

# Highway Development: Attitudes and Economic Climate

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The paper presents some recent findings of the highway impact research conducted at the Pennsylvania State University. The broader research aims at the prediction of economic development, the design of alternative land-use plans for highway protection, and the determination of factors conducive to adoption of protective measures at interchange sites. Some earlier findings are summarized as a background for reporting the results of four attitude studies and four economic analyses pertaining to interchanges.

Generally, attitudes toward planning and zoning were found to have been favorable and made even more so through exposure to literature favorable to those processes. Further, the economic analyses of actual and hypothetical data largely reveal beneficial highway impact. It is suggested that these latter findings are important to any interpretation of the attitudes found favorable both toward highway development and toward the practices of planning and zoning which could lead to highway protection.

There is brief comment on the researchers' continuing efforts to assess the effectiveness of simulated land-use models and to determine community willingness to adopt reasonable land-use control. The paper concludes with an expression of continual need for mutual understanding as the academician and sponsor cooperate in applied research.

•FOR some time, the highway impact research staff of Pennsylvania State University's Institute for Research on Land and Water Resources has been engaged in a three-pronged approach to the study of highway-community relationships. The facets involve efforts to predict economic development at selected interchanges, to design alternative land-use plans for interchange protection, and to determine the factors conducive to community adoption of reasonable protective regulation. Toward this last end, attitude study appears useful; it assumes that citizen acceptance of local highway changes is related to acceptance of rational controls and ultimately to implementation of the necessary protective practices. Three types of attitude study have been undertaken: (a) attitudes toward local highway developments; (b) attitudes toward planning and zoning practices; and (c) attitude change toward both developments and practices.

It is recognized, however, that attitudes are not self-created, nor do they stand alone. They are largely the product of the combined effects of history, frequently recent history, and of the present setting in which they are found. The focus of this paper is on attitudes and on some of the economic considerations which have probably influenced the findings of the attitude research. The economic analyses are also of three types: (a) land use and land value, (b) predictors of interchange development, and (c) economic impact of interchange development. The evidence presented is drawn from more

than a dozen papers and reports prepared by the highway impact research staff within the past four years.

## ATTITUDE STUDIES

The research staff began its gathering of attitude data in late 1958 and continued to do so for the next six years.

### Highway Related Attitudes

First analysis of these data was a two community comparison (1), followed by comparison of attitudes reported in six communities (2). These studies also treated intra-community attitudes as reported by two samples, one of community leaders and the other of "rank-and-file" citizens. Subsequently, follow-up interviews were conducted in four interchange areas, thus providing some opportunity for a look at attitude change through time (3).

The findings may be summarized as follows. Generally, highway change took place in a relatively favorable atmosphere. Whether the change was one of highway widening, bypass, or interchange construction, majorities expressed approval. Many who stated that they had not approved at the time of the construction later reported satisfaction. Most felt that the construction had been beneficial, that the amount of money spent had been "about right," and that the location of the change had been reasonable. The average citizen was quite in accord with the opinions expressed by the community leader.

Concurrent research revealed something of the characteristics of the local users of the new highway facilities (4). Among other variables, occupation, income, and education were found to be positively related to degree of highway use. New arrivals in the study communities ranked somewhat higher on these variables and were also somewhat more likely to use the new facilities. Moreover, along with population increase, community social stratification ranking related to the actual adoption of certain practices which could lead to interchange protection. With this knowledge, the researchers were able, for the first time, to select a research site in which interchange construction was not already a fait accompli. It was here that systematic study of attitudes toward rational controls was initiated.

### Attitudes Toward Planning and Zoning

In all, four specific recent studies have dealt with attitudes toward planning and zoning. The attempt was to determine the receptivity of the community to land-use control for highway protection and, further, to learn whether attitudes toward control are influenced by exposure to the planner's literature.

One effort was carried on in two interchange townships, one of which, Farmville Township (a pseudonym), had recently voted down zoning controls. The other, Pleasant Township (also a pseudonym), was actively considering the formation of a planning commission. The researchers sought within these contexts to delve more thoroughly into attitudes toward control of land use and their relationship to socioeconomic status as measured by occupation and education.

Another survey concerning planning and zoning was conducted with the cooperation of 84 elected officials in 15 townships and 7 boroughs widely distributed throughout the State. It was felt that, since leadership attitudes had been found not to differ appreciably from those of other citizens, perhaps direct approach to formal leaders could be an adequate indicator of community sentiment. The latter idea is no doubt more questionable in larger civil divisions.

The other two investigations attempted the use of standard experimental design to assess the impact of planning literature on attitudes toward adoption of land-use controls. Each experiment sought to assess the respondents' evaluations of planning and zoning mechanisms and to elicit from the individuals how they would be likely to act if confronted with planning and zoning proposals. In each case the materials used were provided by the State Planning Board (5, 16). The last study expressly questioned whether initially unfavorable attitudes would be influenced by a rather detailed presentation of the consequences of unregulated community growth.

TABLE 1  
PLEASANT AND FARMVILLE TOWNSHIPS—STATED DEGREE OF NECESSITY FOR  
COMMUNITY PLANNING BY EDUCATIONAL LEVEL<sup>a</sup>

Degree of Necessity	Percentage									
	Educational Level Pleasant Township						Educational Level Farmville Township			
	1&2	3	4	5	6&7	All	1&2	4&5	6&7	All
Highly necessary	100	88	68	67	53	71	50	50	32	39
Somewhat necessary		12	23	18	16	16	50	50	38	44
Neither necessary nor unnecessary				6	5	3			12	7
Unnecessary			5	9		4			12	7
Do not know			3		5	2				
No response			1		21	4			6	3
Total	100	100	100	100	100	100	100	100	100	100

<sup>a</sup>Data derived from Ref. 6, p. 29.

TABLE 2  
PLEASANT AND FARMVILLE TOWNSHIPS—STATED DEGREE OF NECESSITY FOR  
ZONING ORDINANCES BY EDUCATIONAL LEVEL<sup>a</sup>

Degree of Necessity	Percentage									
	Educational Level Pleasant Township						Educational Level Farmville Township			
	1&2	3	4	5	6&7	All <sup>b</sup>	1&2	4&5	6&7	All <sup>c</sup>
Highly necessary	88	75	63	57	37	61	50	20	6	15
Somewhat necessary	6	13	30	21	21	22	50	20	6	15
Neither necessary nor unnecessary					11	2			19	10
Unnecessary		13	8	15	16	10		60	69	61
Do not know					11	2				
No response	6			7	5	3				
Total	100	101	101	100	101	100	100	100	100	101

<sup>a</sup>Data derived from Ref. 6, p. 29.

<sup>b</sup>N = 116 person-responses.

<sup>c</sup>N = 28 person-responses.

TABLE 3  
OPINIONS TOWARD GOVERNMENT PARTICIPATION  
IN DECISIONS AFFECTING GROWTH<sup>a</sup>

Response Categories	Township Leaders		Borough Leaders		All Leaders	
	No.	Percent	No.	Percent	No.	Percent
Agree	44	83.0	29	93.6	73	86.9
Neutral	4	7.5	1	3.2	5	5.9
Disagree	5	9.5	0	0.0	5	5.9
No response	0	0.0	1	3.2	1	1.3
Total	53	100.0	31	100.0	84	100.0

<sup>a</sup>Data derived from Ref. 7, p. 8.

TABLE 4  
OPINIONS TOWARD THE NECESSITY OF COMMUNITY PLANNING<sup>a</sup>

Response Categories	Township Leaders		Borough Leaders		All Leaders	
	No.	Percent	No.	Percent	No.	Percent
Necessary	49	92.6	30	96.8	79	94.0
Neutral	1	1.8	0	0.0	1	1.2
Unnecessary	2	3.8	1	3.2	3	3.6
No response	1	1.8	0	0.0	1	1.2
Total	53	100.0	31	100.0	84	100.0

<sup>a</sup>Data derived from Ref. 7, pp. 10 and 11.

TABLE 5  
OPINIONS TOWARD NECESSITY OF ZONING ORDINANCES<sup>a</sup>

Response Categories	Township Leaders		Borough Leaders		All Leaders	
	No.	Percent	No.	Percent	No.	Percent
Necessary	46	86.8	29	93.5	75	89.3
Neutral	2	3.8	0	0.0	2	2.4
Unnecessary	5	9.4	2	6.5	7	8.3
Total	53	100.0	31	100.0	84	100.0

<sup>a</sup>Data derived from Ref. 7, pp. 10 and 11.

TABLE 6  
REPORTED PUBLIC EXPRESSION OF OPINIONS ON PLANNING

Response Categories	Township Leaders		Borough Leaders		All Leaders	
	No.	Percent	No.	Percent	No.	Percent
Favorable	14	26.4	15	48.4	29	34.5
No public expression	37	69.8	16	51.6	53	63.1
Unfavorable	1	1.9	0	0.0	1	1.2
No response	1	1.9	0	0.0	1	1.2
Total	53	100.0	31	100.0	84	100.0

TABLE 7  
REPORTED PUBLIC EXPRESSION OF OPINION FOR OR AGAINST ESTABLISHMENT OF ZONING COMMISSION

Response Categories	Township Leaders		Borough Leaders		All Leaders	
	No.	Percent	No.	Percent	No.	Percent
Favorable	23	43.4	19	61.3	42	50.0
No public expression	29	54.7	11	35.5	40	47.6
Unfavorable	1	1.9	1	3.2	2	2.4
Total	53	100.0	31	100.0	84	100.0

TABLE 8  
MEAN SCORES ON THE EVALUATIVE INDEX BEFORE AND AFTER  
EXPOSURE TO BOOKLET—EXPERIMENTAL VS CONTROL GROUPS<sup>a</sup>

Group	Mean Index Scores <sup>b</sup>		Significant Difference Within Each Group
	T <sub>1</sub>	T <sub>2</sub>	
Experimental group	24.09	27.38	Yes ( $t = 3.48$ $p < 0.01$ )
Control group	24.20	23.15	No
Significant difference between the groups	No	Yes ( $t = 3.67$ $p < 0.01$ )	

<sup>a</sup>Data derived from Ref. 8, p. 22.

<sup>b</sup>T<sub>1</sub> = measurement before reading A New Front Door for Your Community (16).

T<sub>2</sub> = measurement after reading A New Front Door for Your Community (16).

There is little question of the positive relationship between socioeconomic status and attitudes toward planning and zoning. Tables 1 and 2 indicate, respectively, the positive relationship between amount of education and a feeling that planning and zoning are necessary to orderly community growth. The findings for occupational level differ very little. Citizens on the whole expressed more favor for "planning" than for "zoning." Persons of higher socioeconomic level appear to have shown relatively less fear for loss of individual liberty in face of such practices. Feeling against government participation in guiding community growth was especially widespread in Farmville Township where zoning had recently been voted down. Sixty-three percent of the responses were that such involvement was "likely to result in an improper restriction of individual rights and liberties." The percentage was twice that found for Pleasant Township (6, p. 37). The study of borough and township officials indicates, as one could readily expect, that they considered it advisable to have more governmental involvement in community development (Table 3). Community leaders overwhelmingly expressed the feeling that community planning and zoning ordinances are necessary (Tables 4 and 5). However, township officials were reluctant to be as outspoken in favor of planning or

TABLE 9  
DISTRIBUTION OF RESPONSES TO THE QUESTION  
ABOUT FAVORING ZONING—EXPERIMENTAL VS  
CONTROL GROUPS<sup>a</sup>

Responses	Experimental Group <sup>b</sup>		Control Group	
	T <sub>1</sub>	T <sub>2</sub>	T <sub>1</sub>	T <sub>2</sub>
Strongly favor	10	18	9	8
Other responses	15	7	11	12
Total	25	25	20	20
	$\chi^2 = 6.12$ $0.02 > p > 0.01$		$\chi^2 = 0.00$ $p = 1.00$	

Significant differences between the changes in the experimental and the control groups

$0.01 > p > 0.001$

<sup>a</sup>Data derived from Ref. 8, p. 22.

<sup>b</sup>T<sub>1</sub> = measurement before reading A New Front Door for Your Community (16).

T<sub>2</sub> = measurement after reading A New Front Door for Your Community (16).

establishment of a zoning commission (Tables 6 and 7). A finding no doubt somewhat attractive to highway planners is that these same local government officials were largely in favor of regulation to enhance community appearance and to prevent traffic congestion. The regulation suggested included that of business growth along highways. The research further indicates that the literature used did influence the attitudes of community residents. Those exposed to the literature expressed increased favor for zoning as a means to development (Tables 8 and 9). More favorable attitudes occurred even among those who had originally been unfavorable (Tables 10 and 11). These latter findings refer to attitude change as measured by an "evaluative index," i. e., favor or disfavor toward zoning. Perhaps more pertinent to the needs of the action oriented highway administrator is the knowledge that, along with increased expression of favor for zoning, these citizens, following exposure to the planning literature expressed increased propensity to support zoning measures.

TABLE 10  
MEAN SCORES ON THE EVALUATIVE INDEX BEFORE AND AFTER  
EXPOSURE TO BOOKLET—EXPERIMENTAL VS CONTROL GROUPS<sup>a</sup>

Group	Mean Index Scores <sup>b</sup>		Significant Difference Within Each Group
	T <sub>1</sub>	T <sub>2</sub>	
Experimental group	15.48	22.66	Yes $\left( \begin{array}{l} t = 7.48 \\ p < 0.001 \end{array} \right)$
Control group	17.24	17.14	No
Significant difference between the groups	No	Yes $\left( \begin{array}{l} t = 5.14 \\ p < 0.001 \end{array} \right)$	

<sup>a</sup>Data derived from Ref. 8, pp. 29 and 30.

<sup>b</sup>T<sub>1</sub> = measurement before reading A Manual for Interchange Area Planning (5).

T<sub>2</sub> = measurement after reading A Manual for Interchange Area Planning (5).

Thus, attitudes toward both highway development and toward rational land-use controls are for the most part favorable or can be influenced toward favor; yet what is the milieu in which such favor is likely to exist? Without doubt, numerous aspects of everyday existence coalesce to provide the matrix in which attitudes are initiated and develop. General satisfaction with such affairs as local government activity, local social life and friendships, local physical environment, and local school system can affect expression of the attitudes studied. However, the satisfactions suggested are unlikely under unsatisfactory economic conditions and are seemingly impossible under conditions of abject poverty. The economist may take issue, but it seems safe to state that the highway impact areas under study are not primarily among the economically disadvantaged, and that since the inception of the study the economy of the state, with minor fluctuation, has shown general improvement. Studies emphasizing the economic facets of highway impact cannot be allowed to go unnoticed if one intends to understand attitudes toward highway change and toward highway protection through local action.

## ECONOMIC ANALYSES

TABLE 11  
DISTRIBUTION OF RESPONSES BY  
EXPERIMENTAL AND CONTROL GROUPS TO  
THE QUESTION ABOUT FAVORING ZONING<sup>a</sup>

Responses	Experimental Group <sup>b</sup>		Control Group <sup>b</sup>	
	T <sub>1</sub>	T <sub>2</sub>	T <sub>1</sub>	T <sub>2</sub>
Favor	12	28	13	16
Neutral	13	8	17	10
Disfavor	17	6	7	11
Total	42	42	37	37
	$\chi^2 = 10.00$ 0.01 > p > 0.001		$\chi^2 = 1.33$ 0.30 > p > 0.20	

Significant  
differences  
between and  
changes in  
the experi-  
mental and  
control  
groups

0.003 > p > 0.002

<sup>a</sup>Data derived from Ref. 8, pp. 29 and 30.

<sup>b</sup>T<sub>1</sub> = measurement before reading A Manual for Interchange Area Planning (5).

T<sub>2</sub> = measurement after reading A Manual for Interchange Area Planning (5).

As expected, the study of the economic impact of highway development has received foremost consideration, and study of land use and land value were among the earliest concerns of the research group. The question of what a highway does to a community was soon joined, however, by that of what a community may do to a highway. This second question was to lead eventually to studies of planned vs unplanned development, development of protective alternative land-use plans, and factors relating to adoption of protective control practices. The following are brief sketches of four of the Institute's most recent economic analyses. These researches were conducted independently and, to an extent, simultaneously. They are therefore not seen as having the temporal continuity and cumulation found in the attitude studies. For these reasons each analysis is presented as a unit and there is no summary of findings after comment about all four studies.

TABLE 12  
PREDICTION EQUATIONS DERIVED FROM A MULTIPLE REGRESSION ANALYSIS—FIRST CLASS TOWNSHIPS<sup>a</sup>

	Equations <sup>b</sup>	Coefficient of Determination
I	$Y_2 = 3,332,310 + 3,600X_{58} + 5,550X_{50} - 67.2X_{65} + 196,000X_{23} - 3,570,000X_7 - 198,000X_{24} + 1,710X_{68}$	$R^2 = 0.868$
II	$Y_2 = 2,886,080 + 3,330X_{58} + 5,430X_{50} - 51.9X_{65} + 172,000X_{23} - 3,340,000X_7 - 103,000X_{24}$	$R^2 = 0.859$
III	$Y_2 = 819,160 + 3,330X_{58} + 5,440X_{50} - 49.8X_{65} + 136,000X_{23} - 2,670,000X_7$	$R^2 = 0.855$
IV	$Y_2 = 9,772,280 + 3,580X_{58} + 5,340X_{50} - 40.1X_{65} + 241,000X_{23}$	$R^2 = 0.839$
V	$Y_2 = 393,920 + 3,710X_{58} + 5,260X_{50} - 35.4X_{65}$	$R^2 = 0.834$
VI	$Y_2 = 253,330 + 3,170X_{58} + 3,630X_{50}$	$R^2 = 0.766$
VII	$Y_2 = 843,280 + 3,320X_{58}$	$R^2 = 0.694$

<sup>a</sup>Data derived from Ref. 9, p. 65.

<sup>b</sup> $Y_2$  = real estate value per sq. mi,

$X_{65}$  = interaction term between population and distance from first order cities,

$X_7$  = miles of state maintained roads per sq mi,

$X_{50}$  = number of industrial employees per sq mi,

$X_{23}$  = interaction between miles of state maintained roads and average width,

$X_{24}$  = average width of state roads, and

$X_{58}$  = population per sq mi,

$X_{68}$  = interaction between average width and distance from first order cities.

TABLE 13

PREDICTION EQUATIONS DERIVED FROM A MULTIPLE REGRESSION ANALYSIS—SECOND CLASS TOWNSHIPS<sup>a</sup>

	Equations <sup>b</sup>	Coefficient of Determination
I	$Y_2 = 8,970 + 1,984X_{58} + 16,937X_{50} - 296.4X_{74} + 47.3X_{82} - 1.84X_{72} - 192,283X_{38} + 12,856,570X_9$	$R^2 = 0.955$
II	$Y_2 = -22,812 + 1,792X_{58} + 25,170X_{50} - 420.0X_{74} + 42.0X_{82} - 1.55X_{72} - 166,809X_{38}$	$R^2 = 0.953$
III	$Y_2 = -140,172 + 1,590X_{58} + 25,733X_{50} - 431.5X_{74} + 39.3X_{82} - 1.48X_{72}$	$R^2 = 0.949$
IV	$Y_2 = -128,016 + 1,764X_{58} + 20,730X_{50} - 374.3X_{74} + 12.6X_{82}$	$R^2 = 0.938$
V	$Y_2 = -30,724 + 1,992X_{58} + 22,600X_{50} - 386.4X_{74}$	$R^2 = 0.920$
VI	$Y_2 = -7,853 + 2,009X_{58} + 13,042X_{50}$	$R^2 = 0.899$
VII	$Y_2 = -9,550 + 2,805X_{58}$	$R^2 = 0.777$

<sup>a</sup>Data derived from Ref. 9, p. 91.

<sup>b</sup> $X_{58}$  = population per sq mi,

$X_{38}$  = 10-mi proximity index,

$X_{38}$  = miles of improved state roads per sq mi, and

$X_{50}$  = number of industrial employees per sq mi,

$X_{72}$  = average width of state maintained roads times the 10-mi proximity index,

$X_9$  = miles of limited access roads per sq mi.

$X_{74}$  = number of industrial employees per sq mi times distance from first order cities,

TABLE 14

NUMBER OF PROPERTIES WITHIN INTERCHANGE COMMUNITIES<sup>a</sup>

Interchange Community	Properties									
	1961		1962		1963		1964		1965	
	No.	No.	Percent Change	No.	Percent Change	No.	Percent Change	No.	Percent Change	
A	564	573	+1.60	584	+1.92	607	+3.94	627	+3.30	
B	2,023	2,079	+2.77	2,123	+2.12	2,168	+2.12	2,215	+2.17	
C	1,488	1,521	+2.22	1,545	+1.58	1,578	+2.14	1,628	+3.17	
D	693	707	+2.02	717	+1.41	753	+5.02	770	+2.26	
Total	4,768	4,880	+2.35	4,969	+1.82	5,106	+2.76	5,240	+2.62	

<sup>a</sup>Data derived from Ref. 10, p. 5.

TABLE 15  
DISTRIBUTION OF REAL ESTATE VALUES OF INTERCHANGE COMMUNITIES BY PERCENTAGES  
ATTRIBUTABLE TO LAND AND TO IMPROVEMENTS<sup>a</sup>

Interchange Community	Land					Improvements				
	1961	1962	1963	1964	1965	1961	1962	1963	1964	1965
A	17.31	17.03	17.00	16.81	16.53	82.69	82.97	83.00	83.19	83.47
B	20.20	19.84	19.33	19.12	18.70	79.80	80.16	80.67	80.88	81.30
C	21.76	21.15	20.90	20.32	20.46	78.24	78.85	79.10	79.66	79.54
D	22.42	22.33	22.25	22.33	22.10	77.58	77.67	77.75	77.67	77.90
Avg.	20.59	20.18	19.85	19.56	19.35	79.41	79.82	80.15	80.44	80.65

<sup>a</sup>Data derived from Ref. 10, p. 14.

TABLE 16  
LAND VALUES IN INTERCHANGE COMMUNITIES AND SURROUNDING AREAS<sup>a</sup>

Interchange Community	Year	Interchange Communities		Surrounding Areas	
		Value (\$)	Change (%)	Value (\$)	Change (%)
A and B	1961	6,218,500		21,024,475	
	1962	6,406,850	3.03	21,263,600	1.14
	1963	6,549,000	2.22	21,558,450	1.39
	1964	6,636,800	1.34	21,888,050	1.53
	1965	6,818,150	2.73	22,126,350	1.09
C and D	1961	5,242,300		22,752,135	
	1962	5,286,300	0.84	23,351,100	2.63
	1963	5,337,250	0.96	24,069,600	3.08
	1964	5,502,850	3.10	24,787,200	2.98
	1965	5,699,440	3.57	25,241,660	1.83
Totals	1961	11,460,800		43,776,610	
	1962	11,693,150	2.03	44,614,700	1.91
	1963	11,886,250	1.65	45,628,050	2.27
	1964	12,139,650	2.13	46,675,250	2.30
	1965	12,517,590	3.11	47,368,010	1.48

<sup>a</sup>Data derived from Ref. 10, p. 19.

TABLE 17  
IMPROVEMENT VALUES IN INTERCHANGE COMMUNITIES  
AND SURROUNDING AREAS<sup>a</sup>

Interchange Community	Year	Interchange Communities		Surrounding Areas	
		Value (\$)	Change (%)	Value (\$)	Change (%)
A and B	1961	25,512,450		77,768,775	
	1962	26,844,300	5.22	80,130,675	3.04
	1963	28,164,800	4.92	83,492,100	4.19
	1964	28,913,700	2.66	85,989,650	2.99
	1965	30,488,750	5.45	87,699,450	1.99
C and D	1961	18,675,300		79,875,750	
	1962	19,394,100	3.85	83,296,800	4.28
	1963	19,828,350	2.24	88,725,650	6.52
	1964	21,008,100	5.95	99,452,400	12.09
	1965	21,682,000	3.21	104,289,500	4.86
Totals	1961	44,187,750		157,644,525	
	1962	46,238,400	4.64	163,427,475	3.67
	1963	47,993,150	3.80	172,217,750	5.38
	1964	49,921,800	4.02	185,442,050	7.68
	1965	52,170,750	4.50	191,988,950	3.53

<sup>a</sup>Data derived from Ref. 10, p. 23.



TABLE 18  
CORRELATIONS OF VARIABLES WITH TOTAL  
HIGHWAY-ORIENTED DEVELOPMENT<sup>a</sup>

Variable	Corr. Coeff.	Proportion of Variation Explained (%)
Cross-route average daily traffic (ADT)	0.514 <sup>b</sup>	26.4
Topography (avg. slope)	-0.388 <sup>c</sup>	15.1
Distance from nearest urban area	-0.360 <sup>c</sup>	13.0
County population change	0.333 <sup>c</sup>	11.0
Local municipal market value change	0.320	10.2
Local municipal population change	0.305	9.3
Nearest urban area population	0.289	8.4
Nearest urban area population change	0.235	5.5
Age of interchange	-0.195	3.8
County population	0.188	3.5
Interstate average daily traffic (ADT)	0.174	3.0
Local municipal market value	0.135	1.8
Local municipal population	0.099	1.0

<sup>a</sup>Data derived from Ref. 11, p. 34. Total units include only service stations,

<sup>b</sup>restaurants, and motels; only complete interchanges were considered.

<sup>c</sup>The correlation coefficient is significant at the 1 percent level.

<sup>c</sup>The correlation coefficient is significant at the 5 percent level.

The first economic analysis attempted to investigate the extent to which highway improvement contributes to community economic development as indicated by market value of real property (9). Data were gathered from a statewide sample of more than 250 Pennsylvania civil divisions, including third-class cities, boroughs, and first and second-class townships. Although the selected measures of highway development exhibited little relationship to real estate values in third-class cities and boroughs, the measures are revealed as important to such values in townships of both classes. Along with industrial employment and population, miles of state maintained roads, average width of state roads, and distance from first-order cities accounted for almost 87 percent of the total variation in the real estate values in first-class townships. Table 12 gives the pertinent equations derived from multiple regression analysis. Population sizes and industrial employment and distance from first-order cities joined with the highway improvement measures of miles of improved roads and miles of limited-access roads to account for over 95 percent of the total variation in the real estate values of second-class townships. Table 13 gives the relevant data.

A second analysis undertook to learn the extent to which changes in land use and value were associated with recent highway development (10). This analysis dealt with all properties within 2 mi of four different interchanges. The data on land use and tax valuation were gathered continuously for the years 1961 through 1965, and the latter included both land value and the value of improvements. In the interchange areas new properties were formed at the rate of 2.4 percent per year (Table 14). Overall value

TABLE 19  
ANTICIPATED EXTERNAL INCOME—HIGHWAY IMPACT  
OVER 5-YR PERIOD<sup>a</sup>  
(\$1,000 units)

Sector	No. of Units	Income (\$)
Service stations <sup>b</sup>	4	800
Motel <sup>b</sup>	1	455
Restaurants <sup>b</sup>	2	850
Auto dealers		20
Department and variety stores		25
Furniture and appliances		15
Clothing stores		15
All other retail		15
Total		2,195

<sup>a</sup>Data derived from Ref. 12, p. 13.

<sup>b</sup>Businesses resulting from interstate highway construction.

of real estate in the interchange areas increased at 3.8 percent per year as compared to 4.4 percent in the surrounding areas (Table 15). Land value at the interchanges increased at 2.2 percent as compared to 2.0 percent in the adjacent areas (Table 16), but the respective rates of increase for improvements to real property were 4.2 and 5.1 percent (Table 17). As late as 1965, business uses occupied least acreage in the study area; residential uses accounted for one-tenth of the land area; open-space uses such as farming and forestry utilized nearly four-fifths of the total area. Therefore, it seems especially profitable to study alternative land-use plans for these interchanges.

The third analysis was a study of economic development at 36 interchanges on five different interstate routes (11). The factors considered as independent included: type of interchange, average daily traffic on the interstate and cross route, distance to nearest urban center, age of the interchange, average slope within the interchange community, population, and market value of real property (Table 18). The ultimate goals of this analysis are to determine what factors influence economic growth and eventually to predict economic change within  $\frac{1}{2}$  mi of an interchange facility. The study reports that highway-oriented commercial development accounted for more than two-thirds of the total development, with service stations, restaurants and motels in a 6:4:3 ratio (11, p. 43); industrial, residential, and recreational development took place on land somewhat removed from the interchange. The survey also suggests that average daily traffic on the cross route, interchange community topography, and distance from nearest urban center are important variables in the prediction of interchange economic development.

The final economic analysis employs the input-output techniques of the regional analyst (12). In this case study the "region" is a county within which the last section of an interstate route is being constructed. Efforts to predict economic development at interchanges within the county were based on engineering plans of the proposed section of the highway, economic development data from public sources, site inspection for topographic detail and state of existing development, and projection of average daily traffic figures. Analysis of these variables led to the "reasonable expectation" that, within 5 yr of completion of the highway, economic development would include addition of one trucking terminal, one 100-unit motel, two restaurants, and four service stations. Table 19 gives anticipated external income within the 5-yr period. The analysts foresee a subsequent annual increase in economic activity amounting to \$5,000,000, of which net income to households will amount to nearly \$780,000 and \$230,000 will be added to government income (12, p. vi). The foregoing values assumed the stability of the national economy at the 1963 level.

The results of these economic analyses suggest an economic climate conducive to the fostering of attitudes which are favorable to highway development and perhaps also toward protection of the highway facility. The actualities of the first three analyses and the forecasting of the fourth all point to local highway construction as advantageous. It is not difficult to accept the idea that although citizens cannot quote the specifics of economic change, they are aware that it is taking place; and if it is favorable, they do not wish to stifle it. Development of appropriate protective land-use plans may be the solution they seek.

### PROTECTION MODEL AND IMPLEMENTATION

The first efforts of this highway impact research staff to develop a computerized simulation model for interchange land-use planning suggested some community variables which appeared related to community acceptance of any proposed plan (13). A simplified general model has since been developed, and analysis of its recent application to a suburban "dormitory" interchange community is now under way (14). The likelihood of community acceptance of land-use regulation has also received additional attention (15). Locally initiated zoning, for example, tends to occur when county planning exists, when local behavior is affected by the thinking of new arrivals to the community, and when strongly favorable attitudes toward zoning are expressed. Some people would argue the futility of attempts to seek indicators of willingness to accept land-use regulation in face of the local power of economic interests. However,

education focusing on the permissive rather than the prohibitive aspects of planning and zoning may very well begin with those interests which are so largely a part of the economic climate in which their own and others' attitudes exist.

#### UTILIZATION OF FINDINGS

This paper has touched on three interrelated phases of applied highway impact research: the prediction of interchange community growth, the development of land-use plans intended to protect the highway facility from succumbing to unplanned obsolescence, and the search for indications of community willingness to adopt such plans. These are highly exoteric goals, but the tentative nature of the reported findings may surely lead the "practical man" to question their usefulness. This condition is one which is invariably faced by the researcher who, by the nature of his discipline, must deal in abstractions.

These findings cannot be as visible as those of the researcher who reports, in pounds per square inch, the results of having crushed concrete objects of various sizes, shapes, and composition. True, attitudes may be difficult to measure, and conceptual models may be difficult to comprehend. Even the more measurable economic variables are often related to appraisal and projection. Yet much of the abstruseness may be overcome and utilization enhanced by continual communication and cooperation between researcher and sponsor. The need for mutual understanding of attitude study may become paramount if highway officials and academicians are to continue their relationship. Yielding only to economic climate, attitudes can hardly be supplanted as the major independent variable throughout the highway's involvement in a program of national beautification.

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