

Palm Coast Draft Turn Lane Technical Guidelines on November 10, 2020

Attachment 4A

The purpose of this document is to assist the City and design professionals regarding turn lane design as part of a development for a property accessing a City street. It determines:

- a) when a turn lane is required to be built as a condition of access to the City street, and
- b) the required dimensions of the turn lane.

These guidelines provide guidance for developers on what to expect for design and construction requirements on a roadway connecting to their driveway (entrance) when developing a property.

Turn lanes for left-turning and right-turning traffic are desirable for the safe execution of speed change maneuvers. Turn lanes also allow for the storage and protection of left-turning or right-turning vehicles while allowing through traffic to pass safely with minimal induced delay.

Deceleration lanes shall be provided at all intersection and/or access points adjacent to the project on all City-maintained and privately-maintained roadways as required by these guidelines. (Turn lanes along Flagler County owned roadways will be determined by Flagler County after receiving input from the City.) However, these guidelines shall not be construed in any manner to allow a left-turn lane and/or a right-turn lane into a project where such turning movement is not approved by the City.

All table values referenced in this document presume design of a single turn lane. The City will use the latest edition of the Florida Department of Transportation's (FDOT's) publication: "Standard Plans and Manual of Uniform Minimum Standards for Design, Construction and Maintenance for Streets and Highways" (commonly referred to as the "Florida Greenbook") as a design reference. The City will be the sole judge, when backed by engineering analysis, to define whether a multi-lane turn lane design is adequate in dimension.

Turn Volume Thresholds that Require the Addition of a Dedicated Left Turn Lane from the City Street

A left turn lane shall be provided at each access driveway of the project when a Left-Turning Vehicle (LTV) count during a Peak Hour (Weekday AM, Weekday PM, Weekend Mid-Day) from the City roadway entering that driveway meets or exceeds the criteria below. The roadway column in the table below shall be utilized for the type and volume of traffic on the roadway from where the turn would originate and shall be based on the Average Annual Daily Traffic (AADT) from the City's bi-annual traffic counts and projected forward including background traffic from other projects, as determined by the City, until the time when the project and its driveway are reasonably expected to finish construction and be open.

Left Turn Lane Thresholds

Posted Speed	2 Lane Roadways	2 Lane Roadways	4+ Lane Roadways	4+ Lane Roadways
Limit	AADT of 5,000 or less	AADT over 5,000	AADT of 10,000 or less	AADT over 10,000
Up to 25 mph	40 LTV/Peak Hour	35 LTV/Peak Hour	50 LTV/Peak Hour	40 LTV/Peak Hour
30 - 35 mph	30 LTV/Peak Hour	25 LTV/Peak Hour	35 LTV/Peak Hour	25 LTV/Peak Hour
40 + mph	20 LTV/Peak Hour	15 LTV/Peak Hour	25 LTV/Peak Hour	20 LTV/Peak Hour

Turn Volume Thresholds that Require the Addition of a Dedicated Right Turn Lane from the City Street

A right turn lane shall be provided at each access driveway of the project when a Right-Turning Vehicle (RTV) count during a Peak Hour (Weekday AM, Weekday PM, Weekend Mid-Day) from the City roadway entering that driveway meets or exceeds the criteria below. The roadway column in the table below shall be utilized for the type and volume of traffic on the roadway from where the turn would originate and shall

be based on the AADT from the City's bi-annual traffic counts and projected forward including background traffic from other projects, as determined by the City, until the time when the project and its driveway are reasonably expected to finish construction and be open.

Right Turn Lane Thresholds

Posted Speed	2 Lane Roadways	2 Lane Roadways	4+ Lane Roadways	4+ Lane Roadways
Limit	AADT of 5,000 or less	AADT over 5,000	AADT of 10,000 or less	AADT over 10,000
Up to 25 mph	175 RTV/Peak Hour	150 RTV/Peak Hour	155 RTV/Peak Hour	120 RTV/Peak Hour
30 - 35 mph	120 RTV/Peak Hour	100 RTV/Peak Hour	100 RTV/Peak Hour	70 RTV/Peak Hour
40 + mph	70 RTV/Peak Hour	60 RTV/Peak Hour	60 RTV/Peak Hour	40 RTV/Peak Hour

Other Criteria

When a project's driveway meets at least 75% of the above thresholds for Peak Hour (Weekday AM, Weekday PM or Weekend Mid-Day) left or right turns and at least one of the following criteria is also present, the City, in its sole judgment, may require the developer to provide the turn lane.

1. Sight distance is limited due to curves or hills or other unalterable object.
2. The intersection or driveway is just after a signalized intersection where acceleration or driver expectancy would make a separate right turn desirable (this would also be the case downstream soon after a dual left-turn lane onto a four-lane roadway).
3. At least 50% higher than normal crash experience (or 33% above normal rear-end collisions) or the City has determined that this roadway section has a Level of Service (LOS) of D or lower.
4. Severe skewed angle of the intersection so that right-turn traffic has to slow more than would be expected for a 90-degree turn.
5. The turn-lane into the project occurs at an existing or proposed signalized intersection where adequate right-of-way exists or is available from the development.

Construction Timing

Turn lanes shall be constructed with the infrastructure and prior to the vertical construction of any buildings unless the City allows some of the vertical building construction prior to completion of the turn lanes. When a project is phased, the turn lanes shall be constructed with the earliest phase that the turn lane meets at least 50% of the criteria for requiring the turn lane.

Turn Lane Design Standards

A turn lane shall consist of the following components: A taper and a full width lane length of a turn lane. The total length of the turn lane shall be the taper length plus the full width lane length.

A taper shall be the longitudinal length of a development of a lane from zero width to full width. Find the length of taper required in the tables below (See Sections *Left turn Lane Table* and *Right Turn Lane Table*).

Turn lane widths shall be a minimum of 11 feet on roadways where the posted speed is 40 mph or less (see exceptions in next sentence).

Turn lane widths, when turn lanes are required, shall be a minimum of 12 feet on roadways where at least one condition below is present:

1. Where the posted speed is 45 mph or greater.
2. With more than two lanes of opposing traffic.
3. With medians at least 16 feet wide separating opposing traffic lanes.

Turn lane length shall be measured along the lane segment constructed at full lane width. The required turn lane length of right turn lanes and left turn lanes exiting the City street shall be determined by choosing the greater of:

1. The minimum full width turn lane length. The minimum full width turn lane length shall be 75 feet.
2. The calculation of full width turn lane length based on conditions in the following tables. Total required full width turn lane length shall be the sum of the deceleration length dimension (See Left Turn Lane Table; See Right Turn Lane Table) plus the storage length dimension (see Storage Length Dimension Table - SLDT).

Shorter turn lanes will not be allowed except under special circumstances as approved by the City.

Storage Length Dimension Table For Unsignalized Intersections*

Largest Peak Hour Volume in Vehicles Per Hour (vph)	Storage Length (feet)*
Up to 25	30
26 to 50	50
51 to 75	75
76 to 100	100
Every additional increment, or partial increment, of 50 vph	75

**Per FDOT Greenbook*

Dimensions in the SLDT presume the traffic in the turn lane consists of less than 5% heavy vehicles (where a heavy vehicle is any vehicle longer than 34 feet including a trailer). If heavy vehicle percentage will be between 5% and 20% of turning vehicles, increase storage length by 20%. If heavy vehicle percentage will be greater than 20% of turning vehicles, increase storage length by 100%.

Left Turn Lane Length

The requirements for lengths of tapers, deceleration and storage for left turn lanes are based on the speed limit of the road and are shown in the following table:

Left Turn Lane Table For Unsignalized Intersections*

Posted Speed Limit Of Roadway (mph)	Length of Taper (feet)	Length of Deceleration (feet)	Length of Storage (feet)*
Up to 25	50	0	100% of SLDT Value
30	75	0	100% of SLDT Value
35	75	75	100% of SLDT Value
40	90	75	100% of SLDT Value
45	100	100	100% of SLDT Value
50	100	135	100% of SLDT Value

**For 2 Lane Roadways less than 5,000 ADT and for 4-Lane Roadways less than 10,000 ADT, reduce the 100% qualification to 70%. Per FDOT Greenbook*

Total required full width turn lane length shall be the sum of the deceleration length dimension plus the storage length dimension. The taper is not considered part of the full width turn lane length.

Right Turn Lane Length

The requirements for lengths of tapers, deceleration and storage for right turn lanes are based on the speed limit of the road and are shown in the following table:

Right Turn Lane Table For Unsignalized Intersections*

Posted Speed Limit Of Roadway (mph)	Length of Taper (feet)	Length of Deceleration (feet)	Length of Storage (feet) Stop Condition	Length of Storage (feet) Free Flow
Up to 25	50	0	50% of SLDT Value	0
30	75	0	50% of SLDT Value	0
35	100	75	50% of SLDT Value	25% of SLDT Value
40	100	75	60% of SLDT Value	30% of SLDT Value
45	100	100	75% of SLDT Value	35% of SLDT Value
50 +	100	135	80% of SLDT Value	45% of SLDT Value

**Per FDOT Greenbook*

Total required full width turn lane length shall be the sum of the deceleration length dimension plus the storage length dimension. The taper is not considered part of the full width turn lane length. Right turn lane lengths at traffic signal controlled intersections shall be based on queue lengths determined through an engineering traffic study.

Deviations

The City may grant a deviation from these guidelines in part or in whole after determining that any of the following conditions make compliance infeasible:

1. Right-of-way constraints do not permit the installation of the turn lane or to its full dimensions. This does not include cases where the developer is unwilling to provide the developer's own property from the development under consideration for additional right-of-way to construct or compensate for the turn lane.
2. Existing topographic or roadway geometric features would cause construction of the turn lane to be prohibitively expensive if constructed to standards.
3. Unusual roadway features would cause a turn lane to be detrimental to the health, safety and general welfare of the public. This could include a case where a right-turn lane could negatively impact bicyclists or pedestrians.
4. Such turn lane or in its full dimension would require removal of a specimen or historic tree as described in Section 11.02.04.A of the Land Development Code or significantly impact a high quality wetland.

Calculation Examples

Example 1

A 30 mph 2 lane 2-way road. AADT of 4,000. Heavy Truck percentage into property: 15%. Largest Peak Hour projected left turns: 32 vph. Largest Peak Hour Projected Right Turns 62 vph.

Compare to Turn Volumes Threshold Tables

Is Left Turn lane required? 32 vph > 30 LTV threshold Yes. Left turn lane is required.

Is Right Turn lane required? 62 vph < 120 RTV threshold. No. Right turn lane is not required.

Calculate Left turn Length

See Left Turn Lane Table

For 30 mph,

Taper = 75 feet

Deceleration Length = 0 feet

SLDT for 32 vph = 50 feet

Truck factor for 5 to 20% trucks = 1.2

Full width length = $0 + (1.2 * 50) = 60$ feet round up to nearest 10 feet → 60 feet

Final answer: Left turn lane length = 50 foot taper plus 60 feet full width lane = 110 feet.

Full width lane = 11 feet for 30 mph road with no special conditions.

Note: The transition from the typical two-lane width to the beginning of taper is covered in the FDOT Greenbook, which is referenced as the design guidelines for the transition.

Example 2

A 45 mph 4 lane road with divided median. AADT of 12,800. Heavy Truck percentage into property: 2 to 4%. Largest Peak Hour projected Left turns: 44 vph. Largest Peak Hour Projected Right Turns 164 vph.

Compare to Turn Volumes Threshold Tables

Is Left Turn lane required? 44 vph > 20 LTV threshold Yes. Left turn lane is required.

Is Right Turn lane required? 164 vph > 40 RTV threshold Yes. Right turn lane is required.

Calculate Left turn Length

See Left Turn Lane Table

For 45 mph

Taper = 100 feet

Deceleration Length = 100 feet (deceleration occurs in taper)

SLDT for 44 vph = 50 feet

Truck factor for 2-4% trucks = 1.0

Full width length = $100 + (1.0 * 50) = 150$ feet round up to nearest 10 feet → 150 feet

Final answer: Left turn lane length = 100 foot taper plus 150 feet full width lane = 250 feet.

Full width lane = 12 feet for 45 mph road

Calculate Right Turn Length

See Right Turn Lane Table

For 45 mph

Taper = 100 feet

Deceleration Length = 100 feet (deceleration occurs in taper)

SLDT for 164 vph = 100 feet plus two units of 50 vph = $100 + (2.0 * 75) = 250$ feet

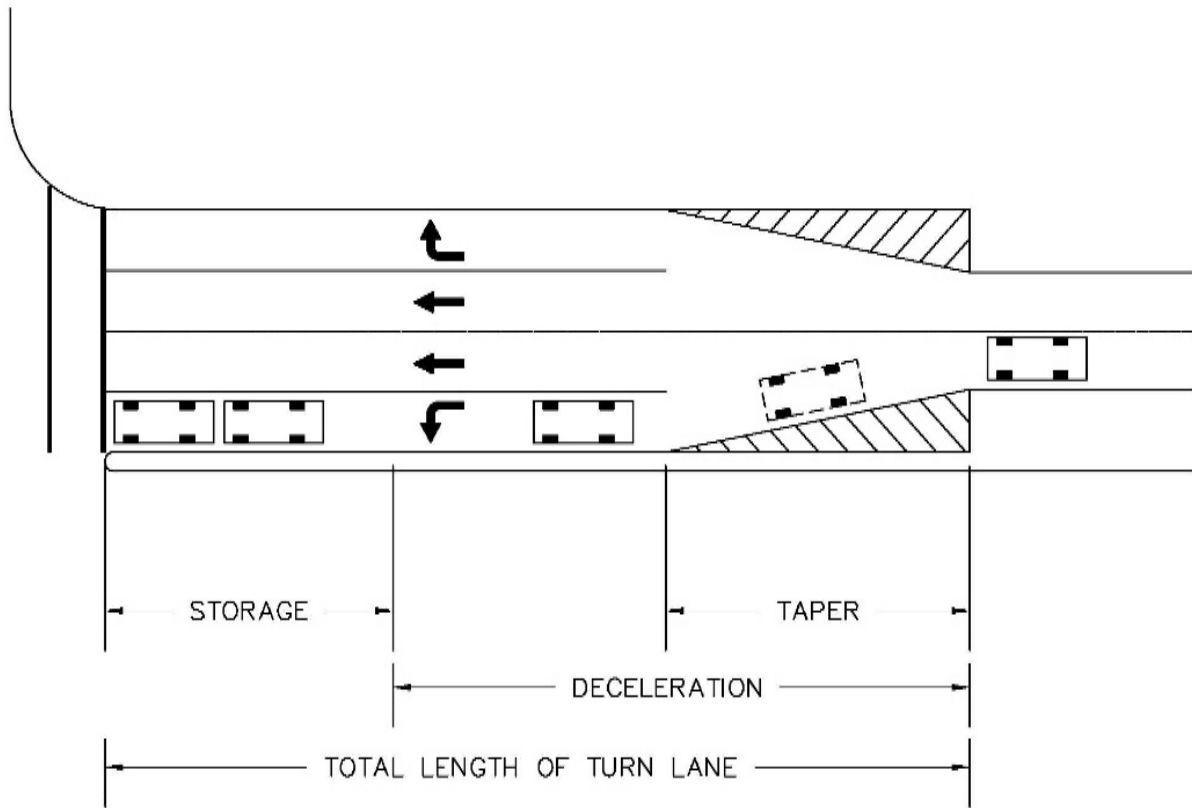
Truck factor for 2-4% trucks = 1.0

Full width length = $100 + (1.0 * ((0.75) * 250)) = 100 + 187.5$ feet = 287.5 feet round up to nearest 10 feet → 290 feet

Final answer: Right turn lane length = 100 foot taper plus 290 feet full width lane = 390 feet.

Full width lane = 12 feet for 45 mph road.

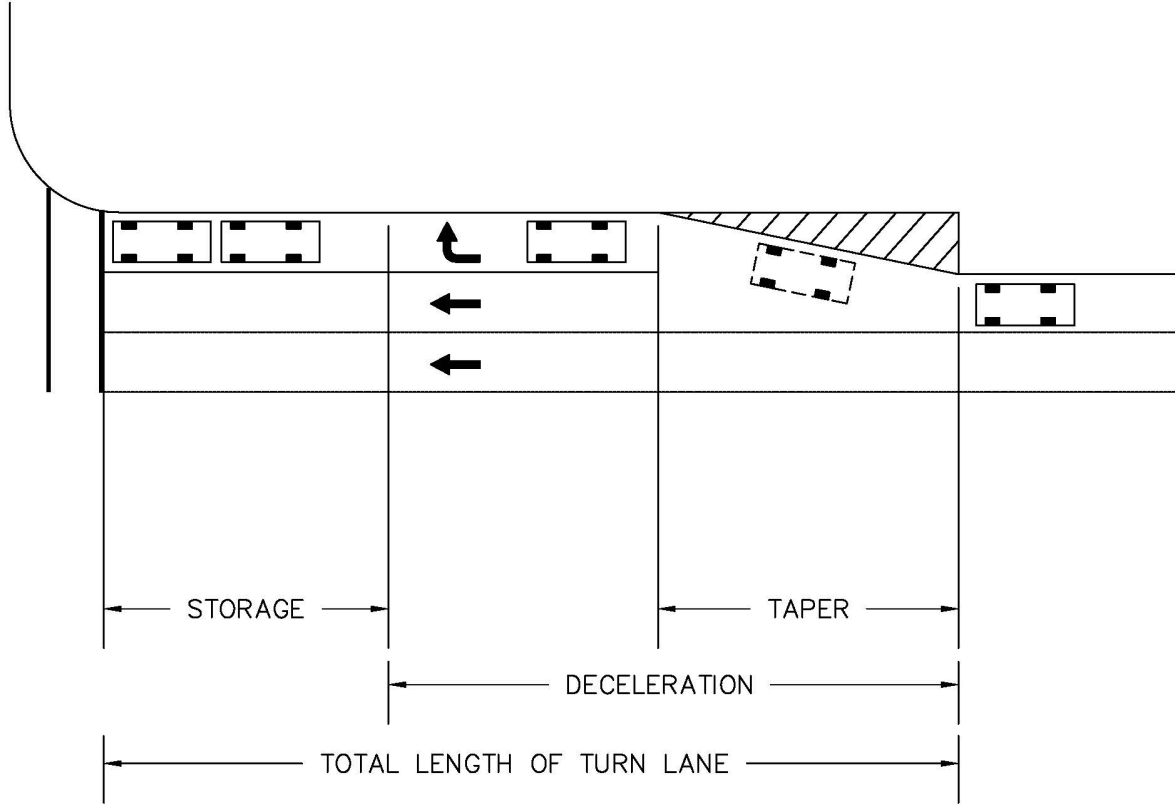
Left Turn Lane Detail



LEFT TURN LANE DETAIL

11/10/20

Right Turn Lane Detail



RIGHT TURN LANE DETAIL

11/10/20