Southwest Region University Transportation Center

Congress Avenue Regional Arterial Study: Long Term Improvement Schemes and Capacity Analysis

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16. Abstract

Due to social, political, environmental, and economic factors, solving urban traffic congestion through freeway construction is not likely. Development of a new arterial street class, called regional arterial, or super street, as a means of increasing urban network capacity and reducing congestion, is a feasible alternative. A long term staged improvement program for an arterial street, Congress Avenue, in Austin, Texas is presented. Based upon anticipated future traffic growth along the IH35 corridor, time lines for Congress Avenue improvements are developed. The effectiveness of the arterial in maintaining desirable travel speeds and diverting freeway traffic is evaluated.

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CONGRESS AVENUE REGIONAL ARTERIAL STUDY: LONG TERM IMPROVEMENT SCHEMES AND CAPACITY ANALYSIS

by

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Research Report SWUTC 95/60019-4

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EXECUTIVE SUMMARY

This is the fourth in a series of four reports describing a long term "super street" development improvement program for Congress Avenue in Austin, Texas. The program is designed to demonstrate the feasibility and effectiveness of conversion of a typical arterial street to "regional arterial" or "super street" status. This process should produce user benefits quantified in terms of reduced fuel consumption and delay time.

A staged implementation program is designed and presented. The potential for diversion of traffic from the IH35 corridor and resulting congestion relief is assessed. Regional arterial or super street design concepts developed through the other three reports are used within this effort.

ACKNOWLEDGEMENTS

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ABSTRACT

Due to social, political, environmental and economic factors, solving urban traffic congestion through freeway construction is not likely. Development of a new arterial street class, called regional arterial, as super streets, as a means of increasing urban network capacity, and reducing congestion, is a feasible alternative. A long term staged improvement program for an arterial street, Congress Avenue, in Austin, Texas is presented. Based upon anticipated future traffic growth along the IH35 corridor, time lines for Congress Avenue improvements are developed. The effectiveness of the arterial in maintaining desirable travel speeds and diverting freeway traffic is evaluated.

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INTRODUCTION

In large urban areas, the backbone of the transportation network is the freeways and arterial streets. During peak periods, in many Texas urban areas, traffic demand on the freeway system has reached or exceeded capacity. Due to increased construction cost, shortage of space, political constraints, and environmental concerns, construction of new freeway facilities or major expansion of existing freeways are unlikely. Therefore, more attention is being focused on improving urban arterial streets and studying the potential role for "strategic arterials" (also referred to as "super streets"). The strategic arterial concept is to upgrade existing arterials to provide higher capacity and travel speeds than are normally found on arterial streets.

PROBLEM STATEMENT

Declining mobility is a serious problem in the Austin Metropolitan Area. IH35 is the major facility within the most important North-South transport corridor. During peak periods, traffic congestion begins daily on the IH35 segments near downtown and usually propagates upstream, resulting in level of service F for a substantial section length and time period. Expansion of IH35 to accommodate increasing traffic demands is not likely due to construction cost, social, economic, and politcal constraints. A more feasible alternative means of increasing the IH35 corridor capacity could be improvement of a parallel arterial street. Congress Avenue parallels IH35 from the Austin central business district (CBD) southward approximately 10 miles. Upgrading Congress Avenue to the so called "super street" level to enhance corridor mobility is an attractive alternative. Ideally, a Congress Avenue "super street" may provide a desirable alternative travel route for many trips which would ordinarily use IH35. However, the extent to which this goal can be achieved will depend largely on driver preference for freeway and the quality of service that could be provided on Congress Avenue.

PROJECT OBJECTIVES

The basic objectives of this study were to:

1. identify the potential improvements needed to create a conceptual super street from Congress Avenue;
2. recommend the level of physical improvements schemes and schedules for Congress Avenue to fulfill long term super street needs, and
3. estimate the potential for Congress Avenue to alleviate IH35 congestion.

SCOPE AND LIMITATIONS OF STUDY

Congress Avenue, south of the Colorado River, is oriented in a north-south direction and runs almost parallel to IH35 until the two intersect approximately 10 miles south of the CBD. Resources allocated to this study were limited and these limitations dictated the analysis form and depth. Instead of using a conventional four-step demand estimation technique, a supply-oriented approach was chosen.

Intersections turning movement surveys along Congress Avenue conducted as part of this study in 1991 [9] served as primary data. An annual growth rate of 2.5% was assumed to predict future traffic volume for each year between 1993 to 2010.

The high speeds and capacities envisaged for the super street can only be provided if the majority of signal cycle time is given to traffic on the super street. In this study, a green time over cycle time (g/C) ratio of 0.6 for the super street is assumed. This policy may cause large delays to certain cross streets until drivers adjust travel habits. However, traffic performance on cross streets is not directly addressed.

LITERATURE REVIEW

The regional arterial, or super street, is proposed as a facility class that would have continuity, speed, and capacity characteristics that would attract short and medium-length trips. A super street, as defined in [6], "would consist of an upgraded arterial street with certain distinct design and operating characteristics. It would have design speed of 40 to 50 mph, grade separation at some cross streets, partial access control, and favored treatment for arterial traffic at nongrade separated intersections."

Ward [12] proposes a conceptual system of improved arterial streets for Harris County, Texas. Based on computer simulation, it was shown that such a conceptual system would divert a significant amount of traffic from both freeways and other arterials. Analysis shows that upgrading a typical segment of ordinary urban street to Strategic Arterial Street System (SASS) standards will be cost-effective. This report also points out that the critical factor in establishing a SASS will be prioritization of route selection in anticipation of future urbanization and reserving adequate amounts of right-of-way, at the right place, at the right time.

Lang [5] develops an analysis for determining whether or not grade separation is warranted for intersections along urban arterial streets. A case study of four major intersections along Congress Avenue in Austin, Texas is provided. Also, this study discusses numerous geometric design considerations for grade-separated interchanges and other roadway facilities.

Mullins [8] uses the Texas travel demand models as a tool to macroscopically estimate potential demands and the magnitude of any reduction in travel demand on other parts of the regional transportation system due to the implementation of a system of strategic arterials. Results of the traffic assignment show that while speed does play a role in the demand on and diversion of traffic to strategic arterials, the other controlling factor is the strategic arterial capacity. Analysis results of proposed strategic arterial systems in the Dallas/Fort Worth region are found to be comparable to those from the Houston region in terms of the effectiveness of strategic arterial systems in reducing demand on freeway systems.

Fitzpatrick [2] uses the TRANSYT-7F traffic simulation model to evaluate the mobility impacts from improvements to an existing arterial street, US 90A in Houston, and to the conceptual corridor. The primary measure of effectiveness used to describe the mobility impacts was average through speed. This research shows that at-grade intersection improvements produce limited increases in through speed due to the existing congestion. Grade separations, however, produce significant increases in travel speeds.

Savgur [9] develops a hierarchy of short-term improvements ranging from signal timing improvements to minor geometric modifications for a Congress Avenue super street. He also develops a guideline for designing signal timing plans which provide priority to the super street. Impacts of short-term modifications and evaluation of arterial performance after improvement plan implementation is discussed.

CRSS [1] performs a variety of travel demand forecasts to develop a transportation plan for the Austin Metropolitan Area. Three land-use growth expectations; short-term, mid-term, and long-term for both population and employment were comprehensively investigated. These growth predictions served as a basis for travel demand forecasting and analysis. Numerous network alternatives were tested in an effort to configure the best network for each land-use growth scenario. Morning peak hour traffic volume predictions for the long-term centralized high growth scenario were used in this study.

METHODOLOGY AND RESEARCH APPROACH

Due to the lack of travel demand data, this study used a supply-oriented micro level approach. Macro level transportation planning models which consider interactions between demand and supply were not used, however, capacity analysis and Level of Service (LOS) evaluation procedures presented in the Highway Capacity Manual (HCM) [10] for signalized intersections and urban arterial streets were extensively used.

Capacity analysis and Level of Service evaluations for particular intersections were performed for each year from 1993 to 2010. Evaluation criteria, including both LOS and v/c ratios, were used respectively to warrant improvements. Appropriate traffic management schemes were recommended based on the analysis. All physical improvements up to year 2010, recommended by the previous three reports documenting this study were assumed given. The purpose of this part of analysis was to examine the potential abilities of Congress Avenue to accommodate traffic flow that may transfer from IH35 or other arterial streets as Congress is upgraded to the super street facility class.

ISOLATED SIGNALIZED INTERSECTION

According to Savgur [9], bottlenecks on Congress Avenue are at five intersections — Riverside, Oltorf, Ben White, Stassney, and William Cannon. However, Ben White is being upgraded to freeway level and the construction is progressing. After Ben White is upgraded, the intersection should not be a concern. Therefore, the intersection of Ben White was excluded from further examination. The other four are vigorously analyzed and tested using different traffic management schemes.

The AM and PM peak time periods have been considered because these are the critical conditions. The LOS and v/c ratio on each approach of the four intersections were estimated using the HCM methods. The HCM estimates the LOS using vehicular delays from Equation 3.1 and Table 3.1.

$$d = \frac{0.38C\,[1 - g/C]^2}{[\,1 - (g/C)(X)\,]} + 173\,X^2\,\{\,(X - 1) + [(X - 1)^2 + (16X/c)]\}^{1/2} \qquad 3.1$$

where d = average stopped delay per vehicle for the lane group, in sec/veh;

C = cycle length, in seconds;

g/C = ratio of effective green to cycle length;

X = v/c ratio for the lane group;

v = flow rate for the lane group, in veh/hr;

c = capacity of the lane group, in veh/hr.

TABLE 3.1 CRITERIA FOR DETERMINING LEVEL OF SERVICE

LOS	Delay Criteria
A	<= 5.0
B	5.1 to 15.0
C	15.1 to 25.0
D	25.1 to 40.0
E	40.1 to 60.0
F	> 60.0

Source [10]

The detailed approach for this part of the study is shown as a flowchart in Figure 3.1. The g/C ratio for the super street was set by policy to 0.6 in order to provide high speeds and capacity. Based upon Savgur's [9] recommendations, all left-turn movements from cross streets are prohibited.

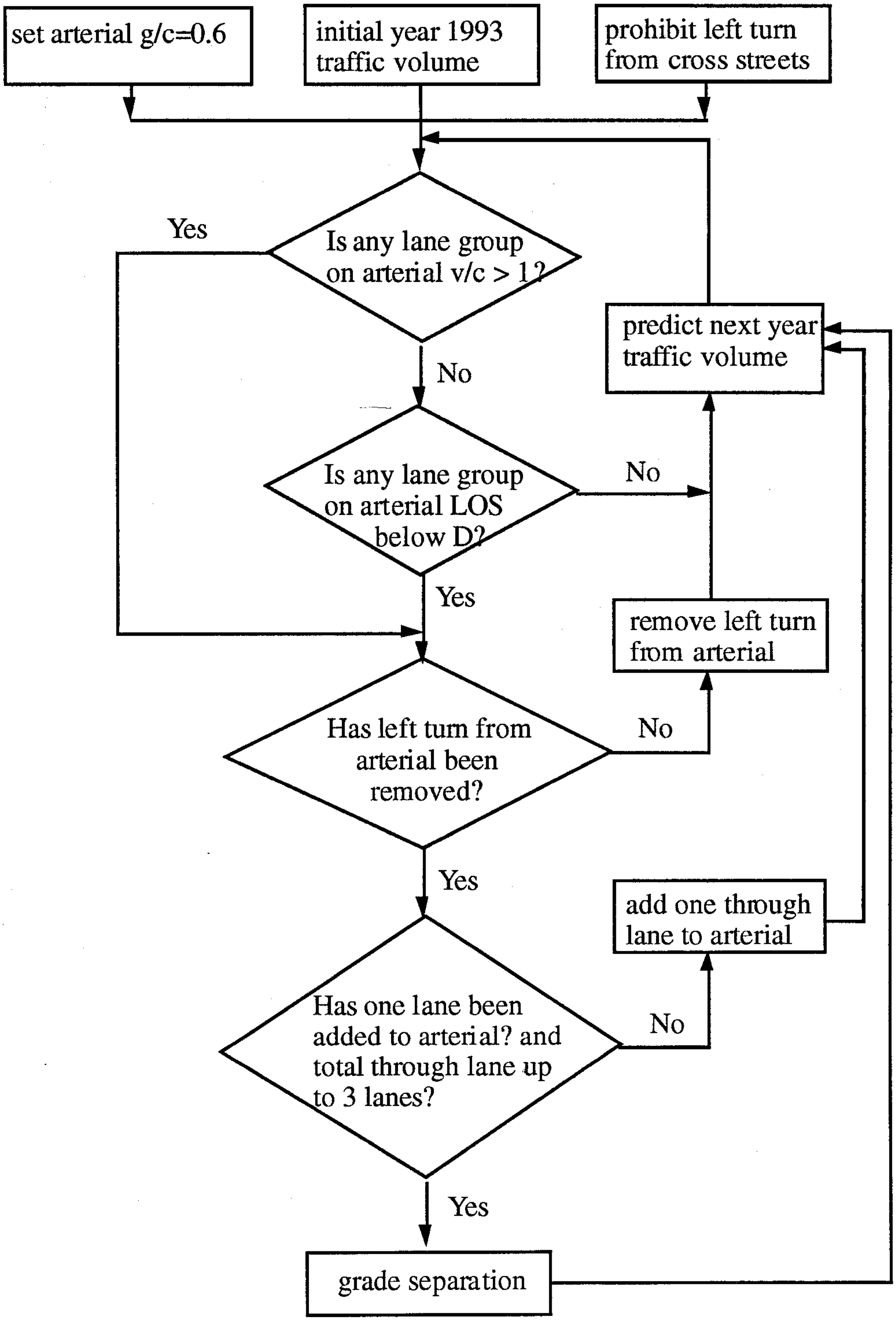


Figure 3.1 Flowchart for isolated signalized intersection analysis

Current signal timing plans expend significant fractions of each signal cycle serving cross street left-turning vehicles. If left-turning movements from the cross street are prohibited, then cross street traffic can only move through or right, resulting in an increase in the cross street vehicle processing rate. This will result in a decrease in the cross street signal time or g/C ratio, and the time saved can be added to the arterial green phase. Left turns from the cross street will have to be indirect left turns. Drivers wanting to turn left should be directed to go across the intersection and turn right into an adjacent street and turn right again into the arterial. To estimate traffic volumes after the left-turn movement prohibition is implemented, a worst case scenario was assumed. That is, left turn volumes were added to both the cross street through as well as the arterial through traffic.

The Highway Capacity Software (HCS) was used to perform signalized intersection capacity analysis. Since the traffic volume changed every year, HCS test runs were performed repeatedly for different phasing split combinations, but the prior assumption that an arterial g/C ratio of at least 0.6 was never violated. Basic assumptions made in applying HCS were:

1. An ideal saturation flow value of 1700 vehicles per hour of green was used,
2. the initial 1993 geometric configurations are based on the recommended short-term improvement schemes proposed in the previous research [9], see Figure 3.2, and
3. where appropriate, perfect progression is assumed.

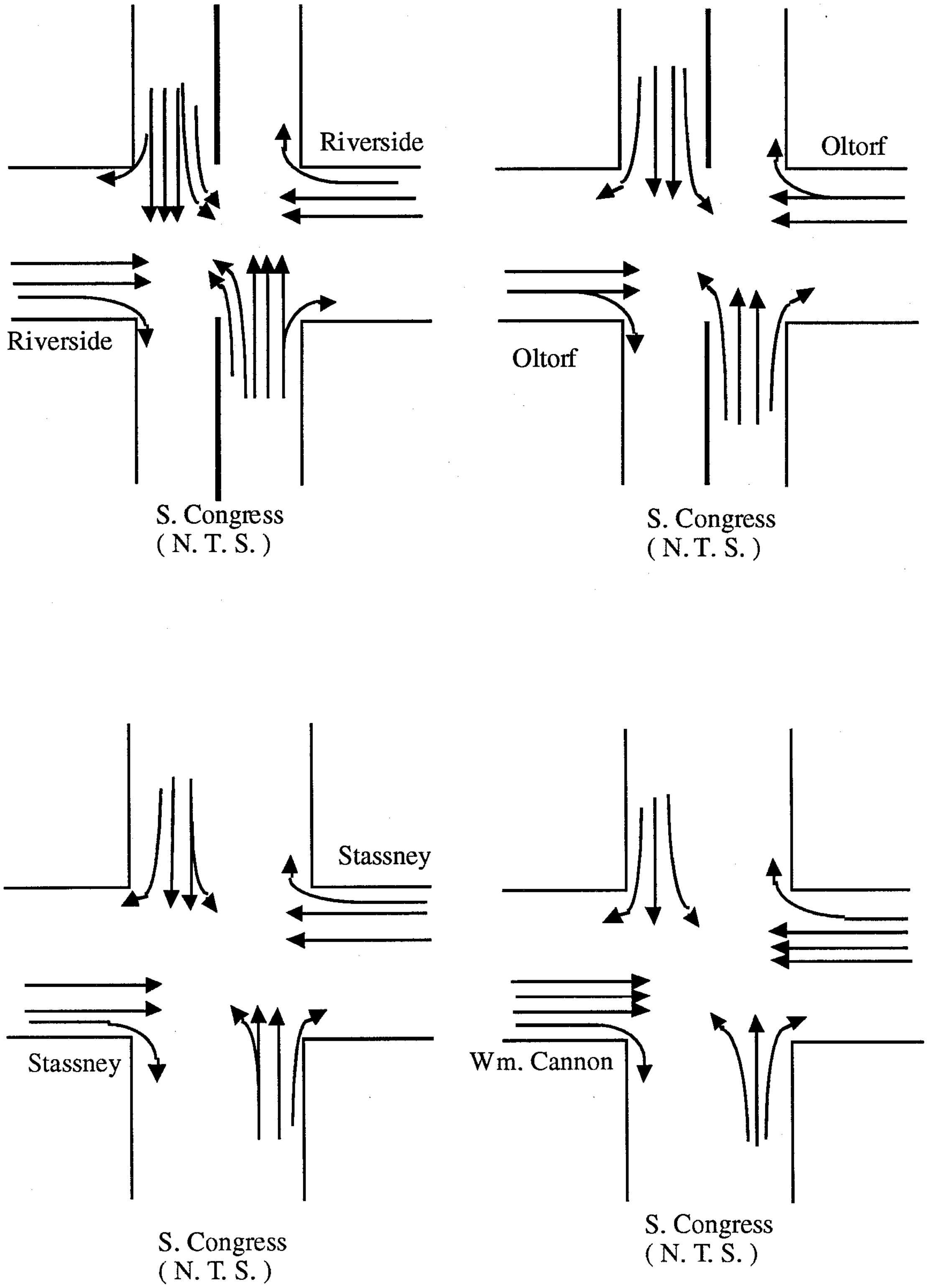


Figure 3.2 Initial Configuration after implementing short term improvement schemes

Both LOS and v/c were used as criteria and from each, slightly different conclusions were drawn. If any super street movement had v/c>1 or LOS lower than D, then an appropriate improvement scheme was recommended. Generally, a three-level improvement scheme was proposed.

Level 1: prohibit left turns from the super street;

Level 2: after prohibiting left turns, add one through lane to the super street, producing a maximum of through lanes in one direction;

Level 3: when all relevant at-grade solutions have been exhausted implement a grade separation.

Where left-turning movements from the super street are prohibited, left turns should be directed across the intersection to execute through right turns, completing a left-turn movement effectively. Capacity analysis treated left-turn volumes as part of both the cross and super streets.

ARTERIAL STREET

The section of arterial street analyzed in this study includes South Congress Avenue and the segment of 1st Street between Congress and IH35 and includes all signalized intersections. The operation of vehicles on arterial streets is influenced by three main factors: (1) the arterial environment, (2) the interaction between vehicles, and (3) the effect of traffic signals. The arterial street Level of Service, according to HCM, is defined in terms of the average travel speed of all arterial through vehicles. The average travel speed is computed from the running time on the arterial segment(s) and the intersection approach delay. It is strongly influenced by the number of signals per mile and the average intersection delay.

$$\text{ART SPD} = [(3600) * (\text{Length})]/[(\text{Running Time per Mile}) * (\text{Length}) + (\text{Total Intersection Approach Delay})] \tag{3.2}$$

where

ART SPD = arterial or section average travel speed, in mph;

Length = arterial or section length, in miles;

Running time = total of the running time per mile, in seconds;

Total Intersection Approach Delay = total of the approach delay at all intersections within the defined arterial or sections, in seconds

The correct delay to use in the arterial evaluation is the total approach delay, which can be related to the intersection stopped delay as follows:

$$\text{Approach delay} = 1.3 * d \tag{3.3}$$

d is the average stopped delay calculated from Equation 3.1. Detailed approaches are shown in Figure 3.3.

In this part of the analysis, the arterial street means the super street. The year 2010 physical improvement schemes derived from isolated signalized intersection analysis conclusions were treated as given conditions in the arterial street analysis. In addition, the super street g/C ratio was set to 0.6 for all intersections and 100 vph were added to the super street through traffic, assuming they transferred from other facilities. The basic traffic flow, without transfers, on the super street for year 2010 was estimated from 1991 traffic survey data [9] using a 2.5% annual growth rate.

There are two different ways to accommodate traffic demands that exceed corresponding capacities. The first approach, simple but unrealistic, adds the same amount of additional traffic to the through movement of every

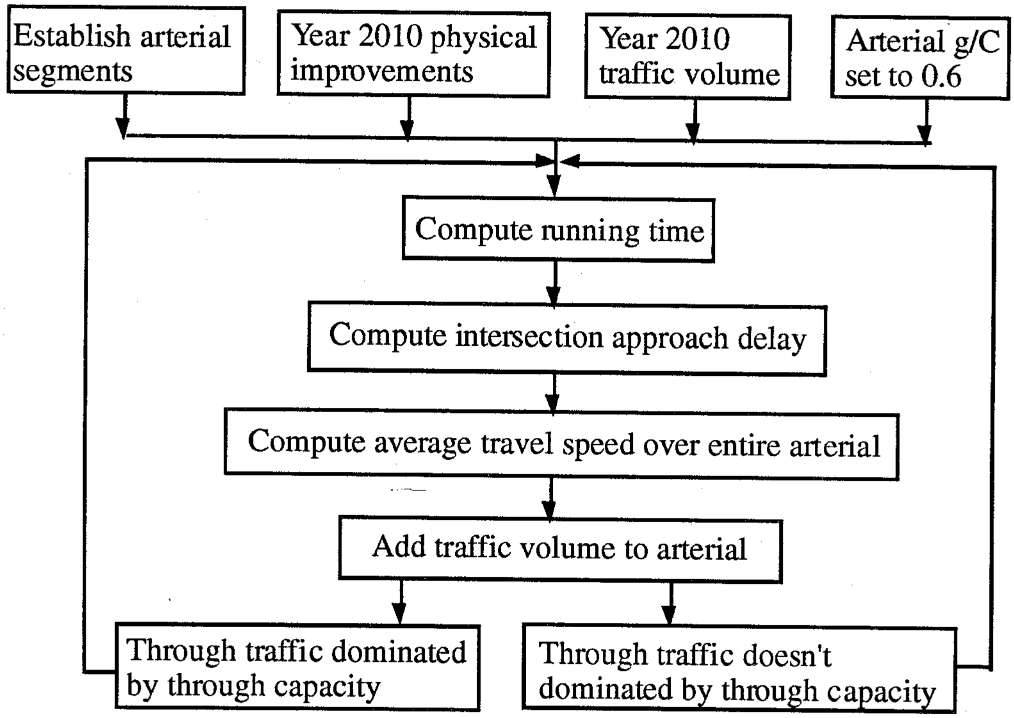


Figure 3.3 Flowchart for arterial street analysis

intersection on the arterial street no matter whether the total through traffic volume exceeds the through capacity or not. The second approach, on the other hand, considers the effect of through movement capacity constraints on the through traffic demands. The downstream approach inflow is primarily dominated by upstream outflow capacity. The maximum throughput cannot exceed the corresponding through capacity.

As super street traffic demands grow, they will eventually exceed capacity. Whenever demand exceeds capacity, delay increases dramatically and conventional delay estimation tools such as the HLM become unreliable. The HCM signalized intersection delay equation, Equation 3.1, yields reasonable results for v/c between 0.0 and 1.0. According to HCM, the equation "may be used with caution for values of v/c up to 1.2, but delay estimates for higher values are not recommended." Therefore, a better method to approximate overflow delay is desirable. Of course, one can simply collect real delay data. Such information is usually rather site specific and for forcasted future demands, not possible. Two other techniques, deterministic and empirical models were examined.

Arrival and departure curves for an oversaturated approach are shown as Figure 3.4. The dashed line divides the total area representing delay into two components: uniform delay (UD) below the dashed and overflow delay (OD), above. In calculating overflow delay, it is useful to think of the dashed line as the departure curve, even though the real departure is the stair step curve.

Average uniform delay, according to Figure 3.4, is half the red interval.

$$UD = \frac{C[1 - (g/C)]}{2} \text{ sec/veh} \tag{3.4}$$

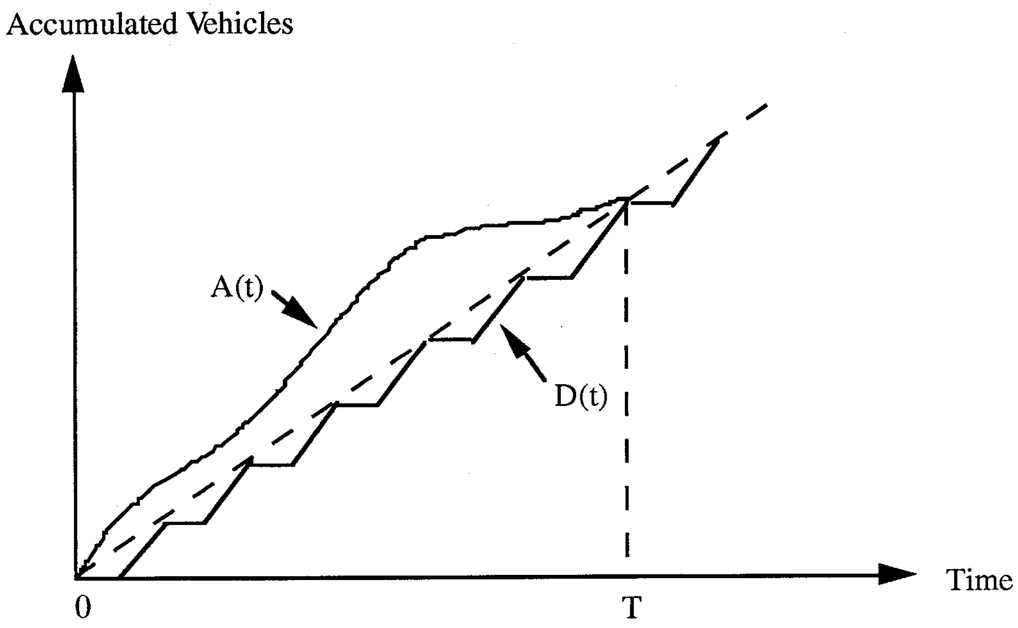
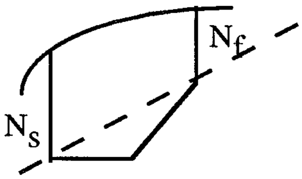


Figure 3.4 Arrival and departure curves for an oversaturated approach

If one can collect queue length field data, then average overflow delay can be approximated as:

1. Calculate average overflow delay in a given cycle, that is

$$OD = C\left(1 - \frac{N_f - N_s}{2N_f}\right) \text{ sec/veh}$$



Where
N_s = queue at start of cycle length
N_f = queue at end of cycle length
C = cycle length

2. Over several cycles of an observation period the average overflow delay can be approximately expressed as

$$OD = \frac{T\overline{N}}{A(T) - A(0)} \text{ sec/veh}$$

Where
T = length of overflow period
$\overline{N}$ = average queue as observed at end of each cycle
$A(t)$ = cumulative demand as a function of time

The denominator of the above equation is the total number of vehicles arriving during the overflow period. This approach requires queue length measurements, therefore, it is not desirable for this study and is excluded from further consideration.

Deterministic Model

For the special case of constant volume, v, and capacity, c, shown as Figure 3.5, the overflow delay can be calculated easily. The length of the horizontal line is T(v - c) / c. The average overflow delay for those that arrive between zero and T is the area of the lower triangle divided by the number of vehicles arriving during that period.

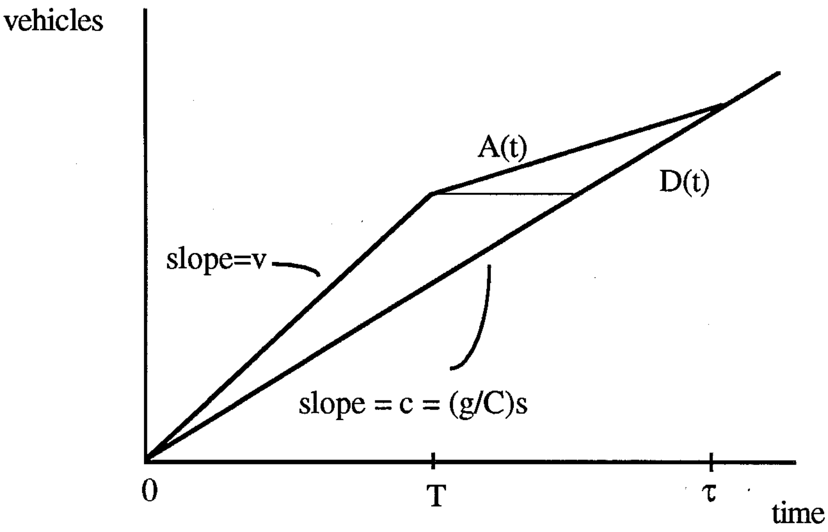


Figure 3.5 Overflow delay in a highly idealized period

OD for lower triangle $= [T(v - c) / c]\,[vT] / 2[vT]$

$$= (T / 2)\,[(v / c) - 1] \qquad 3.5$$

The same is true for those that arrive between T and τ, so the average overflow delay is the same for both groups, hence OD = (T / 2) [(v / c) - 1]. Consequently, the average approach delay, d, is

$$d = \frac{C[1 - (g/C)]}{2} + \frac{T}{2}[(v/c) - 1] \text{ sec/veh} \qquad 3.6$$

where C : cycle time , in sec;

g : effective green time, in sec;

v : flow rate, in vehicles per unit time;

c : capacity, in vehicle per unit time.

This model ignores the effects of random variation. This is no problem when the queue is very large because the error due to random effects will be small compared with the estimated delay, but this error can be a problem if the intersection is only slightly oversaturated. However, this model works well when v/c is considerably more than one.

Empirical Model

The model illustrateded here was developed in Australia by Akcelik as part of the Australian intersection analysis procedure.

$$OD = \begin{cases} (T/4)\{[(v/c) - 1] + [[(v/c)-1]^2 + 12[(v/c) - (v_0/c)]/cT]^{1/2}\} & \text{if } v/c > v_0/c \\ 0 & \text{otherwise} \end{cases}$$

Thus the average approach delay, d, is

$$\begin{aligned} d = {} & (C/2)[1-(g/C)] + (T/4)\{[(v/c) - 1] + [[(v/c)-1]^2 \\ & + 12[(v/c) - (v_0/c)]/cT]^{1/2}\} \end{aligned} \tag{3.7}$$

where

$v_0/c = 0.67 + s(g/600)$;

s = saturation flow rate, in vehicles per unit time;

T, v, g, and c have the same meaning as previously described.

In this model, v_0/c can be thought of as the smallest v/c ratio for which the random or overflow delay is large enough to be worth calculating. The above equation can be used with any convenient time units, as long as they are consistent throughout the equation. For example, if the time is in seconds, then s and c should be in vehicles per second.

Comparison between HCM, Deterministic, and Empirical Model

In order to find an appropriated model for this study, a comparison between these three models is shown as Figure 3.6. Obviously, the deterministic model produces the smallest values, the HCM model produces the largest, and the empirical model falls between the two. No claim is made that the empirical formula is correct, rather it yields answers that do not violate elementary logic in the troublesome regions of v/c much larger than unity. In these regions, the HCM model and the deterministic model are suspect. Consequently, this study will use the empirical model to estimate delay where v/c > 1.0.

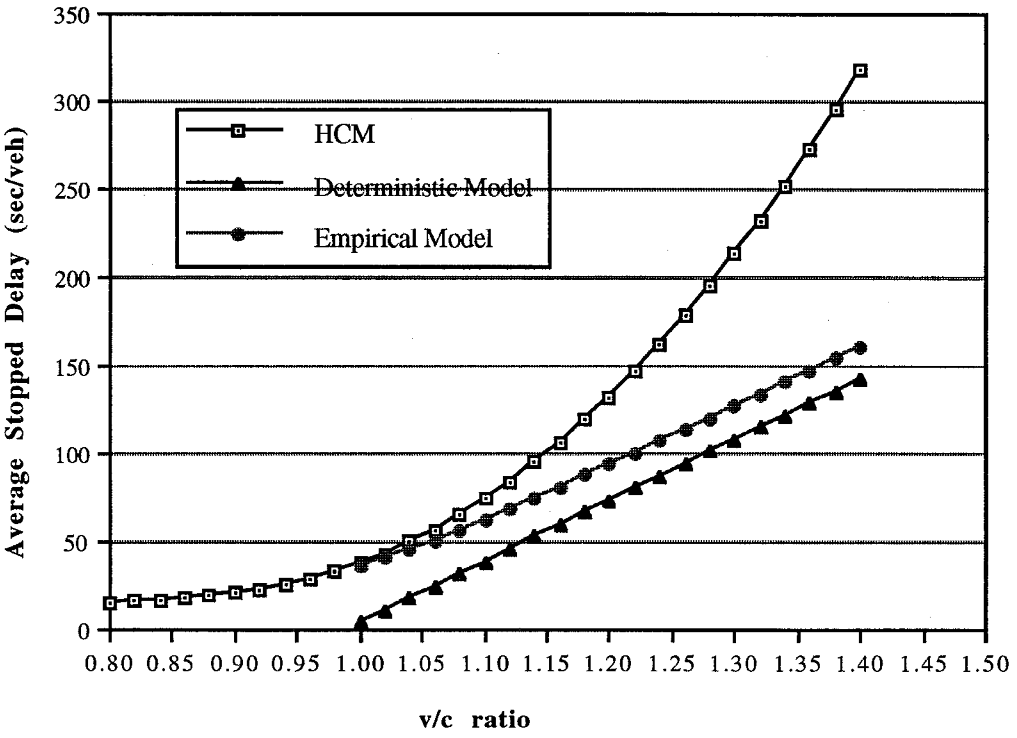


Figure 3.6 Comparison between HCM, deterministic, and empirical model

RESULTS ANALYSIS

This chapter presents results of isolated signalized intersection and arterial street (super street) capacity analysis. Basic assumptions made before performing the analysis include: the super street always has a g/C ratio set by policy to 0.6; all left-turn movements from cross streets have been prohibited; and cross streets operational performance will not warrant super street improvements. Results of the isolated signalized intersection analysis can be used as a reference schedule for implementing super street improvements. Results of the arterial street analysis, on the other hand, can serve as a sensitivity analysis which demonstrates the potential ability of the super street to accommodate traffic flow diverted from other facilities, especially IH35.

ISOLATED SIGNALIZED INTERSECTION

The time of each recommended improvement presented in this analysis is the time when it must be accomplished. Therefore, the construction work must be started earlier. Since traffic patterns for morning and afternoon peak periods are different, they may suggest different improvement schedules. Therefore, both periods were involved in this analysis. The time when cross streets develop a Level of Service (LOS) lower than D or a v/c ratio greater than one was identified, but no further improvement schemes were recommended.

AM Peak Period

Two criteria, LOS and v/c ratio, were used to examine performance. Results of the recommended improvement schemes for AM peak using LOS and v/c as criteria respectively have been presented in Table A.1 and A.2. The combination of the results of these two criteria was presented in Table A.3.

Since the intersections of Stassney and William Cannon have heavy cross street traffic demands, provision of 60 percent of the cycle time (g/C=0.6) to the super street may produce cross street performance problems unless left turns are prohibited at least on the arterial and same signal time redistributed. Left turns should be prohibited on the super street at Oltorf, Stassney, and William Cannon by years 2003, 2005, and 2008, respectively. Both the northbound and southbound approaches to Oltorf must be expanded to three through lanes by year 2008. Recommendations, based on v/c or LOS, were slightly different. In general, using LOS as the criterion will give more conservative results than using the v/c ratio.

PM Peak Period

Results of the PM peak period capacity analysis reveal that more serious operational problems occur during the PM because traffic demands are higher. Results are presented in Table A.4 to A.6. Cross streets approaches on Riverside, Oltorf, Stassney, and William Cannon will have operational problems until arterial left-turning movements are prohibited and signal time redistributed during the years 2004, 1997, 1994, and 2003, respectively. These rates are earlier than the corresponding AM peak schedule. Many physical geometric improvements are needed based on the PM results. For example, the Riverside intersection must have a grade separation by year 2007 according to the v/c criterion, and 2009, based upon the LOS. In addition, the northbound and southbound approaches of Oltorf and William Cannon should expand to three lanes and two lanes, respectively, by year 2006. Provision of a grade separation at Riverside is consistent with conclusions made by previous research [5]. In that study, the benefit/cost ratio was the criterion used.

Benefit/cost ratios for Riverside, Oltorf, Stassney, and William Cannon were estimated to be 1.05, 0.62, 0.40, and 0.90, respectively.

The combination of the AM and PM results using LOS and v/c as criteria is presented in Table A.7 and A.8, respectively. The recommended physical improvement schemes are summarized as follows:

Riverside: Prohibit left turns from the arterial by year 2004 and provide grade separation by year 2007.

Oltorf: Prohibit left turns from the arterial by year 1997 and expand Congress Avenue to three through lanes by year 2005. In order to provide consistent geometric design along this section of roadway, which is an important super street design concept, the whole section from Riverside to Ben White should be expanded to three through lanes.

Stassney: Prohibit left turns from the arterial by year 1994.

Wm. Cannon: Prohibit left turns from the arterial by year 2003, and expand Congress Avenue to two through lanes by year 2006.

Presentations of their improvement schemes using bar charts are presented in Figure A.1 to A.8.

ARTERIAL STREET

Conclusions for year 2010 derived from the above analyses were treated as given in this part of the analysis. Results with and without capacity constraints on through traffic are presented in Figure 4.1 and 4.2 respectively. Obviously, the latter, which adds additional demand without regard to capacity, produces more dramatic results.

Figure 4.1 indicates that if 1200 vehicles per hour are transfered to Congress Avenue, then the average travel speed will be reduced to 35 mph which is almost a 25% reduction. The corresponding reduction for no capacity constraint case is 48%. In order to fulfill the super street goal of high mobility, average travel speeds must be maintained higher than 35 mph. As a result, additional traffic that may be transfered from other facilities is limited to about 1200 vph to 1400 vph, depending on the time of day.

According to the predictions of a previous report [1], long term traffic volumes on IH35 are tabulated in Table 4.1. The numbers in the table indicate that travel demands along IH35 will be much higher than corresponding capacities. Therefore, even though 1400 vph of the predicted travel demands on IH35 are assumed to transfer to the super street, the Level of Service of IH35 is still LOS F.

This analysis reveals that upgrading Congress Avenue to the super street level can help alleviate IH35 traffic congestion but the effectiveness is limited. In other words, one cannot expect that the IH35 traffic congestion problem can be solved only through implementation of a Congress Avenue super street. As a matter of fact, the most effective alternative is increasing the IH35 capacity. If this alternative is infeasible, then other travel demand management alternatives should be considered. These alternatives include carpool/vanpool, enhancement of public transit operations, telecommunication, and provision of HOV lanes.

TABLE 4.1 LONG TERM IH35 AM PEAK HOUR TRAFFIC PREDICTIONS

Section	Northbound	Southbound
Town Lake - Riverside	9700 vph	9400 vph
Riverside - Oltorf	9700 vph	7800 vph
Oltorf - Woodward	9400 vph	7400 vph
Woodward - Ben White	9400 vph	7000 vph
Ben White - Slaughter	14300 vph	9400 vph

Source [1]

Year 2010 Assumption

1) Left turns prohibited on cross streets
2) Left turns prohibited on Congress at Oltorf, Stassney, and Wm. Cannon
3) Riverside Dr. grade separation
4) Demand constrained to available capacity

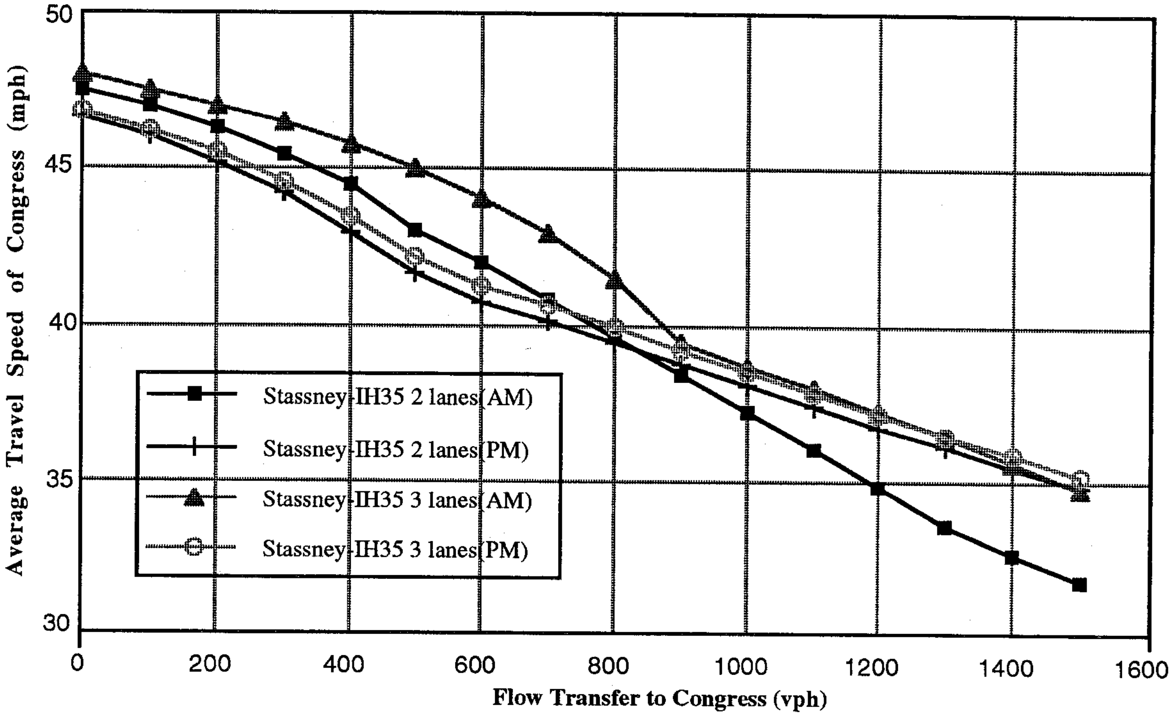


Figure 4.1 Year 2010 Congress average travel speed curve with capacity constraint

Year 2010 Assumption

1) Left turns prohibited on cross streets
2) Left turns prohibited on Congress at Oltorf, Stassney, and Wm. Cannon
3) Riverside Dr. grade separation
4) Demand not constrained

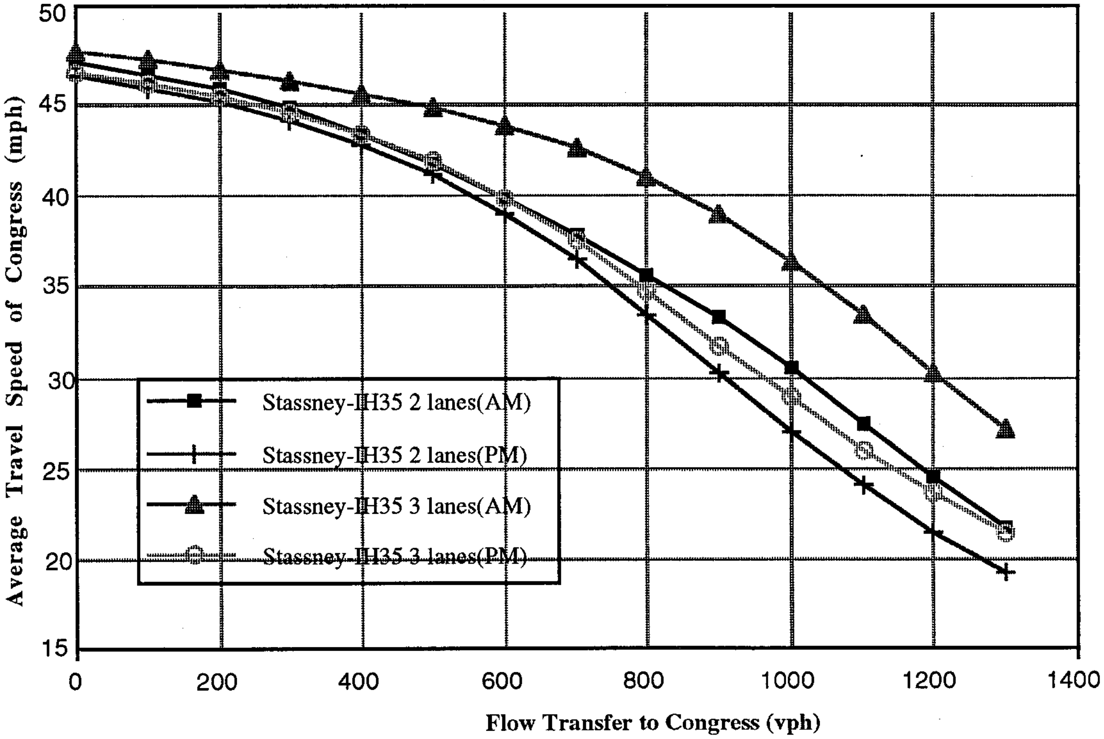


Figure 4.2 Year 2010 Congress average travel speed curve with capacity no constraint

CONCLUSIONS AND RECOMMENDATIONS

Congress Avenue is proposed as a candidate super street. A supply-oriented approach to physical improvement scheme development and potential from IH35 is presented.

A green time per cycle (g/C) ratio of 0.6 for the super street was assumed to be established by policy. Delays on cross streets were estimated, but improvements were generally planned only for the super street.

The recommended physical improvement scheme for the super street is summarized for each cross street location:

Riverside: Prohibit left turns from the arterial by year 2004, and provide grade separation by year 2007.

Oltorf: Prohibit left turns from the arterial by year 1997, and expand

Congress Ave.: Expand to three through lanes by year 2005 in order to provide consistent geometric design along this section of roadway, which is an important super street design concept, the whole section from Riverside to Ben White should be expanded to three through lanes.

Stassney: Prohibit left turns from the arterial by year 1994.

Wm. Cannon: Prohibit left turns from the arterial by year 2003, and expand Congress Avenue to two through lanes by year 2006.

To fulfill the high mobility super street goal it should, the super street is to have average travel speeds higher than 35 mph. Additional traffic, diverted from other facilities that can be accommodated, is about 1200 vph to 1400 vph, depending on the time of the day. Upgrading Congress Avenue to the super street can help alleviate IH35 traffic congestion, but the effectiveness is limited.

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APPENDIX

Table A.1 Using LOS as Criteria (G/C set to 0.6) Checked for AM peak

Year	Riverside	Oltorf	Stassney	Wm. Cannon
1993	-Prohibit left turns from Riverside	-Prohibit left turns from Oltorf	-Prohibit left turns from Stassney	-Prohibit left turns from Wm. Cannon -Cross street Los E
1994				
1995			-Cross street Los E	
1996				
1997				
1998	-Cross street Los E			
1999				
2000				
2001				
2002				
2003		-Congress Los E -Prohibit left turns from Congress		
2004				
2005			-Congress Los E -Prohibit left turns from Congress	
2006				
2007				
2008				-Congress Los E -Prohibit left turns from Congress
2009		-Congress Los E (after prohibit left turns) -Congress expands to 3 through lanes		
2010				

Note : Calculation is according to HCM method

Table A.2 Using V/C as Criteria (g/C set to 0.6) Checked for AM peak

Year	Riverside	Oltorf	Stassney	Wm. Cannon
1993	-Prohibit left turns from Riverside	-Prohibit left turns from Oltorf	-Prohibit left turns from Stassney	-Prohibit left turns from Wm. Cannon -Cross street v/c >1
1994				
1995				
1996				
1997			-Cross street v/c>1	
1998	-Cross street v/c>1			
1999				
2000				
2001				
2002				
2003				
2004				
2005		-Congress v/c > 1 -Prohibit left turns from Congress		
2006			-Congress v/c > 1 -Prohibit left turns from Congress	
2007				
2008		-Congress v/c > 1 (after prohibit left from Congress) -Congress expands to 3 through lanes		
2009				
2010				

Note : Calculation is according to HCM method

Table A.3 Combine v/c and LOS (g/C set to 0.6) Checked for AM peak

Year	Riverside	Oltorf	Stassney	Wm. Cannon
1993	-Prohibit left turns from Riverside	-Prohibit left turns from Oltorf	-Prohibit left turns from Stassney	-Prohibit left turns from Wm. Cannon -Cross street v/c >1 and Los E
1994				
1995			-Cross street Los E	
1996				
1997				
1998	-Cross street v/c>1 and Los E			
1999				
2000				
2001				
2002				
2003		-Congress Los E -Prohibit left turns from Congress		
2004				
2005			-Congress Los E -Prohibit left turns from Congress	
2006				
2007				
2008		-Congress v/c > 1 (after prohibit left from Congress) -Congress expands to 3 through lanes		-Congress Los E -Prohibit left turns from congress
2009				
2010				

Note : Calculation is according to HCM method

Table A.4 Using LOS as Criteria (g/C set to 0.6) Checked for PM peak

Year	Riverside	Oltorf	Stassney	Wm. Cannon
1993	-Prohibit left turns from Riverside	-Prohibit left turns from Oltorf	-Prohibit left turns from Stassney	-Prohibit left turns from Wm. Cannon -Cross street Los E
1994			-Congress Los E -Prohibit left turns from Congress	
1995				
1996			-Cross street Los E	
1997		-Congress Los E -Prohibit left turns from Congress		
1998	-Cross street Los E			
1999				
2000				
2001				
2002				
2003				- Congress Los E -Prohibit left turns from Congress
2004	-Congress Los E -Prohibit left turns from Congress			
2005				
2006		-Cross street Los E -Congress Los E (after prohibit left from Congress) -Congress expands to 3 through lanes		-Congress Los E (after prohibit left from Congress) -Congress expands to 2 through lanes
2007				
2008				
2009	-Congress Los E (after prohibit left turns) -Grade separation			
2010				

Note : Calculation is according to HCM method

Table A.5 Using v/c as Criteria (g/C set to 0.6) Checked for PM peak

Year	Riverside	Oltorf	Stassney	Wm. Cannon
1993	-Prohibit left turns from Riverside	-Prohibit left turns from Oltorf	-Prohibit left turns from Stassney	-Prohibit left turns from Wm. Cannon -Cross street v/c >1
1994				
1995			-Congress v/c > 1 -Prohibit left turns from Congress	
1996				
1997			-Cross street v/c>1	
1998	-Cross street v/c>1	-Congress v/c > 1 -Prohibit left turns from Congress		
1999				
2000				
2001				
2002				
2003				
2004				
2005	-Congress v/c > 1 -Prohibit left turns from Congress	-Congress v/c > 1 (after prohibit left turns) -Congress expands to 3 through lanes		
2006		-Cross street v/c>1		
2007	-Congress v/c > 1 (after prohibit left turns) -Grade separation			-Congress v/c > 1 -Prohibit left turns from Congress -Congress expands to 2 through lanes
2008				
2009				
2010				

Note : Calculation is according to HCM method

Table A.6 Combine v/c and LOS (g/C set to 0.6) Checked for PM peak

Year	Riverside	Oltorf	Stassney	Wm. Cannon
1993	-Prohibit left turns from Riverside	-Prohibit left turns from Oltorf	-Prohibit left turns from Stassney	-Prohibit left turns from Wm. Cannon -Cross street v/c >1 and Los E
1994			-Congress Los E -Prohibit left turns from Congress	
1995				
1996			-Cross street Los E	
1997		-Congress Los E -Prohibit left turns from Congress		
1998	-Cross street v/c>1 and Los E			
1999				
2000				
2001				
2002				
2003				-Congress Los E -Prohibit left turns from Congress
2004	-Congress Los E -Prohibit left turns from Congress			
2005		-Congress v/c > 1 (after prohibit left turns) -Congress expands to 3 through lanes		
2006		-Cross street Los E and v/c > 1		-Congress Los E (after prohibit left turns) -Congress expands to 2 through lanes
2007	Congress v/c > 1 (after prohibit left turns) -Grade separation			
2008				
2009				
2010				

Note : Calculation is according to HCM method

Table A.7 Using LOS as Criteria (g/C set to 0.6) Combine AM & PM peak

Year	Riverside	Oltorf	Stassney	Wm. Cannon
1993	-Prohibit left turn sfrom Riverside	-Prohibit left turns from Oltorf	-Prohibit left turns from Stassney	-Prohibit left turns from Wm. Cannon -Cross street Los E
1994			-Congress Los E -Prohibit left turns from Congress	
1995			-Cross street Los E	
1996				
1997		-Congress Los E -Prohibit left turns from Congress		
1998	-Cross street Los E			
1999				
2000				
2001				
2002				
2003				- Congress Los E -Prohibit left turns from Congress
2004	-Congress Los E -Prohibit left turns from Congress			
2005				
2006		-Cross street Los E -Congress Los E (after prohibit left from Congress) -Congress expands to 3 through lanes		-Congress Los E (after prohibit left from Congress) -Congress expands to 2 through lanes
2007				
2008				
2009	-Congress Los E (after prohibit left turns) -Grade separation			
2010				

Note : Calculation is according to HCM method

Table A.8 Using v/c as Criteria (g/C set to 0.6) Combine AM and PM peak

Year	Riverside	Oltorf	Stassney	Wm. Cannon
1993	-Prohibit left turns from Riverside	-Prohibit left turns from Oltorf	-Prohibit left turns from Stassney	-Prohibit left turns from Wm. Cannon -Cross street v/c >1
1994				
1995			-Congress v/c > 1 -Prohibit left turns from Congress	
1996				
1997			-Cross street v/c>1	
1998	-Cross street v/c>1	-Congress v/c > 1 -Prohibit left turns from Congress		
1999				
2000				
2001				
2002				
2003				
2004				
2005	-Congress v/c > 1 -Prohibit left turns from Congress	-Congress v/c > 1 (after prohibit left turns) -Congress expands to 3 through lanes		
2006		-Cross street v/c>1		
2007	-Congress v/c > 1 (after prohibit left turns) -Grade separation			-Congress v/c > 1 -Prohibit left turns from Congress -Congress expands to 2 through lanes
2008				
2009				
2010				

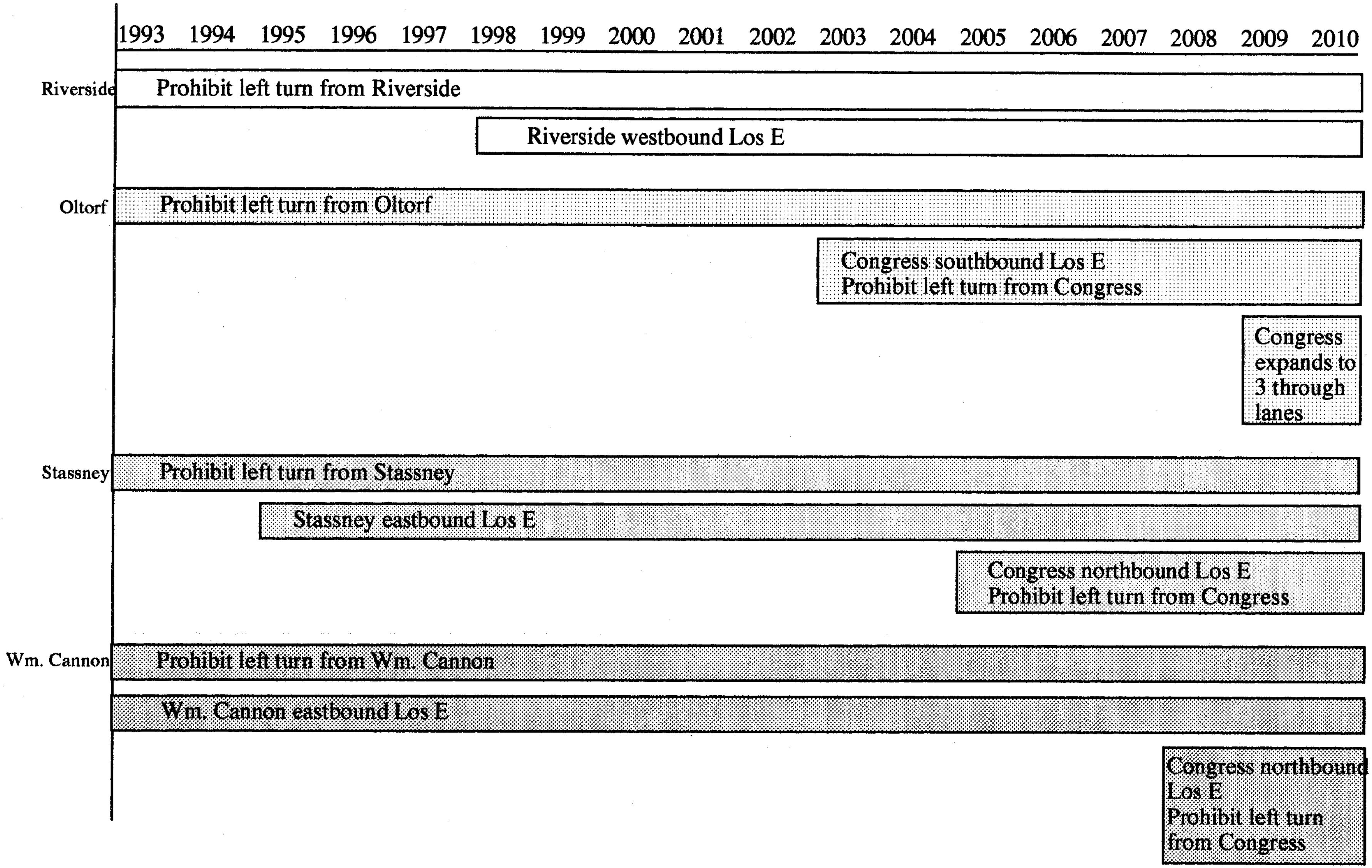

Figure A.1 S. Congress Improvement Schedule Bar Chart (AM, using LOS as criteria)

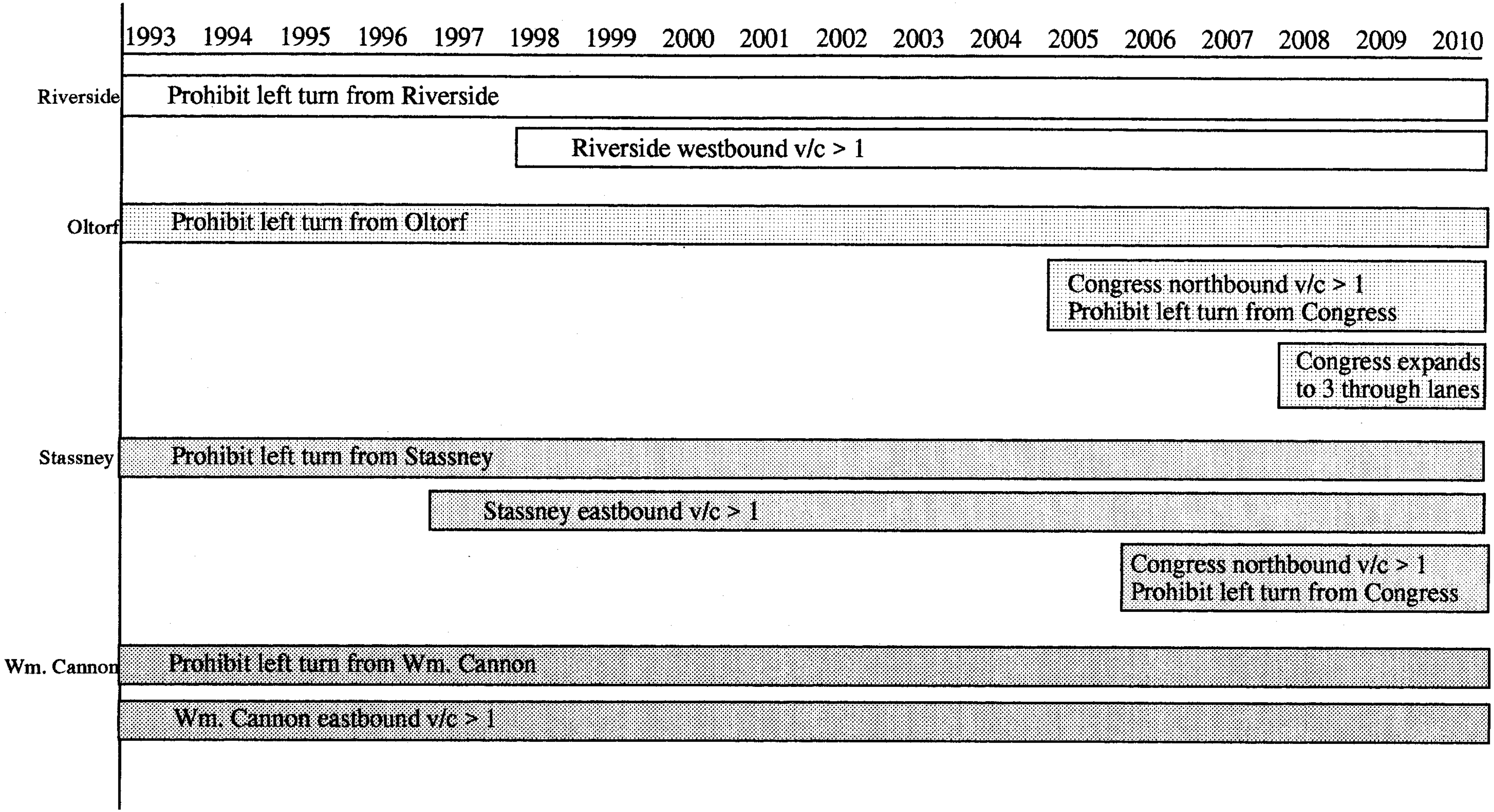

Figure A.2 S. Congress Improvement Schedule Bar Chart (AM, using v/c as criteria)

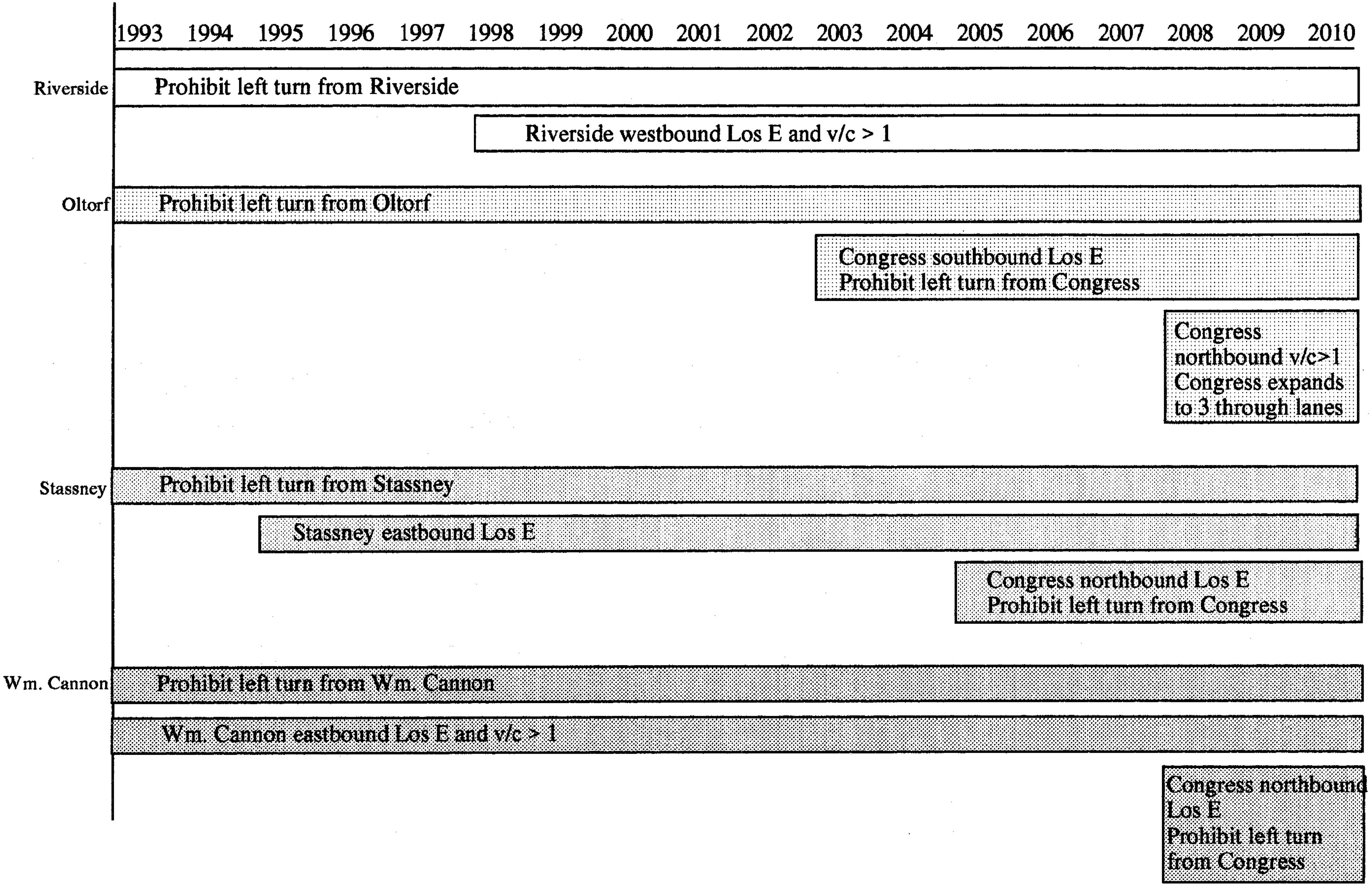

Figure A.3 S. Congress Improvement Schedule Bar Chart (AM, combining v/c and LOS as criteria)

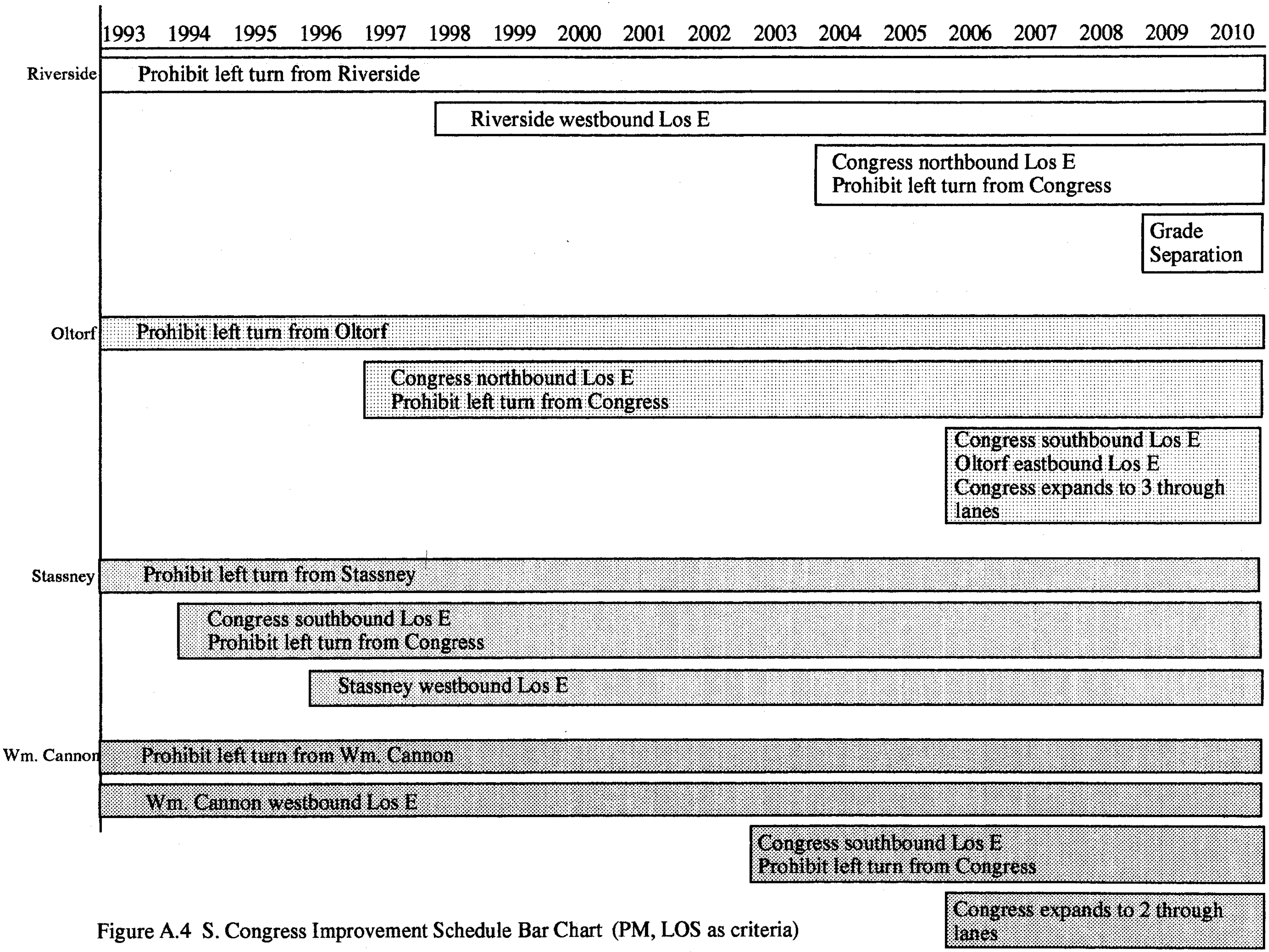

Figure A.4 S. Congress Improvement Schedule Bar Chart (PM, LOS as criteria)

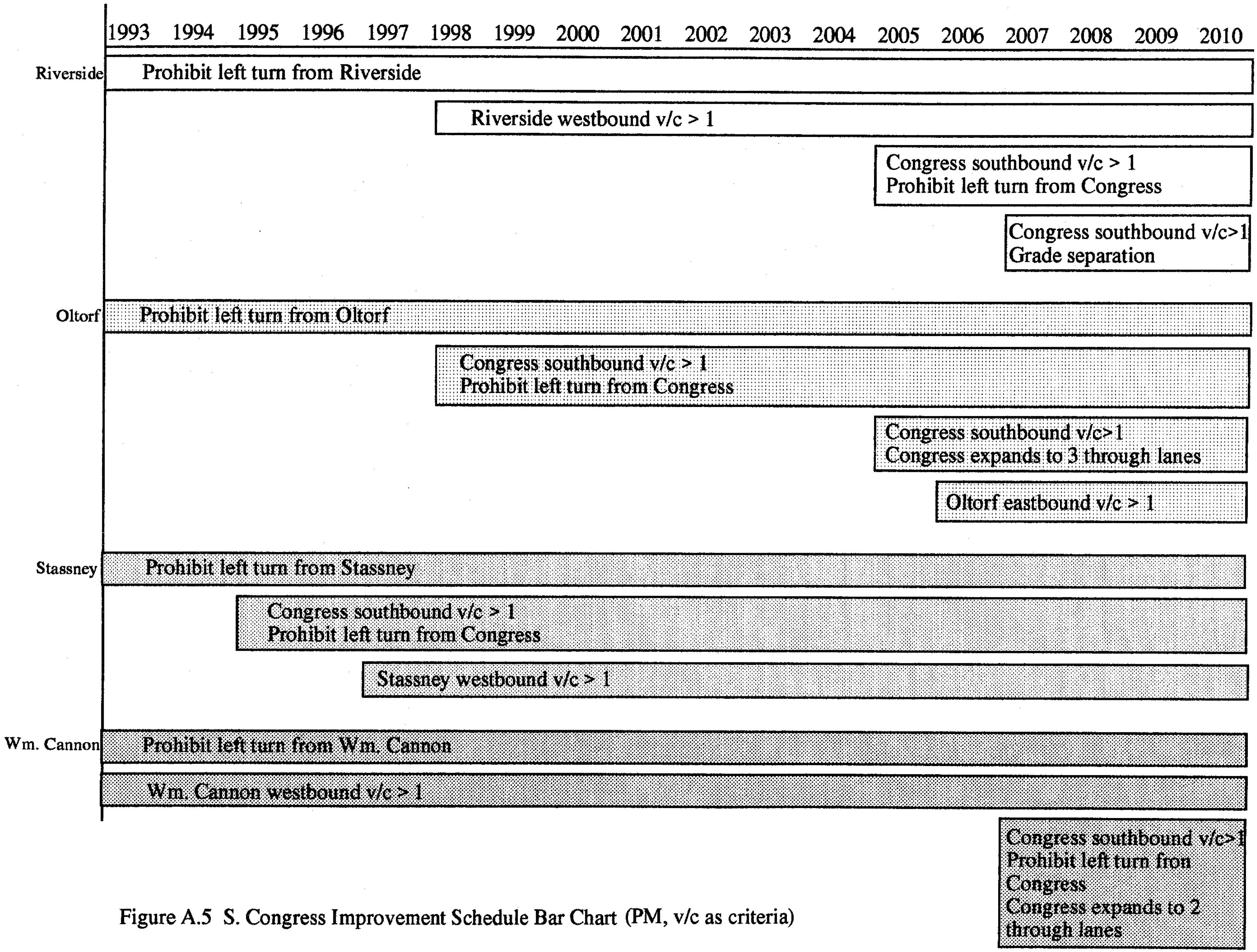

Figure A.5 S. Congress Improvement Schedule Bar Chart (PM, v/c as criteria)

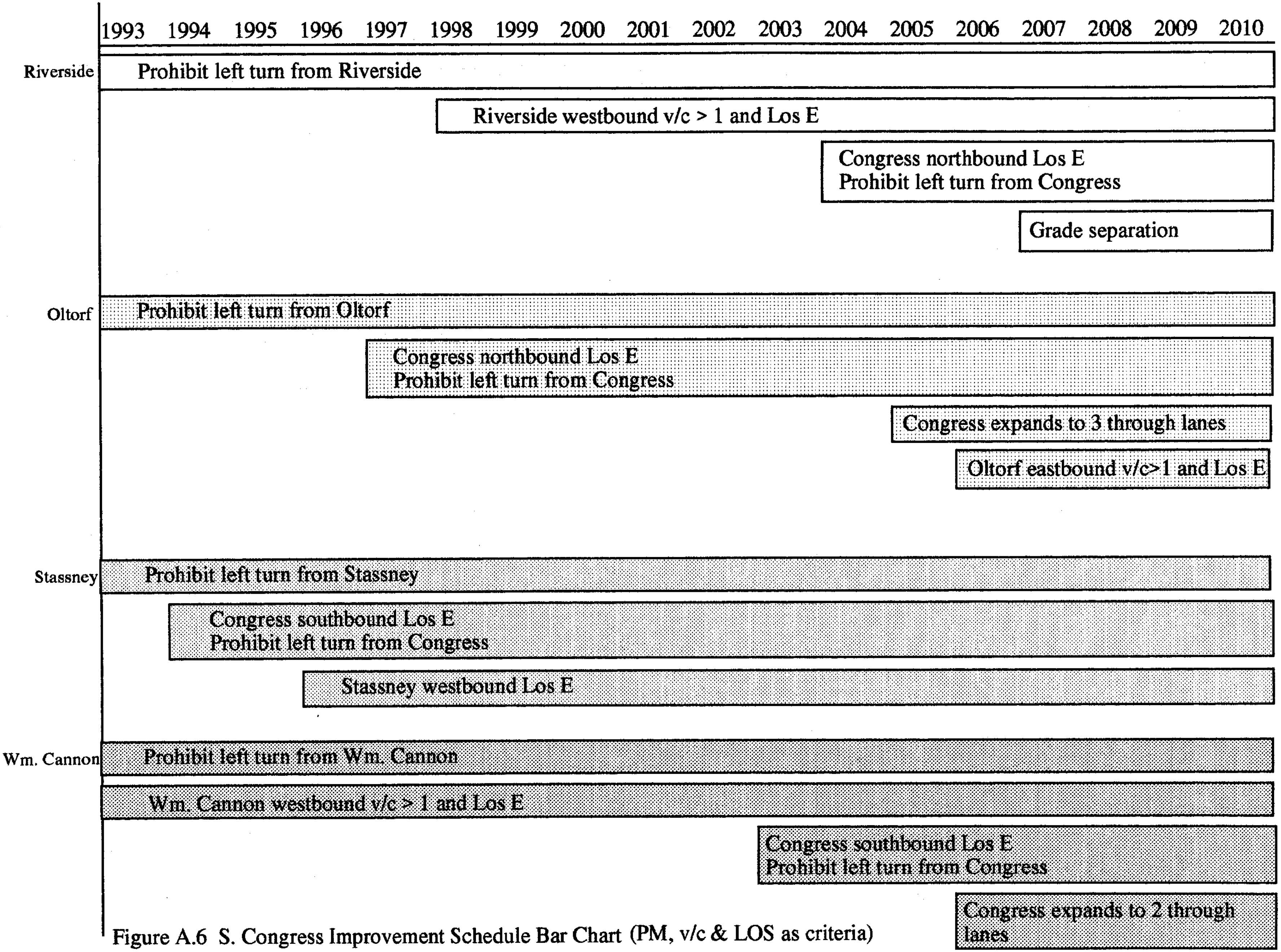

Figure A.6 S. Congress Improvement Schedule Bar Chart (PM, v/c & LOS as criteria)

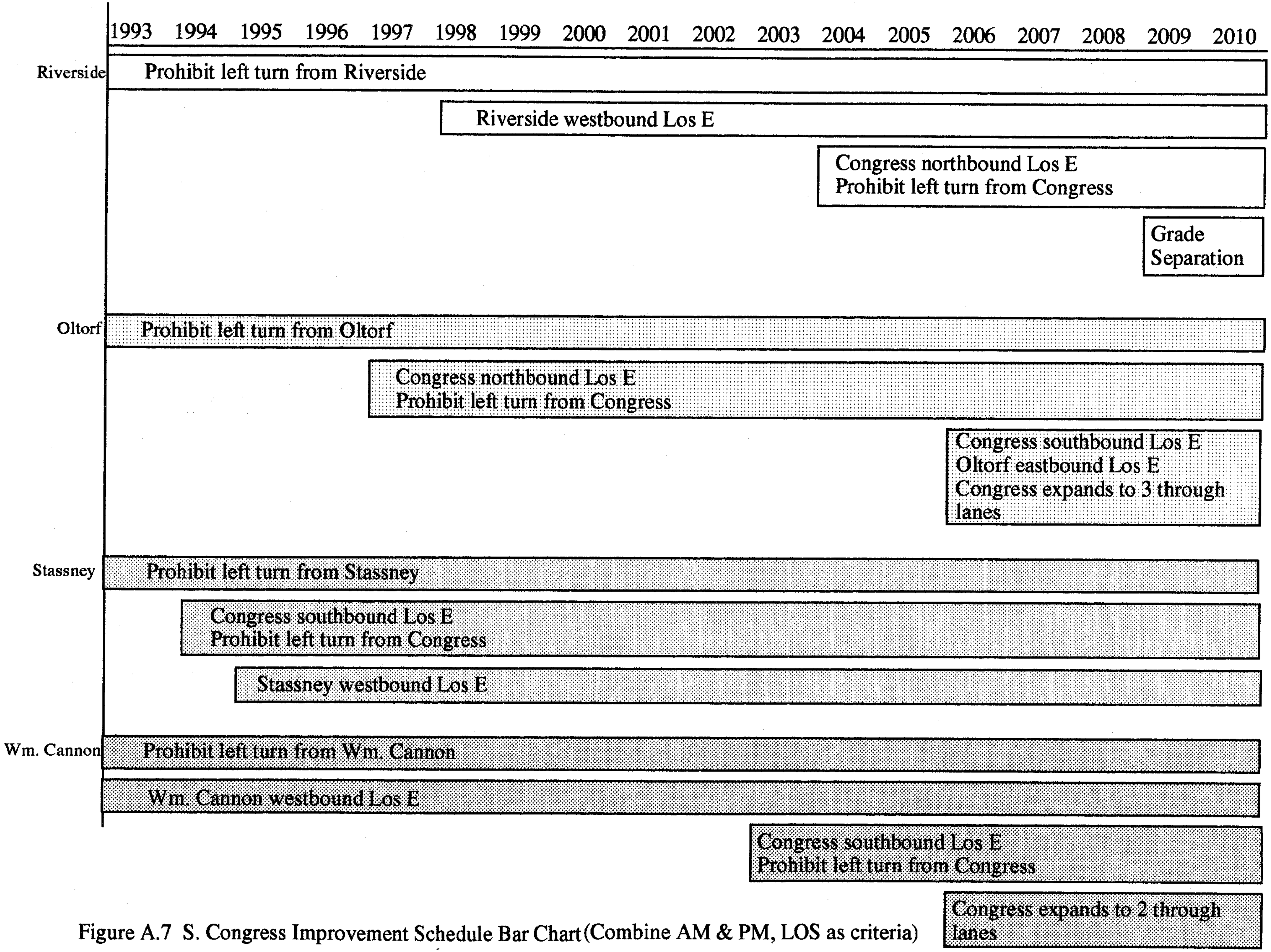

Figure A.7 S. Congress Improvement Schedule Bar Chart (Combine AM & PM, LOS as criteria)

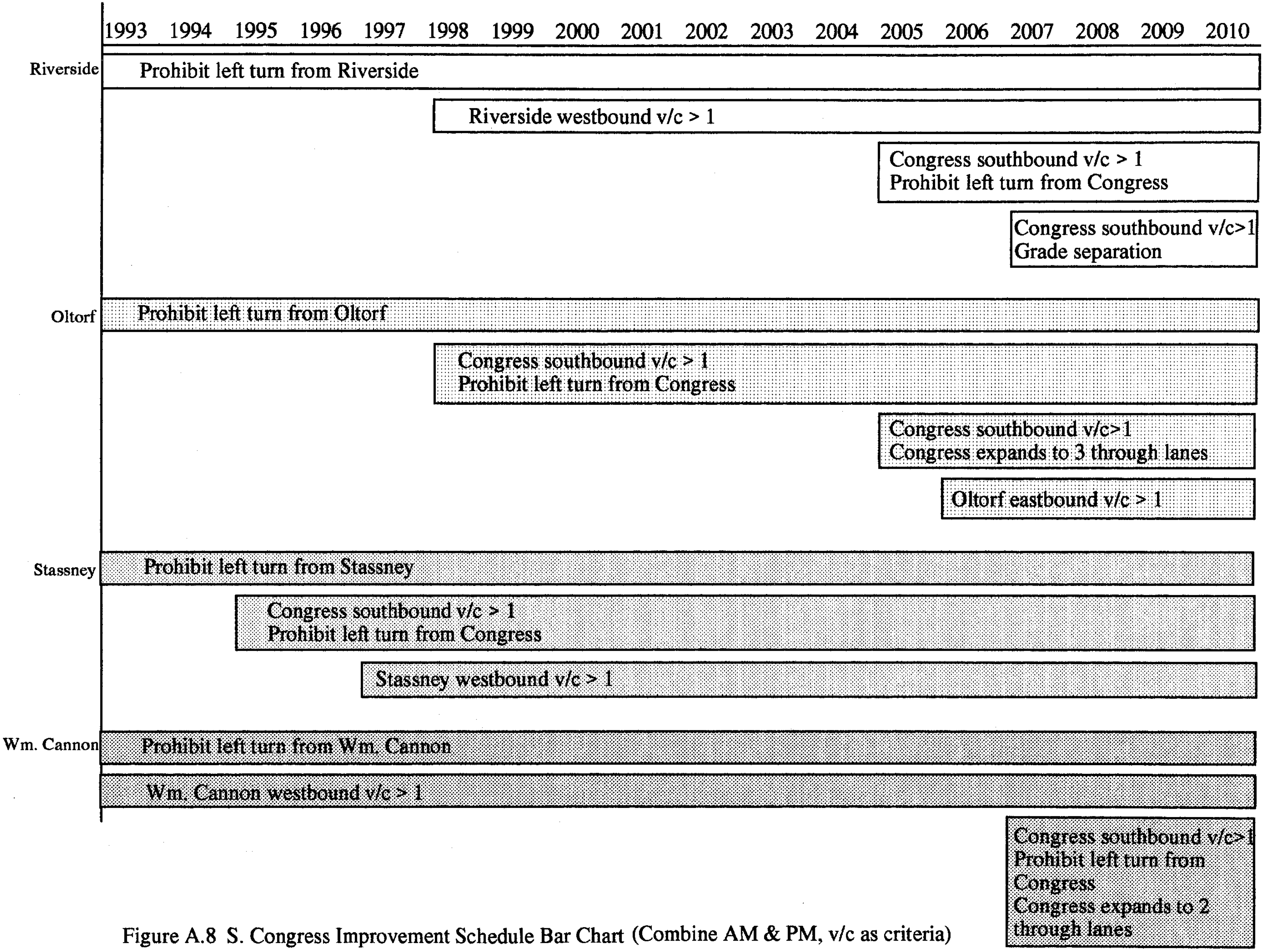

Figure A.8 S. Congress Improvement Schedule Bar Chart (Combine AM & PM, v/c as criteria)