

RESTON TRANSPORTATION STUDY



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I. INTRODUCTION

The name "Reston" has become synonymous with new town development and is one of the first places thought of whenever information is sought on what life will be like in planned new cities created in places where only virgin land previously existed. Reston, one of the pioneer efforts in new town development in the United States, justifies inspection for even though only about 9,000 people now live there, the town has gained a reputation for being a place where things happen.

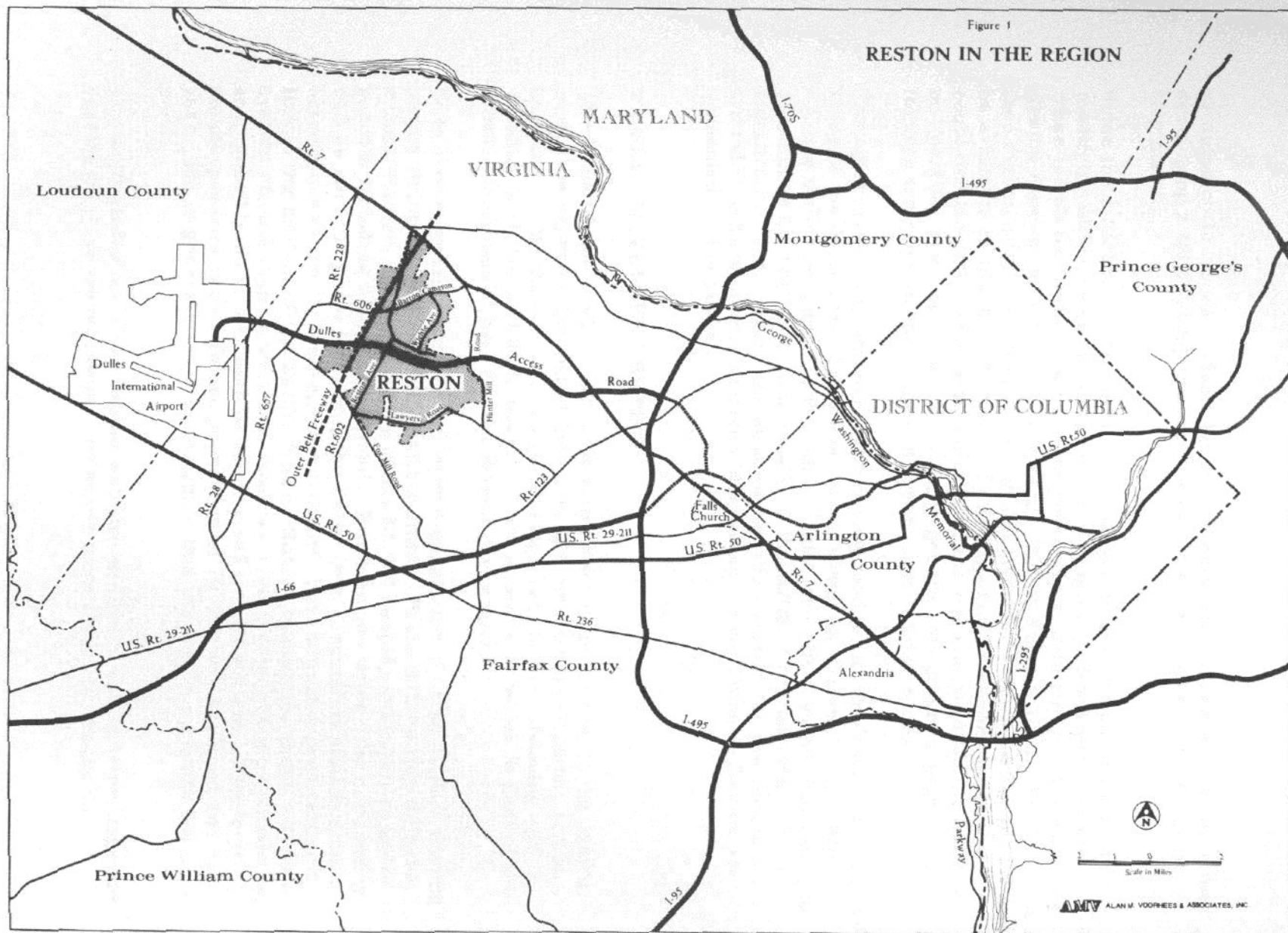
The guiding principle of Reston's developers, (currently Gulf-Reston, Inc.), has been to provide people with a choice of living conditions in a setting which respects the natural features of the terrain. Thus, a prospective Reston resident has a choice of housing types from single family to high-rise apartment, a choice of setting from quiet cul-de-sac to outlooks on the centers of activity, a choice between a vehicle trip and a walk trip to obtain life's necessities or enjoy its pleasures, and a choice of employment either in the same community or anywhere within the Metropolitan Washington Region -- of which Reston is a part (Figure 1). These items and many more are the important elements which make Reston what it is today, and are the things that must be preserved as the transportation plan is re-evaluated in this current study.

OBJECTIVE AND SCOPE OF STUDY

A walkway system for pedestrians and cyclists, in addition to a road system has been part of the planning for Reston since its inception. However, the community lacks a public transportation system for those who need or prefer to use this mode of travel. With this under consideration, and with a desire to evaluate the requirements of new towns for transit, the officials of Reston, Fairfax County and the Urban Mass Transportation Administration joined together to institute this study.

Particular emphasis was to be placed on the use of transit to integrate land use and transportation planning in a way that would improve the quality of life in the new town. More succinctly, the objective of the study was to develop a transportation system for Reston which allows for a choice by the trip maker between driving an automobile, walking or cycling, and riding a public transit system designed to serve internal transportation needs.

In scope, the study was to consider the whole universe of person trips by all modes and all age groups. Estimates were to be made of the trips that could be made on a transit system versus those that would use walk, cycle



or automobile modes. These estimates were then to serve as a basis for developing a total transportation system to serve the desired levels of trip making.

Since the initiation of the study, two changes in current plans have had a modifying influence on the scope of work originally developed. One of these is related to the Town Center presently scheduled for the area along Reston Avenue immediately north of the Dulles Access Road. In preparing the original scope of work, it was anticipated that a Town Center plan would be available to which certain specific transportation recommendations could be directed. The town center plan has been delayed and, therefore, no specifics are available. Thus, only general design principles are set forth in the recommendations and appendices of this report.

The other modifying influence is Congressional action to conduct a \$150,000 study of the feasibility of express transit along the Dulles Access Road to service Dulles Airport. In the light of this, any effort within this study to detail possible transportation modes in the Dulles Corridor would be insignificant. Therefore, only anticipated trip volumes for the Dulles Corridor and comments on possible express transit stops in Reston are presented in this report.

A FULLY DEVELOPED RESTON

The focus of this study is not Reston in 1970 but the Reston of the 1980's, when it is expected that all of the currently planned development will be completed. By then, a full mix of housing, recreation, shopping and working facilities will be in place to form a new town which is part of the overall development plan for the Washington region.

At full development, Reston will have a population of about 70,000-80,000 people living in about 19,500 dwelling units. There will be five villages, a Town Center, employment for about 30,000 people, and a full range of schools including a post high school. For transportation, the community will be served by two freeways; the Outer Belt Circumferential and the outer lanes of the Dulles Access Road; and, possibly an express transit line in the median of the Dulles Access Road. Internally, there will be a system of walkways as well as a roadway system to serve the community, and, possibly there will also be an internal transit system. For traffic planning calculations a future population of 70,000 was assumed and the year 1985 is generally used to designate this stage of community development.

The characteristics of the people who live in Reston will have an important bearing on their travel needs, and which mode they will choose to

travel. To frame this study properly, these characteristics were assumed to be as follows:^{1/}

- The average Reston family is anticipated to have above average income.
- The adult population will have attained a higher than average educational level.
- The family unit in each dwelling unit type is taken as a constant for that particular type, (for example; townhouses have 3.8 persons per unit).
- The dwelling unit types are indicative of a life cycle phase of the families who reside there. (For example, high rise apartments will be primarily occupied by single persons, older couples, and young couples with no children and a high percentage of the adult family members will be employed.)

Developments during the study suggested that the travel needs of Reston residents might be modified considerably by the addition of housing units for lower income people. Such being the case, total trip making would decrease slightly and transit trip making would increase. These differences, because of the minor impact of the lower income groups, are not expected to be great and would have only a small effect on overall transportation needs. Therefore, no change was made in the definition of the 1985 population and the study is based on the above stated characteristics.

PLAN OF REPORT

The stated purpose of this study was to produce a technical analysis of the need for internal transit. The approach used and the results achieved therefrom are presented in Chapters III through VI of this report. Chapter II provides an overview of the process and the findings in a summary which was developed for the users of this report who do not require detailed knowledge of the analysis.

Study procedures are presented in Chapter III. After a brief discussion of the policy framework in which the study was conducted, the chapter leads into an analysis of the possible number of future trips, how these trips might be distributed to various points in Reston and around the region,

^{1/} Based upon discussions with Reston officials during the early stages of the study.

and by which transportation mode these trips might be made. These steps lead to the determination of the number of trips over specific segments of the highway and transit system. Two such full scale tests, plus a modified third test, to further analyze highway needs are discussed in Chapter IV.

The results of this testing established the framework for the "Application of Test Results" presented in Chapter V. This chapter contains descriptions of the recommended transit and highway system, as well as a first stage Transit Demonstration Project.

Chapter VI discusses briefly the conditions at Reston's boundaries and specifically examines traffic volumes on external approach routes and those trips generated by Dulles Airport.

Since transportation facilities are among the more important elements which shape a community, new or old, several observations were made during the various analysis stages concerning the effect of transportation facility planning upon the shape of Reston. These observations are contained in Appendix A for use in future planning phases. Appendix B contains copies of survey forms used in the initial data collection. A summary of the characteristics of the zones used in defining the community's transportation needs is presented in Appendix C.

II. SUMMARY

One element in the typical approach to transportation planning is to make field studies in an attempt to determine the socio-economic and trip making characteristics of the population. These characteristics are then projected to estimate what conditions will be 15 to 25 years hence. This approach had little application to Reston since the population at the inception of the study was less than one-tenth of the planned total. Therefore, although some field data were collected, information from other sources and simulation techniques had to be relied upon to provide a framework for the estimation of future transportation needs. In effect, if transportation planning might be divided into parts, only a limited effort went into the measurement of existing conditions while most of the activity in this study was directed at forecasting future conditions.

In the original definition of scope for this study, the development of new technology was not envisioned. Instead, the use of existing tools, applied in ways which might be unique, was considered to be more desirable. Therefore, the procedures used were similar to those used in the forecast phases of most transportation studies, i.e., the two major divisions of the analysis were the determination of travel demand and the evaluation of transportation systems.

Travel demands were determined by first estimating the number of trips at their source ("productions") and where they go ("attractions" -- within or outside of Reston), by trip purpose. Trip purposes were defined as: work, shop, school, recreation, social, and personal business. With the number of productions and attractions determined, a model of interactions^{1/} between productions and attractions was developed to estimate the relative attractiveness of each place to all other places. This model provided an estimate of the number of trips people make on a typical day as well as a possible distribution of productions and attractions and established the basis for subsequent phases of the study. These were: (1) a "modal choice" analysis of trip making to estimate the number of people who will travel as transit passengers, automobile passengers, or auto drivers; and, (2) an analysis of actual routes for trips by each mode using an "assignment model". These "models" are mathematical relationships which, due to the large number of calculations implicit in their processing require the use of a high speed computer.

^{1/} In transportation study parlance, this is known as a "distribution model" and is typified by such names as Gravity Model, Opportunity Model, etc.

The remainder of the study was directed to determining transportation systems which could meet the transportation needs of a fully developed Reston. The findings, conclusions and recommendations of these studies are described briefly in the remainder of this chapter.

FINDINGS

The findings of this study provided a foundation for the consideration of transit service alternatives, and possible changes in highway and street plans. They also provided a means of identifying a first stage transit demonstration project. A limited field data collection effort was undertaken to determine basic travel information, attitudes toward a potential transit system, usage by children, and other characteristics of Reston residents. A major finding of this survey was that residents are in favor of a transit system and that children are likely to be the principal users. The fare should not exceed 25 cents and service should be offered daily.

From the interviews related to travel characteristics, it was found that Reston residents make from eleven to fifteen trips per day per dwelling unit, depending on the type of unit. These data compare favorably with trip information gathered from other sources^{1/2/} and used as input for this study. The estimates based on this information provided vehicle trip rates of from six to fifteen trips per unit. This information also correlates well with data obtained from actual traffic counts.

Walk trips were expected to play a significant part in the analysis of trip making but observations and review of other studies of walk behavior indicate that these trips tended to be made mainly for social-recreation purposes, were very short in length and were made in addition to, rather than as a substitute for, vehicle trips.^{3/} Thus, as the trip generation analysis proceeded, it became clear that walk trips would not significantly diminish the number of vehicle trips made in Reston each day. The estimates that were developed indicate that about 275,000 daily trips will be made by vehicle, either automobile or transit, for all purposes, both in

^{1/} Cleveland Seven County Transportation Study Data Books. 1969

^{2/} Washington Metropolitan Area Transportation Authority METRO Study. Technical Report No. 3. 1967.

^{3/} Report on the Walking Trip Survey, Chicago Area Transportation Study (Report No. 73), 1961, Roger L. Creighton.

and out of Reston. With an estimated future population of 70,000, this is just under four trips/person, or about fourteen trips per dwelling unit.

The analysis of the choice of transportation mode used data developed for the Washington Metropolitan Area Transportation Authority (WMATA) and demonstrated the extreme sensitivity of transit patronage to such factors as walking time at each end of the transit trip, average transit travel speed when compared to auto speed, and intervals between transit vehicles. These factors should be established within the Master Plan and the design details that guide the development of a new town. Some of these design decisions have already been made in Reston; others were the subject of the tests conducted.

Two basic tests were made using the trip information summarized in the previous paragraphs. The first test was based on the existing Reston Master Plan and assumed speeds on the highway network predicated on uncongested conditions. Predictably, the resulting transit usage was minimal, only 1.3 percent of all person trips, exclusive of school trips. In addition, the highway system was heavily loaded with volumes on Reston Avenue, at the interchange with the Dulles Access Road, ranging up to 45,000 vehicles per day -- an intolerable level.

The second test was designed to show the effect of introducing a transit system that optimized, to the extent possible, service to the areas of highest trip activity and assumed congestion on the highway system. A restraint on this test transit system was that it was to operate essentially on the planned street system and would not penetrate the clusters of development as might have been done if development was not so far advanced. Under these conditions, the system attracted 2.75 percent of person trips (exclusive of school trips). When school trips were added to this, a total of just over 14,000 daily transit trips were generated or approximately five percent of all trips. It is essential to appreciate that the transit predicting techniques applied in the study while being the most advanced procedures available, are not fully sensitive to the conditions existing in a new town like Reston since no real precedents exist. AMV believes that transit riding would possibly be greater than the 14,000 daily trips if the system is designed and managed in an optimum manner, and is responsive to the needs and desires of the residents it serves.

To estimate revenues which might be gained by the transit system, it was assumed that school children would be transported on the Reston system and that a payment would be made to the system by Fairfax County, in lieu of the County providing regular school buses. Under these circumstances, the system could generate at least \$2,900 of revenue per eleven hour operating day with a 25 cent fare for non-school riders. This contrasts with operating costs which were estimated to be \$4,000 per day if

the capital cost of vehicles is included, or \$3,200 per day if these capital costs are omitted, thus generating deficits of \$1,100 or \$300 per day respectively in the 1980's.

Several highway changes were tested which provided better operating conditions, particularly along Reston Avenue where some volumes were reduced as much as 20 percent. In contrast to the 45,000 per day recorded in the first test, the volume in the final highway test was just over 38,000 per day. Contributing to these changes were the additions of a partial interchange at Wiehle Avenue and the Dulles Access Road, and an extension of Wiehle Avenue to the south of the Dulles Access Road.

Of the total 275,000 daily trips estimated to be generated, over 100,000 of these are expected to travel into and out of Reston. About 40,000 would be expected to use the Dulles Access Road to and from the east, and about 9,000 to and from the west. The remainder will be on various other routes such as the Outer Beltway, Virginia Route 7, Reston Avenue (Route 602), Baron Cameron Avenue (Route 606), and Lawyer's Road. In addition, Dulles International Airport is expected to generate about 600 air passenger trips daily, both into and out of Reston, with 150 to 200 of these in the peak hour.

The knowledge of the overall transportation picture for Reston in 1985 for both transit and highways, as discussed in the preceding paragraphs, established the base for defining a first stage transit demonstration project. The objective of this demonstration project would be to provide a framework for testing various alternative concepts of transit service in a new town and to determine the level of acceptance of transit by the Reston community which has, in its acceptance of the commuter bus system, greatly exceeded expectations.

CONCLUSIONS

As a result of the findings summarized in the previous section, it is concluded that:

- The design of the community will have a significant impact on transit patronage. For example, transit patronage will decrease proportionately as walking distance to a transit line increases (See Section III, Modal Split, and Appendix A for a discussion of the factors affecting transit patronage.)
- Designing a transit system which will attract sufficient patronage to meet capital and operating costs is difficult. If operating costs are to be met, use of the transit system to provide school service appears necessary, requiring payments to the system

from the Fairfax County School system in lieu of a separate county operated school bus system within Reston (See Section V, Recommended Transit Plan for economic discussion).

- Varying operating techniques, which might help reduce operating costs of the transit system, need to be tested. An example of these would be the possibility of mixing scheduled and "on-call" services to reduce the number of vehicle operating hours without substantially affecting level of service.
- The ability of Reston citizens to encourage transit usage has already been demonstrated by the success of the commuter bus service now operating to downtown Washington. Reston at its present stage of development would make an excellent testing ground to test operating techniques and special vehicles designed for an intimate "small town" system. This could be best accomplished through a U.S. Department of Transportation sponsored demonstration project.
- With few exceptions, the highway plan developed for Reston is adequate to serve community needs (See Section IV, Results of Testing). One addition should be a partial interchange to and from the east on the Dulles Access Road at Wiehle Avenue. Another should be the extension of Wiehle Avenue south of the Dulles Access Road to Glade Drive, continuing along Soapstone Drive.
- With the implementation of changes suggested for the highway network, Reston should seek two stops on the proposed express transit line to Dulles Airport. While the proposed express transit feasibility study will need to consider the pro's and con's of any stops for Reston, it seems clear that the development of a superior environment in the County and in Reston would be enhanced by a high quality public transit service and that two stopping points could prove more advantageous than one when all the costs and benefits are measured. One stop at Wiehle Avenue would attract the vehicle oriented change-of-mode trips, so that these will not increase highway congestion on Reston Avenue. The second stop would be in the planned town center to service this central point and the nearby employment.
- The anticipated magnitude of traffic volumes attracted to the Dulles highway corridor strongly suggest the need for the construction of the proposed additional lanes on this road before Reston is fully developed. The 150 to 200 trips that may go to and from the airport in peak hours should not create major difficulties.

- Transportation demand in the Dulles corridor will increase rapidly once access to Reston is available. AMV believes that a useful and highly significant planning principle could be examined by constructing the express transit line in the corridor before adding additional lanes to the Dulles Access Road.

RECOMMENDATIONS

Based on the conclusions discussed in the preceding section, it is recommended that:

- A transit demonstration project be undertaken in Reston to test new operating techniques and the potential for transit service in a community where development has advanced sufficiently to provide places for people to go. The findings of this demonstration would then be used to design a system to serve the whole community, with fallout that might be applied to other new towns, and to metropolitan areas generally.
- The internal transit system be used to carry school children in lieu of a separately operated school bus system and that Fairfax County provide to the system those funds normally expended for this purpose.
- The Reston highway plan be modified to include a partial interchange with the Dulles Access Road toward the east at Wiehle Avenue and that Wiehle Avenue be extended south to Glade Drive, continuing as Soapstone Drive. In making this recommendation, it is acknowledged that a balance must be struck between land use planning and transportation services. However, the demonstrated need for interchange ramps at Wiehle Avenue and the desirability of locating a second transit stop on the proposed express transit line near Wiehle Avenue in addition to the balancing of highway loads throughout the community argue strongly for the extension of this roadway.
- Two stops on the proposed express transit line should be considered to serve Reston. Under this scheme one stop would be located west of Reston Avenue to serve the Town Center and its related employment and a second stop located east of Wiehle Avenue to serve vehicle oriented commuters to Washington. (See Figure IV-9 for location).
- The parallel lanes on the Dulles Access Road be scheduled for completion prior to Reston reaching its full development.