I-4 SAMR Update

Technical Memorandum #2: K Factor Development

FDOT District 5

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ATKINS

Plan Design Enable

Table of contents

Tables

Figures

1. Purpose

The purpose of this technical memorandum is to document the development of the K factors that were used in the development of the Design Hour Traffic for the I-4 SAMR Update in October and November of 2011 and to recommend K factors moving forward from this point in the project.

It should be noted that the K factors that were developed in October of 2011 were for the western section of the project only. No recommendations have been done for the eastern section at this time. This report will address both sections moving forward.

It is also important to know that since this project began back in October of 2011, FDOT has released a new Project Traffic Forecasting Handbook with some changes to the way in which K factors are handled. This will be discussed later.

1.1. Comparison K Factors

The K Factors from the original I-4 SAMR from April 2000 were used as a comparison for this latest update done in October of 2011 to ensure consistency in the output traffic volumes. Table 1 below shows the April 2000 factors.

Table 1. I-4 SAMR K Factors (April 2000)

Roadway	K_{30} Factor
I-4	9.00
Tolled Roadways	9.00
Arterials	10.20 – 11.00

The analysis of 33 FDOT traffic sites (shown in appendix A) yielded the following recommendations shown in Table 2 back in October of 2011.

Table 2. Adopted Design Traffic K Factors (October 2011)

Roadway	Actual K Factor	Adopted K Factor
I-4	8.49	9.7
Tolled Roadways	11.88	9.7
Arterials	8.94	10.2

The methodology that was used to develop these factors was to look at 33 traffic count sites over a 3 year period from 2008 to 2010 and to average those counts which are shown as the "Actual K Factors" in Table 2 above.

The FDOT Project Traffic Forecasting Handbook, March 2006 Figure 3.7, shows the following recommended K factors:

Table 3. Recommended K-factors (K_{30}) for Design Traffic Forecasting (March 2006)

Road Type	Low	K_{30} Average	High	Standard Deviation
Rural Freeway	9.60	11.8	14.6	1.43
Rural Arterial	9.40	11.0	15.6	1.42
Urban Freeway	9.40	9.7	10.0	0.28
Urban Arterial	9.20	10.2	11.5	0.92

In an effort to remain consistent with the prior I-4 SAMR traffic factors, the average K factor from Table 3 for the Urban Freeway of 9.7 was selected for both I-4 and the Tolled Roadways and the average K factor for urban arterials of 10.2 was selected for all arterials and this is what is shown in Table 2.

The original K factors for this project were chosen not only for consistency with the past work efforts but also because of the high proportion of tourist traffic in this corridor. The tourists do not behave like the residents of the area do in that they are not as likely to change their departure times to avoid the higher peak travel times, This causes what is known as peak spreading where the peak travel period begins to last longer overtime due to worsening congestion. Tourists tend not to modify their behavior for this. Another issue in this area in particular is the shift work a the attractions such as Disney and Universal Studios. This doesn't allow the works much flexibility in their departure times either and thus lessens the effects of peak spreading.

1.2. FDOT Project Traffic Forecasting Handbook January 2012 Standard K Factors

In the newly released FDOT Project Traffic Forecasting Handbook (January 2012), the Department implemented Standard K Factors. The I-4 SAMR Update project was originally started under the March 2006 version of that document which did not have Standard K Factors. The project was put on hold in November of 2011 and has been restarted since the release of the new January 2012 version of the document. The Department would like to know the impacts changing to the new Standard K Factors will have on the Design Hour Traffic calculations. Figure 1 shows the new FDOT Standard K Factors

Figure 1. FDOT Standard K Factors

FDOT Standard K Factors

Area (Population) [Examples]	Facility Type	Standard K Factors* (%AADT)	Representative Time Period
Large Urbanized Areas with Core Freeways (1,000,000+) [Jacksonville, Miami]	Freeways	8.0 - 9.0 ***	Typical weekday peak period or hour
	Arterials & Highways	9.0**	Typical weekday peak hour
Other Urbanized Areas (50,000+) [Tallahassee, Ft. Myers]	Freeways	9.0 **	Typical weekday peak hour
	Arterials & Highways	9.0 **	Typical weekday peak hour
Transitioning to Urbanized Areas (Uncertain) [Fringe Development Areas]	Freeways	9.0	Typical weekday peak hour
	Arterials & Highways	9.0	Typical weekday peak hour
Urban (5,000-50,000) [Lake City, Key West]	Freeways	10.5	100th highest hour of the year
	Arterials & Highways	9.0 **	Typical weekday peak hour
Rural (<5,000) [Chipley, Everglades]	Freeways	10.5	100th highest hour of the year
	Arterials	9.5 **	100th highest hour of the year
	Highways	9.5	100th highest hour of the year

*	Some smoothing of values at area boundaries/edges would be desirable.
**	Value is 7.5% in approved Multimodal Transportation Districts where automobile movements are deemphasized. Essentially, this lower value represents an extensive multi-hour peak period rather than a peak hour.
***	Value is 8.0% for FDOT-designated urbanized 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.

Based on the *Large Urbanized Areas with Core Freeways* and the *** footnote, the recommended K factor for I-4 and the Tolled Roadways would be 8.0 and the arterials would be 9.0.

1.3. Impacts of the new Standard K Factors

The impacts on the development of the Design Traffic from the implementation of the new Standard K Factors could be significant. Table 4 shows the difference in the factors.

Table 4. Comparison of K Factors

Roadway	October 2011 K Factor	Standard K Factor	Difference
I-4	9.7	9.0	-1.7
Tolled Roadways	9.7	8.0	-1.7
Arterials	10.2	9.0	-1.2

I order to demonstrate the impact, we have put together examples of the differences the calculations could have using actual count volumes from the 2011 FTI DVD for sites in the study area.

Example 1:

Count Station 750535 I-4 0.880 Miles East of SR535 = 152,629

152,629 X 9.7 = 14,805 (October 2011 K)

152,629 X 8.0 = 12,210 (Standard K)

Example 2:

Count Station 750595 SR536, 0.315 Miles W of SR535 (East of I-4) 31,289

31,289 X 10.2 = 3,191 (October 2011 K)

31,289 X 9.0 = 2,816 (Standard K)

Based on the Precision of Data from Section 1.8 of the Project Traffic Forecasting Handbook, most of the DDHVs for this project will be rounded to either the nearest 100 for those numbers between 1,000 and 9,999 or to the nearest 500 for those numbers between 10,000 and 99,999.

This means that the impact in the examples above would be to round 14,805 up to 15,000 and round 12,210 down to 12,000 for example 1 and to round 3,191 up to 3,200 and to round 2,816 down to 2,800 for example 2.

2. Conclusions

The percentage change between the existing K factors and the Standard K factors does appear to be significant in these examples as it is 17% to 21% different. This area has significant tourist traffic as well as a large number of employees that are on shift work meaning that these trips are made during a specific time period and are not able to shift their departure times to travel during less congested time periods. The standard K factors for this type of facility and area type assume that there will be significant peak spreading in the future. The major concern with using the standard K factor instead of the K factor being recommended here which is based on historic K factors from this facility, would be with the intersection analysis at ramp terminal or cross street intersections. The standard K factor would yield lower turning movement volumes that could create significant changes to lane calls and/or signal timings due to the large differences in the K factors. What this means is that with standard K values lower volumes will be produced which could lead to the under designing the interchanges. The prior traffic provides a higher and more reasonable standard given the unique nature of the corridor and as such we recommend staying with it.

The other implication could be the change to the work already done for the western segment. The work already done was for the design year only and for a Build scenario and a No-Build scenario.

Appendices