

Interchange Development Along 180 Miles of I-94

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All interchanges on 180 mi of freeway are analyzed and classified in relationship to the community. Guidelines are set up for predicting benefits. For each classification, the degree of development and the observed and expected land values are given. Business success of service stations and motels in relationship to an interchange classification is also analyzed.

•DOES EVERY interchange on a limited-access freeway develop benefits? The introduction of the freeways, and particularly the advent of the interstate program, have caused many appraisers, investors, and property owners to ponder this question. A number of studies conducted in Michigan and other states during the past several years demonstrated that benefits accrue at some interchanges. However, they did not provide a predictable pattern to use on other interchanges for anticipating changes in highest and best use or in estimating value increment. To help solve this problem, a 180-mi stretch of I-94 with 66 interchanges was selected because it extends as a freeway across the full width of Michigan and serves both rural communities and large cities (Fig. 1).

STUDY BACKGROUND

The history of I-94 actually began in 1942 with the Detroit Industrial Expressway, constructed between Detroit and the west side of Ypsilanti, $\frac{1}{2}$ mile east of US 23. The expressway had crossings at grade and points of direct access for the adjoining ownership. In 1956, the expressway was extended westward to the west side of Ann Arbor. This was constructed as a limited-access facility with interchanges and overpasses on the main roads. Several side roads entered at grade, but these were closed in 1963.

In 1953, another section was constructed which skirted the north side of Jackson. This was limited access with overpasses and several substandard off- and on-ramps. The substandard interchanges are being upgraded or eliminated. The three that are being eliminated have not been included in this study because the market reaction would reflect this factor.

With the advent of the Interstate Program in 1957, the remainder of I-94 was constructed to freeway standards. The entire freeway was opened to traffic on Dec. 19, 1960.

This study did not consider I-94 east of US 23 (Detroit Industrial Expressway) because of the various highway improvement programs instituted since 1952 by the Michigan State Highway Department. The changes included several new interchanges and the elimination of several at-grade intersections. This has undoubtedly influenced the market, and so might not give a true picture.

Types of Interchanges

In the first step of this analysis, the 66 interchanges (see Land Economic Study No. 14 of the Michigan State Highway Department for individual interchange write-ups) were



Figure 1. Study site.

separated into four major categories: full, partial, closed, and terminal interchanges. Full interchanges are those which allow the motorist to leave the freeway when traveling in either direction, reach any quadrant, and then return to the freeway to continue in either direction. Partial interchanges are those which serve off-traffic in only one direction and allow on-traffic in only one direction. Closed interchanges occur at the intersection of two limited-access highways; adjoining land is accessible only by indirect or circuitous routes. Terminal interchanges are those in the area where the freeway is being terminated and channeled into noncontrolled-access highways. The percentage breakdown as to type of interchange is shown in Figure 2.

LAND-USE ANALYSIS OF FULL, PARTIAL, AND CLOSED INTERCHANGES

The variations of land uses among the full, partial, and closed interchanges were compared. Attempts were made to locate all sales by checking county records, by contacting real estate agencies, and by personal contact of the owners. The purposes of the sales were determined by buyer contact and all physical activity was checked. The land use was classified in each quadrant of the interchange as commercial, industrial, residential, vacant, or governmental.

Commercial use was rated the highest because it is most clearly associated with the freeway user, as well as being compatible with the freeway. If there was commercial activity in a quadrant, either by actual use or by sale for future commercial use, the quadrant was classified as commercial.

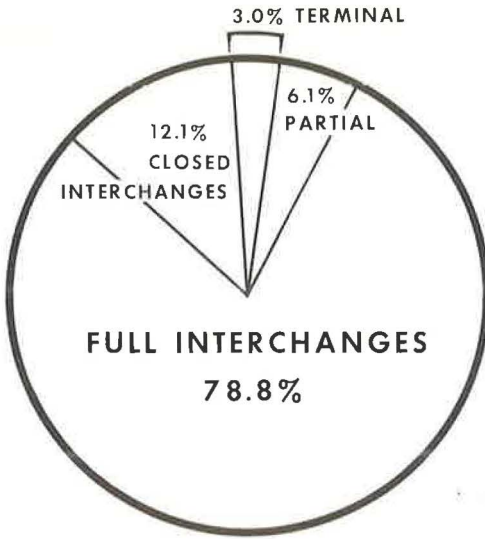


Figure 2. Percentage distribution by type of 66 interchanges on I 94 from Indiana state line to US 23 east of Ann Arbor.

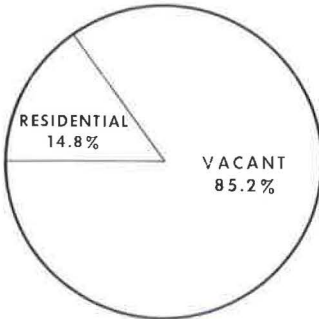
Industrial use was considered the next level of activity. This use has been found to be compatible with freeways, but dependency on proximity to the freeway is not as critical as commercial use. If a quadrant had both commercial and industrial use, the commercial use dominated the classification even though the industrial use might have occupied more area.

The residential rating was given to all quadrants with houses, including farm dwellings. If a sale had occurred for another use, i.e., commercial or industrial, the sale-use classification dominated, but when the property had not sold, it was classified as residential regardless of market potential or asking price.

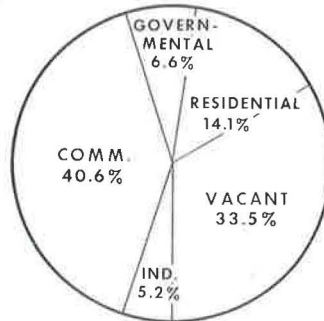
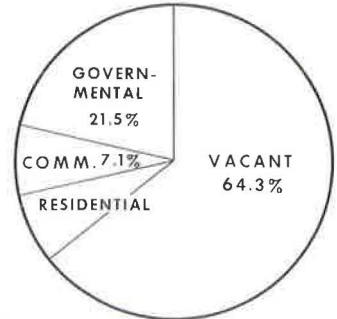
The vacant classification was given to land which had not been committed. This included farms or land being held without any activity. If it had been sold, its classification reflected the reason for the sale.

The governmental classification covered lands owned by governmental agencies or by institutions and so not available for development.

**CLOSED INTERCHANGES (8)
QUADRANTS (27)**



**PARTIAL INTERCHANGES (4)
QUADRANTS (14)**



**FULL INTERCHANGES (52)
QUADRANTS (208)**

Figure 3. Land-use relationship.

The land-use relationship by type of interchange is shown in Figure 3. The terminal interchange was not considered representative and, therefore, was not analyzed.

It is immediately apparent that development at full interchanges has shown a marked response to the freeway, which is in sharp contrast to the closed or limited-access interchanges. The only partial interchange having major activity was closely associated with a nearby full interchange. From this we can conclude that access which permits movement in both directions on a freeway is practically an axiom for commercial development on freeways. Benefits would be unusual on partial interchanges and practically nonexistent on closed interchanges.

ANALYSIS OF FULL INTERCHANGE

At this point, the analysis is confined to the full interchange. Although each full interchange is an entity, certain broad categories tend to stand out. To try to bracket these categories, four major groupings of the full interchange have been established.

1. Major city interchanges. This designation was used for interchanges at cities with over 10,000 population and located on the most direct route into the city. If a state or US-designated trunkline made a reasonably direct penetration into the city, it was automatically included (Fig. 1).

2. Secondary city interchanges. This included all of the interchanges around the cities of over 10,000 population, but it excluded those routes classified as major city interchanges.

3. Small town interchanges. This was the main, and generally the only, interchange adjoining a city or town of under 10,000 persons. A further restriction was that the interchange would be within 1 mile of the city limits or within 2 miles of the center of the city.

4. Rural interchanges. This included all interchanges that were not associated with a city or town.

Each of these categories shade into the other because of the adjoining environment and opportunities for investment. Some of the secondary city interchanges around Kalamazoo are upgrading toward major city interchanges, whereas the secondary city interchanges near Battle Creek verge on a rural classification. The percentage breakdown of quadrant development is shown in Figure 4.

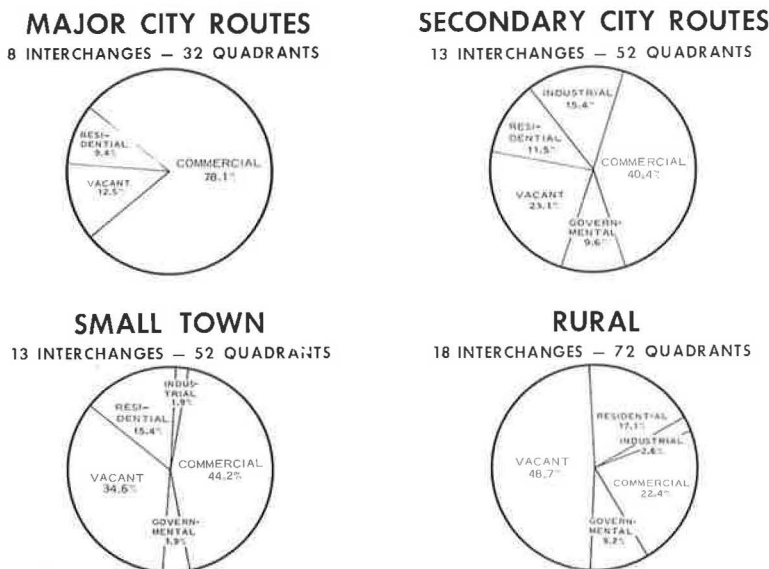


Figure 4. Full interchange, percentage breakdown of quadrant development.

The major city interchange stands out with its heavy emphasis on commercial activity (almost 80 percent of the quadrants). This activity covers not only service stations, but also 100-unit motels, restaurants, and shopping centers. Those lands at major city interchanges which have not been channeled into interchange uses are being held at prices considerably above the 1959-1960 price level.

Secondary city and small town interchanges have very similar patterns of commercial development. More industrial development was found at the secondary city interchanges than at the small town interchanges. The interchange near the city provides industry with quick, convenient access plus identity, and it is nearer the market or supplier.

The rural interchanges are conspicuous because of the small amount of commercial and industrial use that has developed. Only one out of four quadrants has reflected activity. Part of this can be explained by no supporting local market and lack of identity by association with cities or towns listed on maps.

The various types of commercial uses within 1,000 ft of the interchange were explored in relationship to the interchange classifications. A summary of the quantity of use per interchange is shown in Table 1.

The major city classification is outstanding in all phases of commercial development. Service station development varied from two to five per interchange. Six of the eight interchanges had at least three restaurants. Motels are chiefly associated with the major city interchange; they are at present a rarity on the other interchanges. In the rural areas, less than half the interchanges had service stations and approximately a quarter had restaurants.

DEVELOPMENT OF LAND VALUES ON FULL INTERCHANGE

After preliminary analysis of various sales, it became apparent that a well-informed market did not exist in 1960. The initial sales around the full interchange varied with the skill of the negotiator. Secondary sites often sold for greater amounts than did the prime locations. This can be partially explained by the fact that the freeway was a new concept in 1960. The investor had little or no experience on which to base his decisions, and, therefore, with this uncertainty, competition was slow in developing. Many times the seller did not recognize the market potential; when an apparent "bonanza" was offered, he was quick to accept without actual testing of the market. For these reasons, any averages on market value reaction give a very incomplete picture of today's market on I-94. Were I-94 constructed today with the background of experience available, the market reaction would be more pronounced, and truer relationships between price and interchange could be developed.

Recognizing these limitations, the sales of 1959 through 1963 are compared with the appraised value as estimated by the independent appraiser in 1958 and 1959. The results are presented in Table 2 and Figure 5.

Part of the increment can be explained by the general land market rise. In the control areas studied, values have increased 10 to 185 percent. An increment range of 15 to 35 percent, though, would probably bracket the average for general land increment.

TABLE 1
QUANTITY OF COMMERCIAL DEVELOPMENT PER INTERCHANGE ON
FULL INTERCHANGES

Interchange Classification	No.	Service Stations	Restaurants	Motels	Shopping Centers	Sales Uncommitted ^a
Major city	8	3.38	2.38	1.25	0.38	0.38
Secondary city	13	1.38	0.46	0.15	0.08	0.54
Small town	13	1.23	0.54	0.00	0.00	0.62
Rural	18	0.44	0.28	0.00	0.00	0.50
Average		1.33	0.71	0.31	0.08	0.52

^aKnown sales where no construction has started.

TABLE 2
VALUE INCREMENT AS PERCENT OF
BEFORE VALUE

Interchange Classification	Service Stations Only (%)	All Other Sales (%)
Major city	441	227
Secondary city	388	215
Small town	641	205
Rural	627	161
Average ^a	505	201

^aService station sales, 15; other sales, 52.

A study of the 1963-1964 market, indicating the probable range in values for service stations sites, is shown in Figure 6. The site size listed is that which tends to predominate. The range of value would bracket most sales. Occasionally, a superior site may sell for more or a poor site requiring considerable preparation or having poor view may sell for less.

Although experience in other land uses is more limited than that of service stations, we are able to draw some conclusions. At major city interchanges, motels and major restaurants are paying \$12,500/acre for 4 to 5 acre sites. In

one case, a major department store paid \$19,750/acre. Several of the tracts were purchased or developed in the early 1960's. Since they are not on the market today, the true market cannot be measured without consideration of the improvements.

BUSINESS SUCCESS AND THE FULL INTERCHANGE

Has the full interchange location proven successful for business, and is the money being spent for sites justified? To answer these questions partially, the service stations have been explored in detail. The gross use tax returns of four major motels and four minor motels have also been examined.

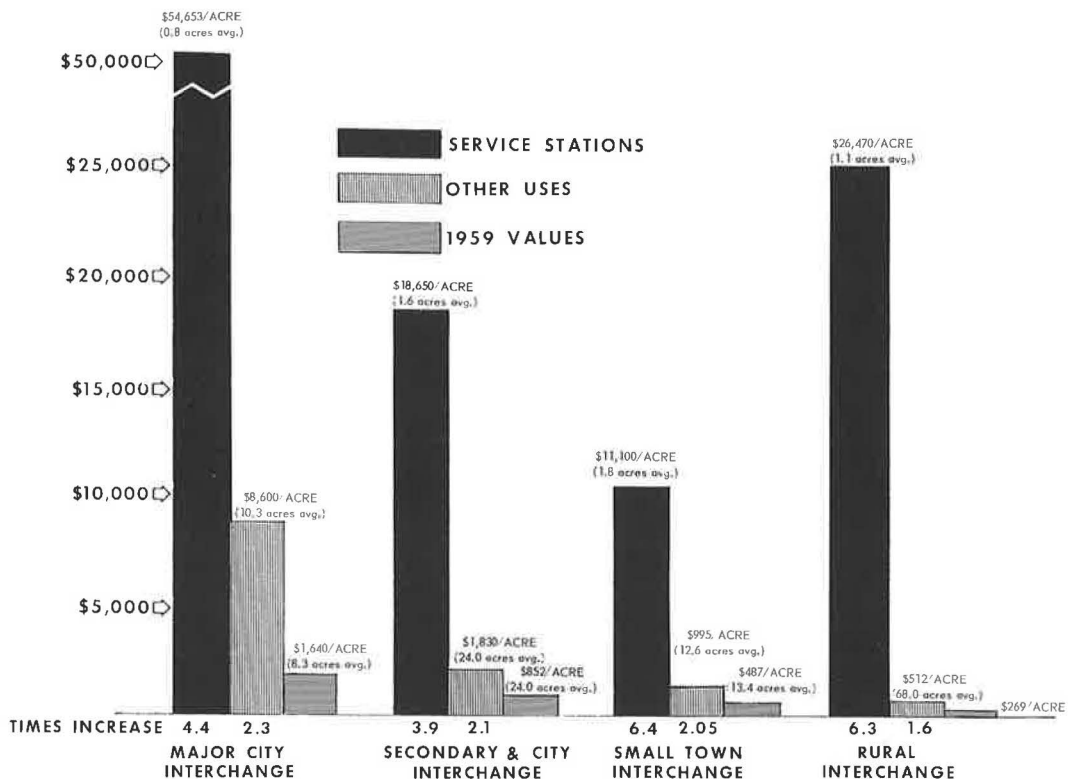


Figure 5. Full interchange land value changes, 1960-1964 sales averages compared to 1959 appraised values.

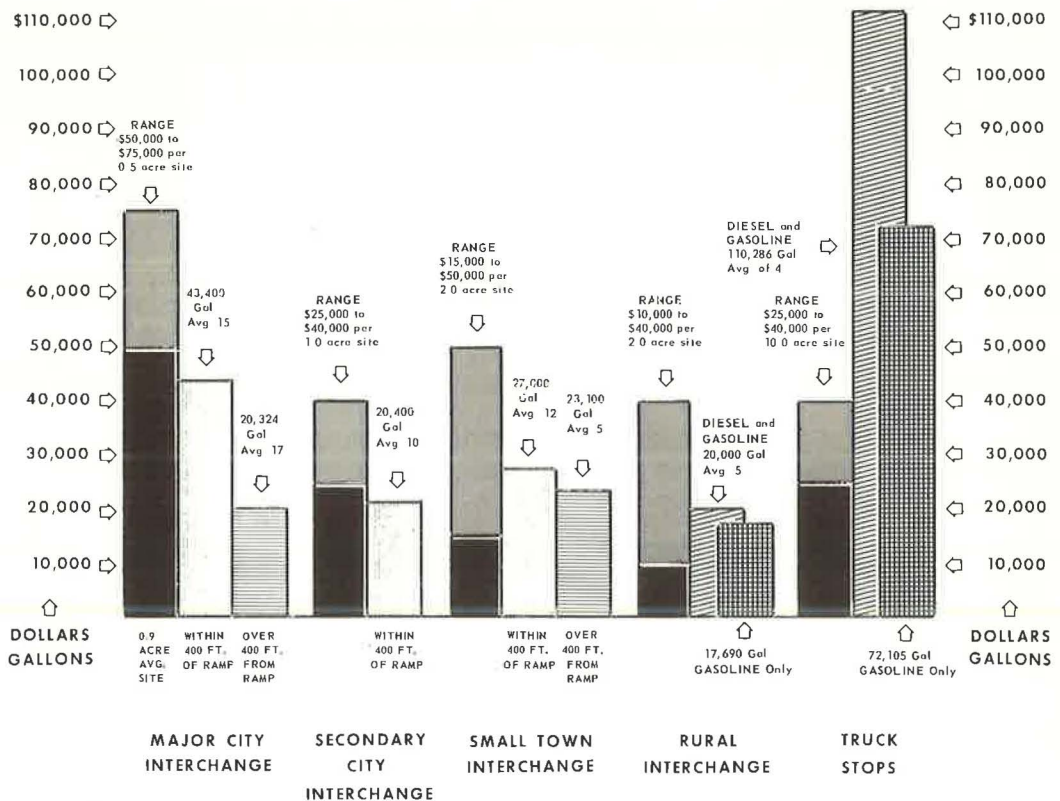


Figure 6. Full interchange service station activity showing 1963 price range for sites and 1963 gallonages.

Service Stations

All of the petroleum companies cooperated in this study by furnishing a month-by-month pumpage for 1963. Inasmuch as each company is in a very competitive position, we have held the individual gallonages in confidence and have dealt with the stations by averaging the gallonage of the stations within each interchange classification. A statistical analysis was made to find the standard deviation of the mean and to test whether there was a significant difference of business success between the interchange classifications. The results are given in Table 3.

The major city interchange stands out from all other classes. The pumpage is almost double the average of the other three groups. It was 60 percent better than for small town interchanges and 117 percent better than for rural interchanges. Although

TABLE 3
SERVICE STATION GALLONAGE COMPARISON, FULL INTERCHANGE

Interchange Classification	No. Stations	Avg. Gal/Mo (thousands)	Std. Dev. of Mean ^a	Std. Error of Dif. Between Means ^b			
				Major City	Secondary City	Small Town	Rural
Major city	15	43.4	21.70	-	6.6 S	6.6 S	7.2 S
Secondary city	10	20.4	9.35	6.3 S	-	4.6 NS	5.4 NS
Small town	12	27.0	11.11	6.6 S	4.6 NS	-	5.7 NS
Rural	5	20.0	10.09	7.2 S	5.4 NS	5.7 NS	-
Total	42	30.4					

^aA standard deviation from the mean brackets approximately 68 percent of the stations.

^bS = significant; NS = not significant.

there was considerable variation of pumpage within the major city class, the differences between the major city and the other classes were found to be statistically significant.

The small town interchanges averaged 30 to 35 percent above the secondary city and rural interchanges. This difference, though, was not found to be significant. The fact that the secondary city interchange is grouped with the small town and rural interchanges indicates that the aura of the large city contributes little to the service station business at the secondary city interchange. As the city builds out to the freeway, the secondary city interchange will probably move toward the major city interchange in development patterns and values. The four truck stops (three on secondary city interchanges and one at a small town interchange) were not considered in this analysis. A graphic presentation of the relationship between prices paid and gallonage pumped is shown in Figure 6.

Service Station Sites at Interchange vs Those Over 400 Feet Away

To test whether there is an advantage of being next to the freeway, a group of 17 stations on the major city routes over 400 ft away from but within 1 mi of the interchange were checked. They averaged 20,800 gal/mo (std. dev., 9.9), which compares with 43,400 gal/mo at the interchange. The difference is found to be statistically significant and sharply focuses on benefits derived from the interchange.

In the case of the small town locations, only five stations were studied, with all but one in the business district. They averaged 23,100 gal/mo, which compares with 27,000 gal/mo at the interchange. This indicates that the interchange sites were in a superior position to the small town station. The size of the sample, though, makes the results inconclusive, and the difference was not significant. In each case, the interchange station was outside or on the edge of the city limits. The reader might contemplate the business success of the station at the edge of a small town without the freeway.

Service Stations and Competition

As more and more service stations are added along I-94, the danger of excessive competition becomes a pertinent question. To test this point, seven service stations were selected from small town and major city interchanges which had operation records through 1963 and the first half of 1964. In 1963, these stations averaged 38,700 gal/mo. In the first half of 1963, the seven test stations filed tax returns amounting to \$17,293. During the same period in 1964, the return mounted to \$18,579, an increase of 7.5 percent (Fig. 7). Thus, the established stations more than held their own even though there was a 36 percent increase in the number of new stations. Fuel tax collections for Michigan registered a 7 percent increase in the first half of 1964 over the same period in 1963. The traffic on I-94 increased 9 percent during the same interval.

Motels and Freeways

At almost every major city interchange, a motel is in operation or under construction. From this alone, we can conclude that certain interchanges have special motel attraction. Because the motel has been a little slower than the service station to swing into activity along I-94, we do not have as much business experience to analyze. Many of the larger motels were opening for business during the winter of 1962-1963. Immediately after opening, motels go through a break-in period with their occupancy rate gradually building up to a normal level. This tends to limit the value of comparison at this time. Also, an actual return per room or motel was not available for detailed analysis.

To try to bridge this lack of information, the motel use tax returns were analyzed. Returns were obtained on four large and four small motels, averaging 97 and 19 rooms per motel, respectively. The general hotel-motel business trend, as indicated by use tax returns from the entire state, is used as a comparison to test the business climate for the freeway motels (Table 4).

1963 Average Monthly Pumpage — 38,700 Gallons per Station for 7 Test Stations

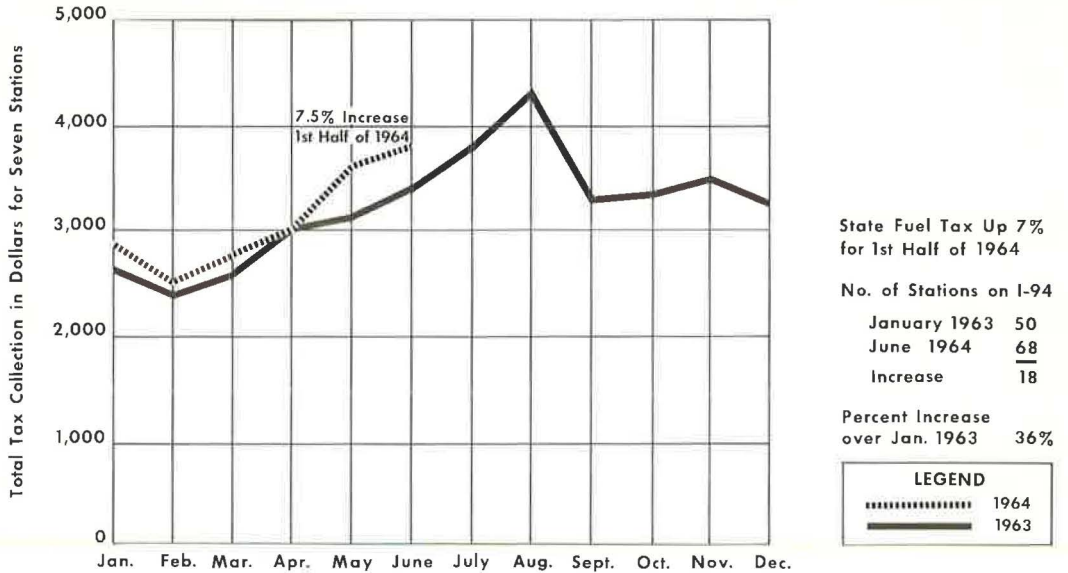


Figure 7. Service station and competition, 1963-64 sales tax comparison.

Because the data on large motels were incomplete before January 1963, the small motels are used as a yardstick. Their pattern of increase follows the general trend in returns for the state at large. The state-at-large returns would be expected to increase due to the general growth of hotel and motel accommodations; the fact that the small motel has increased proportionately as rapidly as the state at large indicates that the construction of new motels has not adversely affected the small motel business success (Fig. 8).

The large motels have registered a much better return in 1964 than in 1963 (Fig. 9). This can be partially explained by the fact that two of the four motels were going through a break-in period in the early part of 1963 (one opening in November 1962 and the other in January 1963). To obtain a better comparison, the second quarters of 1963 and 1964 are analyzed.

During this period, their returns increased 22 percent compared to the state-at-large increase of 9.2 percent. The increase can be attributed primarily to new business and was not at the expense of other motels on I-94 (Fig. 8).

Another indication of business success is the construction of new motels and the adding on to the present facilities. Three new motels, under construction, will add

Type Motel	Total No. Rooms	Returns (\$)		Increase (%)	Returns (\$)	
		2nd Half 1962	2nd Half 1963		1st Half 1963	1st Half 1964
Large	387	N. A.	19,754	-	13,816	17,776
Small	74	2,521	2,829	12.2	2,253	2,460
State at large	-	-	-	5.5	-	-

^a A 4 percent motel-hotel use tax collected on all room sales.

250 units. At Ann Arbor, the Holiday Inn Syndicate is preparing to add 56 units in November. The effect of the new units (a 30 percent increase) on present facilities is unknown. Undoubtedly, the traffic growth will tend to absorb the additional motel units (Table 5). It is estimated by the Traffic Division of the Michigan State Highway Department that the number of vehicles on I-94 will more than double in the next 10 years. This should easily absorb the motels that are now under construction.

This motel study indicates that the investment made in land and improvements has proven sound. We can conclude that the land use for motels is proper for the major city interchange. How successful motels will be at lesser interchanges remains to be tested.

TRUCK STOPS

In analyzing various interchanges, certain ones were found to be focal points for truckers. Was the primary factor in the development of the successful truck stop chance, management, or location with respect to the highway system? Management combined with extensive parking areas, diesel fuel, 24-hr service, and reasonably priced food in liberal servings undoubtedly help. However, it takes more than this—it takes a special type of location. The most successful truck stops are oriented toward an intersection of a major trunkline or with the industrial complex of a major city. Four such locations which have developed are discussed in the following.

1. Napier Road. The Famous Truck Stop is located at this secondary city interchange. Napier Road is the first interchange west of the junction of I-196, which serves the Holland-Grand Haven-Muskegon area; as a result, the Famous Truck Stop is in the direct line of the Chicago-Western Michigan traffic and the I-94 traffic. The proprietor had previously owned and managed a truck stop on US 31 and US 33, northeast of Benton Harbor.

2. Sprinkle-Cork. The Half Way House and Marathon Service are located at this secondary city interchange, which adjoins the industrial area in southeast Kalamazoo and the city of Portage. It is also the first interchange east of the junction of US 131 freeway where land was available for development.

3. US 27. The Coffee Cup with Phillips 66 Service is located at this interchange of US 27 serving central Michigan and eastern Indiana. As a result, it is the branching-off point for a number of trucks traveling on I-94. This advantage may be lost, though, due to the proposed relocation of US 27 approximately 1½ mile west, which will be known as I-69. When this occurs, the most strategic location will be Eleven Mile Road, a secondary city interchange. Anticipating this advantage, the Te-Khi Grill with Texaco and the Country House with American Oil have already been constructed.

4. Sargent Road. H and M Grill with Phillips 66 Service is located at the secondary city interchange on the northeast side of Jackson. It is also the first interchange east of US 127 freeway, south. The trucker going from Detroit to the Jackson area must pass this interchange. Previous to construction of I-94, a restaurant-truck stop and a weigh station were located on old US 12, east of Sargent Road. One year after the freeway opened to traffic, the weigh station was relocated. During this interim period,

RETURNS^a

Increase (%)	Returns (\$)		Increase (%)	Returns (\$)		Increase (%)
	1st Qu. 1963	1st Qu. 1964		2nd Qu. 1963	2nd Qu. 1964	
28.6	5,529	7,652	38.4	8,287	10,124	22.2
9.2	1,003	1,092	8.9	1,250	1,368	9.4
9.5	-	-	9.8	-	-	9.2

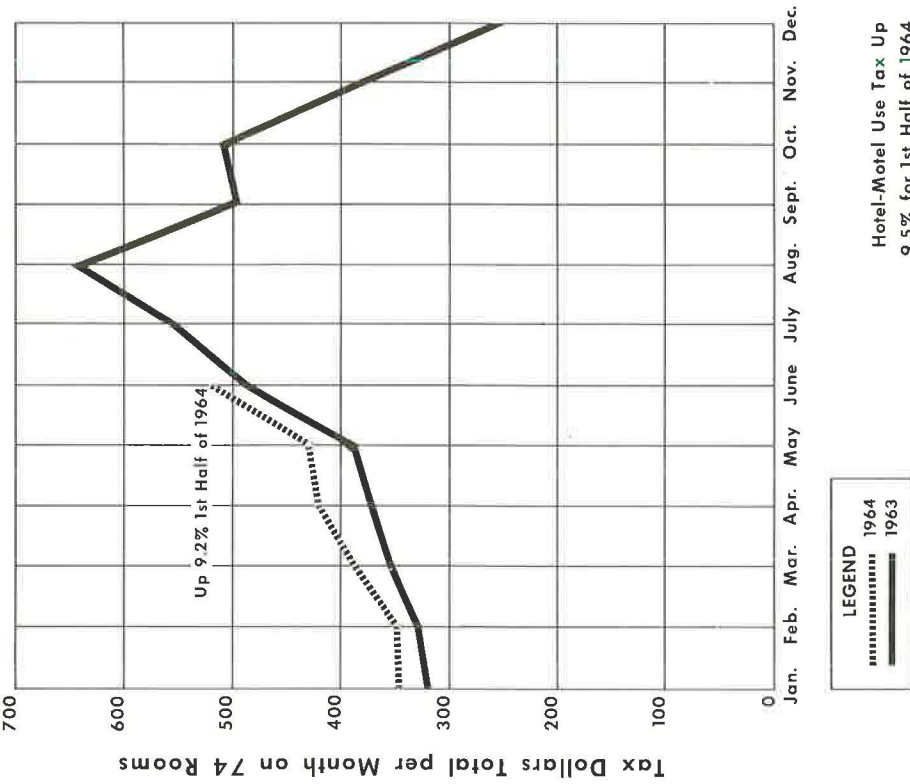


Figure 8. Use tax returns on four small motels.

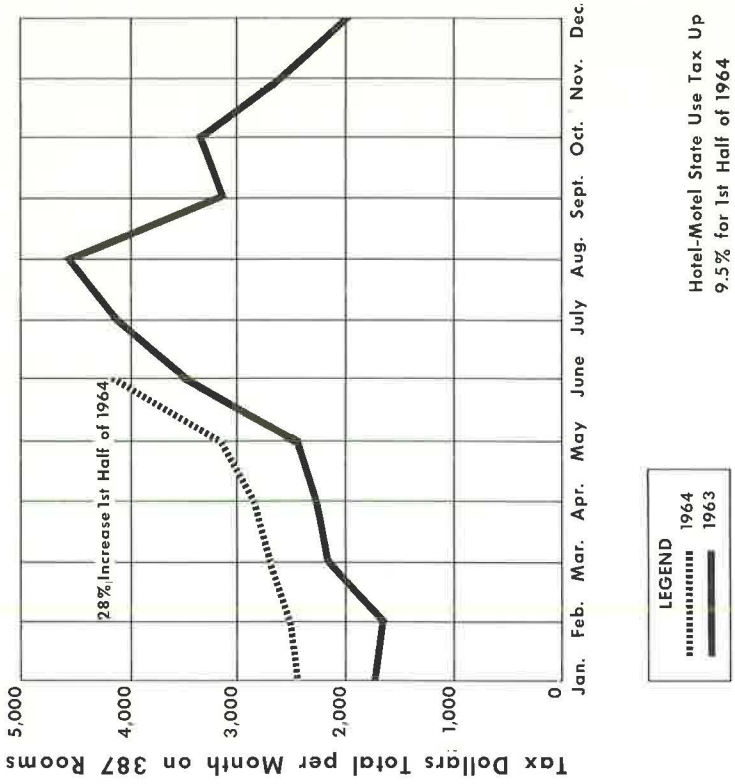


Figure 9. Use tax returns on four large motels.

TABLE 5
AVERAGE DAILY TRAFFIC
COUNT AT MARSHALL^a

Period	ADT
1962	9,508
1963	10,597
1964	11,514
Increase 1963 over 1962 (%)	11.5
Increase 1964 over 1963 (%)	8.7

^aFrom average for April, May and June.

the H and M Grill was opened and developed a truck business. The combination of freeways plus the weigh station helped to make this location a success.

These four truck stops, which are open 24 hr a day, averaged 110,000 gal/mo in 1963. Their pumpage varied little with the seasons, which is in sharp contrast to a typical highway service station.

A truck stop (20-yr operation history) on old US 12, just west of the I-94 and Mich. 60 interchange, was excluded from this study because of its location in a terminal area.

At the present time, I-94 ends 4 mi south of LaPorte Road, a feeder to the Indiana Toll Road. Eventually, when Indiana has completed its portion of the Interstate Program, I-94 will connect the Gary-South Chicago industrial complex with Michigan. In the interim, a large percentage of the trucks are using the old US 12 route. As a result, a true freeway pattern does not exist.

Several rural interchanges had restaurant-service stations which were trying to develop trucker business. Pumpage averaged only 15 to 30 percent of those stops considered to be strategically located.

Truck stops require 5- to 10-acre sites at grade with the crossroads. The fact that there were no truck stops at a major city interchange indicates that those locations commanded more expensive development.

It is realized that the volume of data is limited. Therefore, it has been the intent to point out what appeared to be a direct relation between the highway network and the truck stop as to location. Further research will help to clarify truck stops and land use at interchanges.

SUMMARY

This study, made 3½ yr after the opening of the freeway, demonstrates the following.

1. All major city interchanges developed high commercial values, with service station sites selling for \$75,000/site or up to \$170,000/acre, and restaurant and motel sites selling for \$12,500/acre. Almost 80 percent of the major city interchange quadrants have some form of commercial development. Considering all of these major city interchanges, there was an average of 3.38 service stations, 2.38 restaurants, 1.25 motels, and 0.38 shopping center per interchange.

2. At the secondary city interchanges, some form of commercial development can be expected. This is indicated by the fact that 40 percent of the quadrants have been put to commercial use. The average per interchange was 1.38 service stations, 0.46 restaurant, and 0.15 motel. In addition, there was some industrial development. The lesser amount of commercial development and the lower gasoline pumpage indicate that the secondary city interchange should not be classified with the major city interchanges.

3. Almost every small town interchange is likely to have commercial development. There was an average of 1.23 service stations and 0.54 restaurant per interchange. Gasoline pumpage has averaged more at the small town interchange (27,000 gal/mo) than at the secondary city or rural interchange (20,000 gal/mo).

4. Rural interchanges have been slow to show development, with less than 50 percent having development or sales for commercial use. Only one quarter of the quadrants were commercially or industrially occupied. This would indicate that allowance for benefits must be treated with extreme caution. A rural interchange near an active recreation area or near an industrial complex may develop high land values.

5. No sales of land in an interchange area indicated a loss in value by reason of grade change, triangulation, or reduction of access. Potential service station sites

registered a five-fold increase, and the averages of all other sales indicated a doubling of values.

6. Partial or half interchanges showed little reaction to the freeway, except where the interchange was closely associated with a full interchange.

7. Closed interchanges (the intersection of two limited-access freeways) showed no signs of enhancement from the freeway.

8. At major city interchanges, service stations within 400 ft of the interchange averaged twice the gallonage of those 400 ft to 1 mi away from the interchange, indicating that the proximity to the interchange afforded a better business location and so would command a higher value.

9. The business success recorded by service stations and motels demonstrates that the investments in land and buildings at the interchanges have been justified.

10. The continued increase in volume of business at interchanges indicates that supply has not yet exceeded demand.

In the final analysis, this study demonstrates that the question is not whether there are benefits at an interchange, but how great are the benefits. The amount of benefits on a future interchange can best be estimated by comparing it with a similar class of interchange on an existing facility.

EPILOGUE—THE PRINCIPLE OF CHANGE

A basic principle of real estate activity is change, and probably the most dynamic example of this principle is found in the interchange area.

The limited-access freeway has broken the mold of the old highway commercial pattern. It concentrates development rather than diffuses it and, consequently, allows investment in more lavish improvements. It has given a permanency to investments that never existed before in the history of highways.

In the end, the ever-increasing traffic and the traveling habits of the public will determine the intensity of use. To anticipate these changes, our investigation must and will continue to give us better understanding.