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Tech Brief

Computer Modeling and Simulation of New Jersey Signalized Highways (VOLUME II – Cost and Benefit Analysis)

FHWA/NJ-2005-009

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SUMMARY

The New Jersey Department of Transportation was in the process of implementing optimal signal timing plans as a temporary installation for managing traffic flows associated with Route 23 and Route 42/322 in New Jersey. To help understanding the value of such a system, a cost benefit (C/B) analysis was conducted in this project. Benefit Analysis Tool (BAT) was developed to estimate the benefit with a robust way.

INTRODUCTION

While the nature of traffic flow is highly dynamic and continually changes, particularly in developing communities, many transportation agencies lack a programmatic approach to ease congestion through the optimization of traffic signal timing plans. Prior research initiatives demonstrated the benefits of signal timing improvement.

The conducted C/B analysis was based on accepted procedures and evaluation frameworks for optimal signal timing plans. Outputs from SYNCHRO based on optimal signal timings were used to estimate the benefits for compared to that under existing conditions. Many variables were applied to develop models and estimate the system

impacts before and after implementing the optimal signal timings on Route 23 and Route 42/322.

RESEARCH APPROACH

The research approach tasks are listed below, and itemized tasks are illustrated in Figure 1.

- Task 1. Obtain SYNCHRO output.
- Task 2. Develop Cost and Benefit Model.
- Task 3. Compute Benefits.
- Task 4. Perform Sensitivity Analysis.

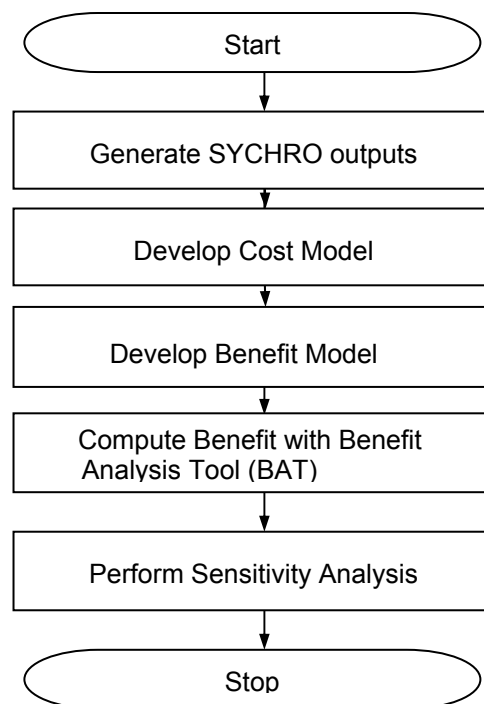


Figure 1. Configuration of Research Approach

RESULTS

- Table 1 indicated that the benefit of the optimized signal timings on Route 23 and Route 42/322 outweighs the total cost by a ratio of 1 to 24 and 1 to 20, respectively. The total cost includes engineering and network modeling costs, of approximately \$101,388 for on Route 23 and Route 42/322, which achieves the net benefit of more than 3.8 million dollars per year.

Table 1. Benefits and Costs

Study Corridor	Time Period	Daily Benefits ¹	Yearly Benefits ²	Cost ³	B/C ratio ⁴
Route 23	AM	3,584	935,434	73,494	1:24
	Noon	442	115,434		
	PM	2,667	696,182		
	Total	6,694	1,747,049		
Route 42/322	AM	2,485	648,585	102,903	1:20
	Noon	2,230	582,030		
	Off Peak	303	79,083		
	PM	2,865	747,765		
	Total	7,883	2,057,463		
TOTAL		14,577	3,804,512	176,397	1:21

1. Sum of benefits of the three time periods (AM, Noon, and PM)

2. 261 days x daily benefit.

3. Total cost.

4. Based on yearly benefit.

- The benefit was estimated from reduced travel time, fuel consumption, and environmental impacts. Additional benefits in terms of accident cost reduction, customer satisfaction, productivity, and others were not included. The calculation of benefits was based on Microsoft Excel based Benefit Analysis Tool (BAT, Figure 2) developed in this project, which can be revised for other signal optimization projects.

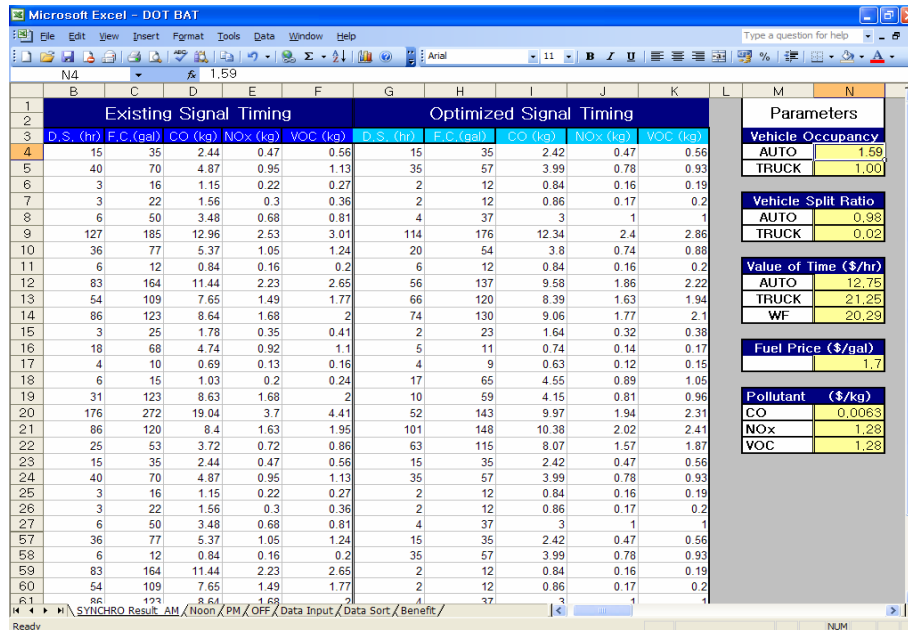


Figure 2. Benefit Analysis Tool (BAT)

CONCLUSIONS

- Models were developed for estimating benefits of implementing optimized signal timing plans, based on reduced cost incurred by travel time, fuel consumption, and vehicle emissions of the studied corridors. Among these benefits, travel time saving is the major benefit (e.g., 86.9% for Route 23, 90.6% for Route 42/322).
- Benefits of the optimal signal timing were 6,694 \$/day and 1,747,049 \$/year for Route 23, and 7,883 \$/day and 2,057,463 \$/year for Route 42/322. The resulting B/C ratio based on yearly benefit was 1 to 24 and 1 to 20 for Route 23 and Route 42/322, respectively, and overall 1 to 21. In addition to the initial benefits, accumulative benefits indicate that yearly benefits will be drastically increased as costs are fixed.

RECOMMENDATIONS

- It is recommended to review traffic signal and system performance on a yearly basis to maintain its effectiveness and efficiency.

- The application of optimized signal timing plans for Route 23 and Route 42/322 was economically justified. Further evaluation of the studied corridors, while the optimized timings are in operation, to validate the results of the C/B analysis was recommended.
- Benefits of reduced accident cost due to the implementation of optimal signal timings should be conducted with the application of New Jersey specific accident data.
- Future studies should focus on developing New Jersey specific parameters (e.g., vehicle occupancy, pollutant unit cost, etc.) to improve benefit estimation models.

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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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