Modeling Automated Highway System Guideway Operations

by

Eric J. Siess

Thesis submitted to the Faculty of the

Virginia Polytechnic Institute and State University

in partial fulfillment of the requirements for the degree of

MASTER OF SCIENCE

in

Civil Engineering

APPROVED:

Donald R. Drew, Ph.D., Chairman

Wei H. Lin, Ph.D.

Antonio A. Trani, Ph.D.

December, 1997

Blacksburg, Virginia

Modeling Automated Highway System Guideway Operations

by

Eric J. Siess

Donald R. Drew, Chairman

Department of Civil Engineering

(ABSTRACT)

The purpose of this research is to explore the operational characteristics of a Maglev-based Automated Highway System and how it would interact with freeway operations. The extension of traditional traffic flow phenomenon, including weaving, merging, and stopping distance, into the automated system is looked at. These are also extended into platoon operations and their effect on such properties as gap control and ultimately the capacity of such a system. The ability to incorporate an AHS system into the existing Interstate Highway System is investigated. This includes placing the magways in the right-of-way of the highway system and interfacing the AHS with the existing freeways. A model is developed and run to simulate the assignment of traffic between the freeway and the guideway links. Both operational concepts of user equilibrium and system optimal conditions are explored, and equations are found to estimate the amount of traffic which can be found on the links based on the total traffic volume.

Acknowledgments

I would like to extend my sincere gratitude to Dr. Donald Drew for serving as my advisor and helping me through both the development of this thesis and my academic career at Virginia Tech. Thanks also goes to Dr. Antonio Trani and Dr. Wei Lin for not only serving as members of my committee, but for providing support and assistance whenever needed. Additional thanks to Dr. Trani for the insight and guidance he has provided me through the past several years.

A very special thanks goes to my parents, Gail and Joseph Siess, and my sister, Kerri, for their unflagging support throughout the many years of academic work at Virginia Tech. None of the accomplishments I have achieved would have been possible without them. All of my achievements belong not just to me, but also to them.

Thank you to my roommates, John Sozio and Ben Hall, who I could always count on providing a distraction or lending an ear when I needed it most. Additional thanks to John for being a great friend through it all from the very beginning.

Thanks to my friend Roger Bodnar, who showed me exactly what the thesis experience was all about before I began mine. Also thanks for the support and interest through it all.

Additional thanks to my close friends Fay Barrett, Cheryl Britton, Erin Moore, Mike Caro, Matt Dovie, Ben Sturtevant, and Kit Schkloven for providing the interest and support needed to complete my thesis and just for being someone I could count on when I needed to.

Thanks to the Via family for providing the endowment which provided the funds for my graduate education. Without your support the last year and a half would not have been possible.

Finally, thanks to all my fellow graduate students in the Transportation Division for providing encouragement and support towards the completion of this thesis and my graduate degree.

Table of Contents

List of Figures