FINAL REPORT

AN EVALUATION OF CONGESTION-REDUCING MEASURES USED IN VIRGINIA

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(The opinions, findings, and conclusions expressed in this report are those of the author and not necessarily those of the sponsoring agencies.)

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ABSTRACT

Congestion on our nation's highways, especially in urban areas, is a serious problem that is growing steadily worse. In Virginia, it is estimated that 28 percent of the daily vehicle miles of travel (VMT) occurring during peak hour traffic is congested (volume/service flow ratio > 0.75). Further, it is estimated that the cost of urban area congestion in Virginia will amount to more than $4 billion in the year 2000.

Transportation professionals in Virginia need to be cognizant of and familiar with congestion-reducing measures so as to implement them at every opportunity. Accordingly, this research was conducted to (1) develop a categorical list of congestion-reducing measures, and (2) document the implementation of and experiences with these measures in Virginia. The latter included a subjective evaluation of each measure's effectiveness, cost, and barriers to implementation. The scope was limited to a literature review and a survey of transportation officials in Virginia.

Based on the literature, 53 congestion-reducing measures were categorized by whether they manage the existing supply of transportation facilities, add to that supply, manage the existing transportation demand, or control demand growth. Experiences with these measures were documented from the survey of transportation professionals in Virginia. Conclusions were reached regarding the effectiveness, cost, and ease of implementation of individual measures as well as categories of measures.

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INTRODUCTION

Congestion on our nation's highways, especially in urban areas, is a serious problem that is growing steadily worse. Over the last several years, the problem has attracted the attention of transportation engineers, planners, and researchers at all levels of government, and several national conferences have been held on congestion. Headline stories on congestion are frequently seen in urban newspapers.

Although Virginia is predominantly rural (78 percent of its road mileage is considered to be rural), there are few Virginians who have not experienced congestion at some time in their travels. There are 11 major urban areas located totally or partially in Virginia and 33 smaller urban areas. These urban areas, which contain about 22 percent of the highway system's mileage, have about 54 percent of the travel. Statistical summaries from the Virginia Department of Transportation's (VDOT) 1989 Highway Performance Monitoring System indicated that 28 percent of the daily vehicle miles of travel (VMT) occurring during peak hour traffic in Virginia was congested (volume/service flow ratio > 0.75).

Congestion in urban areas is costly. Previous research has shown that day-to-day (recurring) congestion cost motorists in Virginia's urban areas an estimated $172 million in 1986. If the additional costs caused by incidents (nonrecurring congestion) are added, the cost to Virginia's motorists was approximately $430 million. Further, it was estimated that the cost of urban area congestion will amount to more than $4 billion in the year 2000.[1]

Transportation professionals in Virginia need to be cognizant of and familiar with congestion-reducing measures so as to implement them at every opportunity. Specifically, it would be helpful to have some knowledge of their effectiveness, their cost, and the feasibility of implementing them. That is, it would be important to know which measures can be quickly and easily implemented and have the greatest impact on reducing congestion at the least cost. This study was undertaken to collect this information.

PURPOSE AND SCOPE

There were two equally important objectives of the research. The first was to develop a categorical list of congestion-reducing measures that would provide transportation professionals in Virginia with a readily available, comprehensive list of measures they might consider implementing in their area. The second objective was to document the implementation of and experiences with congestion-reducing measures in Virginia, including a subjective evaluation of each measure's effectiveness, cost, and barriers to implementation. This would provide transportation professionals in Virginia with a rational method to select the measures they might consider implementing.

The research was limited to a synthesis of existing literature and a survey of transportation professionals in Virginia. Intelligent vehicle/highway system (IVHS) measures were not specifically included in this study. This was primarily due to the time frame when the initial list of measures was developed and the survey was conducted. Obviously, IVHS technology can be applied to many of the measures listed.

METHODS

A comprehensive literature review was undertaken to develop a list of congestion-reducing measures currently being used. The primary source of literature was a computerized search through the DIALOG data base.

To address the second objective, transportation professionals in the state were sent a questionnaire aimed at determining what measures had been implemented in recent years to reduce congestion. Further, they were queried as to the relative effectiveness of the measures, the relative cost of the measures, and any barriers experienced in the implementation of the measures. The questionnaire entitled "Survey of Congestion-Reduction Measures Used in Virginia" was mailed to officials in all 41 cities, 29 towns (population greater than 3,500), 13 urban counties, and 21 planning district commissions (PDCs) in Virginia. A copy of the questionnaire is included in the Appendix. The metropolitan planning organizations (MPOs) in the state are linked to the PDCs and thus had input to the survey. Within VDOT, the questionnaire was sent to the nine district traffic engineers, the Transportation Planning Division, the Rail and Public Transportation Division, and the planning section in the Northern Virginia District office.

The questionnaire consisted of a categorical listing of measures from the literature that have been used to reduce congestion. Respondents were asked whether each measure has been or is being used in their area and then to evaluate the measure as to its effectiveness, cost, and implementation. Respondents were also encouraged to add measures not listed and provide available documentation supporting their responses. The instructions indicated that measures were to be evaluated subjectively relative to congestion-reducing measures in general and according to the following rating scale:

- *Effectiveness*

  0 = measure has minimal effect on decreasing congestion
  1 = measure has average effect on decreasing congestion
  2 = measure has maximum effect on decreasing congestion

- *Cost*

  0 = measure is inexpensive to implement/operate
  1 = measure has an average cost to implement/operate
  2 = measure is very costly to implement/operate

- *Implementation*

  0 = measure is very easy to implement, with few or no physical, legal, or institutional barriers
  1 = measure can be implemented, with some physical, legal, or institutional barriers
  2 = measure is difficult to implement, with significant physical, legal, or institutional barriers

RESULTS

Categorical Listing of Measures

A total of 53 measures used to reduce congestion were identified in the literature. Although numerous sources were reviewed, the primary reference was the Institute of Transportation Engineer's "Toolbox."[2] The measures were categorized into those that address the supply side of transportation and those that address the demand side.

Supply side measures relate to the highway system or roadway itself and are sometimes referred to in general as transportation system management (TSM) measures. Supply measures are further categorized into those that manage or more efficiently utilize the capacity of the existing system and those that increase or add to the capacity.

Demand side measures relate to the modification of travel behavior or travel demand and are often referred to in general as transportation demand management (TDM) measures. Demand measures are further categorized into those that manage or reduce existing demand and those that avoid or control demand growth.

Figure 1 depicts the supply side/demand side relationship, and Table 1 lists the 53 congestion-reducing measures in the four categories just defined.

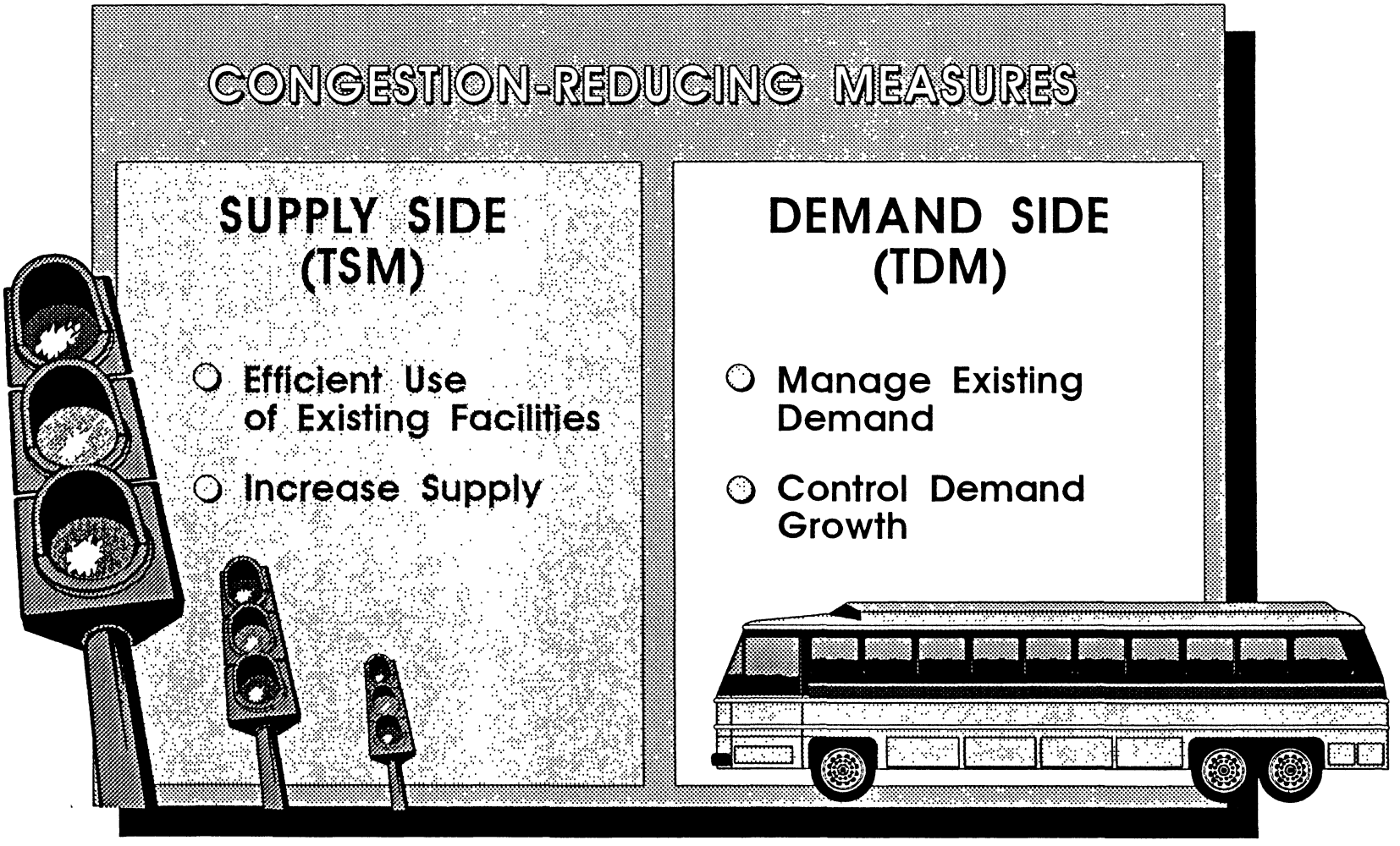

Figure 1. Categorization of Congestion-Reducing Measures.

Table 1
CONGESTION-REDUCING MEASURES AND THEIR USE IN VIRGINIA

Measure	Used		Average Effectiveness	Average Cost	Average Implementation
	Yes	No			
Category I.A.: Managing Existing Supply/Using Existing Capacity More Efficiently					
Incident detection/management system/program	14	65	1.1	0.8	0.8
Traffic surveillance/control system	12	69	1.6	1.1	1.0
Motorist information system	7	74	1.1	0.9	0.6
Traffic management team	11	70	1.1	0.5	0.5
Integrated freeway and arterial surveillance/control system	3	76	1.4	1.4	1.1
Converting existing facilities to HOV facilities	8	75	1.3	1.0	1.5
Providing additional lanes w/o widening (shoulders, narrower lanes)	34	47	1.4	0.7	0.7
Coordinated signal systems (arterial, grid, closed loop)	66	15	1.6	0.8	0.5
Ramp metering	6	73	0.9	1.1	1.0
Other signal improvements, including hardware, upgrades, retiming, removal	71	16	1.3	0.8	0.3
Improving other traffic control devices	54	25	1.1	0.7	0.4
Intersection improvements, including channelization, turn lanes, signing, bus stop relocation	75	9	1.4	1.0	0.7
Turn prohibitions	59	22	1.0	0.1	0.5
One-way streets	52	32	1.2	0.5	0.9
Reversible traffic lanes on arterials	5	76	1.2	0.8	1.0
Removing/restricting on-street parking	64	17	1.2	0.2	0.9
Arterial access management	19	61	1.1	0.4	1.1
Goods movement management	8	65	0.7	0.5	1.2
Traffic management during highway reconstruction or other major improvements	60	22	1.0	0.9	0.6
Prohibiting maintenance/repairs on major routes during peak traffic hours	52	28	1.7	0.5	0.4
Category I.B.: Increasing Supply/Adding Capacity					
Constructing new highways	56	26	1.7	1.9	1.4
Reconstructing highway with improved design	64	18	1.6	1.6	1.4
Widening by adding general purpose lanes	51	29	1.5	1.5	1.3
Constructing HOV lanes	9	74	1.7	1.5	1.7
Providing highway grade separations	27	55	1.8	1.9	1.5
Providing railroad grade separations	26	54	1.5	1.9	1.3
Choosing toll-based financing to expedite construction of new facilities	13	70	1.7	1.4	1.6

continues

Table 1 (continued)

Measure	Used		Average Effectiveness	Average Cost	Average Implementation
	Yes	No			
Category II.A.: Managing/Reducing Existing Demand					
Daily flexible work hours (staggered/flextime)	33	50	1.2	0.2	0.5
Alternative work hours (compressed work week)	23	58	0.9	0.1	0.5
Promoting nonvehicular alternatives to auto usage	26	56	0.7	0.8	0.8
Communication in lieu of travel (teleconferencing)	17	65	0.8	0.4	0.6
Communication in lieu of travel (telecommuting)	11	71	0.8	0.7	0.8
Implementing transportation management associations or organizations	19	63	0.8	0.7	0.7
Promoting/supporting ridesharing as an alternative to auto usage:					
Commuter-matching services	31	51	1.0	0.6	0.5
Reduced tolls	7	72	0.8	0.6	0.7
Providing public information on rideshare/transit	40	42	0.8	0.4	0.2
Guaranteed ride home program	11	72	0.3	0.3	0.3
Tax incentives for vanpools	12	69	0.8	0.7	0.8
Implementing/improving transit fixed-route services	34	49	0.8	1.0	0.6
Implementing express bus services	22	62	1.2	1.2	0.9
Implementing/improving rail transit or commuter rail services	10	74	1.3	1.5	1.3
Implementing/improving paratransit services	32	52	0.6	1.2	0.8
Reducing or not increasing transit fares	13	69	0.8	1.1	0.7
Subsidizing transit usage	28	55	0.9	1.2	0.6
Implementing parking strategies to encourage modal shift:					
Car/vanpool preferential parking	19	65	1.1	0.3	0.5
Park and ride lots	40	44	1.1	0.9	0.9
Differential parking rates	7	76	0.6	0.5	0.5
Governmental control of supply and location	11	70	0.6	0.7	0.8
Category II.B.: Avoiding/Controlling Demand Growth					
Growth management by public policy/ordinance/planning	41	35	1.1	0.7	1.4
Auto-restricted zones	25	52	1.3	1.0	1.3
Designing multiuse sites to minimize traffic (e.g., on-site services)	18	61	0.9	0.8	0.8
Road/congestion pricing (excluding traditional toll construction)	1	77	1.0	1.5	1.0
Requiring congestion-reduction strategies: reduced trip generation, transit for proposed development	11	67	1.2	0.6	1.4

Table 2
EVALUATION OF CONGESTION-REDUCING MEASURES BY CATEGORY

Category	Yes Responses		Average Effectiveness	Average Cost	Average Implementation
	Range	Average			
TSM					
Managing existing supply	3-75	34	1.2	0.7	0.8
Adding to supply	9-64	35	1.6	1.7	1.5
TDM					
Managing existing demand	7-40	21	0.9	0.7	0.7
Controlling demand growth	1-41	19	1.1	0.9	1.2

Experiences in Virginia

Responses from the survey of state transportation professionals were used to document the use of and experiences with congestion-reducing measures in Virginia. A total of 85 questionnaires were returned. Responses were received from transportation professionals in 23 cities, 8 counties, and 8 MPOs/PDCs located in an urbanized area (population of 50,000 or more) and 23 cities and 7 PDCs located in nonurbanized areas. Responses were also received from 9 transportation planning engineers, 6 district traffic engineers, and 1 public transportation engineer in VDOT.

A summary of the responses is provided in Table 1. The use of and the average rating for the effectiveness, cost, and implementation of the individual measures are included. Table 2 summarizes the same information by each of the four categories of congestion-reducing measures.

Evaluation of Individual Measures

Based on the information in Table 1, the most commonly used measures and the number of respondents reporting the use of the measure by category were as follows:

- *Managing existing supply*
  - —intersection improvements: 75
  - —other signal improvements: 71
  - —coordinated signal systems: 66
  - —remove/restrict on-street parking: 64
  - —traffic management w/maintenance: 60
  - —turn prohibitions: 59
  - —improving other traffic control devices (TCDs): 54
  - —one-way streets: 52
  - —prohibiting maintenance/repairs during peak traffic: 52

- *Adding to supply*

  —reconstructing highways: 64
  —constructing new highways: 56
  —widening w/general purpose lane: 51

- *Managing existing demand*

  —park and ride lots: 40
  —provide information on rideshare: 40
  —improve transit fixed-route: 34
  —daily flexible work hours: 33
  —improve para-transit: 32
  —commuter matching services: 31

- *Controlling demand growth*

  —growth management by policy, ordinance, or planning: 41

Based on the information in Table 1, those measures that are the most effective in reducing congestion, least expensive, and easiest to implement can be determined. This is accomplished by arbitrarily choosing average ratings of 1.5 or greater, 0.5 or less, and 0.5 or less to represent the most effective, least expensive, and easiest to implement, respectively. The results are as follows:

- *Most effective measures* (average rating ≥ 1.5)

  —providing highway grade separations
  —constructing new highways
  —choosing toll-based financing
  —constructing HOV lanes
  —prohibiting maintenance/repairs during peak traffic
  —reconstructing highways with new design
  —coordinated signal systems
  —traffic surveillance/control systems
  —providing railroad grade separations
  —widening with general purpose lane
  —providing additional lanes without widening

- *Least expensive measures* (average rating ≤ 0.5)

  —turn prohibitions
  —alternative work hours
  —removing/restricting on-street parking
  —daily flexible work hours
  —guaranteed ride home program
  —car/vanpool preferential parking
  —arterial access management
  —providing information on rideshare/transit
  —teleconferencing
  —prohibiting maintenance/repairs during peak traffic
  —one-way streets
  —differential parking rates

—goods movement management
—traffic management teams

- *Easiest to implement measures* (average rating ≤ 0.5)

—providing information on rideshare/transit
—guaranteed ride home program
—other signal improvements
—prohibiting maintenance/repairs during peak traffic
—improving other TCDs
—traffic management teams
—commuter matching services
—car/vanpool preferential parking
—turn prohibitions
—differential parking rates
—daily flexible work hours
—alternative work hours
—coordinated signal systems

Some measures performed the best for more than one characteristic. The only measure that was rated on average the most effective, least expensive, and easiest to implement was the prohibition of maintenance and repair work during peak traffic conditions.

If average effectiveness (an average rating of 1.0) is substituted for most effective, then four more measures can be added: traffic management teams, daily flexible work hours, carpool/vanpool preferential parking, and turn prohibitions.

If average implementation (an average rating of 1.0) is substituted for easiest to implement and average effectiveness is still considered, then two more measures can be added: one-way streets and removal/restriction of on-street parking.

Finally, if average cost (an average rating of 1.0) is substituted for least expensive such that all attributes are average or better, then 11 more measures can be added: commuter matching services, coordination of signals, other signal improvements, improving other TCDs, provision of additional lanes without widening (shoulders or narrow lanes), incident detection/management systems, reversible traffic lanes on arterials, traffic management during highway reconstruction/maintenance, motorist information systems, park and ride lots, and intersection improvements.

Use of Measures by Category

The range and average number of positive responses for the measures in each of the four categories are given in Table 2. For example, measures in the category of measures that manage existing supply were reportedly used by between 3 and 75 respondents, or by an average of 34 respondents.

Measures that address TSM received a much higher number of positive responses than the measures addressing TDM, both with regard to the upper limits of

the range and the average. Specifically, measures in the categories of supply were reportedly used by a maximum of 75 and 64 respondents, with an average of 34 and 35; comparable numbers in the categories of demand were a maximum of 40 and 41 with an average of 21 and 19.

Effectiveness of Measures by Category

The average rating for the effectiveness of the measures in each of the four categories is given in Table 2. For example, measures in the category of measures that manage existing supply received an average rating of 1.2. Note that average effectiveness is rated at 1.0 and maximum effectiveness at 2.0.

The TSM measures were rated on average higher than the TDM measures, that is, 1.2 and 1.6 versus 0.9 and 1.1. Also, the measures that add to the supply were rated on average considerably higher (1.6) than the measures in the other three categories.

Cost of Measures by Category

The average rating for the cost of the measures in each of the four categories is given in Table 2. For example, measures in the category of measures that manage existing supply received an average rating of 0.7. Note that average cost is rated at 1.0 and least cost at 0.0.

The measures that add to the supply were rated on average as the most expensive (1.7). Also, the measures that address the existing, either through efficient use of the existing supply or management of the existing demand, were rated on average as the same, and the average rating of 0.7 represents a cost of less than average.

Implementation of Measures by Category

The average rating for the implementation of the measures in each of the four categories is given in Table 2. For example, measures in the category of measures that manage existing supply received an average rating of 0.8. Note that average implementation is rated at 1.0 and easiest to implement at 0.0.

The measures that address the existing, either through efficient use of the existing supply or management of the existing demand, were rated on average as about the same (0.8 and 0.7), and the rating represents a minimum of problems in implementation. Also, measures in these two categories were rated on average easier to implement than measures that add to the supply or control the demand growth, that is, 0.8 and 0.7 versus 1.5 and 1.2.

CONCLUSIONS

1. Congestion-reducing measures can be separated into two basic categories: those that address the supply side (highway system or roadway itself) and those that address the demand side (travel behavior) of transportation. The former are sometimes referred to as transportation system management (TSM) and can be further divided into measures that manage or more efficiently use the existing supply and those that add to the supply. The latter are often referred to as transportation demand management (TDM) and can be further divided into measures that manage existing demand and those that control demand growth.

2. The term TSM was initially used in relation to the transportation planning process and represented actions that make better use of existing transportation facilities and services. The term is now being used in some cases in reference to measures that concern only the supply side of transportation.

3. Many measures on the list of congestion-reducing measures have appeared over the years on lists of measures or strategies to implement the Traffic Operations Program to Improve Capacity and Safety (TOPICS), to save energy, and, most recently, to reduce air pollution (transportation control measures).

4. In general, measures dealing with supply have been used for years, whereas measures dealing with demand are relatively new. Accordingly, since the supply measures are used much more than the demand measures, they represent the traditional approaches to reducing congestion. More emphasis on the implementation of demand measures appears to offer potential for reducing congestion.

5. Measures that reduce congestion by managing the existing supply are most often rated above average in effectiveness and below average in cost and ease of implementation.

6. Measures that reduce congestion by adding to the supply are usually rated the most effective; however, they are also usually rated the most expensive to implement or operate and the most difficult to implement.

7. Measures that reduce congestion by managing the existing demand are most often rated below average in both cost and ease of implementation; however, they are also most often rated below average in effectiveness.

8. Measures that reduce congestion by controlling demand growth are most often rated above average in effectiveness and below average in cost; however, they are most often rated above average in ease of implementation.

9. On average, TSM measures are more effective in reducing congestion than TDM measures. Measures that add to the supply are rated very high in effectiveness.

10. On average, measures that manage the existing supply and demand are rated relatively inexpensive to implement or operate and relatively easy to implement.

11. On average, measures that add to the supply and control the demand growth are rated the most expensive and the most difficult to implement. Measures that add to the supply (not surprisingly) are rated very expensive to implement or operate.

12. Relative to congestion-reducing measures in general, the following measures were rated by transportation professionals in Virginia as average or better in terms of their effectiveness in reducing congestion, cost to implement or operate, and ease of implementation.

    - TSM measures (supply side)

      —incident detection/management systems
      —motorist information systems
      —traffic management teams
      —providing additional lanes without widening
      —coordinated signal systems
      —other signal improvements (e.g., re-timing)
      —improving other TCDs
      —intersection improvements
      —turn prohibitions
      —one-way streets
      —reversible traffic lanes on arterials
      —removing/restricting on-street parking
      —traffic management during highway reconstruction and maintenance
      —prohibiting maintenance/repairs during peak traffic

    - TDM measures (demand side)

      —daily flexible work hours
      —commuter matching services (ridesharing)
      —carpool/vanpool preferential parking
      —park and ride lots

REFERENCES

1. Arnold, E.D., Jr. 1988. *Congestion on Virginia's Urban Highways.* VTRC Report No. 88-R24. Charlottesville: Virginia Transportation Research Council.

2. Institute of Transportation Engineers. 1989. *A Toolbox for Alleviating Traffic Congestion.* ITE Publication No. IR-054A. Washington, D.C.

APPENDIX

Survey of Congestion-Reduction Measures Used in Virginia

SURVEY OF CONGESTION-REDUCTION MEASURES USED IN VIRGINIA

INSTRUCTIONS

Attached is a categorical listing of measures used to reduce traffic congestion. Please review the list and indicate whether the measure has been or is being used in your area. Also, if you have personal knowledge or experience with the use of the measure, please evaluate it as to its effectiveness, cost, and implementation. Further, please enclose a copy of available documentation of an evaluation of or justification for implementing the measure. Finally, please add and evaluate any measures being used in your area that are not listed.

The effectiveness, cost, and implementation should be evaluated according to the following scale:

Effectiveness (relative to congestion-reduction measures in general)

0 = measure has minimal effect on decreasing congestion
1 = measure has average effect on decreasing congestion
2 = measure has maximum effect on decreasing congestion

Cost (relative to congestion-reduction measures in general)

0 = measure is inexpensive to implement/operate
1 = measure has an average cost to implement/operate
2 = measure is very costly to implement/operate

Implementation (relative to congestion-reduction measures in general)

0 = measure is easy to implement, with little or no physical, legal, or institutional barriers
1 = measure can be implemented, with some physical, legal, or institutional barriers
2 = measure is difficult to implement, with significant physical, legal, or institutional barriers

Please submit the completed survey, along with available documentation, by October 11, 1991, to:

E. D. Arnold, Jr.
Virginia Transportation Research Council
P.O. Box 3817, University Station
Charlottesville, VA 22903
(804) 293-1931; SCATS 745-1931

SURVEY OF CONGESTION-REDUCTION MEASURES IN VIRGINIA

Name of Person Completing Survey: _____ Telephone No. _____

Organization: _____ Job Title: _____

Address: _____ Major Areas of Transportation Responsibility: _____

_____ _____

CATEGORY I.A.
Managing Existing Supply/Using Existing Capacity More Efficiently

	Measure	Used ?		Circle Correct Response: Effectiveness	Cost	Implementation
I.A.2	Traffic surveillance/control system	Yes	No	0 1 2	0 1 2	0 1 2
I.A.3	Motorist information system	Yes	No	0 1 2	0 1 2	0 1 2
I.A.4	Traffic management team	Yes	No	0 1 2	0 1 2	0 1 2
I.A.5	Integrated freeway and arterial surveillance/control system	Yes	No	0 1 2	0 1 2	0 1 2
I.A.6	Converting existing facilities to HOV facilities	Yes	No	0 1 2	0 1 2	0 1 2
I.A.7	Providing additional lanes w/o widening (shoulders, narrower lanes)	Yes	No	0 1 2	0 1 2	0 1 2
I.A.8	Coordinated signal systems	Yes	No	0 1 2	0 1 2	0 1 2
I.A.9	Ramp metering	Yes	No	0 1 2	0 1 2	0 1 2
I.A.10	Other signal improvements, incl. hardware upgrades, retiming, removal	Yes	No	0 1 2	0 1 2	0 1 2
I.A.11	Improving other traffic control devices	Yes	No	0 1 2	0 1 2	0 1 2
I.A.12	Intersection improvements, incl. channelization, turn lanes, signing, bus stop relocation	Yes	No	0 1 2	0 1 2	0 1 2
I.A.13	Turn prohibitions	Yes	No	0 1 2	0 1 2	0 1 2
I.A.14	One-way streets	Yes	No	0 1 2	0 1 2	0 1 2

continues

CATEGORY I.A. (continued)

Measure	Used ?		Circle Correct Response: Effectiveness	Cost	Implementation
I.A.15 Reversible traffic lanes on arterials	Yes	No	0 1 2	0 1 2	0 1 2
I.A.16 Removing/restricting on-street parking	Yes	No	0 1 2	0 1 2	0 1 2
I.A.16 Removing/restricting on-street parking	Yes	No	0 1 2	0 1 2	0 1 2
I.A.17 Arterial access management	Yes	No	0 1 2	0 1 2	0 1 2
I.A.18 Goods movement management	Yes	No	0 1 2	0 1 2	0 1 2
I.A.19 Traffic management during highway reconstruction or other major improvements	Yes	No	0 1 2	0 1 2	0 1 2
I.A.20 Prohibiting maintenance/repairs on major routes during peak traffic hours	Yes	No	0 1 2	0 1 2	0 1 2
Additional measures:					
_____	Yes	No	0 1 2	0 1 2	0 1 2
_____	Yes	No	0 1 2	0 1 2	0 1 2
_____	Yes	No	0 1 2	0 1 2	0 1 2
_____	Yes	No	0 1 2	0 1 2	0 1 2

continues

CATEGORY I.B.
Increasing Supply/Adding Capacity

Measure		Circle Correct Response				
		Used ?		Effectiveness	Cost	Implementation
I.B.1	Constructing new highways on new alignment	Yes	No	0 1 2	0 1 2	0 1 2
I.B.2	Reconstructing highway w/improved design	Yes	No	0 1 2	0 1 2	0 1 2
I.B.3	Widening by adding general purpose lanes	Yes	No	0 1 2	0 1 2	0 1 2
I.B.4	Constructing HOV lanes	Yes	No	0 1 2	0 1 2	0 1 2
I.B.5	Providing highway grade separations	Yes	No	0 1 2	0 1 2	0 1 2
I.B.6	Providing railroad grade separations	Yes	No	0 1 2	0 1 2	0 1 2
I.B.7	Choosing toll-based financing to expedite construction of new facilities	Yes	No	0 1 2	0 1 2	0 1 2
Additional measures:						
_____		Yes	No	0 1 2	0 1 2	0 1 2
_____		Yes	No	0 1 2	0 1 2	0 1 2
_____		Yes	No	0 1 2	0 1 2	0 1 2
_____		Yes	No	0 1 2	0 1 2	0 1 2
_____		Yes	No	0 1 2	0 1 2	0 1 2
_____		Yes	No	0 1 2	0 1 2	0 1 2
_____		Yes	No	0 1 2	0 1 2	0 1 2

continues

CATEGORY II.A.
Managing/Reducing Existing Demand

Measure	Used ?		Circle Correct Response: Effectiveness	Cost	Implementation
II.A.1 Daily flexible work hours (staggered/flextime)	Yes	No	0 1 2	0 1 2	0 1 2
II.A.2 Alternative work hours —compressed work week	Yes	No	0 1 2	0 1 2	0 1 2
II.A.3 Promoting non-vehicular alternatives to auto usage	Yes	No	0 1 2	0 1 2	0 1 2
II.A.4 Communication in lieu of travel—teleconferencing	Yes	No	0 1 2	0 1 2	0 1 2
II.A.5 Communication in lieu of travel—telecommuting	Yes	No	0 1 2	0 1 2	0 1 2
II.A.6 Implementing transportation management associations or organizations	Yes	No	0 1 2	0 1 2	0 1 2
II.A.7 Promoting/supporting ridesharing as an alternative to auto usage:	(Please evaluate specific measures below.)				
II.A.7.a commuter matching services	Yes	No	0 1 2	0 1 2	0 1 2
II.A.7.b reduced tolls	Yes	No	0 1 2	0 1 2	0 1 2
II.A.7.c providing public information on rideshare/transit	Yes	No	0 1 2	0 1 2	0 1 2
II.A.7.d guaranteed ride home program	Yes	No	0 1 2	0 1 2	0 1 2
II.A.7.e tax incentives for vanpools	Yes	No	0 1 2	0 1 2	0 1 2
II.A.8 Implementing/improving transit fixed-route services	Yes	No	0 1 2	0 1 2	0 1 2
II.A.9 Implementing express bus services	Yes	No	0 1 2	0 1 2	0 1 2
II.A.10 Implementing/improving rail transit or commuter rail services	Yes	No	0 1 2	0 1 2	0 1 2
II.A.11 Implementing/improving paratransit services	Yes	No	0 1 2	0 1 2	0 1 2
II.A.12 Reducing transit fares	Yes	No	0 1 2	0 1 2	0 1 2
II.A.13 Subsidizing transit usage	Yes	No	0 1 2	0 1 2	0 1 2
II.A.14 Implementing parking strategies to encourage modal shift:	(Please evaluate specific measures below.)				
II.A.14.a car/vanpool preferential parking	Yes	No	0 1 2	0 1 2	0 1 2
II.A.14.b park and ride lots	Yes	No	0 1 2	0 1 2	0 1 2

continues

Measure	Used ?		Circle Correct Response: Effectiveness	Cost	Implementation
II.A.14.c differential parking rates	Yes	No	0 1 2	0 1 2	0 1 2
II.A.14.d governmental control of supply and location	Yes	No	0 1 2	0 1 2	0 1 2
Additional measures:					
_____	Yes	No	0 1 2	0 1 2	0 1 2
_____	Yes	No	0 1 2	0 1 2	0 1 2
_____	Yes	No	0 1 2	0 1 2	0 1 2
_____	Yes	No	0 1 2	0 1 2	0 1 2
_____	Yes	No	0 1 2	0 1 2	0 1 2
_____	Yes	No	0 1 2	0 1 2	0 1 2
_____	Yes	No	0 1 2	0 1 2	0 1 2
_____	Yes	No	0 1 2	0 1 2	0 1 2

continues

CATEGORY II.B.
Avoiding/Controlling Demand Growth

Measure	Used ?		Circle Correct Response: Effectiveness	Cost	Implementation
II.B.1 Growth management by public policy/ordinance/planning	Yes	No	0 1 2	0 1 2	0 1 2
II.B.2 Auto-restricted zones	Yes	No	0 1 2	0 1 2	0 1 2
II.B.3 Designing multi-use sites to minimize traffic (e.g., on-site services)	Yes	No	0 1 2	0 1 2	0 1 2
II.B.4 Road/congestion pricing (excl. traditional toll construction)	Yes	No	0 1 2	0 1 2	0 1 2
II.B.5 Requiring congestion-reduction strategies, reduced trip generation, or transit considerations for proposed development	Yes	No	0 1 2	0 1 2	0 1 2
Additional measures:					
_____	Yes	No	0 1 2	0 1 2	0 1 2
_____	Yes	No	0 1 2	0 1 2	0 1 2
_____	Yes	No	0 1 2	0 1 2	0 1 2
_____	Yes	No	0 1 2	0 1 2	0 1 2
_____	Yes	No	0 1 2	0 1 2	0 1 2
_____	Yes	No	0 1 2	0 1 2	0 1 2
_____	Yes	No	0 1 2	0 1 2	0 1 2