INTERSTATE 73
ECONOMIC IMPACT ANALYSIS
A SUMMARY AND SYNTHESIS

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(A Cooperative Organization Sponsored Jointly by the
Virginia Department of Transportation and
the University of Virginia)

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TECHNICAL ASSISTANCE REPORT

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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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PART 3
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EXECUTIVE SUMMARY

The Transportation Planning Division (TPD) of the Virginia Department of Transportation (VDOT) is currently considering seven corridors along which VDOT may build the future Interstate 73. The division describes these seven routes and their variants in a report entitled **Possible Interchange Locations/ Potential I-73 Corridors** (December 1993). The purpose of this technical assistance project is to estimate the impact that construction of I-73 along any one of these corridors would have on the state's economy.

The project estimates the economic impact by two different methods. The first method, called the "Exits" methodin this report, is undertaken in cooperation with the Virginia Employment Commission (VEC)'s Economic Information Services Division. A published study of development around the interchanges along I-95 in North Carolina forms the basis for predicting the number and types of business establishments that would be attracted to each interchange along each proposed corridor. VEC's IMPLAN computer model uses these predictions to forecast the impact on employment and income for each corridor under consideration. A separate fifteen-page report, **An Economic Impact Analysis of the Potential Interstate 73 Corridors** (VEC/EISD, February 1994), describes the first method and its results.

The second method, called the "Dollar" method in this report, assigns a dollar value to the existing highway net in the localities affected by each of the corridors under consideration; the value is equal to estimated replacement cost. A productivity multiplier or "elasticity" value is selected from the range of such values estimated in recent research efforts. The magnitude of the projected cost for the future I-73 in comparison with the value of the existing road net, together with the chosen elasticity, determines for each corridor an estimate of the impact on taxable sales and adjusted gross income in each locality through which I-73 would pass, and an estimate of the impact on taxable sales and adjusted gross income in the state as a whole. A six-page report, **Interstate 73 Economic Impact Analysis Part 2** (VDOT/VTRC, February 1992), describes the second method and its results.

This third report summarizes the findings of this project. First it translates the forecasts from the first two reports into equivalent terms so that the forecast quantities can be compared. Next it discusses, and attempts to explain, the evident differences between the forecasts. Finally it suggests using a weighted average of the two sets of forecasts to create a best low-end, middle, and high-end forecast for each potential I-73 corridor from among the numbers generated.

Tables V, VI, and VII attached to this report give the low, middle, and high forecasts of each potential corridor's impact on employment, total employee compensation, taxable sales, and adjusted gross income.

A. In attempting to explain the similarities and differences between the first two reports, it is helpful to keep in mind the different fundamental assumptions that underlie the analysis in each of them.

The two analytical methods chosen were ones that could be applied quickly to readily available data. Some alternative methods, such as an analysis based on projected traffic volumes, were rejected because adequate data are not yet available. Others, such as a statistical analysis of the

relationship between economic activity and transportation facilities in southwestern Virginia, were rejected because they take too much time.

The first analysis, which will be called the "Exits" analysis, bases its forecasts on a set of development scenarios prepared for each interchange along each potential corridor; for the "Exits" analysis, more interchanges mean more economic impact. (This simple relationship results from the method in which the development scenarios for VEC's IMPLAN program were constructed; the IMPLAN program itself does not impose it.) The second analysis, which will be called the "Dollars" analysis, bases its forecasts on some asssumptions about the productivity of highway investment; for "Dollars", a higher dollar cost means more economic impact.

B. The "Exits" analysis predicts the impact of I-73 on annual employment (EMP) and annual employee compensation (EC). The "Dollars" analysis predicts the impact of I-73 on annual taxable (TS) sales and annual adjusted gross income (AGI). To compare the two sets of results, it is necessary to see what the "Exits" forecasts imply about TS and AGI, and/or to see what the "Dollars" forecasts imply about EMP and EC. The first four attached tables summarize the output of the first two reports, and "translate" each report's forecasts into terms that permit comparison with the other report.

These "translations" depend on the data in the reports themselves **plus** data on statewide employment and the average annual weekly wage in the Commonwealth of Virginia for 1991 and 1992, supplied by VEC, and data on statewide taxable sales for 1992 and adjusted gross income for 1991, supplied by the Department of Taxation. These additional data are shown below:

		1991	1992
Employment	2,762,991	2,789,772	
Average Weekly Wage	($)	458	479
Taxable Sales ($M)		-	42,905
Adjusted Gross Income ($M)	82,714	-	

Table I, "Estimated Impact on Employment, EC, TS, & AGI: "Exits" Method", tabulates the EMP and EC impacts predicted by "Exits" and adds two pairs of secondary predictions for TS and AGI, the first pair derived from the EMP impact and the second pair derived from the EC impact. The numbers in the third and fourth columns rely on the simple assumption that the ratio between EMP impact and TS (or AGI) impact in the counties under study is equal to the ratio between total EMP and total TS (or AGI) in the Commonwealth, and that the ratio remains constant from year to year. Likewise the fifth and sixth columns rely on the assumption that the ratio between EC impact and TS (or AGI) impact in the study area equals the ratio between total EC and total TS (or AGI) statewide.

The "Exits" analysis does not report explicit estimates of the impact for Alternative 2AB. The numbers in the fifth row are calculated as the sum of the impacts of Alternatives 2A and 2B minus the impact of Alternative 2. Because the mathematical model that IMPLAN uses is linear, this sum should exactly equal the IMPLAN estimate of the impact for Alternative 2AB.

The next three attached tables, II through IV, "Estimated Impact on Employment, EC, TS, & AGI: "Dollars" Method", tabulate the TS and AGI impacts predicted by the "Dollars" method for each of three hypothetical elasticities (elasticity measures the economy's sensitivity to new public investment; see Section C of the second report), and add two pairs of secondary predictions for EMP and EC, the first pair in each case derived from the TS impact and the second pair from the AGI impact.

For all corridors except Alternatives 3 and 3A these three sets of forecasts are drawn from the "equ. cost" tables in the second report. The accounting method that underlies the "equ. cost" tables values the proposed I-73 facilities at the average replacement cost of such facilities in Virginia; the accounting method that underlies the "est. cost" tables values them at their estimated construction cost. Because such factors as terrain and land prices that have little to do with a facility's value in service may affect its construction cost, the "equ. cost" valuation is to be preferred in general, as it assigns a highway of given quality equal value in any location while the "est. cost" valuation assigns a value that varies with location. However, because it does not distinguish between interstate highways with different numbers of lanes, the "equ. cost" valuation produces deceptively small results for Alternatives 3 and 3A, where most of the construction work would involve adding lanes to the existing Interstate 77. Therefore the forecasts for Alternatives 3 and 3A are drawn from the "est. cost" tables in the second report.

In order to put the estimates of AGI impact in 1992 terms comparable with the other estimates, it is assumed here that the 1992 AGI in each county is 5.6% bigger than the 1991 AGI, just as total employee compensation in 1992 is 5.6% bigger than in 1991. As these projected 1992 AGI figures are used in place of the true 1991 figures in constructing the first four tables, all of the tables show an AGI impact 5.6% larger than the value that the 1991 AGI figures would produce. This difference can be seen by comparing the AGI impact estimates in Tables II, III, and IV with the AGI impact estimates in the tables of the second report.

C. Inspection of the tables shows the following patterns:

- The "Exits" forecast for Alternatives 3 and 3A is very low. This is for the same reason that the "Dollars" forecast for these corridors is very low by the replacement cost ("equ. cost") accounting method: neither forecast takes adequate account of lane additions.

- Except for 3 and 3A, the "Exits" forecasts are roughly equivalent to the most optimistic "Dollars" forecasts that use an elasticity of 0.125. The "Dollars" method's EMP forecasts are from 15% to 65% lower than the "Exits" forecasts. The "Dollars" method's EC forecasts are usually higher.

- In general, all of the "Dollars" tables (II, III, IV) estimate relatively high impacts on EC and relatively low impacts on EMP in comparison with the "Exits" table (I). This same observation can made in a different way by noting that in Table I, the TS and AGI impacts derived from EMP are always higher than the ones derived from EC.

- In general, all of the "Dollars" tables estimate relatively high impacts for Alternatives 1 through 4, and relatively low impacts for Alternatives 5 through 7, in comparison with the Table I.

D. In light of what has been said about the analytical methods, the differences and similarities suggest the following tentative explanations and conclusions:

- The only reasonably accurate estimates of the economic impact for

Alternatives 3 and 3A are the "Dollars" estimates based on the estimated construction cost of I-73 (the "est. cost" tables). The "Exits" estimates that rely on the number of new interchanges and the "Dollars" estimates that value I-73 at the average replacement cost per center-line mile of interstate highway ("equ. cost") are not able to deal with these particular cases.

o The "Exits" forecasts are based on development scenarios that may be, for some interchanges at least, very optimistic. Even the most remote intersection is assumed able to attract two gas stations and one motel (see page 2 of the first report). On the other hand, the "Exits" analysis makes little effort to account for the development of business that is not traveller-oriented, and may underestimate the impact of such business.

Most of the research which inspired the choice of elasticities in the "Dollars" forecasts studies investments that added a few percentage points to the public capital stock of the geographic area under study. By contrast, I-73 will represent a huge addition to the public capital stocks in some of the localities where it is built, sometimes over fifty percent. In effect, the "Dollars" analysis is extrapolating a line fitted to small quantities into a region of large quantities where it may not have a good fit. This could make the "Dollars" forecasts either more or less optimistic than is assumed.

In short, reasons exist for either analysis to yield estimates that are more or less optimistic than assumed. Consideration of the absolute size of the numerical results gives no reason to attach more weight to one set of forecasts than to the other.

o The "Exits" method is designed to predict mostly the expansion of the service sector that caters to the needs of travellers, a sector in which the average compensation for employees is lower than the average for all Virginia jobs. The secondary "Dollars" predictions of EMP impact and EC impact in Tables II through IV, on the other hand, assume that the average compensation for the new jobs created by I-73 will equal the state average for all jobs, which would be the case if the proportion of new jobs in each sector equalled the proportion of existing jobs in each sector. Hence, the "Exits" numbers in the first two columns of Table I imply that each new worker earns about $250 per week, whereas the "Dollars" numbers by assumption give each new worker the 1992 state average of $479 per week.

The economic impact of I-73 is likely to be more balanced than the "Exits" analysis suggests, but with a disproportionate number of service jobs to serve travellers on the new interstate. Therefore the best ratio between EMP and EC probably lies somewhere between the ratio shown in Table I for "Exits" and the ratio shown in Tables II through IV for "Dollars".

o It is difficult to explain why "Exits" gives relatively higher forecasts for some corridors while "Dollars" gives relatively higher forecasts to others. Alternatives 5 through 7 do have more interchanges per mile than the other options. As the "Exits" development scenarios focus on the proposed interchanges, the "Exits" method would tend to predict a greater economic impact along these corridors relative to the others, whereas the "Dollars" method, which weighs the cost per mile of highway as well as

the cost of interchanges in its calculations, would tend to predict relatively more impact for Alternatives 1 through 4. This fact is probably part of the explanation.

It is probably not realistic to suppose that construction of additional interchanges in a county, beyond the first three or four, has a large impact on the county's economic development. For this reason, the "Dollars" analysis possibly estimates the **relative** impacts of the corridor alternatives more accurately. Consideration of the relative size of the numerical results, therefore, gives some reason to attach more weight to the "Dollars" forecasts than to the "Exits" forecasts.

The statewide economic impact estimates from the second report (the "Dollars" report) do not appear in the summary tables. Because southwestern Virginia is surrounded on three sides by other states, it can be expected that a relatively large part of the spillover effects of Interstate 73 will fall on localities outside of Virginia. The statewide impact estimates that the second report contains do not take account of this geographic fact, and are probably disproportionately high in comparison with the local impact estimates. They are therefore not tabulated here. The economic impact of each proposed interstate route on the rest of Virginia may be supposed to be of the same order of magnitude as its impact on the localities through which it passes.

E. The above observations suggest that the best economic impact estimates obtainable from this technical assistance project set of forecasts would be a weighted average of the "Exits" forecasts and the "Dollars" forecasts, with more weight given to the latter.

Tables V, VI, and VII, "Estimated Impact on Employment, EC, TS, & AGI: Weighted Average", show weighted-average estimates of the economic impacts for each proposed I-73 corridor, under each of the three assumptions about elasticity used in the "Dollars" study.

The EMP impact estimates are calculated by the following formula:

$$EMP_{est}(E) = \frac{EMP_{\$,TS}(E) + EMP_{\$,AGI}(E) + EMP_X * \left(\frac{E}{0.125}\right)}{3}$$

where

- E represents the assumed value of the elasticity,
- $EMP_{est}(E)$ represents the weighted average estimate of EMP impact for elasticity E,
- $EMP_{\$,TS}(E)$ represents the "Dollars" estimate of EMP impact derived from TS impact for elasticity E (the first column in Tables II, III, and IV),
- $EMP_{\$,AGI}(E)$ represents the "Dollars" estimate of EMP impact derived from AGI for elasticity E (the third column in Tables II, III, and IV), and
- EMP_X represents the "Exits" estimate (the first column of Table I).

The weighted EC impact estimates are calculated analogously.

The TS impact estimates are calculated by the following formula:

$$TS_{est}(E) = \frac{4 * TS_{\$}(E) + \left(TS_{X,EMP} + TS_{X,EC}\right) * \left(\frac{E}{0.125}\right)}{6}$$

where

- $TS_{est}(E)$ represents the weighted average estimate of TS impact for elasticity E,
- $TS_{\$}(E)$ represents the "Dollars" estimate of TS impact for elasticity E (the fifth column in Tables II, III, and IV),
- $TS_{X,EMP}$ represents the IMPLAN estimate of TS impact derived from EMP impact (the third column in Table I), and
- $TS_{X,EC}$ represents the IMPLAN estimate of TS impact derived from EC impact (the fifth column in Table I).

The weighted AGI impact estimates are calculated analogously.

The estimates for Alternatives 3 and 3A are exceptions. For these two corridors, the estimates of TS and AGI impact are taken directly from the "Dollars" numbers in Tables II through IV, and the estimates of EMP and EC impact are simple averages of the "Dollars" estimates derived from TS impact and AGI impact.

As the formulae indicate, in each case except Alternatives 3 and 3A the "Exits" estimate (or estimates) is given a one-third weight and the "Dollars" estimate (or estimates) is given a two-thirds weight; the "Exits" estimates are also scaled down by the factor E/0.125 in creating the low-end and mid-range estimates in Tables V and VI (for Table VII, E equals 0.125 so that E/0.125 equals one).

A KEY TO THE ABBREVIATIONS, ACRONYMS, AND SHORT NAMES

AGI - adjusted gross income.

ALT 1 (ALT 2, etc.) - The proposed I-73 corridor labelled Alternative 1 (Alternative 2, etc.) by the Transportation Planning Division of VDOT.

"Dollars" - The forecasting method used in the report **Interstate 73 Economic Impact Analysis Part 2** (VDOT/VTRC, February 1994).

EC - employee compensation; earned income.

EMP - employment.

Empl - employment.

"equ. cost" - equivalent cost; here it specifically means valuation of highway assets at the average replacement cost for such assets in Virginia.

"est. cost" - estimated cost; here it specifically means valuation of highway assets at their estimated construction cost.

"Exits" - the forecasting method employed in the report **An Economic Impact Analysis of the Potential Interstate 73 Corridors** (VEC/EISD, February 1994).

the first report - **An Economic Impact Analysis of the Potential Interstate 73 Corridors** (VEC/EISD, February 1994).

IMPLAN - Impact Analysis for Planning, a microcomputer program that performs regional input-output analysis.

the second report - **Interstate 73 Economic Impact Analysis Part 2** (VDOT/VTRC, February 1994).

TS - taxable sales.

REFERENCES

An Economic Impact Analysis of the Potential Interstate 73 Corridors, Economic Information Services Division, Virginia Employment Commission, Commonwealth of Virginia, Richmond, VA, February 1994

Interstate 73 Economic Impact Analysis: A Guide to the Methodology and Results, Part 2, Virginia Transportation Research Council, Department of Transportation, Commonwealth of Virginia, Charlottesville, VA, February 1994

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TABLE I. Estimated Impact on Employment, EC, TS, & AGI: "Exits" Metho

			Derived from Empl		Derived from EC	
ALT	+Empl	+EC $M	+TS $M	+AGI $M	+TS $M	+AGI $M
1	1319	16.65	20.29	41.30	10.28	20.92
2	1076	13.52	16.55	33.69	8.35	17.00
2A	2473	30.47	38.03	77.43	18.81	38.30
2B	1507	18.45	23.18	47.18	11.39	23.20
2AB	2904	35.40	44.66	90.92	21.86	44.50
3	49	0.59	0.75	1.53	0.36	0.74
3A	49	0.59	0.75	1.53	0.36	0.74
4	1093	13.69	16.81	34.22	8.45	17.20
5	3438	40.21	52.87	107.64	24.83	50.54
6	4830	68.29	74.28	151.22	42.16	85.84
6A	5087	71.68	78.23	159.27	44.26	90.09
7	4095	56.98	62.98	128.21	35.18	71.62

TABLE II. Estimated Impact on Empl, EC, TS, & AGI: "Dollars" Method

Elast = 0.02

	Derived from TS		Derived from AGI			
ALT	+Empl	+EC $M	+Empl	+EC $M	+TS $M	+AGI $M
1	178	4.44	151	3.75	2.74	4.47
2	129	3.21	126	3.14	1.98	3.74
2A	254	6.33	242	6.03	3.91	7.17
2B	211	5.24	189	4.72	3.24	5.62
2AB	336	8.37	305	7.60	5.17	9.05
3	59	1.48	66	1.64	0.91	1.95
3A	54	1.35	62	1.54	0.83	1.84
4	112	2.80	124	3.09	1.73	3.68
5	193	4.81	208	5.18	2.97	6.16
6	580	14.44	495	12.32	8.91	14.67
6A	505	12.58	454	11.32	7.77	13.47
7	335	8.34	361	9.00	5.15	10.71

TABLE III. Estimated Impact on Empl, EC, TS, & AGI: "Dollars" Method

Elast = 0.05

	Derived from TS		Derived from AGI			
ALT	+Empl	+EC $M	+Empl	+EC $M	+TS $M	+AGI $M
1	448	11.16	379	9.43	6.89	11.22
2	323	8.04	316	7.88	4.96	9.38
2A	639	15.92	608	15.15	9.83	18.03
2B	528	13.16	476	11.85	8.13	14.10
2AB	845	21.04	767	19.11	12.99	22.75
3	149	3.70	165	4.10	2.28	4.89
3A	136	3.38	155	3.87	2.08	4.60
4	282	7.01	311	7.75	4.33	9.23
5	485	12.08	522	13.00	7.46	15.47
6	1453	36.18	1240	30.88	22.34	36.76
6A	1266	31.52	1139	28.38	19.46	33.78
7	838	20.89	905	22.55	12.90	26.84

TABLE IV. Estimated Impact on Empl, EC, TS, & AGI: "Dollars" Method

Elast = 0.125

	Derived from TS		Derived from AGI			
ALT	+Empl	+EC $M	+Empl	+EC $M	+TS $M	+AGI $M
1	1135	28.28	958	23.87	17.46	28.42
2	814	20.27	798	19.87	12.51	23.65
2A	1619	40.32	1540	38.36	24.90	45.67
2B	1335	33.25	1202	29.93	20.53	35.63
2AB	2140	53.30	1944	48.43	32.91	57.65
3	374	9.31	415	10.34	5.75	12.31
3A	341	8.50	391	9.73	5.25	11.59
4	710	17.69	785	19.55	10.92	23.27
5	1226	30.53	1319	32.85	18.85	39.10
6	3654	91.02	3121	77.73	56.20	92.52
6A	3186	79.34	2869	71.47	48.99	85.08
7	2107	52.49	2278	56.73	32.41	67.53

TABLE V. Estimated Impact on Employment, EC, TS, & AGI:
Weighted Average Elast = 0.02
(Low-End Forecast)

ALT	+Empl	+EC $M	+TS $M	+AGI $M
1	180	3.62	2.64	4.64
2	142	2.84	1.98	3.84
2A	297	5.75	4.12	7.87
2B	214	4.30	3.08	5.62
2AB	369	7.21	5.22	9.65
3	62	1.56	0.91	1.95
3A	58	1.44	0.83	1.84
4	137	2.69	1.82	3.82
5	317	5.47	4.05	8.33
6	616	12.56	9.05	16.10
6A	591	11.79	8.44	15.63
7	450	8.82	6.05	12.47

TABLE VI. Estimated Impact on Employment, EC, TS, & AGI:
Weighted Average Elast = 0.05
(Mid-Range Forecast)

ALT	+Empl	+EC $M	+TS $M	+AGI $M
1	451	9.08	6.63	11.63
2	357	7.11	4.97	9.63
2A	745	14.42	10.34	19.73
2B	536	10.80	7.72	14.09
2AB	925	18.10	13.10	24.19
3	157	3.90	2.28	4.89
3A	145	3.62	2.08	4.60
4	343	6.75	4.57	9.58
5	794	13.72	10.15	20.86
6	1542	31.46	22.66	40.31
6A	1480	29.52	21.14	39.14
7	1127	22.08	15.14	31.21

TABLE VII. Estimated Impact on Employment, EC, TS, & AGI:
Weighted Average Elast = 0.125
(High-End Forecast)

ALT	+Empl	+EC $M	+TS $M	+AGI $M
1	1138	22.93	16.73	29.31
2	896	17.89	12.49	24.21
2A	1877	36.39	26.07	49.73
2B	1348	27.21	19.45	35.48
2AB	2329	45.71	33.03	61.00
3	394	9.83	5.75	12.31
3A	366	9.11	5.25	11.59
4	863	16.98	11.49	24.09
5	1994	34.53	25.52	52.43
6	3868	79.01	56.88	101.19
6A	3714	74.16	53.08	98.28
7	2827	55.40	37.97	78.33