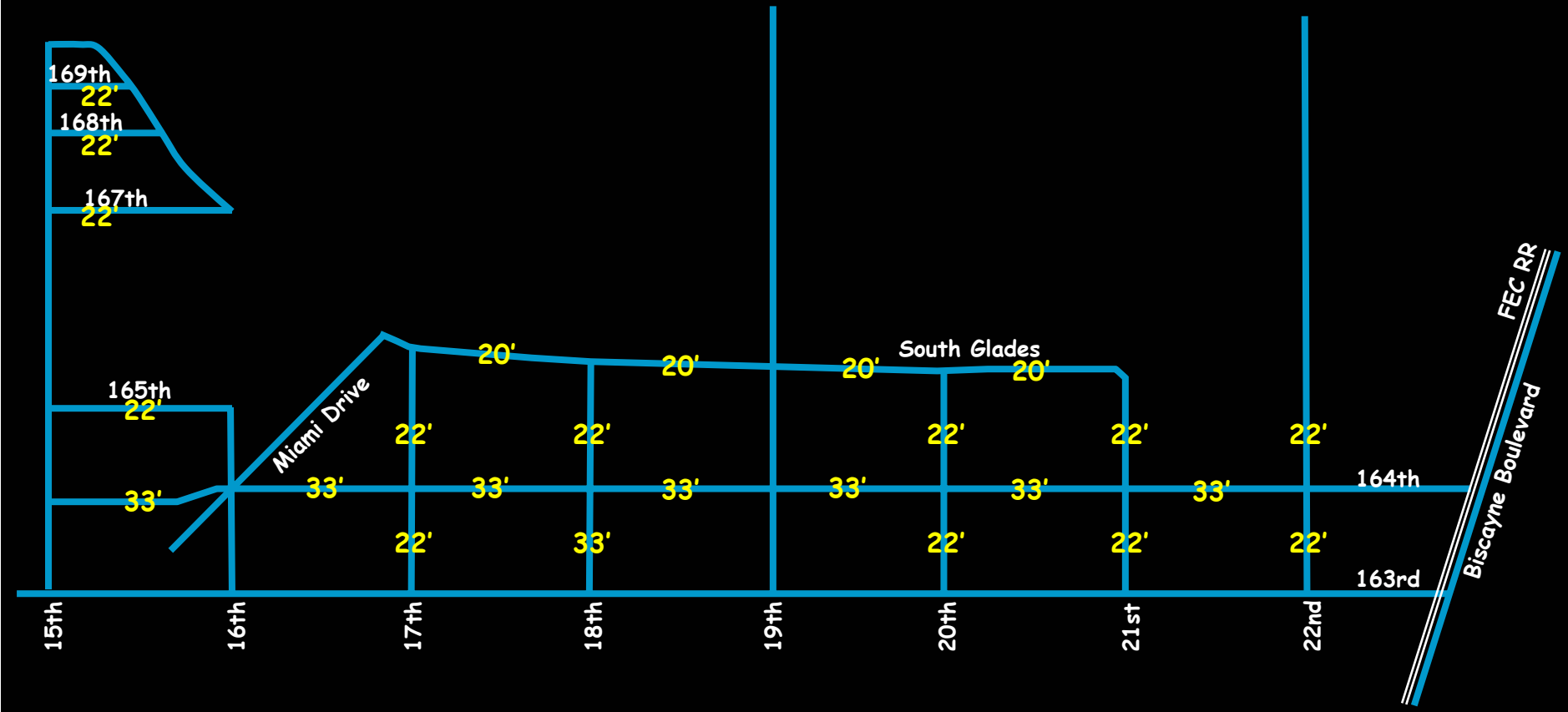
Posted Speed Limits

Remainder Default Speed

Bus Route

Accomodation

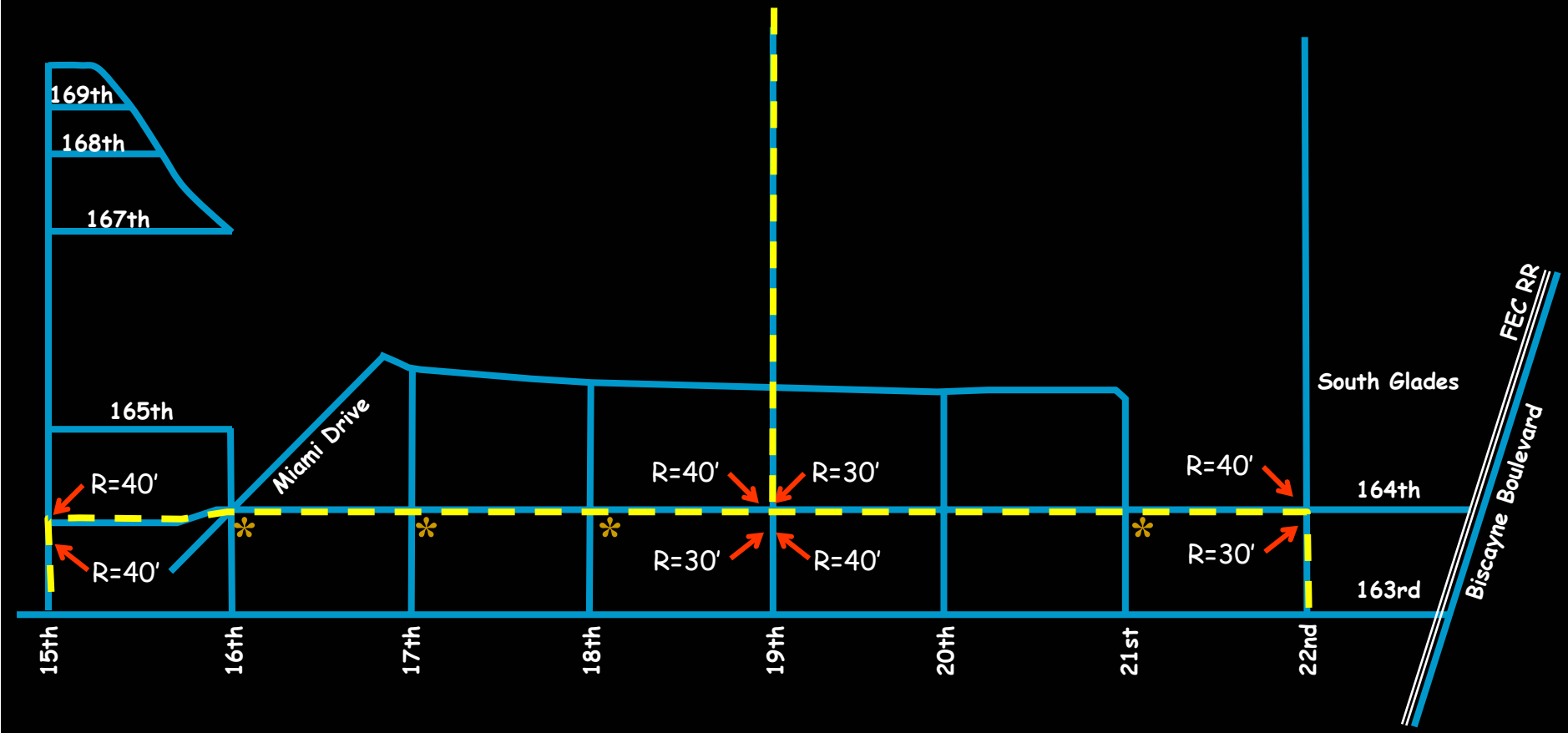
Recommended Mid-Block Travel Lane Widths



i.e.: sum of the width of the travel lanes

Recommended Turning Radii

For Existing and Future Bus Routes Involving Right Turns



Note: If buses do not and will not turn in the future, then larger radius is not necessary and the default of 25′ can be used.

✻ **With a 90 degree inscribed diameter modern roudabout, the intersection will be bus-route capable**

N

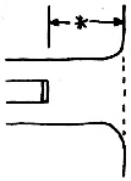
Minimum Distance* Between Stop Bar in the Left Turn Lane** and the Near Curbline Based on Bus Encroachment

		Bus Route's Turns Onto 164th Street					
		From Noth to East (left)	South to East (right)	North and South to East (both)	North to West (right)	South to West (left)	North and South to West (both)
Intersecting Street	N.E. 15th Ave.	55'	55'	55'	n.a.	n.a.	n.a.
	N.E. 19th Ave.	35'	55'	55'	55'	35'	55'
	N.E. 22nd Ave	n.a.	n.a.	n.a.	55'	45'	55'

For East Approach

For West Approach

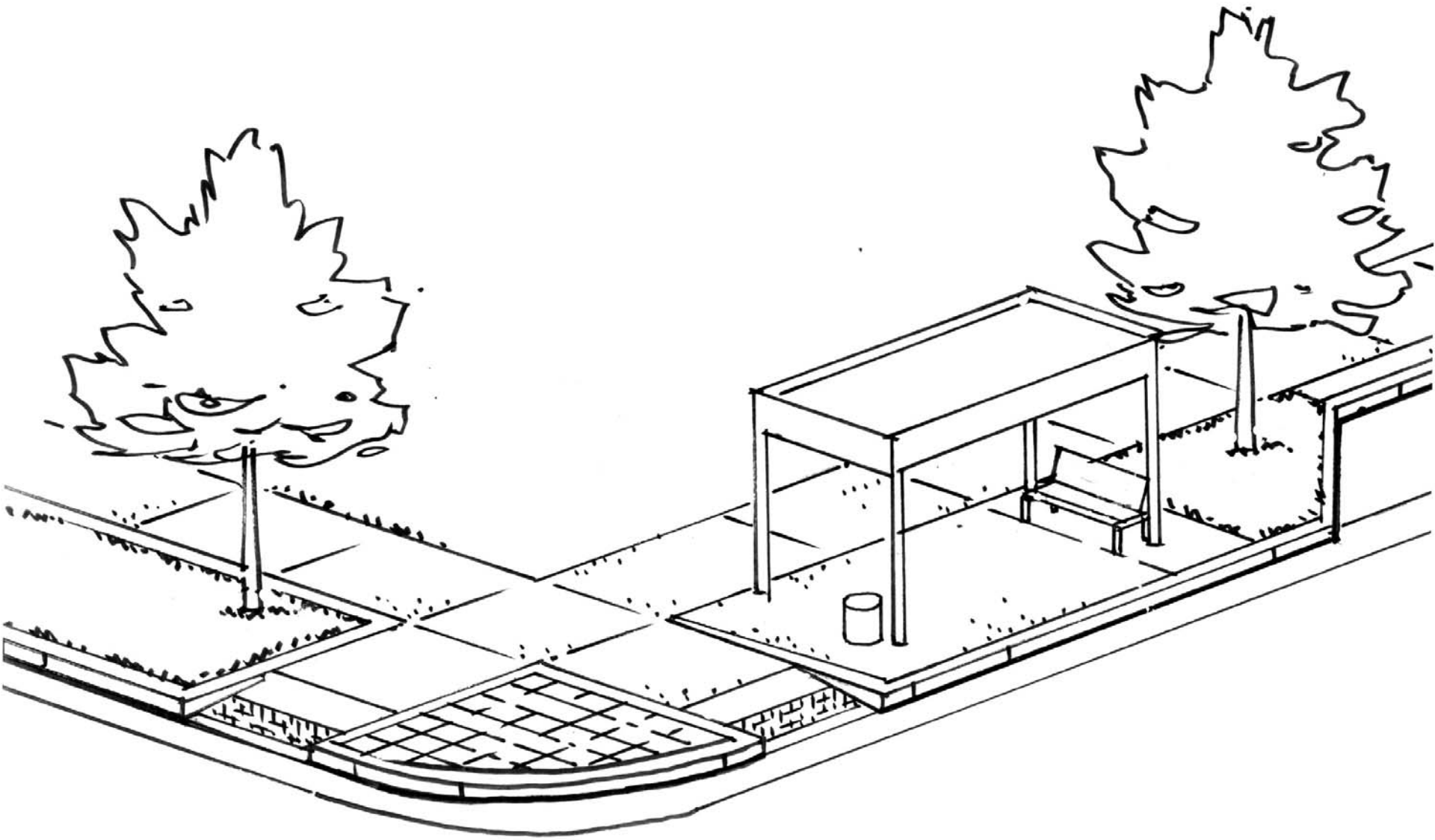
** Also applies to the nose of raised medians



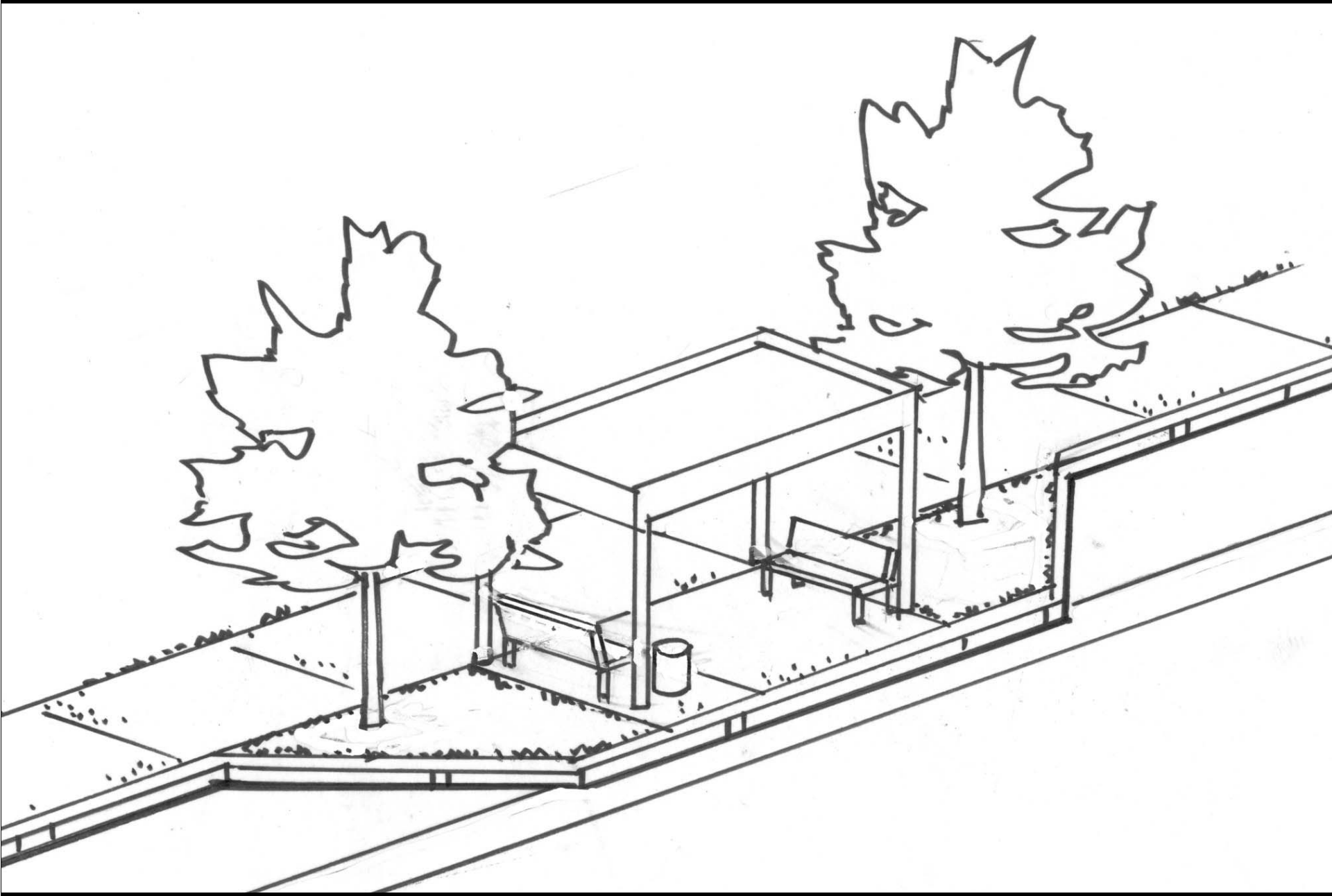
Design Guidance

Bus Stops

Corner Bus Stop Detail

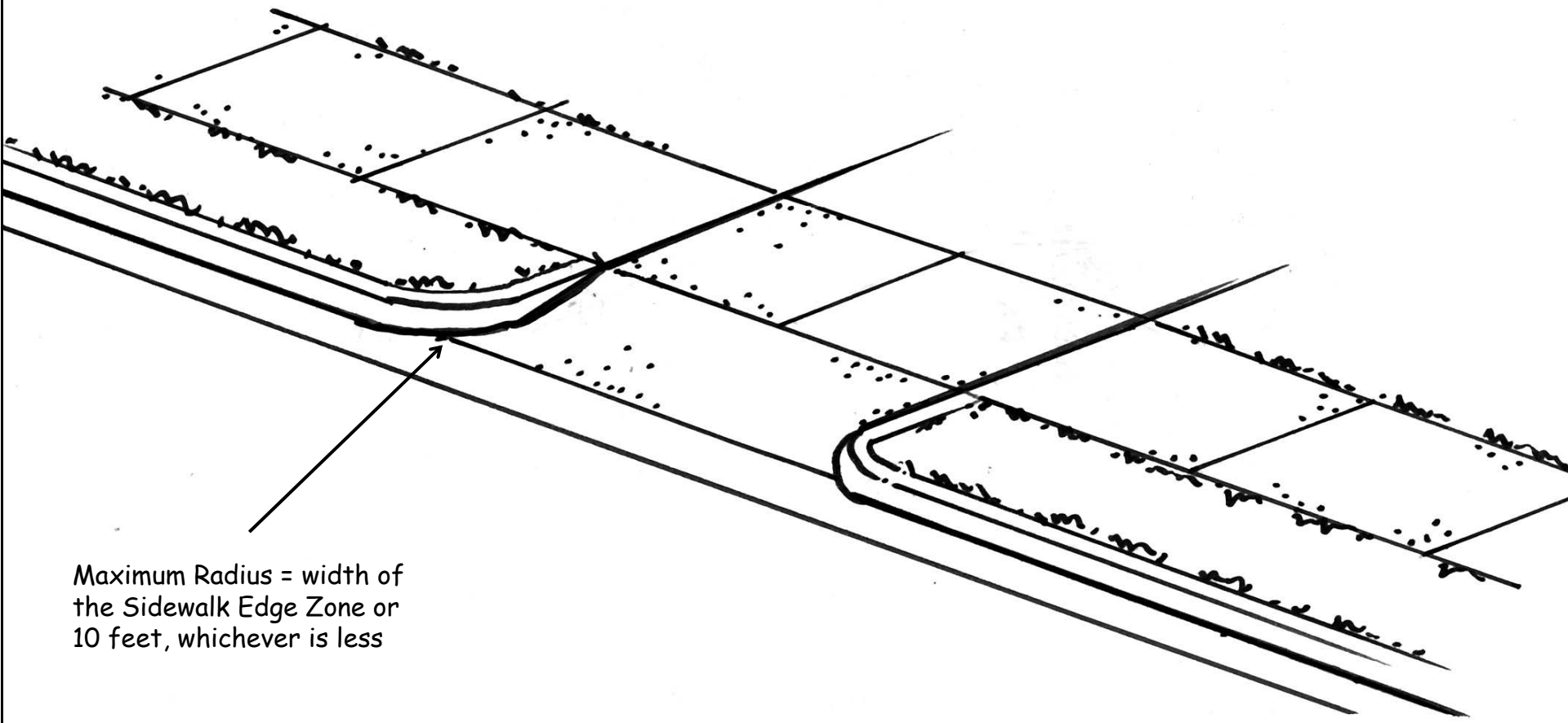


Mid-Block Bus Stop Detail

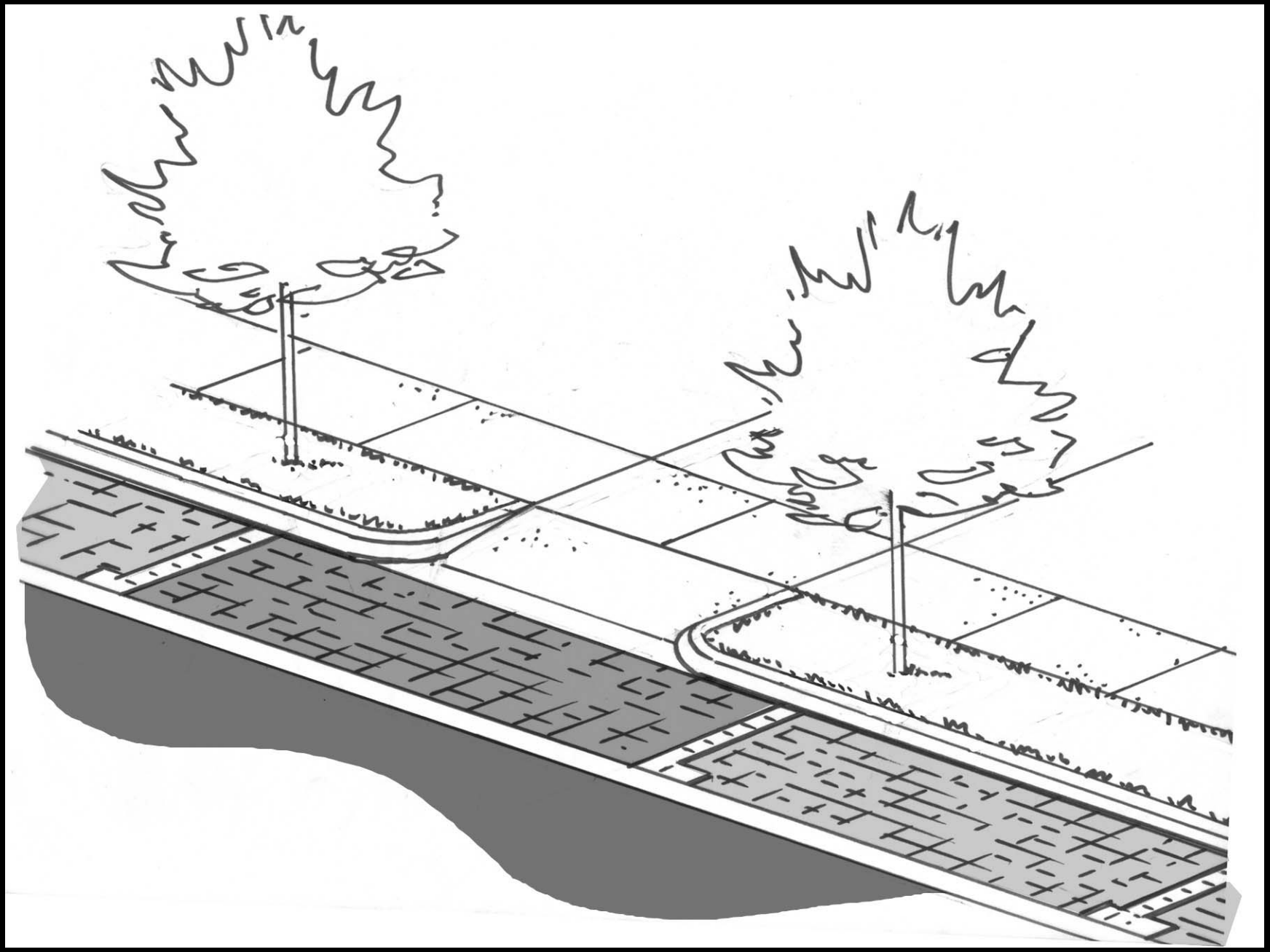


Alleys and Driveways

Sidewalk/Driveway and Alley Detail



Driveway Detail Intersecting Parking Lane



Median Alternative

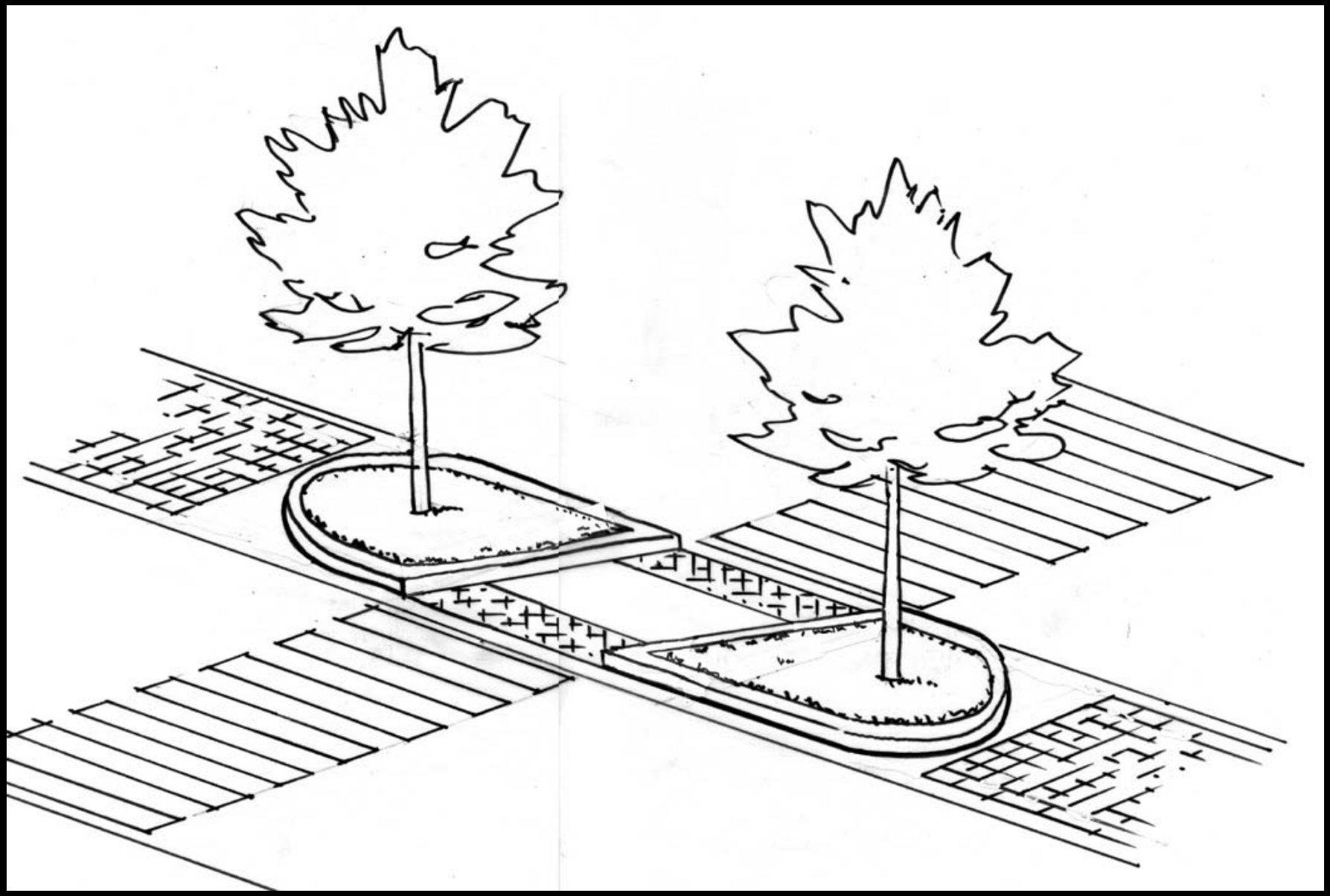
POLICE
GMC

ONE
WAY
ONE
WAY

ONE
WAY
ONE
WAY

ONE
WAY
LARNEY

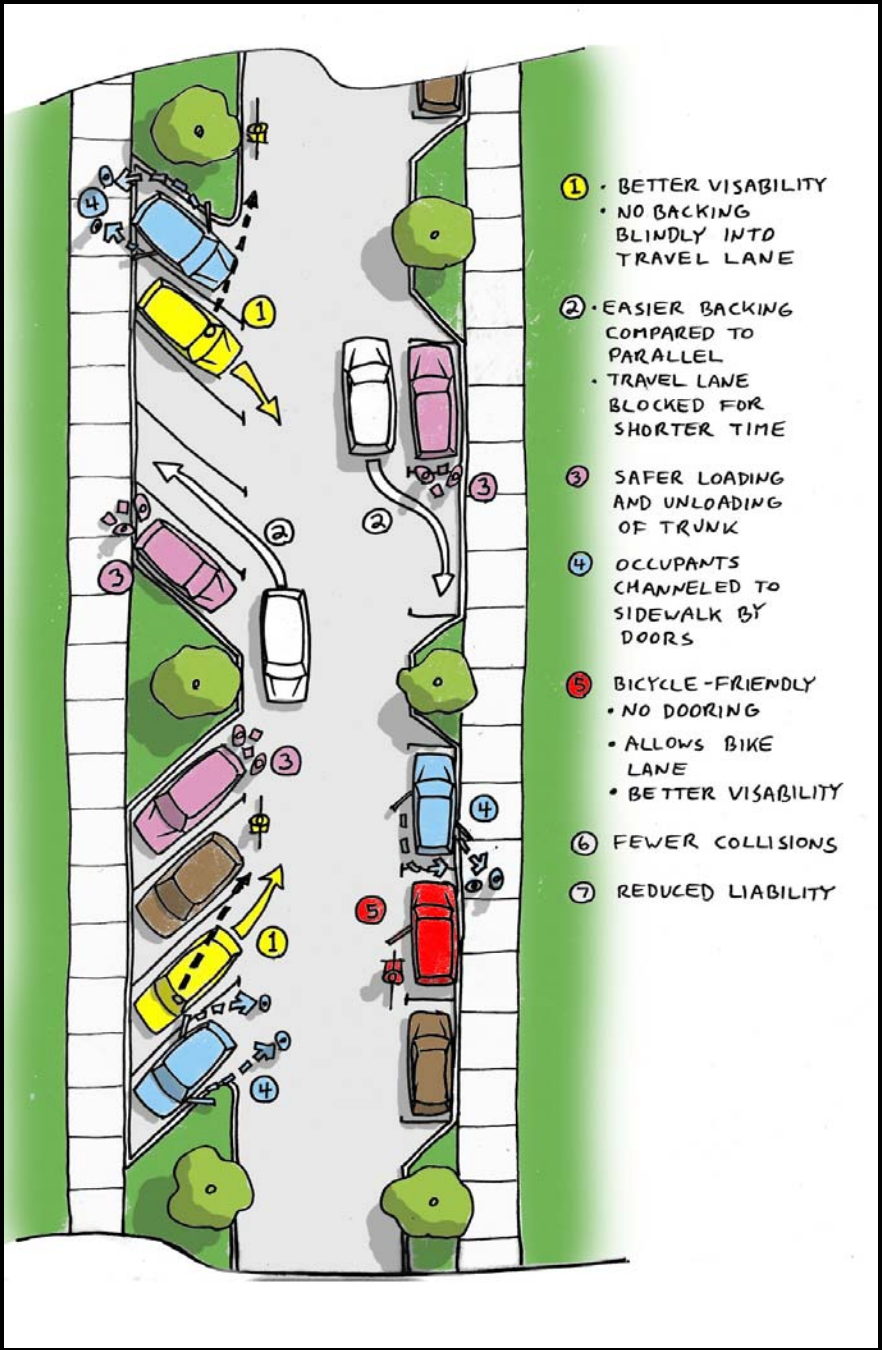
Flush Median /Mid-Block Crossing Detail



SPEED
LIMIT
25

Parking

On-Street Parking



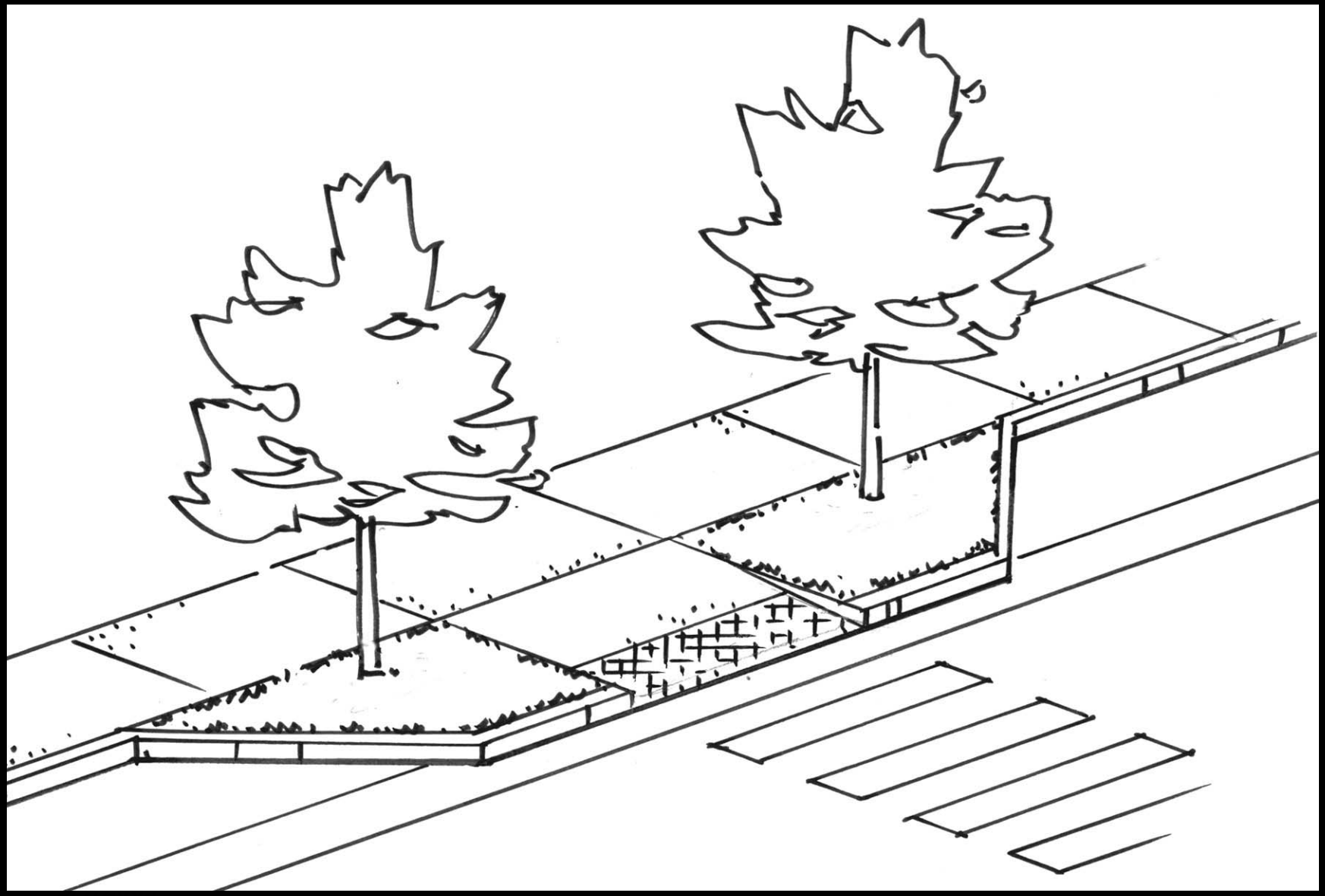
PASTA PIZZA
RESTAURANTS
PRO

TOYOTA

Tastes fresh from the farm.
GOLD KIST FARMS

Bulb-out Details

Mid-Block Pedestrian Crossing Detail

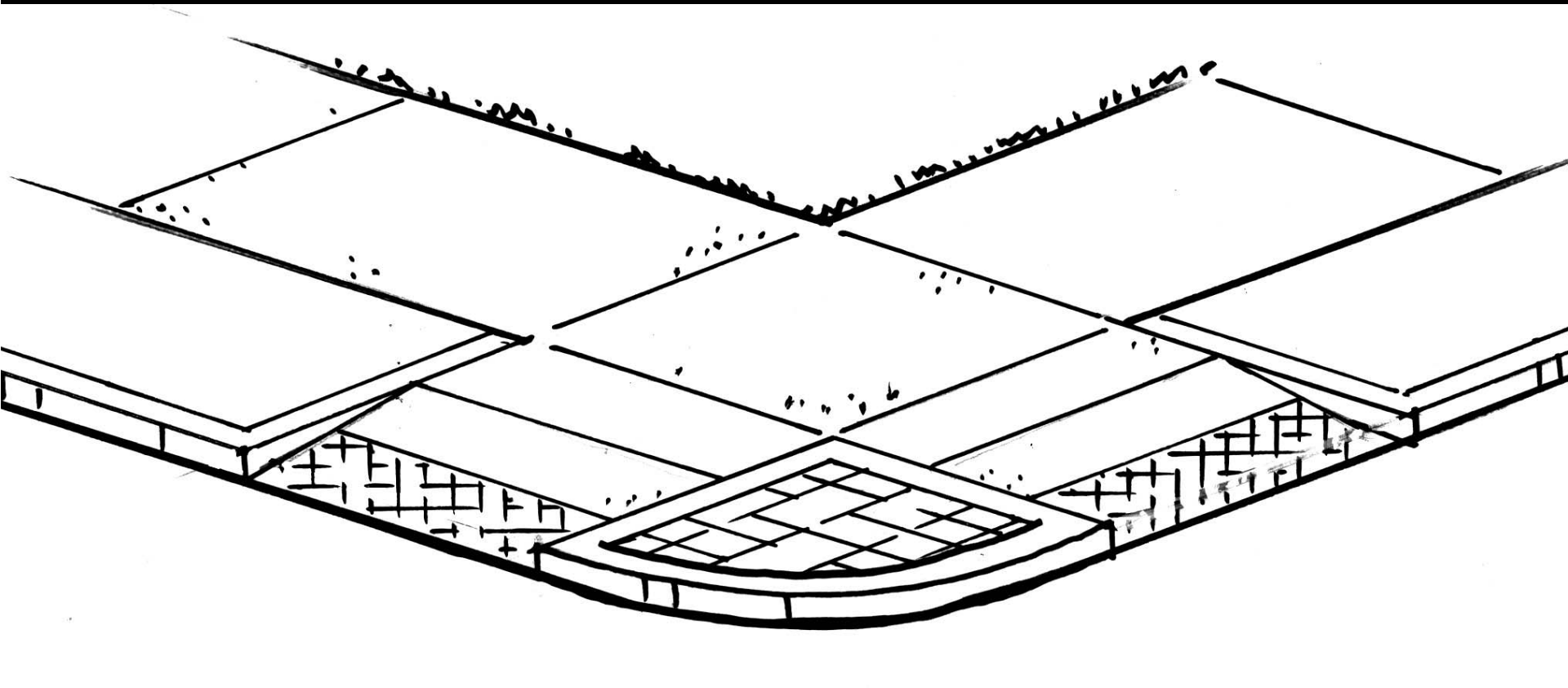


City Center

BUS
STOP

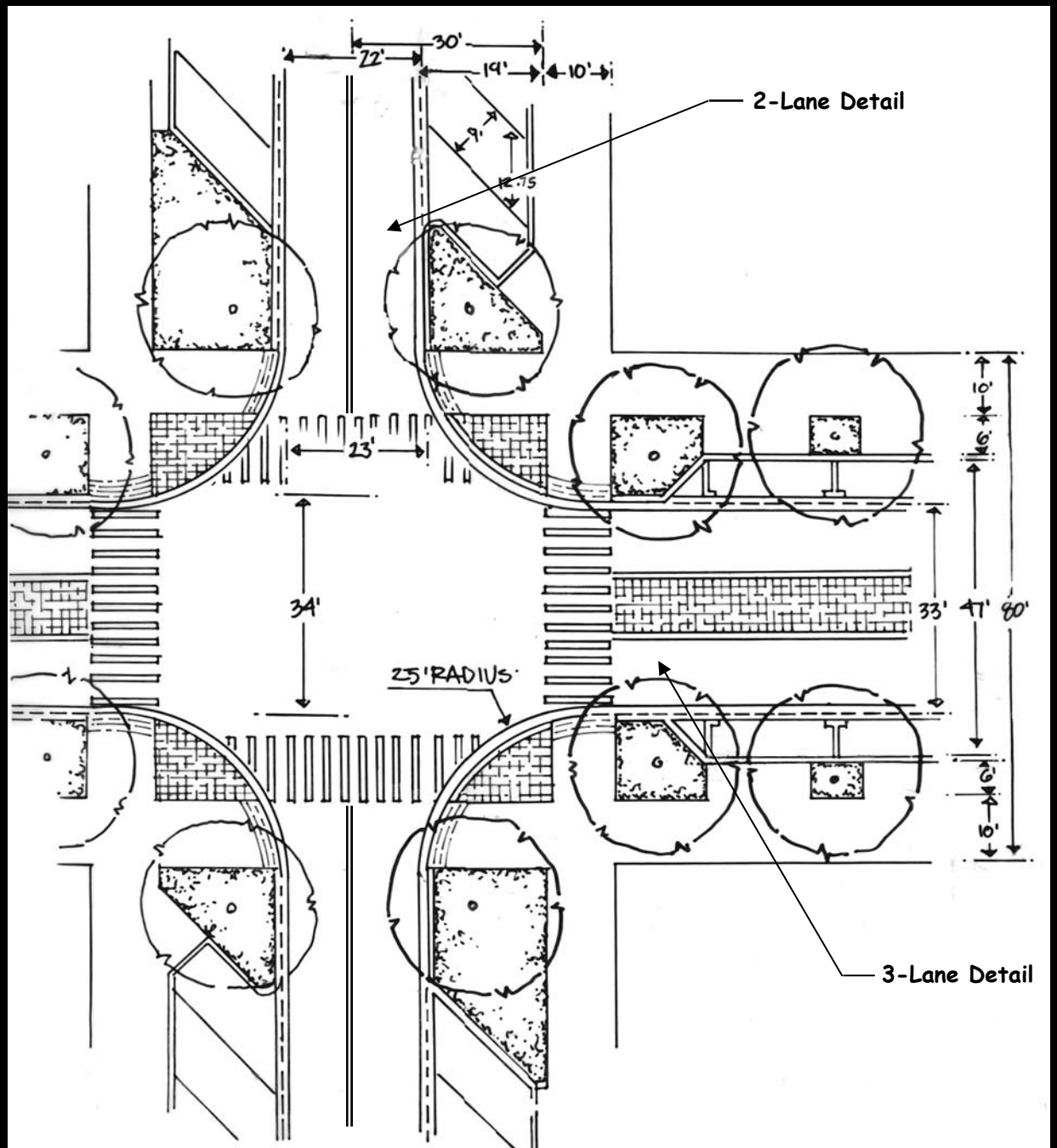
Accessibility Ramp Details

Accessibility Ramp Detail



Typical Intersection Details

Typical Street Detail



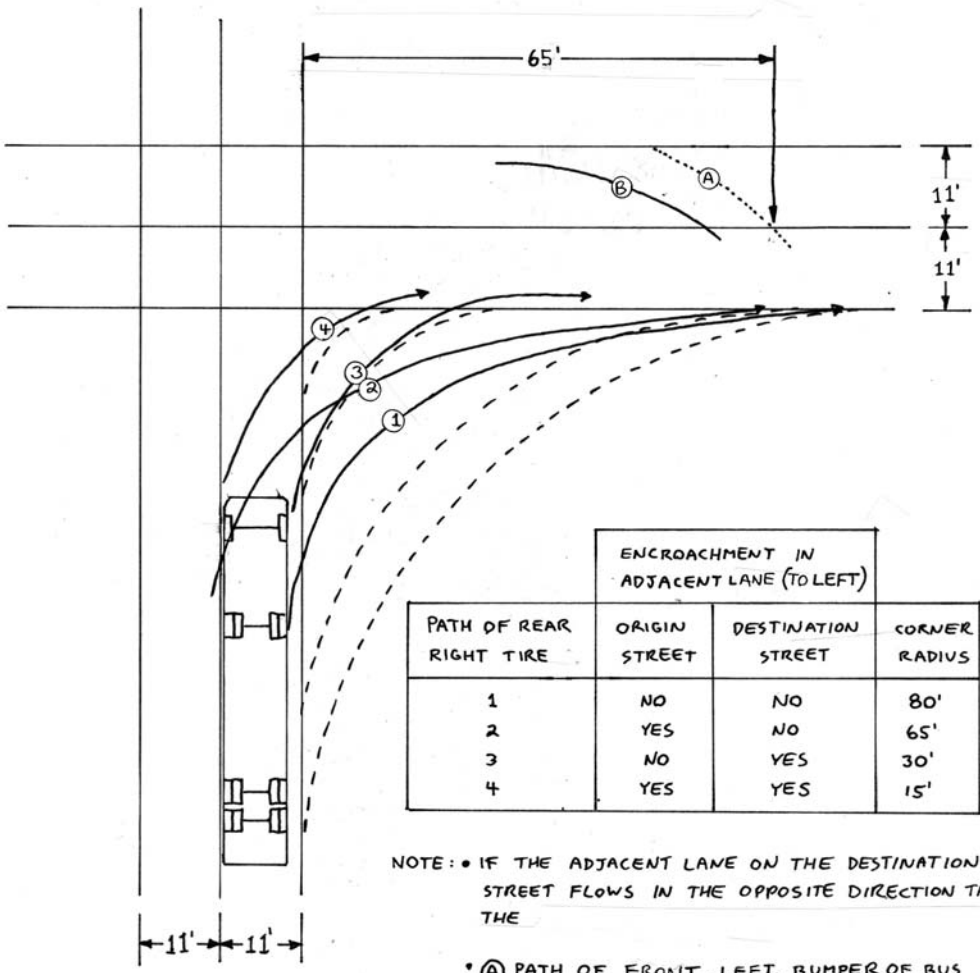
Typical Mid-Block Detail

Typical Mid-Block Detail

Typical Mid-Block Detail

Appendix

RIGHT TURN ANALYSIS FOR WB-40 SEMITRAILER AND "B40" BUS FOR TWO-LANE AND MULTI-LANE STREETS

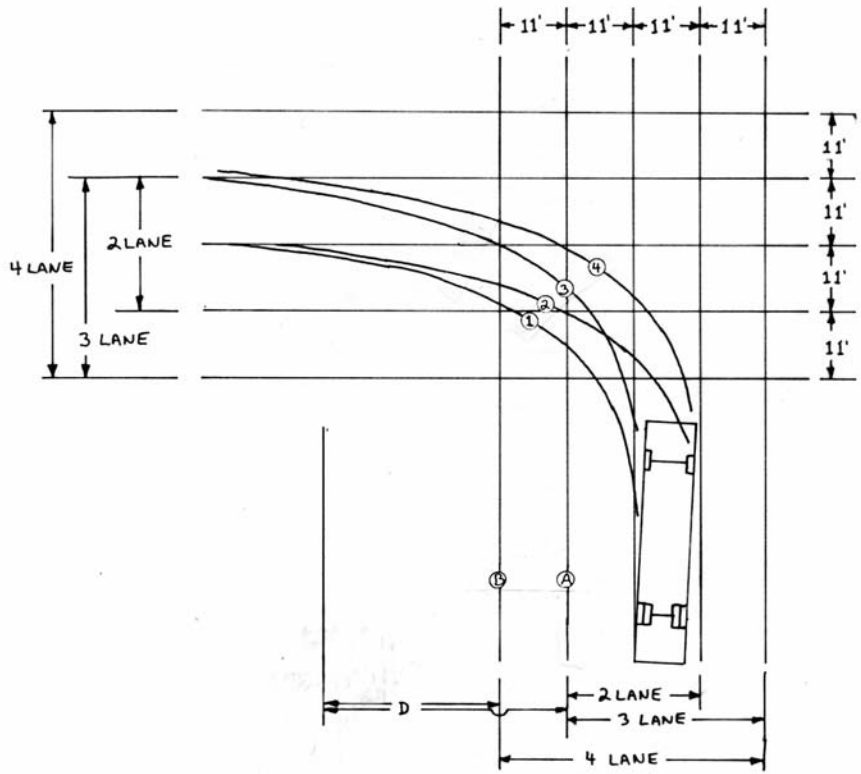


PATH OF REAR RIGHT TIRE	ENCROACHMENT IN ADJACENT LANE (TO LEFT) ORIGIN STREET	DESTINATION STREET	CORNER RADIUS
1	NO	NO	80'
2	YES	NO	65'
3	NO	YES	30'
4	YES	YES	15'

NOTE: • IF THE ADJACENT LANE ON THE DESTINATION STREET FLOWS IN THE OPPOSITE DIRECTION THEN THE

• (A) PATH OF FRONT, LEFT, BUMPER OF BUS
• (B) PATH OF FRONT, LEFT, TIRE

LEFT TURN ANALYSIS FOR "B40" BUS FOR TWO-LANE AND MULTIPLE-LANE STREETS (WB-40 SEMITRAILER IS LESS CRITICAL)



NUMBER OF LANES	ORIGIN STREET	2			3					4					
	DESTINATION STREET	2	3	4*	2		3		4*	2		3		4*	
ENCROACHMENT	ORIGIN STREET (TO RIGHT)	NO	NO	NO	NO	YES	NO	YES	NO	YES	NO	YES	NO	YES	NO	YES
	DESTINATION STREET IN OPPOSING DIRECTION (FEET FROM CURB LINE)**	55_A	55_A	15_A	55_A	45_A	55_A	45_A	15_A	0_A	45_B	35_B	45_B	35_B	0_B	-10_B
PATH OF REAR LEFT TIRE		1	1	3	1	2	1	2	3	4	1	2	1	2	3	4

* TURN IS MADE INTO DESTINATION STREET'S RIGHT HAND LANE

** ROUNDED UP TO THE NEAREST 5 FEET, SUBSCRIPT INDICATES APPLICABLE CURBLINE