

TRAVEL DEMAND FORECASTING

Long-range transportation planning is dependent on the ability to predict future trip-making. In general, the forecasting procedure follows an examination of trends in travel behavior. The forecasted travel demand is contrasted with future conditions of the transportation system. General transportation needs can be determined.

The basic premise of travel demand forecasting is that there is order in travel behavior. Trip-making can be estimated by the examination of forecasts of land use, economic activity, and population. Home-based work trips, for example, are highly predictable with the knowledge of the location and magnitude of dwelling units and employment.

Once trips are estimated or generated for assigned areas, they can be distributed among all analysis areas within the total study area. A trip table can be produced which depicts the expected number of trips between each analysis area or zone. The trips can then be assigned to specific roadways between any two analysis areas. Additional refinements to this process are possible, including identifying trips by purpose (commuting, shopping, etc.) or by mode (automobile, transit, etc.). Travel demand forecasting generally follows this process.

Travel forecasting for the Washington region is conducted by the Metropolitan Washington Council of Governments (COG) in cooperation with state and local governments utilizing various computer programs. Land use inputs to the programs are supplied by the respective local jurisdictions. Traffic forecasts for Fairfax County may be extracted from the regionwide analyses.

Land Use Trends

As previously mentioned, trip-making can be predicted by examining forecasts of land use. The type of land use will determine the type and volume of trips originating from and destined for a designated area. Residential land activity will generate trips for purposes such as school trips, social trips, and commuting. Office land activity will predominately attract work trips. The principle that land use determines trips has been corroborated by previous analyses of travel demand, wherein travel demand changes were identified with changes in land use activities. A more detailed discussion of this relationship is given in subsequent paragraphs.

A comparison has been made of existing, committed, and planned residential development in order to determine the likelihood and urgency of realizing the projections of future travel. This comparison is presented below.

Table 1
DWELLING UNIT INVENTORY
FAIRFAX COUNTY
(January, 1981)

Ring	Single Family	Townhouse	Apartments	Other ¹	Total
1 (Inside Beltway)	33,574	4,668	26,166	512	64,920
2 (Outside Beltway Inside Route 123/ Towiston Rd.)	65,212	15,706	22,530	5,691	109,139
3 (Outside Route 123/ Towiston Rd.)	27,840	7,945	8,121	2,121	46,027
County Total	126,626	28,319	56,817	8,324	220,086

¹Other includes Duplex units, multiplex units and mobile homes.

Source: *Standard Reports - January, 1981*, Fairfax County Office of Research and Statistics (ORS)

Table 2
EXISTING AND ANTICIPATED DWELLING UNITS
FAIRFAX COUNTY
(January, 1981)

	Additional Dwelling Units Existing Dwelling Units (Jan. 1981)	Percentage Residential Construction Activity (Jan. 1981)	Percentage of Total Residential Construction Activity	Increase Over Existing Development
1 (Inside Beltway)	64,920	5,138	8.7%	7.9%
2 (Outside Beltway, Inside Rte. 123/Towiston Rd.)	109,139	21,875	37.2%	20.0%
3 (Outside Rte. 123/ Towiston Rd.)	220,086	58,791	100.0%	28.7%

Note: Residential construction activity is defined as having approved zoning or in subsequent stages of development.

Source: *Standard Reports - January 1981*, Fairfax County ORS

Existing Housing. According to the *Standard Reports - 1981* prepared by the Fairfax County Office of Research and Statistics, as of January 1981, there were 220,086 dwelling units in Fairfax County. Single-family units accounted for the majority of the housing units (57.5 percent) followed by apartments (25.8 percent), and townhouses (12.9 percent).¹ Duplex, multiplex units and mobile home pads accounted for the remaining 3.8 percent. An inventory of the dwelling units in the County is presented in Table 1.

Approximately 30 percent of all existing dwelling units are located within the Capital Beltway. Nearly one-half of all existing dwelling units are located between Route 123/Towiston Road and the Capital Beltway. In general, higher densities are found in the inner portions of the County. Inside the Beltway, for example, there are higher percentages of garden apartments and high-rise apartments. The western and southern portions of the County have higher percentages of single-family and townhouse units.

Anticipated Development. The amount of development anticipated in the near future can also be identified through the examination of data compiled by the Fairfax County Office of Research and Statistics. The number of dwelling units actually in the development process—from the rezoning of land through site plan review, issuance of building permits, and construction—provides an accurate measure of the amount and distribution of committed development. The following data were extracted from the *Standard*

Reports - 1981 compiled by ORS. This information has significant implications for future transportation planning in Fairfax County.

Table 2 presents a comparison of existing and committed dwelling units in the County as of January, 1981. Examination of this table leads to several important findings. Countywide, nearly a 27 percent increase in dwelling units will be experienced. Ninety percent of this activity will occur outside the Beltway. Almost one-half of the development will take place in the western portion of the County, west of Route 123 and Towiston Road.

Planned Housing. Previous travel forecasts in the County have been developed using the adopted Plan land use projections as base data. These land use projections have been forwarded to COG and have become adopted for regional planning in conjunction with a process known as Cooperative Forecasting. This process is a continuing one with the forecasts adjusted periodically to reflect changing conditions.

The Round II Cooperative Forecasts for housing in Fairfax County are shown in Table 3, along with the number of existing, and existing plus committed, housing units. However, some caution should be exercised in making direct comparisons of committed and planned units for the following reasons:

1. The identification of committed development encompasses the entire land development process; from the rezoning of land through site plan review, issuance of building permits, construction of the units, and completion of construction. With the inclusion of rezoning in this "pipeline", the realization of the development activity may be several years away; possibly close to 1990.

2. The forecasting of the future residential base is dependent on several factors which can be quite variable and difficult to predict in themselves. Factors relating to the market such as absorption rates, regional growth rates and even general economic trends present difficulties in the prediction of residential development activity.

3. Finally, the issues presented by residential development activity approaching 1990 forecasts does not address the subsequent build-out of the Plan. With this higher level of development, concerns with regard to 1990 forecasts may be minor. The future impacts of transportation at build-out are not addressed in the Transportation Plan.

Table 3
COMPARISON OF EXISTING, EXISTING PLUS COMMITTED,
AND PLANNED 1990 HOUSING UNITS
IN FAIRFAX COUNTY

	Existing Plus Existing ¹	Committed ²	Planned 1990 ³
Inside Beltway	64,920	70,058	67,138
Outside Beltway Inside Rte. 123/Towlston Rd.	109,139	131,014	125,188
Outside Rte. 123/Towlston Rd.	46,027	77,805	72,820
Fairfax County Totals	220,086	278,877	265,146

¹Based on Fairfax County ORS, *Standard Reports - January 1981*
²Committed units defined as having approved zoning, or in subsequent stages of development. Data based on *Standard Reports - January 1981, Fairfax County ORS.*
³Based on Round II, COG Cooperative Forecast

Nevertheless, the development activity which has occurred since the Plan was adopted has been individually consistent with the Plan, and the overall magnitude of committed development appears to be generally consistent with previous Plan forecasts. Examination of the data in Table 3 leads to several important findings regarding the location, magnitude, and timing of development in the County. Each of these elements has significant transportation implications.

With regard to the location of residential development, most of this growth is occurring beyond the Beltway. The Plan forecasts over 95 percent of such new development to take place beyond the Beltway. In fact, over 90 percent of the committed* development is occurring in such areas. With the continuing presence of the regional core as the major employment destination, the continuation of residential development beyond the Beltway will add to existing radial traffic volumes. Furthermore, vehicle-miles of travel will increase with increasing distances between residences and workplace.

The magnitude of this committed and planned growth also has transportation implications. The Plan forecasts represent a 21 percent increase in the number of housing units Countywide, and a 28 percent increase in units beyond the Beltway. Committed development represents a 27 percent increase in units countywide, and also a 35 percent increase beyond the Beltway. With travel behavior closely related to housing activity, it is evident that corresponding increases in travel demand will result from this residential growth.

Finally, the timing of this development is also significant. Recognizing the previously described difficulties associated with preparing land use forecasts, the projections included in the Plan certainly do not appear unrealistic. With over 90 percent of the forecast 1990 residential growth already committed, these forecasts would appear to be conservative at best. For transportation planning purposes, the travel forecasts derived from these projections assume greater importance in view of their likely realization in the relatively near future.

Travel Characteristics

Existing Travel Demand. In order to evaluate and examine the trends in travel behavior within the County, 1972 was selected as a base year for the analysis of existing traffic due to the availability of data for this year. A simulation of 1972 (base) traffic was performed as an initial step in the TRIMS process. The travel demand was generated by existing (1972) land uses on the existing (1972) transportation network.

With the simulation, various existing travel characteristics were identified as described in the following paragraphs.

1. Trip Distribution: According to the simulation of 1972 base conditions, work trips are distributed in a radial pattern to the core of the metro-

politan area. Fifty percent of all person work trips originating in Fairfax County travel into Arlington, Alexandria or across the Potomac River into Washington, D.C. Nearly 30 percent are destined for Washington, D.C., alone.

2. Mode Split: Mode split is the percentage of total trips which use a given mode for a given purpose, but it normally refers to the percentage of total work trips which occur via transit. Under 1972 base conditions, 20 percent of the work trips from Fairfax County to Washington D.C. are made via transit. This compares to 11 percent transit use to areas within the Beltway and 14 percent transit use for trips crossing into Arlington and Alexandria.

3. Highway Capacity and Level of Service: The simulation of 1972 travel indicated that the highway system is very heavily loaded at the Beltway and in the inner areas of the region. The Potomac River bridges are overloaded, and the roadways at the Beltway are operating at capacity. In terms of level of service, which is used to describe traffic conditions, it is estimated that the roadway system operates at level F at the Potomac River and level E at the County line and at the Beltway. The level of service of the system improves with increased distance to the center of the region.

Summary of Previous Forecasts. Since 1975, several travel demand forecasts have been developed and utilized for the metropolitan region and Fairfax County. The following paragraphs summarize these forecasts.

1. TRIMS (1975): In conjunction with the initial work during the development of the current County Plan, the TRIMS model was utilized in simulating future travel in the County based upon future land use estimates generated by the four area plans. The Countywide Transportation Plan was developed to reflect regional and subregional travel based on the testing of several alternative networks. A range of transportation networks from transit intensive networks with no highway improvements to a combination of both transit and highway improvements was tested.

2. Testing of Transportation Plan Alternatives (1976): In 1976 COG presented major findings resulting from the analysis of several transportation plan alternatives, all based upon the same fixed land use. The transportation plan alternatives which were tested were considered as alternative levels of investment in a transportation system. The alternatives varied from a base network (including the adopted Metrorail system, commuter rail and bus service, and the highway system consisting of existing roads or those under construction) to a network including the adopted Transportation Planning Board (TPB) Plan and all proposed Metrorail extensions.

3. Impact Assessment: 1980, 1985, 1995—Transportation Implications of Growth Forecasts (1977): A transportation impact analysis of revised land use forecasts for the urbanized region was conducted by COG in 1977. The analysis was not

intended to produce detailed design forecasts for individual highway or transit facilities, but rather to show generalized changes in transportation demand and services based on new growth forecasts. A calculation of future travel was made for 1980, 1985, and 1995, given the growth forecasts for households and employment.

4. Metro Alternatives Analysis (1977-1978): In response to a federal request that the Washington metropolitan region undertake an alternatives analysis of certain unbuild segments of the Metrorail system, the Metro Alternatives Analysis (MAA) was conducted by a Joint Policy Steering Committee (JPSC) during an 18 month period in 1977-1978. The JPSC was composed of representatives from the following regional bodies: The Board of Directors of the Metropolitan Washington Council of Governments (COG), the Board of Directors of the Washington Metropolitan Area Transit Authority (WMATA), and the Transportation Planning Board (TPB) of COG. In general, a total of six alternatives were considered for each of four Metrorail corridors ranging from full Metrorail systems to systems in which no additional Metrorail service was provided. Patronage forecasts used in the study were based upon operating assumptions provided by WMATA and on cooperative forecasts of future (1990) population and employment developed by COG and as supplied by respective local governments. Within the scope of this study, travel-demand forecasts for the region and local jurisdictions were developed.

Major Findings and Conclusions. In general, the conclusions resulting from the original travel-demand forecasts as utilized for Plan recommendations have been supported by the subsequent forecasts and analyses as discussed heretofore. It may be noted that the four completed studies utilized two different sets of land use projections. The TRIMS and Transportation Plan Alternatives studies were based on previous regional land use forecasts known as "Alternative 6.2 modified". The latter two studies—namely Impact Assessment and the Metro Alternatives Analysis—were based on the more recent Cooperative Forecast (Round 1) land use projections. While the general findings of the four studies are consistent, some of the variations in the results may be attributed to these land use variations. This issue is further discussed at the conclusion of this section. The following discussion summarizes the major conclusions with the subsequent work, and identifies the implications of future traffic in the County.

1. Travel Needs Determined by Development Patterns: The magnitude and distribution of travel demand is not significantly affected by changes in the transportation network. Rather, land use activity dictates the travel demand. This conclusion from the initial County forecasts has been substantiated by further analyses as documented in the "Testing of Transportation Plan Alternatives" (May 1976) and in another COG study entitled "Transportation Impacts of Alternative Land Use Concepts" dated December 1975. This study concluded that regional transportation indicators vary significantly when land use patterns are changed. The indicator which was most sensitive to land use changes was the distribution of travel demand.

2. Total Magnitude of Travel Will Increase: Continued growth both in Fairfax County and the region as a whole will result in significant increases in travel. This finding is a direct consequence of the relationship of land use patterns and travel demand described previously. With the number of households in the County expected to increase by over 27 percent over 1981 levels as a result of approved rezonings, corresponding increases in travel needs may be expected. Table 4 displays the increases in work trips for Fairfax County projected by the various recent studies. The following significant conclusions may be derived from this data:

- The total number of work trips generated by Fairfax County will approximately double the estimated 1972 levels.
- The number of Fairfax County work trips destined in the radial direction, that is, to Washington, Arlington, and Alexandria, will increase by between 50%-90%, again in comparison with estimated 1972 amounts.
- The number of Fairfax County work trips destined within Fairfax County will more than double.

3. Commuting to Inner Areas Will Continue as a Dominant Travel Pattern for Work: At present work trips from Fairfax County are distributed predominantly in a radial pattern to the core of the metropolitan area. This radial attraction to the core will continue into the 1990's. Between 25 and 30 percent of the work trips from the County are now destined for Washington, D.C. This percentage will drop only slightly into the 1990's. Work traffic crossing into Arlington and Alexandria (and into Washington, D.C.) currently represents 50 percent of all work trips from the County. This percentage will drop to about 40 percent by 1990-1995. These distributions have been substantiated in each of the aforementioned analyses as shown by Table 5.

4. Intra-County Travel for Work Will Significantly Increase: As the County's share of the metropolitan Washington area's office space increases, work trips generated from within the County and destined for locations within the County will increase. By 1990-1995 it is expected that half of all work trips originating in the County will be intra-County work trips. This compares to 40 percent for the base year (1972). In addition, this increase in intra-County travel to work is expected to be represented by a doubling of vehicle work trips in 1990-1995. Tables 5 and 7 indicate these future travel patterns.

5. Transit Use Will Increase for Radial Travel: The mode split (percent of work trips made by transit) of traffic from the County to Washington, D.C. will double by 1990-1995. Current mode splits for travel to the District range between 15 and 20 percent. It is projected that this mode split will increase to approximately 40 percent by 1990-1995. A similar doubling of the mode split for travel from the County into Arlington and Alexandria and into the District is also predicted. These percentages are depicted on Table 6 for the four studies discussed herein.

6. Auto Use Will Increase: Even with the increase in transit use, work trips by automobile to Washington, Arlington and Alexandria will also increase. As shown by Table 7, this increase is forecast to be between 10 percent and 20 percent over existing levels. Automobile usage will progressively increase as the distance from the core increases. Therefore, in addition to the increases to Arlington, Alexandria and Washington D.C., more significant intra-County-traffic increases of between 100 and 200 percent are expected. In addition to the need for suitable radial roadway capacity, cross-County and other non-radial highway facilities will be necessary to accommodate these increases.

Transportation Implications of Development Activity. The analysis of the housing development activity has underscored several concerns with regard to future transportation planning and travel demand. The review has indicated that the 1990 household forecasts will be realized in many areas of the County with the development of property at current zoning categories. There are two extremely critical implications of this finding:

1. Travel Demand—Travel demand and trip-making characteristics are directly related to the magnitude and distribution of development. As the 1990 development projections are realized, and there is little doubt that in large measure they will be, so will the corresponding travel forecasts. Viewed in such a manner, these travel forecasts

**Table 4
PROJECTED INCREASE IN TRAVEL
(WORK TRIPS ONLY)**

Study: Year Published: Time Period:	TRIMS 1975 1972-90	Transportation Plan Alternatives 1976 1968-92	Impact Assessment 1977 1972-95	Metro Alternatives 1978 1972-90 ¹
Total Person Work Trips Fairfax County (% Increase)	89%	145%	95%	99%
Total Person Work Trips from Fairfax County to D.C./Arl/Alex. (% Increase)	87%	85%	54%	43%
Total Person Work Trips within Fairfax County (% Increase)	78%	214%	134%	140%

¹Note: Metro Alternatives Analysis percent increase calculated over TRIMS base data for 1972

**Table 5
PROJECTED INCREASE IN TRAVEL
(WORK TRIPS ONLY)**

Study: Year Published: Time Period: Existing ¹	TRIMS 1975 1972-90	Transportation Plan Alternatives 1976 1968-92	Impact Assessment 1977 1972-95	Metro Alternatives 1978 1990
% of Work Trips Destined to D.C.	29%	31%	26%	17%
% of Work Trips Destined to Arl/Alex.	50%	49%	43%	36%
% of Work Trips Destined Within Fairfax County	40%	38%	47%	48%

¹Note: Existing based on TRIMS data for 1972

**Table 6
PROJECTED INCREASE IN TRAVEL
(WORK TRIPS ONLY)**

Study: Year Published: Time Period: Existing ¹	TRIMS 1975 1972-90	Transportation Plan Alternatives 1976 1968-92	Impact Assessment 1977 1972-95	Metro Alternatives 1978 1990
% Transit Use to D.C.	20%	50%	38%	35%
% Transit Use to D.C./Arl/Alex.	14%	42%	33%	29%

¹Note: Existing based on TRIMS data for 1972

**Table 7
PROJECTED INCREASE IN TRAVEL
(WORK TRIPS ONLY)**

Study: Year Published: Time Period:	TRIMS 1975 1972-90	Transportation Plan Alternatives 1976 1968-92	Impact Assessment 1977 1972-95	Metro Alternatives 1978 1972-90 ¹
Auto Driver Work Trips to D.C./Arl/Alex. (% increase)	22%	N/A	13%	8%
Auto Driver Work Trips within Fairfax County (% increase)	62%	N/A	113%	114%

¹Note: Metro Alternatives Analysis percent increase calculated over TRIMS base data for 1972

must assume greater significance than may have previously been attributed to them.

2. Right-of-Way Availability—In addition, a second major implication of this growth in households is the amount of land which has been or is committed for development. Obviously this property is no longer available for transportation purposes. In the past it has been possible to simply shift the alignment of planned transportation facilities away from development in the County. With the magnitude of committed development, however, opportunities for continuing this practice are fast disappearing if not already eliminated. Under such circumstances, it becomes extremely important for the County to recognize and take every action to protect needed rights-of-way in support of transportation facilities.

Subsequent Analyses. It has been noted that the land use projections which form the basis for travel forecasts have been modified. These modifications have resulted in modest changes in the forecasts of travel, although the major conclusions remain fairly constant. As continued refinements in the land use forecasts are made, their transportation implications will be tested. These subsequent analyses will be incorporated in future updates of the Plan as appropriate.