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Tech Brief

# Computer Modeling and Simulation of New Jersey Signalized Highways (VOLUME I – OPTIMIZATION)

FHWA/NJ-2005-008 June 2005

## SUMMARY

The New Jersey Department of Transportation has undertaken an initiative to systematically improve traffic operations along the state's signalized highway corridors. Two corridors in this study, NJ Route 23 (Figure 1) and NJ Route 42/322 (Figure 2) were selected as studied arterials for undertaking a systematic approach to observe current traffic conditions, obtain current traffic volume data and then assimilate this information as well as existing roadway geometric characteristics into a traffic signal optimization software. The results of these efforts would produce new timing directives that could be readily implemented. Expanding such initiatives to New Jersey's signalized arterials has the potential of reducing congestion and improving air quality.

## INTRODUCTION

Various costly ITS technologies were considered for deployment along ITS freeways, arterials and streets operated by the New Jersey Department of Transportation (NJDOT). In the area of traffic control, these technologies included an optimal array of signal cycle lengths, splits, and offsets while considering dynamic traffic conditions. In taking advantage of these technologies, however, computer models were developed for signalized highways, and the array of decision variables could be optimized.

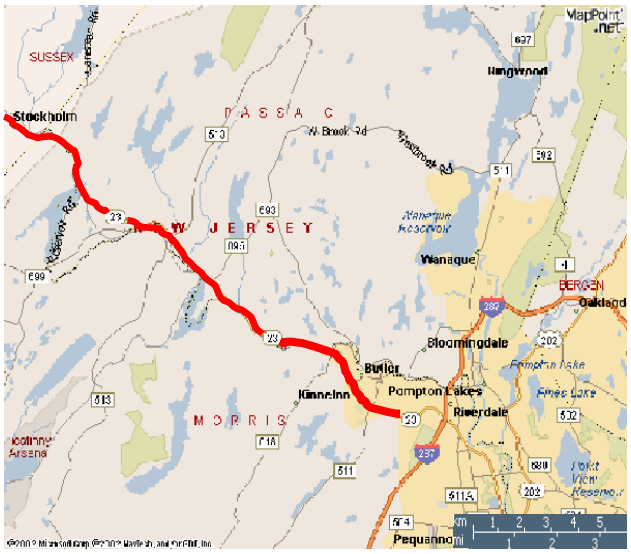


**Figure 1. Route 23 Corridor**


**Figure 2. Route 42/322 Corridor**

## RESEARCH APPROACH

The tasks included in the research approach are listed below:

- Task 1. Site Identification and Data Needs.
- Task 2. Data Collection.
- Task 3. Network Modeling with Synchro and SimTraffic.
- Task 4. Optimization of Signal Timing Plan with Synchro and SimTraffic.
- Task 5. Generation of Timing Directives.

Collected data such as traffic volumes and existing signal timings for Route 23 were obtained from NJDOT. Traffic volume data, for Route 42/322, was collected by the Louis Berger Group Inc. while the existing signal timings were provided by NJDOT. By applying the collected data, the optimal signal timings for the studied corridors were developed.

## RESULTS

- The results of this study include the optimal timing plans and the development of new timing directives for both studied sections on Route 23 and Route 42/322. The directives are produced in a format such that they can be readily understood

by field maintenance personnel and can be easily updated in the future. The revised timing directives were also reviewed and approved by NJDOT's Bureau of Traffic Engineering and Safety Programs to ensure that they comply with NJDOT standards and format.

- Initial results of our analysis indicated that significant improvements in Level of Service (LOS) could be achieved by simply retiming the traffic signals. For example, on Route 42/322, average vehicle delays were reduced by over half at one intersection during the morning peak hour, resulting in a LOS improvement from C to B. Arterial travel speeds and improved progression, overall, also improved.

**CONCLUSIONS**

- While New Jersey has not seen significant increases in overall population, vehicles miles traveled (VMT) continues to increase and activity patterns are constantly changing. These tendencies significantly impact travel patterns. A programmatic updating of existing traffic signal timing plans provides an effective means to be responsive to these changes.
- While the benefits of implementing these changes may not be as profound as adding new roadway capacity, new construction and associated property taking in a state which has earned the distinction of being the most densely populated in the nation, is often controversial and costly. Therefore, an important component to New Jersey's transportation success is extracting as much as possible from its existing infrastructure, which is also consistent with national transportation and environmental policies. Updating existing traffic signal timing plans based on current traffic volume conditions is a highly effective means for reducing driver delay, congestion and improving air quality.
- The primary result of the optimal signal timing is that both studied corridors achieved their significant overall improvements (e.g., signal delay, average speed, fuel consumption, accident rate, vehicle emission rate, etc.). However, these improvements were not obtained in every intersection. For example, while signal delay at Boonton Avenue intersection in Route 23 was decreased by 142

veh-hr for AM period, it was increased nearly 4 veh-hr for AM period at Cotluss Road intersection in Route 23. Although entire network signal delay was drastically improved, some intersections were sacrificed to achieve better results. Thus, it is required to develop a new method enhancing the debased intersections.

**RECOMMENDATIONS**

- A systematic network partitioning process should be developed. Development of such procedure of network partitioning that can control queue management on the one network partition and the adjacent subnetworks would adopt multiple systems and cycle lengths into any types of network condition.
- Traffic signal timing and coordination plans should be routinely updated to ensure system optimization.

**FOR MORE INFORMATION CONTACT:**


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A final report is available online at: **http://www.state.nj.us/transportation/refdata/research/**

If you would like a copy of the full report, please FAX the NJDOT, Bureau of Research,Technology Transfer Group at (609)530-3722 or send an email to **Research@dot.state.nj.us** and ask for:

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