

# **AN ABSTRACT OF A THESIS**

## **APPLICATION OF NONTRADITIONAL INTERCHANGE TREATMENTS TO IMPROVE QUALITY OF SERVICE AND PRESERVE THE SERVICE LIFE OF NARROW OVER- AND UNDERPASS ROADWAYS**

**ASHOK KUMAR MAHENDRAN**

**Master of Science in Civil Engineering**

Handling increasing traffic without causing congestion on the arterials or spillbacks on the freeway is one of the major problems for a traditional diamond interchange with narrow arterial overpass. Often widening the roadway is seen as a solution to solve this problem, but the cost incurred in widening an overpass is high. On the other hand, there are non-traditional interchange treatments which make use of innovative signal phases and geometric design that can effectively handle the increasing traffic without causing spillbacks on the freeway or congestion on the arterials, which are less expensive than traditional widening treatment.

This study focuses on evaluating and comparing the effectiveness of eight traditional and nontraditional interchange treatments using the VISSIM microscopic traffic simulation model. The non-traditional treatments discussed are Texas 3-phase interchange, Texas 4-phase interchange, Tight Urban Diamond Interchange, Tight Urban Diamond Interchange with reversing lanes interchange, Double Roundabout interchange, and Diverging Diamond Interchange. Texas 3-phase and Texas 4-phase treatments controls both the intersection with one controller and signal phases are changed in a sequential order. Tight Urban Interchanges bring both the intersections close together and control as one. Tight Urban Diamond Interchange with reversing lanes brings both the intersections closer and uses the arterial overpass between as reversible lanes. Double roundabout replaces both the intersections by roundabouts. Diverging Diamond interchange crosses arterial traffic on the left side on to avoid the conflicting left turns from and to the ramps and again crosses the traffic back to the right side. These evaluations were done for three congested interchanges in Tennessee with narrow overpass: I-75 at APD 40, Bradley County, I-40 at Genesis Road, Cumberland County, I-40/I-75 at Watt Road, Knox County. Simulations were carried out to evaluate and compare each treatment at different volume levels from 100% of current volume up to its failure or 190% of current volume with 10% increment. The traditional widening treatment is seen as an optimal solution and all other nontraditional treatments are compared to it. The results indicated that these nontraditional treatments could be good alternate treatments that can be implemented at an interchange to mitigate the congestion on the arterials as well as spillbacks on to the freeway caused by excess traffic.