HANDOUT
#1

2/28/11

DRAFT Issue Paper on
Improving Florida's Transportation Planning and Design Analysis Time Period Process
(Adopting Standard K Factors and Level of Service Standards throughout FDOT)

Purpose

Selecting a proper time period is crucial for planning and designing transportation facilities. The ratio of peak hour to annual average daily traffic factor (K) is used in the Department's planning through design phases. It is one of, if not the most critical traffic considerations in the Department's efforts in planning and designing of highway facilities. Yet, in actual practice, there is considerable confusion and inconsistency in how this important traffic factor is used throughout the Department. The purpose of this issue paper is to provide background on the topic, recommend an approach for the Department to adopt, and present positive and negative aspects of the recommended approach.

Background

The concept of arranging hourly volumes in descending order of magnitude and the use of the 30^{th} highest hour in relation to AADT was introduced in the 1950 Highway Capacity Manual. It was inferred that designing roads to the 30^{th} highest hourly traffic volume of the year with an emphasis on rural areas was highly cost effective. The concept caught on and its first appearance in a national design guide was AASHO's "A Policy on Geometric Design of Rural Highways", adopted May 3, 1954. The term developed for the practice of converting daily volumes to the 30^{th} highest volume became K_{30}, commonly referred to as the "design hour". In subsequent years the terms K_{30} and "design hour" were extended into urban areas as well as rural areas, appeared in later editions of the Highway Capacity Manual, and are routinely referenced in college traffic engineering textbooks.

Although it is currently widely recognized throughout the nation that roads in urbanized areas cannot be cost effectively designed based on 30^{th} highest hour demand volumes, the concept of K_{30} as the "design hour" is institutionalized in the U.S., including Florida. FDOT's Project Traffic Procedure and Interchange Handbook are examples. Despite these procedures and guidelines, actual Florida practice for urbanized areas, at least as far back as the 1970s in urbanized areas was to use peak to daily ratios, working with measured peak hour volumes by taking the measured peak hour volume divided by the daily volume. In 1992 FDOT adopted by administrative rule its Minimum Level of Service Rule (Rule Chapter No. 14-94) in which the K_{100} (the 100^{th} highest hourly volume) is used for all planning purposes. Although having its own merits, in urbanized areas the K_{100} largely reflects a compromise between the "design hour" concept of K_{30} and a typical driver's perception of a drive during a weekday commute trip. For urbanized areas other major analysis hour recommendations include using the 5-6 p.m. weekday

period because that is typically the highest hour of travel demand, and using a longer peak period analysis, say from 4-6 p.m. Regardless, the concepts of using K_{30}, K_{100}, peak to daily ratios or other approaches has created much confusion throughout the state on what is the most appropriate K factor to use.

Further complicating the K factor issue is the relationship between demand traffic volumes and measured traffic volumes. During peak travel hours many Florida roadways are oversaturated or constrained: travel demand exceeds the capacity of the roadways to handle it. From analytical highway capacity and quality of service points of view, demand volumes (unconstrained or future volumes) should be used, not necessarily measured volumes. Yet all traffic counts and reported traffic statistics, including K values, are in terms of measured volumes. Using measured K factors for oversaturated roads distorts how roadways should be planned and designed. Measured volumes simply cannot exceed a roadway's capacity even during peak hours, and as such, no roadway would be considered over capacity. Especially problematic is the determination of appropriate K values in large urbanized areas. Of the various FDOT procedural documents covering K, Planning's Quality/Level of Service Handbook is clear that demand volumes should be used, but virtually all other procedures make exclusive use of measured volumes.

The effects of the above considerations result in widespread confusion and inconsistencies in application of K factors and the planning and design of Florida roadways. Furthermore, because of significant cost implications both to the Department and other entities, extensive time and effort are frequently devoted to determining an agreed upon K factor for particular situations.

In addition to being an important transportation consideration, implementation of K factors also may have significant land use planning and economic development implications. Combined with level of service standards, K values have implications on encouraging future Florida growth in existing developed areas and other growth management concepts.

Recommended approach

FDOT should adopt a "design" approach in which K factors are set for roadways from planning through design. Rather than being a variable, K becomes a fixed, cost effective parameter, much like the use of 12-foot through lanes is on major high-speed roadways. The selected K factors should also reflect growth management and economic development considerations. FDOT's recommended K factors and peak hour factors (converting 15-minute flows to hourly volumes) appear as Table 1 and Table 2, respectively. Note there is not a single standard K value to be applied to every roadway in the state; rather there are multiple standard K factors depending upon the area type and facility type to be applied statewide.

It is anticipated these values would be used in 95-98% of all roadway situations. Routine reliance on traffic studies and/or site counts for determining K factor values for planning and design would be minimized. Values would be set primarily by the area in which roadways are located. For example, the K factor for roadways in most urbanized areas would simply be set at 9.0% for all planning through design analyses. An exception process would be set up for specific roadways, but exceptions would be limited. Examples of possible exceptions include a roadway designed for a specific purpose (emergency evacuation), or for the planning/design/operation of

toll ways (Turnpike) or freeway managed lanes. Traffic engineering studies and/or site counts would continue for determining applicable directional distribution factors (D), turning movements, and heavy vehicle volumes.

Special considerations exist in urban and urbanized areas and are addressed in the footnotes of Table 1. In the major urbanized counties of Broward, Duval, Hillsborough, Miami-Dade, Orange, Palm Beach, and Pinellas, FDOT would designate "core" freeways which would use an 8.0% K factor and other freeways would be designated as having either 8.5% or 9% K factors. In those counties the appropriate FDOT district office would take the lead on designating values for the freeways. Final values would be approved by the FDOT Secretary and FHWA. Values for these freeways would be initially set, updated decennially as part of the urban/urbanized area boundary process, and not on a project by project basis. Recognizing the desires for future growth in existing developed areas and multimodal solutions, FDOT will also accept and promote lower K factors for non-freeways in which transportation infrastructure is adequately addressed. A 7.5% K factor becomes applicable for state arterials and highways in approved Multimodal Transportation Districts, in which secondary priority is given to auto vehicle movements. Essentially, this lower value represents the promotion of multi-hour peak period rather than a single peak hour analysis.

FDOT's intent is to have the applicable standard K value for every road segment appear in the most recent Florida Traffic Information DVD. People throughout the state, inside and outside FDOT, rely on the free DVD as the primary source of traffic information on the State Highway System. Using such an approach provides statewide consistency at a minimum cost to FDOT and outside personnel.

Noteworthy, Table 3 contains recommended level of service standards for the State Highway System by area types to be applied from planning through design. They represent goals for FDOT to achieve and maintain. Essentially, Level of Service D would be used within existing urbanized boundaries and Level of Service C would be used in all other areas (rural, non-urbanized urban areas, transitioning areas) and be based on the applicable K factors. It is recognized that many of the state's roadways cannot meet those standards; however, it is the intent that all planning and design analyses be based on those standards and K factors, and additional operational improvements would be explored. It is further recognized that even if the level of service standard cannot be obtained, FHWA will approve federal participation on a project that is justified by need and which improves existing conditions. In cases where Level of Service F occurs, the hourly demand volume to capacity ratio would be the primary measure indicating the severity of the F condition. Other factors to be considered may include duration of congestion, throughput, safety, travel time reliability, average travel speed and ultimate build out of the facility. Overall project design should reflect improvements related to these other criteria, over and above the goal of meeting the level of service standards.

Table 4 contains a preliminary comparison of planning level maximum service volumes for a broad range of typical state roads using the recommended K factors and LOS standards. Those service volumes represent the maximum volume of vehicles a roadway could typically handle at a given level of service. The table should help give reviewers a feel for the effect of these

recommended standard K factors and the level of service standards in combination. Most of the change in volumes is a result of using standard K factors instead of K_{100} factors.

Implementation of the K values on new projects or analyses would become effective immediately upon the Secretary of the Florida Department of Transportation's approval. Prior actions or approvals could remain in effect. For example, if during the Project Development and Environment phase, location and conceptual design approval has been granted, the analysis based on a previous K factor could remain in effect throughout project implementation. The standard K factors should be reevaluated after the initial 2 years of implementation.

Pilot program implementing standard K factors

FDOT District 4 tested implementation of standard K factors from 2009 to 2010. Twenty-six road improvement projects and/or studies were included in the pilot program. Conclusions and recommendations from the pilot study follow:

- Using standard K factors for traffic forecasting at a planning level or Project Development and Environment study level is beneficial, as it can reduce the complexity and time needed to develop traffic forecasts;
- Standard K factors are appropriate for efficiently determining the design hourly traffic volumes for a roadway and consequently planning for the number of through lanes needed for the roadway; and
- Permanent implementation of standard K factors for this purpose is recommended.

Five criteria were used to evaluate the use of standard K factors:

- K factor comparison (standard K factor values compare with K_{30} values);
- Project traffic time comparison (estimated time savings);
- Project traffic cost comparison (estimated cost savings);
- Project traffic complexity comparison (qualitative comparison of the two methods); and
- Comments and feedback regarding use of standard K factors.

Positive and negative aspects of the recommended approach

Positive aspects about the recommended standardized K approach are outlined below:

1) Promotes better transportation and growth management policies and projects
   a) More cost effective plans and designs (cost savings to FDOT)
   b) Better represents drivers' perspectives rather than outdated design criteria
   c) Supports future growth in existing developed areas and multimodal solutions
2) Reduces time and effort developing numbers
   a) Time and cost savings to FDOT
      i) Improved production times, especially applicable on interstate related projects
      ii) Project development can proceed without waiting on an uncertain variable
   b) Makes calculations easier
   c) Frees up time and resources for planners/designers to better address travelers' needs and operational improvements
3) Consistency
   a) FDOT planning through design staff understand what number to be used

b) "Gaming" of numbers inside and outside FDOT is greatly reduced
    i) Gives staff something to rely on to avoid significant debate (provides a standard)
    ii) Avoids paper exercises to justify numbers
c) Department of Community Affairs reviews become more consistent

4) Simple to understand [Keep it simple (KIS) principle]
    a) Does not involve multiple calculation processes or assumptions to determine K factors
    b) Does not imply false precision (showing 0.01% K factor differences when volumes frequently vary by at least 10%)
    c) Greatly simplifies FDOT's LOS standards
5) Initial support from all affected FDOT offices
6) Sensible approach
    a) Generally positive for development interests, especially in urbanized areas
        i) Time and probable project cost savings
        ii) Promotes efficient economic growth and job creation
    b) Supportive of growth management concepts
    c) No cost to taxpayers

Concerns or cautions expressed about recommended standard K approach are outlined below:

1) Traffic variations in K are not sensitive to peculiarities of a roadway (e.g.,)
    a) Orientation (e.g., circumferential vs. radial)
    b) Nearby land use or location within an area type (e.g., transit-oriented design densities)
2) Is not current practice and would necessitate time and effort to change
    a) Does not match any current state or national K procedure
    b) Revisions to current procedures would be needed
        i) Multiple FDOT guidance, procedures, rules and technical tools
        ii) FHWA
            (1) Guidance for preliminary engineering design and acceptance
            (2) Highway Performance Monitoring System
            (3) Policy for Adding or Modifying Access to the Interstate System
        iii) AASHTO's A Policy on Design Standards – Interstate System
        iv) DCA guidance, procedures and rules
        v) Probable changes to many local government comprehensive plans
    c) May cause multiple tracking processes (e.g., if FHWA doesn't change its HPMS requirements)
    d) Creates differences with current agreements
        i) Among FDOT, local governments and developers
        ii) Timing issues regarding phasing in the new approach
        iii) Fair treatment of "grandfathered in" projects
    e) Analysts would no longer be using measured or reported hourly volumes
        i) For at least the last 40 years, FDOT has relied on measured counts
        ii) "Potential for challenge" as to "How can FDOT not accept actual measurements"
    f) Current reported deficiencies will change significantly
    g) Developer "fair share" contributions may drop appreciably in urbanized areas
    h) Significant training and outreach would be needed
    i) Uncertainty about what problems might arise

3) Represents an acceptance of greater motor vehicle congestion in urbanized areas
   a) Previously stated deficiencies/needs will be decreased
   b) Project priorities could change
4) Downplays the role of traffic engineering
   a) Deemphasizes peak hour counts/monitoring which show real volumes and capacities
   b) Generally is not needed outside urbanized areas
5) Some analysts perceive
   a) Planning and design as different process; therefore, it could be appropriate to use different factors for planning and design
   b) De-emphasis on the highway component of the Strategic Intermodal System
6) Too much is being addressed all at once and a step-wise approach is more appropriate (standard K factors / project traffic / capacity analysis / LOS standards / growth management)

Table 1
FDOT Recommended K Values

Area (Population) [Examples]	Facility Type	Standard K Value* (%AADT)	Representative Time Period
Broward, Duval, Hillsborough, Miami-Dade, Orange, Palm Beach, & Pinellas Counties with main core freeways (850,000+) [Jacksonville, Miami]	Arterials, Highways	9.0**	Typical weekday peak hour
	Freeways	8.0-9.0%***	Typical weekday peak period or hour
Other urbanized areas/counties (50,000+) [Tallahassee, Ft. Myers]	All	9.0**	Typical weekday peak hour
Transitioning to urbanized areas (uncertain) [fringe development areas]	All	9.0	Typical weekday peak hour
Urban (5,000-50,000) [Lake City, Key West]	Arterials, Highways	9.0**	Typical weekday peak hour
	Freeways	10.5	100th highest hour of the year
Rural (<5,000) [Chipley, undeveloped areas]	Arterials, Highways	9.5**	100th highest hour of the year
	Freeways	10.5	

* Some smoothing of values at area boundaries/edges would be desirable.
** Value is 7.5% in approved Multimodal Transportation Districts. Essentially, this lower value represents an extensive multi-hour peak period rather than a peak hour.
*** Value is 8.0% for FDOT-designated urbanized main core freeways and may be either be 8.5% or 9.0% for non-core freeways. Values less than 9% essentially represent a multi-hour peak period rather than a peak hour.

Table 2

Required Peak Hour Factor (PHF) Values

Area	Facility Type	PHF Value
Urbanized	All	0.95
Non-Urbanized (rural, urban, transitioning)	Freeways	0.95
	Arterials and Highways	0.90

Table 3

State Highway System Level of Service Standards

Area (Population) [Examples]	Standard*
Urbanized (50,000+) [Tallahassee, Miami]	D
Urban (5,000 to 50,000) [Lake City, Key West]	C
Transitioning (N.A.) [fringe development areas adjacent to urbanized or urban areas]	C
Rural (<5,000) [Chipley, Everglades]	C

* Based on criteria from latest editions of the Transportation Research Board's Highway Capacity Manual and FDOT's Florida's Quality/Level of Service Handbook criteria.

Table 4
Service Volume Implications of Standard K Factors Approach

Area Type	Roadway Facility Type	Lanes	Current LOS Standard (K_{100} Factor %)	Current Standard Maximum Volume	Potential LOS Standard (Standardized K %)	Potential Standard Maximum Volume
Multimodal Transportation District	Arterial	4	E (9.7%)	31,900	D (7.5%)	43,400
Urbanized: Large*	Arterial	4	D (9.7%)	33,200	D (9.0%)	35,800
Urbanized: Other**	Arterial	4	C (9.7%)	25,000	D (9.0%)	34,800
Transitioning/Urban	Arterial	4	C (9.7%)	22,700	C (9.0%)	24,500
Rural: Developed	Arterial	2	C (9.7%)	9,800	C (9.5%)	10,000
Urbanized: Large (Core)***	Freeway	8	D (9.2%)	146,500	D (8.0%)	162,800
Urbanized: Large*	Freeway	6	D (9.2%)	110,300	D (8.5%)	114,900
Urbanized: Other**	Freeway	6	C (9.4%)	90,500	D (9.0%)	105,300
Transitioning	Freeway	4	C (9.4%)	57,600	C (9.0%)	59,100
Urban/Rural	Freeway	4	B (10.3%)	37,100	C (10.5%)	49,000
Rural: Undeveloped	Highway	2	C (9.8%)	8,100	C (9.5%)	8,400

* 1,000,000+ Population
** < 1,000,000 Population

*** Freeway passing through/near central business district