A “Trigger Mechanism” Concept for Arterial Street Improvement Programming

BARRY D. LUNDBERG AND VIRENDRA SINGH

The City of Lincoln, Nebraska, with a current population of 215,000 is growing at about 1.3 percent each year. Increasing traffic volumes are a growing concern to public officials and citizens alike. The streets serving the older sections of the city are of particular concern because of the divisions of opinion regarding the need for widening these streets. In 1995, the Mayor of Lincoln appointed a “citizen task force” to study the need for traffic improvements on five key segments of these streets and recommend a program for improvement. The task force sought a congestion measure which could be applied (as a matter of public policy) to determine when, and to what extent, improvements would be made to these streets, i.e., the term “trigger mechanism.” The primary measure of congestion agreed upon by the task force was “average travel speed” along these streets. This measure would be used to determine the level of congestion and to establish threshold values which would “trigger” successive levels of study and improvement. Key words: congestion improvements, trigger mechanism, congestion measures, arterial traffic.

INTRODUCTION

In early 1995 the Mayor of Lincoln, Nebraska, appointed a citizen task force to study the improvement of traffic flow along segments of five arterial streets serving several older neighborhoods in the City’s core area. The task force was officially named the Congestion Management Task Force (CMTF) and was mandated by the Mayor to: a) develop transportation system improvements that would reduce or prevent traffic congestion on the study streets, and b) recommend a “trigger mechanism” for determining the conditions under which such transportation improvements would be implemented.

In September 1995, Wilbur Smith Associates (WSA) was contracted by the City of Lincoln to assist the CMTF and the City’s transportation staff in studying the extent of traffic congestion on these streets and the development of a “trigger mechanism” process which could be used to determine the need for and timing of specific improvements. WSA engaged HWS Consulting Group, Inc., of Lincoln, Nebraska, to provide local traffic and municipal engineering assistance and the Lincoln-Lancaster Mediation Association to provide facilitation of key CMTF workshops.

CONGESTION MANAGEMENT TASK FORCE SURVEY

At the outset of the study, the consulting team conducted a survey of the CMTF members to determine the member’s thinking regarding key problems, issues and solutions to the traffic problems on the study streets. The results provided good insights as to the areas of agreement and disagreement between the CMTF members. The task force members indicated that primary consideration be given to signal timing, lane additions and intersection improvements. The information provided by the CMTF members helped the study team fashion a process and approach to the project which maximized effective use of the time and data available. The survey helped insure that the study effort would be consistent with the goals and objectives of the CMTF.

STUDY AREA CHARACTERISTICS

The character of the study corridor neighborhoods is that of mature and well established residential areas with some mixed neighborhood commercial development along with a scattering of public or community support facilities. The entire study area is homogeneous in nature with very little differential in the neighborhood ambiance throughout the corridor. At the time the study was conducted the study area was heavily forested with a strong linear planting of trees along all major thoroughfares. The age and size of the trees were such that the majority of these plantings provided a full canopy across many of the streets. One of the main concerns of the CMTF was the extent to which major traffic flow improvements (i.e., lane widening) would impact the existing trees populating the parkways and front yards along the streets.

CONGESTION MEASUREMENT AND TRIGGER MECHANISMS

It was important at the outset of the study to discuss the concept of congestion and to create consensus among the CMTF members on the best way to define and measure congestion on the study streets. This was considered key to future evaluation of alternatives and the development of the trigger mechanism(s) needed for development of an acceptable congestion mitigation strategy. During the first CMTF workshop, the consulting team and the CMTF members reviewed and evaluated various ways of defining and measuring congestion. There was strong agreement that the decision process used by travelers in making mode and route selections is primarily influenced by travel time. Based on this discussion, it
was agreed that “average speed” should be the primary measure of effectiveness (MOE) for evaluating congestion and improvement options along the study streets. Travel time is the common thread, both as a direct measure, and as an element of other indicators. It was also agreed that vehicle delay which is used to estimate Level of Service (LOS) at signalized intersections would be used as a secondary MOE for this study.

TRAFFIC VOLUMES

To determine how the study streets were operating, speed and delay runs were conducted during the morning peak hour, the weekday noon hour, the weekday evening peak hour and a Saturday mid-day time period. The number of runs per period varied according to the variance between each run. Typically, four to six runs were conducted and averaged. The average includes the highest 15 minute period within the peak hour as well as remaining time on either side of the peak 15 minute period. The overall results of the speed and delay runs are shown in Table 1.

Cotner Boulevard is operating in the C-D LOS range with the weekday evening, peak and Saturday mid-day peak being the worst time period. Both are for northbound traffic. (Cotner Boulevard’s relatively poor performance is due to the fact that it is a short segment between O Street and Randolph and is highly influenced by the heavy traffic at the intersection of Cotner and O Streets.) Interestingly, the other study corridors operate better (e.g., a higher average level of speed than perceived by many citizens in Lincoln. Many citizens remark that these streets are very congested during peak periods and that major improvements are necessary. Based on actual field data collected these streets are working quite well and within the acceptable level established by the CMTF.

Traffic volumes on the study streets has remained fairly level with present day ADTs ranging from 10,000 to 17,000; however, the City’s long range traffic forecasts predict considerable traffic growth and congestion on these streets.

### THE “TRIGGER MECHANISM” CONCEPT - A NEW DECISION-MAKING PARADIGM

Making street improvement decisions using the principles inherent in the trigger mechanism concept is vastly different from the traditional approach of programming improvements based on long-range forecasts. The traditional approach often produced a “build it and they will come” result. Use of the trigger mechanism concept facilitates incremental decision-making based on measured need and trends. This can have profound implications for not only development and prioritization of projects but for resource allocation and rational accommodation of actual traffic demand throughout the City’s entire street system.

The trigger mechanism model for the study streets, and its basic operating principals and parameters are shown in Figure 1.

Incorporating the trigger mechanism concept into street improvement decisions represented a significant addition to the City’s planning and transportation system development and management process. It was recognized, however, that streets of different classifications, serving different purposes (e.g., residential streets vs. collector streets vs. residential arterials vs. general community arterials, etc.) would have increasingly higher freeflow speeds. Thus, a different threshold of “trigger” speeds would need to be established for different classifications of streets.

The City of Lincoln adopted an average speed of 18 miles per hour as the trigger for initiating a study that could result in street improvement projects, with 16 miles per hour being the point at which the study recommendations would be implemented. Travel time and intersection delay studies would be conducted annually to monitor operational performance of these streets consistent with the principle of this trigger mechanism concepts. The parameters of the City’s monitoring program will be based on:

- A statistically significant sample size for a 95% level of confidence.
- Floating car technique, where the driver floats with the traffic by attempting to safely pass as many vehicles as pass the test ve-
• Results should focus on “Average Speed” throughout the corridor.

IMPLEMENTATION PROGRAM

Using average speed as the primary measure of congestion, the six study corridors are operating within the acceptable level of service established by the CMTF. However, several intersections along several of these streets were operating at unacceptable LOS peak traffic conditions. Accordingly, the improvements that are needed and appropriate now and in the short run are a combination of traffic signal timing improvements, promoting ridesharing (including transit), maximum practical use of other transportation system and travel demand management techniques, and selective intersection capacity improvements. However, the longer-range traffic forecasts (2015) based on possible community-wide population growth and commercial development in or near the study corridors, suggest that at some future date (perhaps within the next 10 to 15 years) capacity improvements along one or more of these streets may be needed.

A program to effectively deal with the traffic flow conditions on the six study streets was recommended. As a result the City of Lincoln is in the process of revising the 1994 Comprehensive in the following ways:
• Review projects in the Plan and the C.I.P. and place in one of the following categories: “Corridor Improvement Study,” “Project Development Area” or a “Construction Project.”
• The Plan should preclude acquisition of right-of-way in a “Corridor Improvement Study” or a “Project Development Area,” but authorize acquisition of right-of-way for a “Construction Project.”
• All corridors with an average speed of 16 miles per hour and for which additional right-of-way is being recommended would be proposed, at a minimum, for inclusion in the Plan as a “Construction Project.”

Finally, because corridor improvement projects will be initiated by an objective measure, namely the 18 miles per hour average speeds, it is critical that the data used is accurate and verifiable. Implementation of a consistent methodology to measure future performance of the corridors is contingent upon adequate funding. Accordingly, the City of Lincoln is considering annual allocation of $200,000 of Street Construction Funds for conducting travel-time and delay studies. The travel-time and delay studies will be based upon the following issues.

CORRIDOR IMPROVEMENT STUDY CONCEPT

When one or several paralleling arterial streets have reached the threshold average travel speed of 18 miles per hour, with the operating performance steadily dropping, a comprehensive corridor improvement study (CIS) should be triggered. The consultant team recommended that the CIS should have the following important features:
1. Logical Termini: A CIS should cover a route length which extends to a logical and functional terminus on each end, even though the entire length of the corridor may not be in need of improvement at the time of the study.
2. Comprehensiveness: The study should consider all reasonable transportation elements and strategies, ranging from transportation system management (TSM) including traffic signal timing activities to physical improvements.
3. Community Involvement: The public, particularly in the corri-
dor area, should be given the opportunity to provide input and constructive suggestions at the outset of planning and during the development and evaluation of alternatives for improving the performance of the corridor. This should be a truly collaborative process, with each involvement of the directly affected neighborhood.

4. Environmental Orientation: Environmental considerations need to be an integral part of the study process and, in the case of residential arterials such as the study streets, should focus on issues of neighborhood impact such as residential displacement, front yard encroachment, and tree removal.

CONCLUSIONS AND DIRECTIONS

1. Average travel speed should be used as the primary tool for measuring and describing the level of congestion along major corridors, as well as the primary measure of effectiveness for the development and evaluation of congestion reduction actions. This measure is well understood and accepted by citizen groups and local policy makers.

2. The use of “average travel speed” for measuring congestion and planning congestion improvement programs requires a routine program of speed and delay monitoring, sharing this information with the public and policy makers, and rational application of this information with the community’s transportation system improvement process.

3. It is important to undertake a community and neighborhood public involvement program to formulate consensus regarding the “local” definition of congestion (i.e., what is an unacceptable average speed for different corridors and classes of streets, as well as unacceptable levels of service for signalized intersections), and a process for determining corridor improvements (such as the use of “trigger mechanisms” and the CIS described earlier in this paper.)

4. In addition to the use of average speed as the primary determinant of congestion along a corridor, and the primary measure of effectiveness relative to improvement options, conventional level of service (LOS) analysis should be used to determine traffic flow problems and solutions for individual intersections.

5. Successful application of the trigger mechanism process described in this paper hinges on the willingness of the community’s engineers, planners, and policy makers to approach the question of congestion and its mitigation from the point of view of the traveling public and the values of neighborhood residents simultaneously with a commitment to balance these interests.