Appendix A
TDM Strategies

Traditional planning and engineering solutions to traffic capacity problems have focused on construction of additional facilities to accommodate the traffic. Facilities could include additional lanes, bridges, improved traffic signals, and new roadways. Over the past twenty years with the continued proliferation of automobiles and the increased frequency of their use for trips to support daily needs of citizens, other less costly means have been investigated to address the traffic congestion issue. In theory, if the average passenger load per vehicle can be increased, the total number of vehicles on the streets and highways can be reduced and yet satisfy the same number of trip destinations for the public.

Over the past twenty years as the increasing wave of traffic congestion has engulfed major metropolitan areas and outstripped the efforts of government to build additional traffic moving facilities, increasing attention has been devoted to developing and refining Transportation Demand Management (TDM) options that promise to increase the efficient use of transportation facilities.

TDM options include a variety of activities that have an indirect effect on the traveling public. Examples of TDM activities include efforts to increase the efficient use of automobile through ridesharing, placing stricter requirements on the use of parking, adopting local ordinances to address the "drive alone" habit of the public, spreading the work day into alternate hours, encouraging work at home or in proximate remote workplace locations, and development of transportation management agencies (TMA's). In the following section each of these options is briefly discussed along with improved transit service, and some of the lessons learned from applying these tools are provided.

Rideshare Programs

Rideshare programs, by their simple definition, are aimed at combining trips in vehicles (carpools and vanpools) in order to reduce the total number of on-street vehicles. This technique is most effectively accomplished when the workplace destinations of large numbers of people coincide. Similarly, when places of employment are combined into a single district, such as the downtown, additional ridesharing opportunities can be created by employees from different places of employment.

Numerous communities have undertaken the enactment of ridesharing programs, often on a voluntary basis working through local government and participating groups such as Chambers of Commerce. In the Triangle region, the major ridesharing program is conducted by the Triangle Transit Authority (TRI-A-RIDE). The focus of these efforts has been both to encourage employers to urge ridesharing among their employees and to establish a clearinghouse where like-minded individuals can learn of the opportunity to share rides. A series of computer-based programs has been developed to assist agencies in managing the database of dispersed places of residence and employment and to assist in combining the names of compatible individuals for potential ridesharing activities.

The rideshare programs, while simple in concept, face numerous problems when addressed as a stand-alone activity. Without changing other conditions, the commuting public is often asked to increase its travel time to and from work, to lose the opportunity to combine the work trip with other trip purposes, and otherwise to add a measure of inconvenience to the daily trip. Recent experience has indicated that, along with the

ridesharing concept, other programs and actions can be taken to provide incentives for adopting the rideshare routine. As discussed in the next option, the provision of free parking by employers is a major disincentive to sharing rides. If parking were made more scarce, more expensive, or unavailable to large numbers of employees, an immediate incentive would be added to the rideshare formula. Strong support by employers of the objectives of the rideshare program, addressing impacts of single occupant vehicles on the community, and assessment of the actual cost to the employer of supporting the drive-along attitude of the public through the provision of free parking, can have very positive impacts on the number of ridesharing employees.

One concern frequently voiced by opponents to rideshare programs is the possibility of being left at the end of the workday or not being able to leave work during the day for an emergency. A guaranteed "ride home" when different or alternate working schedules are experienced by ridesharing employees helps to minimize this valid objection. Similarly, provision of special facilities for high occupancy vehicles (HOVs) can improve the speed of the trip for ridesharing vehicles and, in areas of heavy congestion, help eliminate the time penalty which may otherwise be paid by some rideshare participants.

An effective rideshare program that promotes multiple occupancy in privately owned automobiles, use of vanpools and, in special situations, buspools, has its greatest impact when combined with other TDM strategies. As a stand-alone activity, an effective rideshare program has been estimated to have a direct regional reduction of one percent of work commute vehicle trips in a metropolitan area (over and above existing ridesharing). However, recent studies in the Los Angeles area have indicated reductions of seven percent in a sub-metropolitan area study.

Parking Supply and Price Control Programs

The employer's free parking policy is one of the primary contributors to the single occupancy vehicle (SOV) as the principal means of getting to work. It has been estimated that nationally, 75 to 90 percent of employee commuters are provided a free parking space by their employer. The cost of the parking space provided by the employer is often greater than the cost of the other elements of the trip. Provision of parking, therefore, represents a substantial employer subsidy that underwrites the drive alone decision of the commuting employee.

In addressing the role of employers and decisions made by employees in determining their mode and method of getting to work, some communities have suggested that free parking be treated as a subsidy. Under these circumstances, when employees are charged for use of the parking space or provided positive incentives through subsidies for use of transit or income subsidies to reflect the cost of parking, a reduction of single occupancy vehicle usage has occurred. One study projected a 17 percent decline in the number of cars driven to work by commuters who now receive employer-paid parking if the employer provided a cash income payment to the employee equivalent to the cost of the parking space. Other parking strategies can address the availability of on-street parking; the cost, abundance and supply of off-street parking; stricter enforcement of parking regulations; and the provision of priority parking spaces for multiple occupancy vehicles.

Trip Reduction Ordinances

In recent years, the enactment of commute or trip reduction ordinances has been undertaken by several communities to reduce the use of single occupancy vehicles for work trips. The ordinances typically take one of two approaches, applying controls either to new developments or to all employers above a minimum threshold number of employees. The controls are often based on zoning

enabling legislation, requiring or encouraging employers to achieve certain minimum levels of reductions in vehicles utilized by employees in the work trip. When ordinances apply to land development, developers often incorporate the ordinance requirements in their agreements with tenants occupying the property. Ordinances dealing with employers in some instances single out larger employers for special attention. In enforcing the ordinances, typically, penalties for failure to comply with the trip reduction process are invoked, while penalties are not applied for failure to achieve the ordinance goal. The ordinances' aim is to achieve tangible trips reduction results through the cooperation and participation of employees. The effect of trip reduction ordinances on travel patterns is yet unclear; however, where vigorously pursued and supported by the broad community, these ordinances should represent a very clear expression of public policy and have a positive result on trip reductions.

Alternative Work Schedules

Peak hour trips represent the period of greatest stress on the transportation system. In the US 15-501 corridor, work trips could represent half of all morning peak hour trips and one third of all evening peak hour trips. If a significant portion of work trips can be shifted to a time slot prior to or following the peak period, a significant reduction in peak period vehicles can be experienced.

Three methods have been identified for spreading the commuter work trips through enactment of staggered hours. The methods include assignment of employees: 1) specific arrival and departure times; 2) flex-time where employees have greater latitude in identifying their work day within certain prearranged time limits; and 3) a compressed work week where four extended work days can result in both travel in off peak periods on the four work days, plus elimination of work trips on the third weekend day.

Enactment of alternative work schedules as a public policy involves cooperative participation by employers as well as employees. Alternative work schedules should be undertaken with consideration for employee needs and preferences. In some instances, alternative work schedules may break-up existing rideshare patterns that exist among fellow employees. Assigned to different time frames, members of a carpool may be required to revert to the use of single occupancy vehicles during the non-peak hours.

In other instances, application of flex-time has permitted employees greater latitude in adjusting their work trip schedule resulting in a greater usage of rideshare opportunities. An objective in applying alternative work schedule policies should be not only to reduce the peak travel volume of vehicles but also to avoid actions that would result in greater use of single occupancy vehicles.

A recent study that examined a variety of shifts in working patterns during peak hours determined a substantial impact could occur on peak volumes. For example, by shifting 30 percent of the work trips by one hour during the P.M. peak, a 10 to 12 percent reduction in peak hour traffic could occur. The resulting new peak period of approximately three hours of an approximately equal volume of traffic would represent a spread or flattened peak hour curve.

Alternative Work Arrangement

A variety of alternative work arrangements have been suggested as alternative means of reducing work trips. Telecommuting, satellite work centers, and job sharing are strategies for restructuring employment so as to require no daily work trip to the prime employment location. Telecommuting involves working at a location other than one's normal work site -- usually either in the home or a work site close to the home. Use of satellite work centers provides the opportunity to work in an office environment on an occasional or regular work basis. Researchers have suggested that reductions of commute work trips ranging from one to five percent could be achieved through an extensive telecommuting and

satellite work center program endorsed and supported by employers in the community.

Transportation Management Associations (TMAs)

Transportation management associations typically are cooperative partnerships between business and local government in addressing growing traffic congestion problems. TMAs have been enacted primarily in suburban growth centers to address a variety of transportation issues. TMAs typically seek to encourage rideshare programs, increase the availability of transit, address parking issues, facilitate internal circulation, and seek financing and implementation strategies to achieve their goals. To date, there is little consensus on the total impact of TMAs on reduction of congestion problems; however, the strategies seem to have clearly met a need for focusing public policies on the congestion issue by garnering support of both government and private enterprise.

In addition to implementing and coordinating TDM efforts, a TMA established for the US 15-501 corridor should oversee the implementation of all elements of the Master Plan. This includes refining the limits and provisions of the transportation corridor overlay zone, formulating guidelines for new development in the corridor, participating in identifying the timing, location and nature of future roadway improvements, and coordinating corridor TDM actions with regional initiatives.

Examples of TDM Strategies and Impacts

Strategy	*Applies To*	*Implementing Agency*	*Potential Reduction 15–501 Peak Hour Trips (1)*	*Example Of Strategy Now In Use*
Employee trip reduction ordinance	Employers with over 50 or 100 employees	City, Town	3% to 8%	Bellevue, WA, South Coast Air Quality Management District (LA)
Transit pass discount program (requires certain employers to provide discounted passes to employees)	Employers with over 50 or 100 employees who provide free or subsidized parking	City, Town State	0.5% to 5%	Bellevue, WA, City of Los Angeles
Telecommuting program	Voluntary program encouraging employers to use telecommuting	City, Town State	Less than 1%	Southern California Association of Governments
Changed work hours	Employers with over 50 or 100 employees	City, Town	10% (does not eliminate trips, but moves them to another time)	Bellevue, WA, Pleasanton and other California cities
Developer trip reduction ordinance	Developments over a certain size (e.g., contributing more than 1% of the ADT to a facility	City, Town	Depends on size of each development – could reduce development trips by 10 % or more	City of Los Angeles, City of Sacramento

1. Trip reductions for individual employers or sites participating in program is higher. Numbers in table reflect range of locations, size of employers, effectiveness of individual programs, etc., inside and outside study area.

Appendix B

Projected 2010 Lane Configurations for Erwin Road and Old Durham-Chapel Hill Road Intersections

Erwin Road at Sage Road

Erwin Road EB	1 Left, 1 Shared Thru & Right
Erwin Road WB	2 Lefts, 1 Shared Thru & Right
Sage Road SB	1 Left, 2 Thru, 1 Shared Thru & Right
Sage Road NB	1 Left, 3 Thru, 1 Right

Erwin Road at Mt. Moriah Rd.

Erwin Road EB	1 Left, 1 Shared Thru & Right
Erwin Road WB	1 Left, 1 Shared Thru & Right
Mt. Moriah Rd SB	1 Left, 1 Shared Thru & Right
Mt. Moriah Rd NB	1 Left, 1 Shared Thru & Right

Old Durham-Chapel Hill Rd. at Lakeview Dr.

OD-CH Rd EB	1 Left, 2 Thru, 1 Right
OD-CH Rd WB	1 Left, 2 Thru, 1 Right
Lakeview Dr SB	1 Shared Left & Thru, 1 Right
Lakeview DR NB	1 Left, 1 Shared Thru & Right

Old Durham-Chapel Hill Rd. at Pope Rd.

OD-CH Rd EB	1 Thru, 1 Shared Thru & Right
OD-CH Rd WB	1 Left, 2 Thru
Pope Rd NB	1 Left, 1 Right

Old Durham-Chapel Hill Rd. at Watkins Rd.

OD-CH Rd EB	1 Shared Left & Thru, 1 Thru, 1 Right
OD-CH Rd WB	1 Left, 2 Thru, 1 Right
Watkins Rd SB	1 Left, 1 Shared Thru & Right
Watkins Rd NB	1 Left, 1 Thru, 1 Right

Old Durham-Chapel Hill Rd. at Garrett Rd.

OD-CH Rd EB	2 Lefts, 2 Thru, 1 Right
OD-CH Rd WB	1 Left, 1 Thru, 1 Shared Thru & Right
Garrett Rd SB	1 Left, 1 Thru, 1 Right
Garrett Rd NB	1 Left, 1 Thru, 1 Right

Old Durham-Chapel Hill Rd. at University Dr.

OD-CH Rd EB	1 Thru, 1 Right
OD-CH Rd WB	1 Left, 1 Right
University Dr SB	1 Left, 1 Thru

Note: OD-CH Rd WB is aligned as the minor "T" roadway.

Appendix C
Preliminary Cost Estimates

WIDEN TO 6 LANES

PREPARED BY: R.A.GARRIS DATE : 7-21-93
REQUESTED BY: H.CRITCHER DATE : 7-16-93

LINE/DES/SEC	ITEM DESCRIPTION	QUANTITY	UNIT BID	AMOUNT
1 SP	SEGMENT #1 (MAINLINE RDWAY)	LUMP SUM	L.S.	1,500,000.00
2 SP	SEGMENT #2 (MAINLINE RDWAY)	LUMP SUM	L.S.	1,000,000.00
3 SP	SEGMENT #3 (MAINLINE RDWAY)	LUMP SUM	L.S.	700,000.00
4 SP	SEGMENT #4 (MAINLINE RDWAY)	LUMP SUM	L.S.	700,000.00
5 SP	SEGMENT #5 (MAINLINE RDWAY)	LUMP SUM	L.S.	675,000.00
6 SP	SEGMENT #6 (MAINLINE RDWAY)	LUMP SUM	L.S.	1,250,000.00
7 SP	SEGMENT #7 (MAINLINE RDWAY)	LUMP SUM	L.S.	1,350,000.00
8 SP	SEGMENT #8 (MAINLINE RDWAY)	LUMP SUM	L.S.	1,000,000.00
9 SP	SEGMENT #9 (MAINLINE RDWAY)	LUMP SUM	L.S.	1,300,000.00
10 SP	FRONTAGE RD. #1	LUMP SUM	L.S.	135,000.00
11 SP	FRONTAGE RD. #2	LUMP SUM	L.S.	400,000.00
12 SP	SLIP-LANE #1	LUMP SUM	L.S.	65,000.00
13 SP	ERWIN RD. (RDWAY. & STR.)	LUMP SUM	L.S.	2,100,000.00
14 SP	ACCESS RD. #1	LUMP SUM	L.S.	100,000.00
15 SP	ACCESS RD. #2	LUMP SUM	L.S.	105,000.00

LINE/DES/SEC	ITEM DESCRIPTION	QUANTITY	UNIT BID	AMOUNT
16 SP	FRONTAGE RD. #3	LUMP SUM	L.S.	400,000.00
17 SP	SAGE RD. (RDWAY. & STR.)	LUMP SUM	L.S.	2,150,000.00
18 SP	RAMP A @ SAGE RD. (Roadway & Str.)	LUMP SUM	L.S.	565,000.00
19 SP	RAMP A'@ SAGE RD.	LUMP SUM	L.S.	145,000.00
20 SP	RAMP B @ SAGE RD.	LUMP SUM	L.S.	200,000.00
21 SP	RAMP C @ SAGE RD.	LUMP SUM	L.S.	280,000.00
22 SP	RAMP D @ SAGE RD.	LUMP SUM	L.S.	170,000.00
23 SP	RAMP D'@ SAGE RD. (Loop)	LUMP SUM	L.S.	320,000.00
24 SP	FRONTAGE RD. #4	LUMP SUM	L.S.	340,000.00
25 SP	FRONTAGE RD. #5	LUMP SUM	L.S.	120,000.00
26 SP	EASTOWNE WEST (RDWAY.)	LUMP SUM	L.S.	800,000.00
27 SP	ACCESS RD. #3	LUMP SUM	L.S.	50,000.00
28 SP	FRONTAGE RD. #6	LUMP SUM	L.S.	245,000.00
29 SP	FRONTAGE RD. #7	LUMP SUM	L.S.	245,000.00
30 SP	EASTOWNE EAST (RDWAY.)	LUMP SUM	L.S.	950,000.00
31 SP	RAMP B @ EASTOWNE EAST	LUMP SUM	L.S.	140,000.00
32 SP	RAMP B'@ EASTOWNE EAST	LUMP SUM	L.S.	110,000.00
33 SP	RAMP C @ EASTOWNE EAST	LUMP SUM	L.S.	125,000.00

LINE/DES/SEC	ITEM DESCRIPTION	QUANTITY	UNIT BID	AMOUNT
34 SP	RAMP C'@ EASTOWNE EAST	LUMP SUM	L.S.	125,000.00
35 SP	C-D NORTH (UP TO I-40)	LUMP SUM	L.S.	550,000.00
36 SP	C-D SOUTH (UP TO I-40)	LUMP SUM	L.S.	625,000.00
37 SP	CIRCULATOR N1 (RDWAY. & STR)	LUMP SUM	L.S.	2,550,000.00
38 SP	CIRCULATOR S1 (RDWAY. & STR)	LUMP SUM	L.S.	1,950,000.00
39 SP	C-D NORTH (AFTER I-40)	LUMP SUM	L.S.	1,150,000.00
40 SP	C-D SOUTH (AFTER I-40)	LUMP SUM	L.S.	1,050,000.00
41 SP	RAMPS (A-B-C-D) ($58,750 each)	LUMP SUM	L.S.	235,000.00
42 SP	MT. MORIAH RD. (RDWAY.)	LUMP SUM	L.S.	1,500,000.00
43 SP	RAMP A @ MT.MORIAH RD.	LUMP SUM	L.S.	310,000.00
44 SP	RAMP A'@ MT.MORIAH RD.	LUMP SUM	L.S.	300,000.00
45 SP	RAMP D @ MT.MORIAH RD.	LUMP SUM	L.S.	205,000.00
46 SP	RAMP D'@ MT.MORIAH RD.	LUMP SUM	L.S.	190,000.00
47 SP	GARRETT RD. (RDWAY.)	LUMP SUM	L.S.	700,000.00
48 SP	RAMP A @ GARRETT RD.	LUMP SUM	L.S.	380,000.00
49 SP	RAMP B @ GARRETT RD.	LUMP SUM	L.S.	345,000.00
50 SP	RAMP C @ GARRETT RD.	LUMP SUM	L.S.	310,000.00
51 SP	RAMP D @ GARRETT RD.	LUMP SUM	L.S.	415,000.00

LINE/DES/SEC	ITEM DESCRIPTION	QUANTITY	UNIT BID	AMOUNT
52 SP	RAMP E FLYOVER (RDWAY & STR)	LUMP SUM	L.S.	740,000.00
53 SP	FRONTAGE RD. #8	LUMP SUM	L.S.	270,000.00
54 SP	FRONTAGE RD. #9	LUMP SUM	L.S.	450,000.00
55 SP	TRAFFIC SIGNALS	22 EA	52,000.00	1,144,000.00
56 SP	SIGNING @ FRANK/US-15-501	LUMP SUM	L.S.	30,000.00
57 SP	SIGNING FOR SAGE RD.	LUMP SUM	L.S.	80,000.00
58 SP	SIGNING FOR EASTOWNE EAST	LUMP SUM	L.S.	150,000.00
59 SP	SIGNING FOR I-40	LUMP SUM	L.S.	120,000.00
60 SP	SIGNING FOR MT.MORIAH RD.	LUMP SUM	L.S.	150,000.00
61 SP	SIGNING FOR GARRETT RD.	LUMP SUM	L.S.	120,000.00
62 SP	STR. #1-FLYOVER 1@40'X 140'	5,600 SF	69.00	386,400.00
63 SP	STR.#5 @ EASTOWNE WEST,2@52'X 160'	16,640 SF	69.00	1,148,160.00
64 SP	STR.#6 @ EASTOWNE EAST,1@106'X 160'	16,960 SF	69.00	1,170,240.00
65 SP	STR.#6 @ EASTOWNE EAST,1@130'X 160'	20,800 SF	69.00	1,435,200.00
66 SP	STR.#7 ON CD NORTH,1@60'X 210'(FLARED)	15,900 SF	69.00	1,097,100.00
67 SP	STR.#8 ON CD SOUTH,1@60'X 210'(FLARED)	15,900 SF	69.00	1,097,100.00
68 SP	STR.#9,US15-501 OVER I-40,118'X 700'	82,600 SF	69.00	5,699,400.00

LINE/DES/SEC		ITEM DESCRIPTION	QUANTITY	UNIT BID	AMOUNT
69	SP	STR.#12,US15-501 OVER MT.MORIAH RD. 2@40'X 160'	12,800 SF	69.00	883,200.00
70	SP	STR.#12,CD NORTH & CD SOUTH @ MT.MORIAH 2@48'X 160'	15,360 SF	69.00	1,059,840.00
71	SP	STR.#13,US15-501 OVER NEW HOPE CK. 2@72'X 150'	21,600 SF	69.00	1,490,400.00
72	SP	STR.#14,US15-501 OVER GARRETT RD. 2@52'X 430'	44,720 SF	69.00	3,085,680.00
73	SP	4@10'X 10' RCBC @ SANDY CK.	LUMP SUM	L.S.	431,000.00
74	SP	REINF.CONC. EARTH WALLS @ I-40	44,000 SF	67.00	2,948,000.00
75	SP	REINF.CONC. EARTH WALLS @ GARRETT RD.	47,000 SF	67.00	3,149,000.00

LENGTH ALONG PROJ = 4.000 MILES CONSTRUCTION COST.....$60,959,720.00

SAY.....$61,000,000.00

*NOTE : EACH LINE ITEM INCLUDES 30% FOR MOBILIZATION & MISCELLANEOUS, AND 15% FOR ENGINEERING & CONTINGENCIES.

• Cross road cost includes bridge cost, & the Y line goes over. other bridges are separate.

REQUEST FOR R/W COST ESTIMATE

DATE: 08-03-93

	ALT. OR SECT.	ALT. OR SECT.	ALT. OR SECT.	ALT. OR SECT.
T.I.P. NO.: N/A				
COUNTY: ORANGE				
PROJECT NO.: N/A				
ENGINEER: N/A				
ESTIMATED NO. OF PARCELS:	112			
RESIDENTIAL RELOCATION:	15/ 180000	/	/	/
BUSINESS RELOCATION:	27/ 405000	/	/	/
LAND AND DAMAGE:	19750000			
UTILITIES:	225000			
ACQUISITION:	1200000			
TOTAL ESTIMATED R/W COST:	21760000			

PROJECT DESCRIPTION AND SPECIAL INSTRUCTIONS:

US 15/501 FROM CHAPEL HILL TO DURHAM.

TYPE OF PLANS FURNISHED FOR ESTIMATE: PRELIMINARY***RETURN TO S STANLEY***

PRIOR ESTIMATES OF LAND AND DAMAGES (WITH DATES):

IF INCREASES OR DECREASES ARE SIGNIFICANT, PLEASE EXPLAIN:

AMOUNT THAT HAS BEEN ADDED TO LAND AND DAMAGE TO COVER CONDEMNATION AND ADMINISTRATIVE INCREASES: $_____ AND OR: 25 %

ESTIMATED BY: P. HUMPHRIES (DATE) 08-31-93

NOTE: THIS ESTIMATE WAS NOT BASED UPON FINAL RIGHT OF WAY PLANS NOR FINAL DESIGN DATA. THEREFORE, ITS ACCURACY IS SUBJECT TO WHATEVER PLANS AND/OR DESIGN DATA PROVIDED BY REQUESTING PARTY.

Appendix D

Transit Construct City Diagram