The Impact of Highway Location on Urban Areas

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In over two decades of being in this highway business, I have discovered that the traffic engineer, almost by definition, is one who is in the forefront of new ideas and progressive thinking. The traffic engineering group as a whole is very responsive to new and dynamic developments.

In discussing the impact of highway location on urban areas, I hope to bring factual information on developing trends which link highways and the urban areas together, hopeful that from these trends we could begin to infer a set of principles, which perhaps govern the inter-relationship between highways and urban developments. These data are presented in the form of figures, derived from special studies undertaken by state highway departments, university groups, and others.

Fig. 1 shows the location of 32 of the largest metropolitan areas of the nation based on 1950 population. In 1950 33 million people lived in the central states of these 32 largest metropolitan areas. If one took the physical areas in 1950 of each of the central cities of these 32 metropolitan areas and put them together, one would get a square approximately 55 miles on end. In that little square, 55 miles on a side, there lived 33 million people. A measure of the job that we have to do in the urban area is to try to provide surface transportation for 33 million people in that small 55-mile square. It is also a measure of your job to provide a sufficient and safe transportation system in a relatively small area for a relatively large group of people. I don’t think you will find this relationship much out of proportion for 1960 in comparison to what it was a decade ago. So, if anything, we will have, as of today, as big a task as ever or maybe even a more aggravated one than that situation indicated in Fig. 1.

A study was made of the Chicago metropolitan area and the result of that study is shown in Fig. 2. It reveals at least part of the impact of improved highways and the motor vehicle on that urban area. You will notice in solid black the settled area as of 1936 which is almost
Fig. 1. Location of 32 of the largest metropolitan areas.

a quarter of a century ago. You will notice those finger-like protrusions which extend in the direction of the mass transit and railroad lines as of many years past. The rest of the areas are the interstitial areas between the very dark areas of the urbanized region as of 1950. You can see how, under the influence of highways and the automobile, the scattered finger-like protrusions are being filled in at least from the
center outward. From an overall standpoint of city structure this is very important because it is much more efficient to service a nucleated community rather than a linear community. The conclusion is that all other things being equal, the motor vehicle and the improved modern highway are providing a salutatory structural impact on the urban area by filling out a nucleated rather than a linear type of community.

Fig. 2. Urbanization in the Chicago area.

Fig. 3 shows generalized population gains since 1950 based on the national average. The dark states are the states that have gained more than the national average and all the others have gained less than the national average. One can see where the population gain has been and what major centers and regions of the country these are
Fig. 3. Population gains since 1950, national average: 10.9 per cent.

centered in. These differences have tremendous implications for those in the transportation business. The areas where these population shifts occur are those areas where we have the greatest and most aggravated problems. One can see that the problems are shifting to the West Coast, to the Southwest, and a little in the South and portions of the Midwest. Indiana, it should be noted, is one of the states that have gained more than the national average.

One of the myths that have recently grown up involving the highway activity is that when we cut a swath of expressway or interstate highway or any other highway even of conventional design through a city, we take off of the tax rolls a tremendous amount of property, at least in the first instance, and this can be a very serious thing from the standpoint of that urban tax base. Studies have been made in regard to this, and the results of one of these studies may be seen in Fig. 4. This particular one was done in California where all the residences were removed from a swath of land almost 200 feet wide. The investigators followed the structures and the owners and tenants of those residences to see what happened.

In this particular instance, there were 90 structures. In 22 cases, the property was retained and relocated in the area by the owners; in other words, the owners physically took the structures to some other area. Apparently the structures were sound enough and capable of
being moved. The assessed valuation at the time of the state acquisition of the 22 structures was $39,000. When they were re-established in other or new locations with their improvements, their assessed valuation on the tax rolls was in excess of $58,000. Eight structures were exchanged or sold to other right-of-way property owners. These eight represented a value at the time of acquisition of a little more than $8,000, after they were re-established, almost $10,000. According to the results, 36 were sold to others at public sale. The assessed valuation at the time of acquisition was almost $45,000, after moving and re-establishment $58,000-$59,000, so that, of these 90 structures, 66, or approximately 70 per cent of them, were not removed from the tax rolls at all. In fact, $92,000 is what came off the tax rolls in the first instance and, by the time they were moved, $127,000 was restored to the tax rolls. So, anybody who says that when you cut a swath of land 100 or 150 or 200 feet through an urban area you remove that amount of property is inconsistent with the facts. That is what these studies increasingly are showing.

Here’s what happened to the remaining structures; of the difference between 66 and 90, 17 were demolished, probably because they shouldn’t have been standing anyway. They represented $14,000. Four of them were moved out of the immediate area, but this wasn’t a total loss since this went to some other area. For about $4,000 worth (three cases) the investigators couldn’t find out what happened to the structures. So, for the total of these 90 structures, actually $119,000 were removed from the tax rolls but $127,000 were restored. Now we are just talking about what happened in the right-of-way itself. This, to us, was very impressive and very important because it explodes a myth
which some people have subscribed to in the past, namely, that when you acquire land for public improvements and highways in particular you necessarily ruin or diminish the tax base by that amount.

The information in Fig. 4 concerns only the structures. What happened to the owners or the tenants of these 90 structures that were in the right-of-way can be seen in Fig. 5. There were 86 grantors or owners, and apparently a couple of persons owned more than one of these structures. Twenty-one of them retained and relocated their own improvements, six purchased improvements from the state or received improvements in exchange, 21 purchased new homes, ten purchased older improvements, five stayed in the area but did not invest in real estate, 12 moved out of the area but stayed in the county, eight moved out of the county entirely, and three couldn't be accounted for. The total value of the grantor's property only was the same as shown in Fig. 4 identified by the structures, $118,000, and in terms of these grantors amounted to $168,000. This is $50,000 in excess of just the structural cost itself and largely accounts for the fact that some of them purchased new improvements or better homes. So whether you look at it from the standpoint of the structures or the owners or the tenants, the tax base benefits directly from the right-of-way acquisition itself.

It should be kept in mind that we're not talking about the impact of the highway on the adjacent areas. We are talking only about the impact of the highway within the right-of-way itself.
We have been discussing the area which is occupied by the highway itself in terms of its impact. Now let’s see what happens, based on studies again, to the highway right-of-way in terms of its impact on the adjacent areas—immediately adjacent, a little farther away, and at the interchange points. We have done a number of studies on this aspect. The earliest of these was done in Westchester County, N. Y., where the Bronx River Parkway was analyzed. Some of the results of this study may be seen in Fig. 6. The Bronx River Parkway joined the city of New York with the residential dormitories of Westchester County and served as the channel of commuting morning and night. The facility was established many years ago. I think the building of the earlier sections was begun in the teens and finally finished in either 1926 or 1927. The investigators studied the trend of assessed valuations from 1905 to 1932 and found that these assessed valuation patterns fell into two types. The greatest increases were in the areas adjacent to the parkway.

Both sides of the expressway within a half or three-quarters of a mile were designated as the affected area, and the rest of the area was called the unaffected area. A trend of the land values in terms of the assessed valuation was obtained. It was discovered that in the affected area along the channel of the expressway itself, land values went up 1,200 per cent between 1906 and 1932. Land values in the rest of the areas went up about 400 per cent. From this it was concluded that there was roughly a three-fold impact of the expressway on the adjacent areas. In other words, the investigators filtered out land values which are going up all the time everywhere due to popula-
tion pressures, and so on. They still ended up with about a three-fold impact over a long period of time.

Another study, and a much more recent one, is illustrated in Fig. 7. This involved Houston, Texas. Houston is a growing area typical of the whole Southwest. In Houston, the State Highway Department studied approximately 2,700 sales over a 15-year period—not just the high sales to make a nice showing here for purposes of illustration, but all sales in the city of Houston between 1940 and 1955. These sales were grouped into four different categories. Group 1 contains

![Histogram](image)

**Fig. 7.**

the areas within half or three-quarters of a mile approximately on each side of the Gulf Freeway. The Gulf Freeway extends from Houston to Galveston. It's a 50-mile expressway to the Gulf. About five and one-half miles of it are in the city of Houston and they are what were studied in the particular case.

Group 1 sales were those within a half or three-quarters of a mile on both sides of the freeway. Group 2, or Area 2, were the secondary areas next to the primary areas. These areas also felt the impact of the expressway but were a little farther away. They were probably
some distance from the interchange points. Groups 3 and 4 were in other quadrants of the city totally removed from the expressway. The 2,700 sales were almost equally divided between these four groups of sales; in other words, there was not an unreasonable skew in any one group which might have had a tendency to distort the results of that particular group.

Here's what the study found. The graph shown in Fig. 7 represents both land and improvements unadjusted for anything, just the bald figures which represented bona fide sales. These are the sales on the open market between a willing seller and a willing buyer that actually took place, 1940-1955. In the areas next to the expressway, the increments were in excess of 120 per cent. The secondary areas showed increments of almost 80 per cent. In the other areas, property values went up about 30 per cent and about 45 per cent. One can get a relative idea by comparing these.

If we just left them unadjusted, there might be some criticism; one person might say that more expensive properties may have been
in one place, that there might have been a lot of factories here and only a lot of residences there, so naturally you’re going to find a lot of increments here which you don’t find there. In order to make the data a little more scientific, investigators eliminated the effect of the improvements by filtering them out and put the data on a land-value-per-square-foot basis. These data are plotted in Fig. 8.

Not only did they eliminate the effect of the improvements, but over a period of time the value of the dollar changes and the value of construction material changes. For example, in 1940 you could build quite a respectable house for $6,000. That same house in 1945, just about the time the boys were coming back from the war and just before land values rose tremendously, cost over $9,000, and by 1950 that same house could be built only for in excess of $14,000. These factors were used, including changes in the cost of construction material. The net of it is that these adjustments even aggravate the comparison. In other words, in the two primary areas directly involved in the expressway, the land value increments went up about 110 per cent and almost 80 per cent, respectively. In the areas removed from the freeway influence, the land values lost or gained very little. The negative value merely means that when you filter out the effect of the improvements, this Area 3 lost ground in terms of land value since it became much less desirable in terms of building and development than any of these other areas.

Fig. 9. Comparison of land values computed on four different bases.
The Texas folks worked with the repeat sales concept, too. In Fig. 9, each of the four bars represents a different method. Those who are inclined to be fussy might argue with one method or another, but, if one puts them all together, one fact stands out, namely, that regardless of the method used, the general impression persists that the areas next to the expressway, or a little farther removed from it, experience a much more beneficial impact in terms of land values than the other areas do.

This has a great deal of practical significance for cities, counties, and anybody who is worrying about tax base. Aside from the struc-
there is an additional effect. For a longer period of time, value and stable new enterprises are added to the tax rolls; this constitutes a continuing contribution to the tax coffers of the particular area you're in. It might also be mentioned in this connection that in Houston and in Texas generally prior to the 1956 Act, it used to be that the cities and the counties had to put up all of the right-of-way, free of charge, for all state improvements. In the Gulf Freeway, the right-of-way of about 5½ miles in the city of Houston cost the city folks about $3 1/2 million which they financed through a bond issue. If they take the increments that they have found in this study and put them on the tax rolls, the taxes resulting from these increments alone will amortize that $3 1/2 million bond issue in about 7 1/2 years. Since 1950, those increments are continuing to rise.

All of these data are documented in studies, many of which range in length from 100 to 200 pages including tables and charts.

In Fig. 10 are some results from a study in California which in some ways was the granddaddy of many of these studies. This one involved a freeway in Fresno. There were 15 sales of property in a
two-year period following the opening of the Fresno Freeway. These identical properties had been sold sometime before the freeway was

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Fig. 12.
planned and built, and they also had been sold afterwards. In other words, they took only the repeat sales so that they would have a sound basis of comparison. Some of them are filling stations, some residences, some storage houses and factories, and so on. The figure gives the exact description.

The average land value, based on sales before the freeway was planned and built, was approximately $1,000 an acre; this $1,000 is the average of the light bars on the graph. After the freeway was opened and two years thereafter, these same parcels resold. The average land value of these sales was $3,000 an acre; that's represented by the dark bars on the graph. These studies show that freeways have a beneficial impact on property in general.

Fig. 11 shows the route of the Fresno Freeway along which the 15 parcels described in Fig. 10 are situated. One can see the type of development that is taking place. It's not a slum area; it's a good stable community, and by providing increased accessibility, it preserves and stabilizes that solid community. Accessibility is very, very important, and any appraiser or economist will tell you that accessibility and value go hand-in-hand. Unless a hunk of land or an enterprise or an activity is accessible, it has little or no value at all. And the minute its accessibility is diminished or impaired because of excessive congestion, it will deteriorate and die. The stabilization of accessibility or the improvement of that accessibility is very important, especially in the urban areas.

We have discussed land value impact. There is another and different kind of impact of highways on urbanized areas. By urbanized we mean more, much more, than just the center of the business area. We mean the whole area, the whole metropolitan area rather than just the inner nucleus.

Let me consider a study that Professor Bone of M.I.T. made for the Massachusetts Highway Department and the Bureau of Public Roads. This was a study of Boston's Route 128. It's a circumferential around the Boston metropolitan area. It's approximately ten miles out from the center of town, and, in the years that it has been established, it has had a profound impact, especially on residences and industrialization in the area. This is what Professor Bone studied and described in a report which M.I.T. issued about a year and a half ago. In Fig. 12 each of the little blocks and each little line represents an industrial park or a new industrial enterprise. There are all kinds of activities—electronics, machine tools, sewing machines and a lot of fine establishments going up. They're all of modern design; most of
them have anticipated their land requirements for the next 10-20 years with plenty of room for future expansion. This figure is a map produced by the State Department of Commerce, and there are now 209 industrial establishments in an area where just a few years ago there was vacant land, just plain farm land.

You may say, "Well, these outfits would go somewhere if you didn't have a 128." Sure, they would go somewhere, but the fact is that here is an association, in time and space, between industrialization and highways of modern design. Apparently, a modern highway—an expressway—serves as a magnet. All of us have got to be aware of these trends, because the minute you put down a highway of modern design, it serves as a magnet, and it will attract activity almost over night. In fact, before the pavement is dry in many instances, land developers, speculators, and others are sizing up the situation at the interchange points and elsewhere.

Fig. 13 shows that in this area new industry accounted for only two per cent of the total, so for all practical purposes that particular portion is of little consequence. Relocated industry constituted the bulk—51 per cent; new branch plants, about 21 per cent and relocated branch plants, about 26 per cent. Now this 51 and 26 per cent were somewhere else previously, in areas that now have lost them.

In terms of total employment in the area, here's the way it looks. The new industry accounts for just a negligible per cent of the employment; for relocated industry, you can see that the employment is roughly related to the per cent of investment and the number of plants. Roughly, there's a rather intimate relationship between the number of plants, the investment, and the employment potential of each of those industries by types.

Professor Bone went to the top management in each of these industrial outfits, to the fellow who actually was responsible for making the relocation decision and asked, "Why did you locate or re-locate along 128?" The reasons for re-location or location were: (1) wanted land for expansion; (2) better access to a labor market; (3) employee accessibility; (4) commercial accessibility; (5) commercial accessibility for raw material and re-delivery of the fabricated product; (6) attractive site; (7) advertising value of being seen by thousands of motorists; (8) good parking facilities; (9) land cost might be cheaper; (10) "package deal"—that is, where an area of land is developed and built to a given specification and offered to the industry at an annual cost; it's a kind of private lease-lend arrangement; (11) to avoid city congestion; (12) lower taxes; and (13) commercial market railroad
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*Research and Development

Fig. 13. Per cent investment, employment, and number of plants by type of industry.

facilities. The answers are summarized graphically in Fig. 14. The most important location factor Professor Bone found, is number four, commercial accessibility in the first category. Sixty-nine per cent of all enterprises that had located at the time of the study along 128 indicated that they were mostly interested in commercial accessibility. Here is another one—land for future expansion—that was very important. In other words, in the constricted downtown areas, these enterprises not only had old plants, physically and functionally obsolete,
Fig. 14. Rating of major factors considered in site selection by industries interviewed on Route 128—September 1957.
but they couldn't go anywhere in terms of expansion. Population was expanding, their business was increasing, and yet they couldn't accommodate to the situation in the downtown areas. So they had to go somewhere, and this was an important motive for the move. Now, if you view this in terms of total per cent of investment, there again the very important location factor is land for future expansion, and also factors 1, 2, 3, and 4, rank in importance.

It can be seen that the highway-oriented factors are among all the factors of highway and industrial location which anybody who consults with and advises industry will recognize as important industrial location factors, and which every industry will consider. It can be seen that in terms of the industries which located along 128, the highway-oriented industrial location factors were among the most important. Of course, land for future expansion has some—but really, very little—highway orientation, but these others, such as access to a larger labor market, employee accessibility, and commercial accessibility, are definitely highway-oriented.

From this we can conclude—and from some other similar studies—that highways of modern design, expressways or sections of interstate highways, in or around the urban areas, will serve to attract business, industry, residences, and all kinds of activity. In our design and location of these facilities, we must take account of this; and this also should be reflected in the kind of regulation that we can finally achieve in the areas adjacent to these expressways. We've got to take account of what actually is happening and what the trends are.

Fig. 15 shows the residential locations of the employees of the industries along 128. You can see they are all over the place. An expressway makes possible accessibility to a much larger employment area than would otherwise be possible, for the simple reason than an employee generally will drive a certain number of minutes to and from work almost regardless of the distance. Let's say he is willing to drive half an hour or up to 40 minutes to and from work. On a modern highway 35-40 minutes will go a lot farther than on a highway of conventional design in the urbanized area.

Fig. 16 is a chart showing the mode of transportation by Route 128 employees prior to the time that 128 was established. It can be seen that of the old employees, 64 per cent went by car, 29 per cent went by transit, and seven per cent walked. Ninety-seven per cent of these same employees, once they shifted to Route 128 employment, traveled to work by motor vehicle. As you might expect, there was a
modern facility, and very few of them used transit—only three per cent as against 29 per cent, formerly.

It might be argued that what has happened along 128 is not indicative, necessarily, of the net situation in the metropolitan areas. Many of these firms came from locations within 3½ to 4 miles of the central business district. What's happened to those abandoned locations?

![Route 128 Study Map](image)

Fig. 15.

These data, in terms of employment, shown in Fig. 17 will show us what actually happened in terms of the overall situation in the entire area. These are the types of industries along 128, classed as distribution, production, research and development, and service-type industries. In terms of all of these industries, they averaged about 179 employees per plant. As a whole, the employment went up in excess of 28 per cent over that of the former, in-town site. The distribution industries lost about 15 per cent, but all the other categories gained. In other words, in the metropolitan areas as a whole, the Route 128 development increased employment by 28 per cent.

There is a need to coordinate highway planning with all other types of planning since, in the urbanized area, we are not operating in a vacuum. You can't build highways without affecting every other
component, public and private, of that urban area. What is actually happening on the ground, in terms of structure and planning, in New Haven, is a good illustration of this principle.

New Haven was one of the first cities to take advantage of the urban renewal act of 1949 and, accordingly, it is much further along with its urban renewal projects in terms of physical structure than just about any other city in the United States. Fig. 18 shows a cross section of what actually is happening in New Haven. You will note the expressway that will serve the area joining up with the streets of ordinary design, as indicated. This has triggered or at least has been an important element in this development.
Fig. 17. Average employment characteristics at Route 128.

Let's see what some of these other things are: for example, note the new First New Haven National Bank Building, eight stories, 150,000 square feet, completion, July 1960. Then, there is a tremendous shoppers' garage, with indoor ramp parking for 1,500 cars, direct access to retail shopping, and convenient location to all downtown New Haven. Note also a couple of high-rise apartments to be built by private capital on a three-acre site, and you will notice plenty of area around them so that air, light, and sunshine can get in. Observe that Church Street has been widened in order to accommodate the increasing traffic flow that the highway and these new uses engender. You might inquire about school and recreation facilities. Note an eight-acre site allocated for new school and recreation facilities. Then there is a 19-acre commercial park to be developed for office, wholesale, or retail uses.

In this process of rebuilding and redevelopment, the investigators had a lot of pre-existing structure, and they wanted to continue to do business. So they designated an entire site as temporary quarters. These businesses, or at least some of them, continued to do business in this general area pending the consummation of what actually is going on right now. I think it will be another six to nine months before most of this will be completed. After the main construction is complete this temporary area will be abandoned to become a large parking lot.

Observe the terrace restaurant with a capacity of 250. There also is a hotel 18 stories, four office floors, 300 rooms, banquet facilities scheduled for completion in May 1962. There is a retail shopping area and department store of 240,000 square feet. This is a good illustration of proper planning. It can be done right, as it is being done here but it takes adequate and painstaking planning of all of the elements.
Fig. 18. Church street redevelopment and renewal area.
Mayor Lee of New Haven has been quite a spark plug in this whole activity.

In trying to build highways one has to be aware of some general trends that are taking place in the central business district as against the suburban areas. If we're going to provide a service, we've got to know what we're servicing so that these trends are most important. We're not building highways to incase them in glass or put them in a museum. We're building highways as a means to an end. They're not an end in themselves. We've got to know what we're serving or intending to serve. It's very legitimate, accordingly, to inquire into the general economic trends.

Fig. 19. Proportion of city retail sales in central business district.

Fig. 19 shows the trend of what's happening in retail sales. As of 1954 in the smallest cities, well in excess of 60 per cent of the sales took place in the central business areas and the other 40 per cent in the outlying suburban areas. But as you get into the cities of 400,000, this 60 per cent has been reduced to about 26 or 27 per cent. In the larger cities of over a million, it's almost 22 or 23 per cent in the central business area and all the rest in the suburban area. In terms of absolute dollars, the downtown stores are still doing as much dollar volume as they did 20-25 years ago. But you know what has happened to the value of the dollar in the last 25 years, so if you discount that and put it on the percentage basis, which is the only sound way of doing it, you find that the central areas are doing a smaller percentage of the total retail business than ever before.

Many of the state highway departments are doing these studies. Fig. 20 shows the results of a study of what happened in the last 12 years, 1946-1958, in the insurance business. This involves just the increase in insurance activities. In terms of the numbers of establishments, 68 per cent of the increment took place in the outlying areas, or two-thirds of the increase in the last 12 years took place in the outlying areas and only one-third near the city center. In terms of employees, the relative percentages are 57, 30, and 13; and in terms of square feet, 44, 40, and 16. In other words, whichever base you use, the bulk of the insurance company increased business has taken place in the suburban areas, about 2 to 1.
Fig. 21 puts it another way. In 1946, 80 per cent of the insurance business was downtown, 13 per cent near downtown, and seven per cent in the outlying areas. Twelve years later, in 1958, this 80 per cent had shrunk to 44 per cent. Less than half now is downtown, and so on. That's in terms of establishments. In terms of number of employees, the change in the last 12 years was from 77 to 47 per cent; in terms of area, the decrease was from 78 to 46 per cent. We now have this available for office buildings, utility companies, and other activities. When you put them all together, you get, for the first time, a very impressive indication of what is happening in our urbanized areas, especially in central areas as against the outlying areas. And we've got to recognize this in the provision of our highway facilities.

Fig. 22 illustrates another industrial study, this one in the Oakland area, Alameda County, California, involving the Eastshore Freeway. Alameda County generally is a highly industrialized area. This particular area was low and generally unsuitable for industry until the Eastshore Freeway came along. The freeway supplied not only an excellent new accessibility to the area, but in the process upgraded, through its drainage improvements, the whole area. Many benefits were involved in this case. Adding this drainage ingredient along with

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**Fig. 21. Location of insurance companies, 1946-1958.**

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Fig. 22. Industrial development on the highway network giving access to the Eastshore Freeway in Alameda County, California.
improved accessibility was all that was needed to make this entire area ripe for industrial development. Each of the little squares that you see are industrial locations, with the white ones representing plants that are built and the black ones plants that are proposed. Most of them are white.

Fig. 23 shows the situation in terms of area. The entire area south of the Eastshore Freeway constitutes about nine per cent of the industrially-appropriate land in Alameda County. The rest of the industrial land was 91 per cent. In this nine per cent area near the expressway here's what happened in terms of industrial expansion. Within a couple of years after the expressway was opened, 43 per cent of the dollars invested in new industry took place there. Other effects are almost as remarkable. Here can be seen a percentage of development far out of proportion to its area. As was mentioned, you add accessibility and drainage, and things begin to happen.

Finally, I want to point out that there is an increasingly available body of facts similar to those summarized in this report. We now have completed about 75 of these studies, and each of them adds a new element of fact which, taken as a whole, is opening up an entirely new world of data to us. Actually we are now in the forefront of a lot of new and profound developments. If you take these facts, as they're emerging from the research assembly lines, and use them to the extent that you can and to the extent that they are applicable in your work, I'm sure they will assist you in doing a much more realistic job.