HIGHWAY RESEARCH BOARD

Bulletin No. 32

One-Way Streets

1950

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1950

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HIGHWAY RESEARCH BOARD

BULLETIN NO. 32

ONE-WAY STREETS

PANEL DISCUSSION
HELD AT THE TWENTY-NINTH ANNUAL MEETING
1949

HIGHWAY RESEARCH BOARD
DIVISION OF ENGINEERING AND INDUSTRIAL RESEARCH
NATIONAL RESEARCH COUNCIL

Washington 25, D. C. December, 1950

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FOREWORD

Because of the great interest that has been manifest in this panel discussion of one-way streets, sponsored by the Department of Traffic and Operations, Highway Research Board, the proceedings of this session are reproduced herewith.

It is the hope of the Department and of the Panel that the experiences related herein will prove helpful to others whose problems involve the possible use of one-way streets. It is also hoped that the discussions will stimulate the search for further information regarding the results of one-way streets.

The panel discussion on one-way streets, sponsored by the Department of Traffic and Operations during the Twenty-ninth Annual Meeting of the Highway Research Board convened at eight-ten o'clock, Tuesday evening, December 13, 1949, in the Reading Room, National Academy of Sciences, Washington, D. C., Mr. Wilbur S. Smith, Department Chairman, presiding.

CHAIRMAN SMITH: This is to be an informal discussion of one-way streets.

At an impromptu meeting of the Department of Traffic and Operations during the meeting of the Institute of Traffic Engineers in Washington a couple of months ago, it was agreed that, in the field of traffic regulations, the one-way street was one of the most interesting topics and one on which information was needed most.

We know that traffic engineers have long recognized the advantages which come from establishing one-way regulations under certain conditions. We know, too, that there are a lot of problems encountered in having one-way streets accepted and there are a lot of difficulties in making them perform successfully in many areas. Several men whom we knew to have had experience in the field of one-way streets were asked to sit as this panel. None of them has prepared any formal statements or comments, because we want to discuss this subject in a very free fashion.

I think it might be a good idea, to develop areas of thinking, to have each member of the panel (and they did not know this until a minute ago) talk for perhaps three and not more than five minutes on some of their experiences in the use of one-way streets. They will not try to explain in detail the applications for which they have been responsible, but will cite experiences with the view of suggesting areas for discussion in the over-all subject of one-way regulations.

Bob Mitchell tells me that one-way streets had been in use in Philadelphia since 1906. He hasn't watched them grow quite that long, but he has been associated with traffic operations plans in the one-way development for a number of years. We will ask Bob to begin the discussion by citing some of the experiences which he has had with one-way streets in Philadelphia. Perhaps he will also want to mention experiences in some of the other cities in which he has been active in recent years as a consultant.

MR. MITCHELL: As Wilbur said, the first change over of traffic movement on streets in downtown Philadelphia from two-way to one-way operation took place as near as we can determine in 1906. Burton Marsh will bear me out on the need for this one-way operation. He was the first traffic engineer in Philadelphia. As a matter of fact we could not handle traffic in the Philadelphia downtown section without the use of one-way streets. All of the streets in the downtown area, except three, are one-way.

The only time we have ever had any opposition to one-way operation was when we changed Chestnut Street and Walnut Street in West Philadelphia from two-way to one-way operation in 1932. It was not difficult to sell one-way operation downtown because the streets were only 26 feet wide and street cars moved in one direction. In West Philadelphia, however, the streets were 44 feet wide and busses were operated instead of street cars.

We ran into considerable opposition from merchants and residents for about three months after the change was made but the one-way operation continues. Papers presented by William Canning at Highway Research Board meetings in 1937 and 1938 cited the amount of time saved in operation, the reduction in accidents and other advantages which accrued in the one-way operation of these two streets. These streets have been accepted as one-way and there has been no question about them nor the hundreds of streets which have been made one-way since that time.

Last year in Philadelphia we had a most unprecedented demand for one-way operation of streets in neighborhoods--not for the improved movement of through traffic, but for the safety and convenience of the people who live in the neighborhoods. The people themselves demanded it. We put into effect one-way operation on over one hundred streets of varying length, from one to four blocks, with parking prohibited on one side, for the convenience of the neighborhoods.

In Charleston, West Virginia, where I had the good fortune to be retained as a consultant to the Citizens' Traffic Committee, a comprehensive system of one-way streets was put in operation this summer after a thorough traffic survey. Almost all of the streets inside and serving the downtown business district were changed from two-way to one-way operation.

Mr. Rothrock, Planning Engineer for the State Road Commission of West Virginia, is here and has some definite figures to show the improvement that was made by these changes. The citizens of Charleston seem very pleased with the operation of the new system and officials of the Transit Company report a 26-percent speed-up of operations. Traffic moves much faster and congestion was completely eliminated.

The big question seems to be whether business of the merchants was hurt or improved by the one-way street operation. No one, as far as I know, has any statistical data, although Wilbur says he has some information which he is going to present tonight. From experience with the merchants' attitude, it is my definite conviction that one-way street operation has very little effect upon business located on those streets. I am convinced that one-way street operation is a boon to business because it is a major factor in reducing traffic congestion.

If the conditions are right, changing from two-way operation to one-way operation can materially assist in moving traffic and improving traffic and business conditions.

CHAIRMAN SMITH: Thank you, Bob.

I know you have had a lot of interesting experiences in the use of one-way streets for emergency conditions and for special events which we hope you will give us as the discussion progresses.

Since you have mentioned the Charleston studies, we would like to hear next from Mr. Rothrock who is Director of the Planning Division of the West Virginia Highway Department and who worked closely with Bob Mitchell in the one-way street system in Charleston, West Virginia.

MR. ROTHROCK: When Mr. Mitchell recommended one-way streets for Charleston, since two of the streets were State highways through the city, the State Road Commission decided to make some studies to try to determine the relative efficiency of the plan. We decided upon a series of before and after time-delay studies, in three phases. We have only completed two phases to date.

Because of Mr. Mitchell's recommendation that the one-way traffic installation would be of benefit, even without changing the signal system to progressive control, the change was so made.

The first phase of our tests was made before the change. The floating car method was used. We had made a chart upon which to record the times of travel from point to point over the streets, one of which was eastbound, 1.64 miles in length, containing 12 traffic signals; and the other, the westbound, was 1.59 miles in length and contained 9 traffic signals.

A method of coding was used to record the causes of delays, and our observers ran enough trips during each hour from 8 A.M. to 6 P.M. over a period of several days to secure what we thought was a reasonable average of travel time.

The results of this first phase showed that the minimum hour average westbound travel time was 7.32 minutes and the maximum 8.15 minutes, or an average of about 7.73 minutes. For the eastbound travel the minimum average was 7.05 minutes, the maximum 9.15, or an average of about 8.10 minutes. An analysis of the delays, that is, all time lost because of necessity for traveling less than 25 M.P.H. due to congestion, etc., indicated a distribution of causes of delays as follows for travel in both directions:

		%
Delays by traffic signals	-	50
Delays by general congestion	-	35
Delays by slow vehicle ahead	-	4
Delays by parking maneuvers	-	2
Delays by bus maneuvers	-	1.-
Delays by cross traffic	-	1.-
Delays by RR crossing blocked	-	7

The second-phase observations consisted of a similar series of trips after the streets were made one-way. Analysis of this phase revealed that practically all the delays except those caused by traffic signals, had disappeared or were of negligible importance.

Since this phase of the study has been made the signals have been put under progressive control, and although the third-phase observations have not been made it is apparent that there are no significant delays to travel.

The traveling public now seems to be satisfied, but because some on-street parking was removed from the routes at the same time that one-way regulations were made, our local problem now seems to be one of providing parking space to replace that lost. Our merchants think so, and they believe they are losing business because of the lack of parking space, but none of them suggest going back to the old two-way traffic system.

I do not know of any way to evaluate the losses which may have been caused to merchants because of the one-way traffic, because there are so many other factors involved, such as a concurrent strike in building trades and coal industry, etc., which may have affected their business. I have talked to several merchant friends who say, however, that their business is as good as ever. Some friends operating filling stations claim the one-way streets have affected their business, but we find that all filling station business has been decreasing, as indicated by the records of wholesalers, so it is difficult to pin the losses down as due to the traffic changes.

After completing the third and final phase of observations I expect to write the whole matter up. I hope to complete it this coming Spring.

CHAIRMAN SMITH: Thank you.

You have presented interesting results of traffic studies and I know there will be a lot of questions that people will want to ask you.

Baltimore, Maryland, is another city where marked improvement of movement on its through routes has been noted since its streets were made one-way.

One gentleman who has been very close to that situation and has a great deal to do with the planning of one-way operations in Baltimore is Charles Murphy, the city's traffic engineer. We would like to hear from him at this time.

MR. MURPHY: My stock reply is that the through traffic is only 1.5 percent of the traffic in the City of Baltimore; while we worry about it, we worry more about the internal movement.

Baltimore is a major city in which the one-way operation is relatively new. We got into our first pair in 1939 when Franklin and Mulberry were made one-way streets. These served as U.S. 40 in the west end of town and were gratefully received by the traveling public.

Because of our good experience on those two streets, it was fairly easy to carry out, or to begin to carry out, the rest of the program. Our major problem was transit operation and it was not until the transit company converted to busses that we put in the next pair of one-way streets, which were Calvert and St. Paul, serving the north end of town. The interesting thing to me about these one-way streets (and one reason I value them so highly) is what they do to your signal timing problem. In Baltimore, as in many of the old cities, we find that almost all the streets in the downtown area are heavily packed with traffic. We do not have existing surface streets that can serve as by-passes, as inner rings for the downtown district. So we have to use the streets that are in the downtown area.

Our problem, in particular, was this. We had Franklin and Mulberry, which were a pair of east-west streets. We then put in Calvert and St. Paul, which were a pair of north-south streets, which were intersected by the east-west arteries. That was a particularly ticklish problem because we had to give 25-mile-an-hour progression east, west, north and south simultaneously.

We worked out a formula to do that and were able to get volumes approaching capacity. We are still getting a few more every week. Recent counts show peak volumes of 650 cars per lane per hour on these one-way streets at an average speed of about 23 miles an hour from the heart of the downtown district out to the extremities of the one-way streets. We are doing that with approximately one delay per mile. The one-way streets are each about three miles long and the delays average about three per run. Runs have been made at all times of the day and particularly in the peak hours.

So I think that this is fairly good traffic movement for a surface street. You have to consider also that these volumes have been attained with an average thirty-second passage channel. So, if you try to compare these volumes with those obtained on an expressway, acknowledging at the outset that you lose half the capacity of a street since it is surface and not grade separated--if you put in that correction factor we are getting about 1300 cars per lane per hour on our one-way streets as compared to the accepted capacity of an expressway of 1500 cars per lane per hour. This approaches the efficiency of operation of an expressway.

The first two pairs of one-way streets that intersected fit into the plan fairly well. It turns out, by making certain minor adjustments and throwing your signal conflicts on streets that are not vital to your plan, that it is possible to extend this interlocking timing system. We have therefore obtained on two pairs of east-west streets and two pairs of north-south streets volumes at peak hours of 650 cars per lane, with a thirty-second passage channel, moving cars at an average speed of 23 miles an hour and with an average of three delays over a 3-mile run.

I have used the following example: Our four north-south streets will carry 5,000 cars an hour outbound. That is the equivalent of a six-lane expressway. To substitute an expressway for this north-south one-way street system, we have had to spend around 16 million dollars. The one-way street system cost us $70,000. Consequently, when you talk about the effect of one-way streets on abutting property values, you have to consider what a job they are doing as an alternate to the expressway.

Our experience has been that the one-way streets are highly beneficial to any business interests, provided that business does something about off-street parking, and quite a few are doing something about it. But there is some question of the effect on those residential areas through which some of the one-way streets go. It is unavoidable that they go through residential areas.

From watching these streets over a period of three years, I believe that we probably will see a transition of use from residential to commercial or to professional. We have seen it in our north-south system. The midtown area on our north-south streets is developing into a fine professional area. There is active off-street parking in that particular area, so they have a combination of facilities of flow and parking. They are going to provide themselves with more parking space, and I think, in the long run, these streets will be beneficial rather than detrimental to abutting property values in that particular area.

Our accident studies show that we can expect from 10 to 15 percent in the

reduction of accidents on these one-way arteries. If the pressures exist, we can carry double the volumes easily.

It is not even a question of comparison, when talking about delays on one-way streets as compared with two-way streets. The only thing that is holding us up now in Baltimore in extending this further is the transit operations. We have to get the street cars off and it is an expensive problem for private enterprise.

MR. SMITH: Thank you.

You have injected several new ideas and you have also presented some outstanding results of achievement with one-way operation.

Mr. Eugene Maier is from Houston, Texas, where he is the Associate Traffic Engineer. In Houston they do everything in a big way, including traffic control and one-way streets. They have had, in recent years, interesting experiences with one-way movements and we would like to hear about a few of those experiences now.

MR. MAIER: We feel that the one-way street system installed early in 1948 in Houston, a city of over 500,000, is unique in several respects. In most cities, one-way streets have been established and accepted because they have been installed on relatively narrow streets. In Houston, the one-way operation was established on a street network where pavement widths varied from fifty to sixty feet.

The extent of the one-way street system is interesting in that eighteen miles of one-way streets which include most of the downtown area and several of the main arteries leading into the central business district were established at one time.

MR. MARSH: Were those widths roadway widths?

MR. MAIER: Street widths. The one-way street system was unique, too, in the manner in which it was effected. Upon completion of preliminary studies and investigations, the one-way street plan was submitted to Council at one meeting and on the following week, without an objection, the plan was unanimously adopted. This would indicate that with proper planning and with adequate pre-selling, a plan, even as revolutionary as an extensive one-way street system which would include all of a downtown business district, can be sold to public officials, businessmen and motorists.

Some of the features of this plan may be of interest to you. We experienced no great difficulty with the installation of this extensive system of one-way movements even though I do not believe that the educational program which preceded the change in traffic flow achieved any great results. Most of the motorists learned the direction of flow on the streets after they drove around in the area of one-way movement. We find that one-way streets are practically self-enforcing for motorists driving in the wrong direction on a one-way street are quickly informed by other motorists of their violation.

We find, as Mr. Murphy has found, that accidents have been reduced, overall speeds have been increased and delays have been materially reduced. "Before

and after" studies revealed a 36-percent reduction in auto injury accidents and a 24-percent reduction in property damage accidents in the business district as compared with city-wide reductions of only 3 percent and 13 percent respectively. Important changes in traffic volumes were noted after the change to one-way regulation. Field studies revealed that volumes on one-way and on two-way streets decreased 13.0 percent. The shifts in traffic volumes from two-way to one-way operation not only confirm the greater capacity of the one-way street but also indicate a definite preference by motorists for driving on streets with one-way movement.

Noteworthy reductions in delays and increase in speeds were observed after the change. During peak periods of off-peak traffic flow, delays on one-way streets were reduced 35 percent as compared to an increase of 1 percent on two-way streets, together with a 26 percent improvement in over-all speeds. During periods of peak traffic flow, delays on one-way streets were reduced 13 percent and on two-way streets 3 percent and over-all speeds improved 20 percent on the one-way streets and 4 percent on the two-way streets.

On many of the one-way streets, average speeds in the off-peak periods approach 30 M.P.H. and in the peak periods of traffic flow, they are in the order of 20 - 25 M.P.H. Progressive signal timing has been installed on some of the one-way streets and these are timed for 30 M.P.H. On four of the one-way streets leading to and from the new Gulf Freeway which are provided with traffic signals timed progressively for 30 M.P.H., some increase in accident experience has been noted. This may be attributed to higher speeds in business and residential areas where block lengths are only 330 ft. We feel that the increase in speed and the movement of traffic are primary considerations but, at the same time, we are making continued studies to reduce accidents to a minimum, recognizing, of course, the relationship between speed and accidents.

With the installation of one-way streets, parking was removed from the right-hand side of the main arteries leading into the business district between 7:00 and 8:30 A.M. and from the right-hand side of the one-way arteries leading from the business district between 4:00 and 6:00 P.M.

Turning movements were eliminated at numerous locations where two-way streets intersected one-way streets. Our Traffic Department was able to establish many restrictive controls in connection with the one-way street plan, because of the authority which has been granted to the Department for establishing traffic regulations. I have explained this matter on numerous occasions but for the benefit of those who are not familiar with the operations of our Department, I might explain that the Traffic Engineer has full authority to establish any traffic control which may be required and the installation of the necessary traffic control signs is all that is required to place such controls in operation. We are not required to refer any traffic regulation to the City Council for approval and I can say very frankly that the Council, during my stay in Houston, has not attempted to tell the Traffic Engineering Department what traffic regulations should or should not be installed nor have they specified where traffic signals should be installed. Inasmuch as we have installed several hundred signals during the past three years, one might say that we have great latitude in the operation of our Department.

I think, Wilbur, this covers very briefly the results which we have achieved with one-way streets in Houston. I do have some additional information regarding the effects of one-way streets upon business which may be of interest if you desire to have it brought out later in the discussion.

CHAIRMAN SMITH: Fine. It would be interesting to hear later about your experiences with the one-way system as an adjunct to the expressway in operation through part of the downtown district.

The next speaker is Charles Michalski, who is qualified to tell us about one-way streets in two large cities. He is currently Director of Planning Section, Bureau of Traffic Engineering, in New York City. Until his assumption of duties there, he was employed in the Traffic Engineering Bureau in Detroit. We would like very much to hear from him now regarding some of the plans and experiences he has had in this field in New York and some of those he has had in Detroit.

MR. MICHALSKI: I would like to start out briefly with some of our experiences in Detroit. Detroit established its first pair of major one-way streets in the fall of 1939 and it worked out rather successfully. All I would like to mention about them is an innovation in our signal system. On two of the major pairs we resort to the use of midblock traffic signals. Our objective was to do two things. We wanted to keep the traffic on the one-way streets under control. We wanted to be organized in exact platoons and also to keep the speeds under control and, at the same time, we did not want to encourage any unusual traffic on the crossing of residential streets. So, instead of installing traffic signals at intersections on these one-way streets, we installed our traffic signals in midblock locations and kept the cross streets under stop sign control. In that way the motorist found it no more advantageous to drive on one cross street in preference to another.

The system is being expanded. As a matter of fact, the City of Detroit is installing midblock traffic signals on their other one-way streets at the present time.

One of the beauties of a midblock installation is that you can put it anywhere you want to and get as nearly a perfect progression as you can possibly get. So much for that.

I might say that Detroit has about 60 miles of one-way streets and they all carry substantial volumes of traffic.

Moving over to New York, we find that the 60 miles are dwarfed. I think the City of New York has something like 1,000 miles of one-way streets. The objectives were not always the same. In Manhattan it would be impossible to operate on the narrow crosstown streets without one-way regulations; however, we find hundreds of miles of one-way streets in other sections of the city, strictly residential areas. There the objective was not to move high volumes of traffic, but to move some traffic and still be able to permit parking.

We hear every day deep concern expressed over the ability of the fire department to move around. I think that had quite a bit to do with the establishment of many miles of this one-way regulation. Anyway, we have so many one-way streets

in Manhattan that it is impossible to time all of them for progressive movement. One of the things that has happened is that, instead of concentrating traffic on thoroughfares at discreet intervals of, say, a quarter of a mile or a half mile apart, we find that traffic is moving on all these streets, not in substantial volumes, but in volumes high enough to cause troubles at intersections.

The result of this diffusion of traffic is profusion of traffic signals. The City of New York has something like 7,300 signalized intersections. I think that dwarfs installations in all of the rest of the country.

Keeping this in mind, we have been struggling with the problem of moving traffic on some of these streets. We concentrate our attention, for the present time, on the Island of Manhattan where nearly every one of the cross streets is a one-way street. There are traffic signals at nearly every one of the intersections. The signals are operated simultaneously and there is no provision for progressive movement.

Early this year a pair of avenues on Manhattan was converted to one-way operation and moderate success was achieved. I say moderate because the signal system was not changed. We hope to be able to accomplish that very shortly. However, we are concerned with the rest of the island and we have developed a plan. It has just been released in the newspapers this last week-end. I have a few copies of the release. We found that it would be very desirable to have one-way operation on the north and south avenues on the island but not altogether practicable.

For instance, on Fifth Avenue we have the Fifth Avenue Bus Company which has a 99-year franchise to operate in both directions. In a court test, not long ago, the City of New York was defeated by a bus company when the City of New York attempted to make another pair of avenues one-way streets.

So in order to accomplish at least a part of our plan we have determined to time the avenues in Manhattan as if they were one-way streets. Alternate avenues will be timed as northbound streets and the intervening avenues will be timed as southbound streets. That means the traffic moving in one direction on each street will get all the breaks and traffic moving in the opposite direction will get no breaks. What this will do, however, is enable us to use a much shorter signal cycle. We plan to reduce the cycle from the existing 90 seconds to 50 seconds. Reducing the signal cycle to 50 cycles will enable us to achieve progressive movement on the major crosstown streets where there is none at the present time. We hope to be able to accomplish this plan in about three years. During the first year we hope to work on about one-third of the island, a square section, so that we can demonstrate to the people of New York the advantages of progressive movement.

I think this is a good place to stop.

CHAIRMAN SMITH: Thank you, Charlie.

We have one other member of the panel, Ed Ricker, Traffic Engineer of the City of New Haven. We have witnessed in New Haven a very interesting one-way system, called the "in-and-out plan" - "in today and out tomorrow." Ed has had to

temper sound technical judgments with political and other considerations, and I am sure he has a great deal of valuable information to bring us, based on his experiences in New Haven.

MR. RICKER: Thank you for holding me up as a horrible example.

I might say we have a contracting firm in New Haven known as the Blakeslee Company and last summer several of our downtown streets were torn up for repairs under contract by the Blakeslee Company. A squib appeared in the newspaper that first we had one-way traffic, then we had two-way traffic and now we have Blakeslee, or "no-damn-way-at-all" traffic.

Now the streets are repaired and they are in the two-way traffic stage. Whether they will be one-way again, I do not know. During 1948 we installed about ten miles of one-way streets in the downtown area of New Haven, which, as probably most of you know, is rather concentrated in the older part of the city. That is where the congestion lies that we were trying to lick with one-way streets.

There were originally nine squares with a few intervening streets and that was the part of the system which "caught the fire." The rest of the system was accepted by everyone. We did what Gene Maier has said, i.e., started out with a pre-education campaign. Before it was announced in the newspapers we talked with such people as the post office, the express company, the transit company, the fire department, the telephone company, all the people who were regular users of the streets, and tried to work things out with them so that whatever system we put in would be to the best advantage of everyone.

Then, when it was released in the press, there was a four week period before the regulation was enacted during which time certain minor changes were made, particularly in the direction of the flow on some small alleys.

In September, 1948, we installed this downtown system. Also last year we installed new controllers on our traffic signals, so we were able to take advantage of a better flow on the one-way streets. In timing the signals we chose the major streets so as to have as perfect progression as we wanted, at about 18 miles per hour. Of course, the results were, as all these other gentlemen have said, immediate in improving the quality of the flow. Chapel Street is the only main street in New Haven. Before we had the signal timing and the one-way streets, it carried enough traffic so that on each change of signal two cars went by in each direction. It sounds pretty small, but that was the main street in New Haven. Afterwards we were carrying in the order of 600 vehicles an hour. Over-all, the volume picked up about 30 percent with some redistribution on the streets and as much as 60 to 70 percent increase on certain streets.

We ran the usual speed and delay surveys and found an improvement in flow of about 30 percent in over-all time of travel. That percentage is not large compared to some others, but we were working in a rather small area.

For the first three months after the one-way streets were installed, the accident rate increased by two and a half times. Then the people began to understand what we were doing and it dropped below the original rate and the severity of the accidents decreased.

I don't think anybody has said that we did not improve traffic flow in the city. However, there grew up an opposition which was spearheaded by the local newspaper. We had a series of hearings, a great discussion raged about the one-way streets, and it was the most popular topic on the radio, television and everywhere else.

We stuck for a period of seven months with one-way streets and then the decision was made to revert five of the streets back to two-way operation. These were the central streets and Chapel Street, previously mentioned, was one of them. From a traffic engineering viewpoint, the most interesting point to me is that, while the system was in and all the streets were under one-way operation, we had an equal facility of flow on all the streets, but, when the system was broken and only four streets in the central part were made two way, the facility of flow on all streets was interrupted, whether they were one-way or two-way.

Some of Wilbur's men from the Eno Foundation made a check of the system before and afterwards. They found the same results that one-way operation is supposed to achieve, i.e., elimination of conflicts due to left turns, improved signal timing, and the concentration of flow on the streets which should be carrying the traffic and which had the extra lane. Most of those advantages were lost when the system is broken, so that is the situation today.

I think we did a reasonable job of selling. During the controversy various service clubs took opinion polls of their members. The percentage in favor of the one-way street ranged from 84 to 100 percent of those voting.

The chamber of commerce also took a poll. I think their percentage definitely in favor was about 67 percent. The percentage definitely against was something like 17 percent. The others were in between. The one-way streets were very popular with the motorists. They were doing a job, but they were taken out for the reasons which you all have more or less to contend with in your own cities.

MR. SMITH: Thank you, Ed.

Now we have heard brief comments and I do not want to prolong talk by the panel. However, I would like to report a few additional facts just for the record. Trying to get geographical representation, I contacted several fellows in other sections of the country asking if they could sit on the panel. While they were unable to be with us, several of them did send data which I think would be interesting and which I would like to summarize briefly.

Mr. Bob Dier, Traffic Engineer of Fresno, California, recently completed a questionnaire study on one-way streets. While we do not normally attach a lot of significance to questionnaire studies in traffic engineering work, I think, there were some significant results in this study.

Mr. Dier requested information concerning one-way streets from all cities of 50,000 population and over which were known to have one-way streets. Returns of 66 percent and 77 percent were received from traffic engineer, police official, and merchant association groups, respectively. The following is a summary of the more pertinent information derived from this study:

SUMMARY OF EXPERIENCES WITH ONE-WAY STREETS IN Cities with a Population of 50,000 or More

(collected by Mr. Robert Dier,
Traffic Engineer, Fresno, California)

PART I - EXPERIENCE OF TRAFFIC ENGINEERS AND POLICE TRAFFIC OFFICIALS

LOCATION OF ONE-WAY STREETS	NO. OF CITIES	PERCENT
Business District	52	80
Bordering Business District	1	2
Residential District	40	71
Industrial	21	38
Other	2	3
No one-way streets	9	16
THOSE WHO RESISTED ONE-WAY PLAN		
Merchants	30	54
Residents (Residential One-Way Streets)	13	23
Motorists	8	14
Mass Transportation	1	2
Truckers	3	5
Building Owners Association	1	2
Fire Department	1	2
Scattered or Unorganized	7	12
No Resistance	17	30
PUBLICIZING PERIOD		
1 Week	7	13
2 Weeks	9	16
3 Weeks	1	2
1 Month	15	27
2 Months	7	13
3 Months	6	11
4 Months	1	2
6 Months	1	2
8 Months	1	1
None	7	13

TRIAL PERIOD	NO. OF CITIES	PERCENT
10 Days	1	1
1 Month	3	5
2 Months	6	11
3 Months	15	27
4 Months	1	2
5 Months	0	0
6 Months	5	9
None	25	45
SUCCESS OF ONE-WAY STREETS		
Were Successful	56	100
Not Successful	0	0
EFFECTS ON ONE-WAY STREETS ON BUSINESS AND PROPERTY VALUES		
Harmful (Partly)	3	5
Benefited	40	71
No Change	7	13
No Comment	6	11
FINAL REACTION TO ONE-WAY STREETS AFTER TRIAL PERIOD		
Merchants		
For	37	66
General Acceptance	10	18
Opposed	4	7
No Comment	5	9
Residents		
For	39	70
General Acceptance	10	18
Opposed	0	0
No Comment	7	12
Motorists		
For	44	79
General Acceptance	7	13
Opposed	0	0
No Comment	5	8
Mass Transportation		
For	33	59
General Acceptance	7	13
Opposed	0	0
No Comment or Not Affected	16	28
Truckers		
For	34	60
General Acceptance	7	13
Opposed	1	2
No Comment	14	25

Mr. Dier reports the following interesting points regarding the survey of experiences with one-way streets:

"One-way streets are found predominantly in residential and business districts.

"Merchants are the chief opponents of any one-way street plan as reported by 54 percent of the cities. Thirty percent of the cities inaugurated one-way plans with no opposition.

"One to three months advance publicity is desirable for a one-way plan as indicated by 51 percent of the cities reporting.

"No trial period was necessary for 45 percent of the cities reporting, but should one be necessary, 3 months is considered the most desirable by 27 percent of the cities.

"Traffic engineers and police traffic officers were unanimous in declaring their one-way street plans successful.

"One-way streets are beneficial to property owners and business concerns as reported by 71 percent of the cities. Only 5 percent reported the systems partially harmful.

"Of extreme interest is the fact that the merchants who are the chief opponents of the one-way plan were reported to be for the plan in 66 percent of the cities. All other groups are reported to have a high regard for one-way streets."

In questioning merchants' associations Mr. Dier obtained the following reactions relative to one-way streets:

SURVEY OF ONE-WAY STREET OPERATION

Cities with a Population of 50,000 or More

PART II - CONCENSUS OF OPINION OF MERCHANTS' ASSOCIATIONS

1. Are you for _____ ; Against _____ ; or Neutral _____ to one-way streets?

Results to Date

For	39 Cities	80%
Against	5 Cities	10%
Neutral	5 Cities	10%

2. Have one-way streets had permanent, harmful effects on adjacent business?

Harmful	2 Cities	4%
Not Harmful	44 Cities	90%
No Comment	3 Cities	6%

3. Are the over-all benefits of the one-way street plan sufficient to receive your favorable recommendation?

Would Recommend	42 Cities	86%
Would Not Recommend ..	3 Cities	6%
No Comment	4 Cities	8%

4. Is the one-way street plan popular with the general public?

Popular	40 Cities	82%
Not Popular	5 Cities	10%
Neutral	3 Cities	6%
No Comment	1 City	2%

A more complete report on the survey undertaken by Mr. Dier is contained in the January issue of Traffic Engineering magazine, published by the Institute of Traffic Engineers.

From Louisville, Kentucky, we had a report from Mr. W. F. Watkins, Traffic Engineer. He stated that there are 26 miles of one-way streets in Louisville. In commenting on his experiences Mr. Watkins said:

"Our system is designed to connect population pools or areas with downtown Louisville; in other words, we have a pair of one-way streets connecting each of our large population centers with our downtown area. We have found one-way streets to be extremely useful in expediting the flow of traffic as well as reducing all types of accidents on such streets. We have numerous time studies and reports from the transit company which indicate that the movement of traffic has been greatly speeded up by conversion of streets to one-way. We have found no depreciation in property value. I do not know of even one instance where a firm was forced to go our of business because of the installation of the one-way street. We have, however, found that in some instances for a period of sixty to ninety days business might decrease from 20 to 30 percent; after that length of time business comes back to its former level. We have had one or two large companies check the reasoning behind this and they report that during the first sixty to ninety days they have lost some of their old customers and then after that period of time the old customers are replaced with a new group of customers. By the use of one-way streets we have been able to reduce the load on a major artery by as much as 6,000 cars in twelve hours and transfer this load to a parallel street which may only be carrying 2,000 to 3,000 cars per day. Thus by the use of one-way streets we have, in some instances, been able to equalize our traffic load over a street which was overloaded and a street which was underloaded. One-way streets have been popularly accepted by the vast majority of people in our city. We have some complaints from bus riders where originally busses would move two ways on the street and after the street is made one-way the busses, of course, could only move in one direction. This causes the bus riders who live on these streets to walk an extra block in going to and from their destination."

The Traffic Engineer of Seattle, Washington, Mr. J. W. Arch Bollong, provided information concerning experiences with one-way streets and plans for additional one-way streets. The results of the Seattle experiences closely parallel

thos which have been cited for other cities. The following comments by Mr. Bollong are of particular interest:

"We have formulated questionnaires for business houses, residents and others in the vicinity of the one-way streets now in operation to ascertain the loss or gain in business, the difficulty or lack of difficulty in parking, and other pertinent data.

"Our success with a set of one-way streets seven blocks in length is quite apparent from the traffic facility and control standpoint. It might be well to say that each of these seven blocks is signalized throughout its entire length. It might be well also to state that the speeds in both directions have been increased from an average of 17 miles per hour to 25 miles per hour. The traffic volume has been increased approximately 30 percent.

"We have oversigned this initial installation in order that proper public education may be attained, which oversigning has shown good results.

"We have found that in the left-turning from the lane next to the curb into streets having two-way traffic operation, a set-back of the stop line some 20 feet is required, caused by left-turning cars standing at the property line awaiting the signal order and creating conflict.

"We now have on the drafting board an additional set of one-way streets some mile and a half in length through the Central Business District, running north and south parallel to the waterfront; also another set in a suburban district where an arterial 40 feet in width is heavily congested, due to businesses at various locations throughout its length and heavy out-of-town travel. The cost of widening this arterial would be in the neighborhood of $2,000,000, and by one-way operation we can, with the expenditure of $30,000 or $40,000, make the greatest use of existing facilities and increase its capacity from 30 percent to 40 percent, we are sure."

Another set of data was collected by Mr. Frank C. Balfour, Chief Right-of-Way Agent, California Division of Highways, and was furnished by Mr. J. C. Young, Traffic Engineer. The data are particularly interesting because they offer or suggest a factual measurement of the effect of one-way operation (and I think it can be applied to other traffic activities) on business.

State sales tax figures were used to measure the effect of one-way regulations in Sacramento on business. Since sales tax figures on individual businesses were not available, the results were developed on a percentage basis. Mr. Young stated:

"This study was made on 16th Street in Sacramento, the capital of the State of California, and having a population of approximately 134,000.

"As it is a matter of law in the State of California that the sales tax figures on individual businesses are not accessible to the general public nor subject to publication in any form, it will be impossible to give you the entire report in dollars and cents as it was developed. However, we can give you the summary and results on a percentage basis.

"In an attempt to eliminate as many of the controversial conditions as possible, we have used in this study only those properties depending entirely upon the traffic on 16th Street. Corner locations which have the benefit of frontage on cross streets have not been included.

"Sixteenth Street is one of the four main cross city arterials. It was converted to a one-way street August 20th, 1948. Prior to that date it was carrying approximately 26,000 cars per day. The traffic count during the period it operated as a one-way street was approximately 23,000 cars per day. One study included the fourth quarter of 1947 and the first and second quarters of 1948 before the one-way street was in effect, and the fourth quarter of 1948 and the first and second quarters of 1949 during operation as a one-way street.

"Our first studies, made by personal contact and interviews with the various property owners affected, produced an unsatisfactory and varying result.

"In the utilization of the gross sales tax method, comparison was made with the taxable retail sales in the County as a whole. As these figures are developed on a classified system of licensed businesses, it was necessary to group the various businesses under three general classifications for comparison of volume. The resulting figures are as follows:

	County	16th Street
Auto Supply Stores, Garages, Auto Dealers, Service Stations and Tire Shops	- 7.75%	- 5.67%
Eating and Drinking Places	-14.35%	- 5.52%
All Other Business	+ 1.80%	+ 9.67%
All Businesses	- 1.66%	- 0.21%

"These figures were derived from a study of 41 businesses being all on that section of the street which was converted to one-way traffic. The businesses included 5 auto supply stores, 5 restaurants with liquor, 5 service stations, 3 auto repair shops, 5 restaurants without liquor, 5 grocery stores, 2 drug stores, and a miscellaneous group including shoe repair shops, men's apparel stores, radio and household appliance stores, etc."

A very comprehensive one-way plan has been under consideration in Portland for several years. The following information regarding the plan for Portland and results of one-way systems in other Oregon cities was reported by Mr. F. T. Fowler, traffic engineer of Portland, Oregon.

"In January 1947 I submitted to the City Council a report recommending the adoption of a one-way traffic plan for the metropolitan business district of Portland.

"This plan involved approximately thirty-five miles of streets in the congested west side district. After two years of meeting and conferences with the Chamber of Commerce, Building Owners and Managers, Retail Trade Bureau, and other interested groups, the plan was adopted by the Council on January 11, 1949, and $75,000 was made available in the budget for installation of the one-way grid.

"The primary obstacle that we have had to face in the installation of the one-way system has been the transit operation. The installation date has been twice postponed at the request of the Portland Traction Company. There are, at the present time, three street car lines which are to be replaced by busses as well as approximately 11,000 feet of trolley bus overhead to be shifted for one-way operation.

"In most part, the objections experienced from the downtown merchants have not been regarding one-way vehicle movement but have stemmed from the necessary changes in the mass transportation routes.

"In order to institute the 'One-way Plan' with a minimum of confusion, the entire one-way area will be put into effect on the same date. To accomplish this, the lane painting has already been done and the signal system has been set up for a 15 MPH progression in the future direction of travel. On the north-south streets which have 50 ft. roadways, two lanes have been assigned to the direction coincident to the one-way movement and one lane to the opposition. These two changes have made travel in the correct direction so advantageous that, with the co-operation of the newspapers and other sources of public information, the motorists are rapidly becoming accustomed to using the streets in the correct direction.

"The transition period during which the trolley overhead is in place for one-way operation while the street is still in use two ways, has presented some problems, particularly where the bus line is approaching a left turn. It has been necessary in some cases to eliminate parking at these corners.

"In order to leave as much curb space as possible available for parking, we intend to establish bus loading zones only during the rush hours. During the remainder of the day, the busses will load at near-side stops in the right hand lane adjacent to the parking lane. A careful location of these stops on a skip-stop basis at those corners where a right turn cannot be made should eliminate any serious interference with other vehicles.

"The internal arrangement of certain parking garages, auto shops and freight docks in the one-way area has presented a number of problems. In one case, it would be necessary for a large trucking firm to move each vehicle seven blocks in order to move from one side of their building to the other. Until such time as these establishments can adapt their plant to fit the one-way scheme, we propose to establish an additional lane next to the curb by eliminating parking and allowing the use of this lane in the reverse direction. We will mark this lane in such a way as to make its use legal and post warning signs for the oncoming traffic. Although this arrangement is not ideal, the public reaction should not be adverse as these lanes will be in most cases less than 100 ft. long and will not interfere with the normal operation on the street.

"In the mechanics of signing the one-way area we have deviated from the 'Manual of Uniform Control Devices' in several respects. We have abandoned the standard 12 in. x 36 in. one-way arrow in favor of an 18 in. x 24 in. sign. We felt after experiments on an existing pair of one-way streets that the 18 in. x 24 in. size was more suitable for use in a metropolitan district where in many cases it is difficult to install a 36 in. sign. Instead of the near right hand

and far left hand locations specified by the manual, we are using far right and left hand locations. We found that in numerous cases the near right hand sign was obscured by busses and trucks loading at the curb. We are using 'No Right Turn' and 'No Left Turn' signs at the peripheral intersections only. In the grid area itself we will rely exclusively on the 'One-Way' signs except that during the introductory few weeks we will place portable standards with 'No Left Turn' and 'No Right Turn' signs in the street area.

"Following the example set by the Oregon State Highway Department, we are using dashed center lines or lane lines on all one-way streets as an additional indication to the motorists. We are also using eight-foot arrows painted in each lane.

"The 'Portland Plan' of traffic signal installation adapts itself nicely to one-way operation. As the walk-wait signal is in the location that we plan to place our 'one-way' signs, at signalized intersections the sign will be attached directly to the walk-wait head. The two overhead signal heads at each intersection which face away from the one-way operation will be reversed in direction but won't be moved. This will give us a far right hand and near left hand location for the overhead signals. Our limited experience with this type of installation has been very successful. In some cases the far right hand signal will have to be moved closer to the center line in order to be visible from the left hand lane. On the messenger wire beside the far right hand signal head we will install a 24 in. x 30 in. self-illuminated sign similar to the 18 in. x 24 in. 'One-Way' sign. These cabinet type signs, illuminated from the rear by two U-shaped fluorescent tubes are highly effective in the metropolitan district.

"At intersections where there are no signals or where the street lighting is not adequate, we will use scotchlite signs. We are using No. 246 white wide angle C scotchlite with the message die cut from an 18 in. x 24 in. sheet which is appliqued on a porcelain enamel sign.

"The results of six-month trial of a one-way grid on the neighboring City of Eugene, Oregon, 1940 population 20,838, have recently been released. Six months after the grid system was inaugurated a questionnaire was sent to all the business and professional men within the city and to all property owners within the grid system.

"Excerpts from the questionnaire and the answers obtained from those within the grid system are as follows:

"1.	Do you favor the present one-way street grid plan?	Yes 79%
"2.	Do your customers like the one-way traffic plan?	Yes 71%
"3.	Do outsiders and tourists, whom you know, like the one-way plan?	No 61%
"4.	Would you approve elimination of parking on Willamette and on Broadway as an alternate to one-way use of these streets?	No 83%
"5.	Would you favor return to the former two-way use of all downtown streets within the present grid pattern?	No 81%

"One of the problems that has arisen in Eugene is the fire hazard on warm days caused by gasoline leaking from tanks of cars parked on the left side of the street. This seems to be a local problem caused by an unusually high crown as we have never had this trouble on a pair of one-way streets in operation for over two years.

"As a result of the experience in Eugene, the Portland Hotel Association voiced an objection to the one-way plan. Their contention was that the strangeness of a one-way system to out-of-town motorists drove them away from the downtown hotels. We hope that this trend will not be as great here in Portland which is a terminal point rather than way point for most motorists."

Data such as those just related from Fresno, California; Louisville, Kentucky; Seattle, Washington; Portland, Oregon; and the California State Highway Department, coupled with results already reported by panel members, reflect the wide interest in one-way streets and provid very useful suggestions for other cities.

Gentlemen, the meeting is now open for discussion. As I said in the beginning, we want to make this a very informal discussion. Many interesting points have been raised. You have, undoubtedly, many more which you want to raise with the members of the panel and others. We know that many of you in the audience have had experiences which we are sure equal and exceed some of those you have heard from the panel members. Will you now tell us about your own experiences or raise questions which you would like to have discussed? These proceedings are being recorded, so they can be made available through some publication of the Highway Research Board.

MR. MARSH: I would like to ask Gene Maier what factors decided the elimination of parking on the right hand side.

MR. MAIER: On the inbound one-way streets, parking is removed from the right-hand side in the morning from 7:00 to 8:30 A.M. This is in the lane in which the buses move. On the outbound streets from 4:00 to 6:00 P.M., parking is prohibited as this provides a lane for bus movements and eliminates the changing from the curb to a moving lane which causes serious congestion.

Houston transit operations are entirely with gasoline busses. With the installation of the one-way street plan, sixteen loop lines within the business district were tied together and, as a result, approximately 6,000 bus turning movements were eliminated per day. At the same time, approximately one-hundred twenty-five bus zones in the downtown business district were relocated. Taking advantage of the numerous changes occurring in connection with the establishment of the one-way street plan, an effort was made to properly locate these bus zones. Adequate length was provided and both near and far-side zones were established. No near-side zones were established which would block a permitted right turn at an intersection.

I would like to add that a one-way street plan in itself is not enough but that to achieve real improvement in traffic operation, other restrictive regulations must be adopted at the same time.

MR. MARSH: On those arteries bus movement was an important factor, was it not?

MR. MAIER: Yes.

MR. MITCHELL: I might say we are preparing to install on Chestnut and Walnut Streets in West Philadelphia a no-stopping regulation on the righthand side for thirty blocks. As you know, normally we clear the lefthand side. The reason we are trying the rightside is just for that purpose, because there are heavy bus routes on these two streets.

MR. RICKER: I might comment about your original point about the parking on the right or the left. One of the students at the Yale Bureau last year made a study on one of our one-way streets where we allowed parking on both sides. He found that the advantage, if there was any, accrued to the parking on the lefthand side. It might be a little surprising. The motorist took a shorter time to park and a shorter time to unpark. He was more apt to get out to the curb rather than get out into the moving traffic line.

The only apparent disadvantage was that he could not park quite as close to the curb on the left as on the right.

MR. VAN RIPER: I have an elementary question I would like to ask the panel. What are the "do's and don'ts" in establishing one-way streets?

MR. MITCHELL: You will have to wait for the new traffic engineering handbook.

MR. RICKER: I can tell you one. Don't establish a comprehensive pattern of one-way streets just before the economic cycle pitches down. That was our mistake. Every business loss is attributed to one-way streets.

MR. MARSH: Don't permit a monopoly newspaper; isn't that right?

CHAIRMAN SMITH: In connection with the point Ed Ricker just made; I have found it was far better to put them in in the fall when the business cycle is usually on the incline. When they are doing business, merchants are not inclined to complain so much about traffic changes. If you wait until January, they may blame a general business decline on the one-way operation.

MR. HOWIE: There is a plan in Portland for one-way streets. It has been delayed because of the fact that the street car system cannot be revised. It is scheduled to go into effect the 1st of January, when the last of the street cars are off. In the meantime the traffic engineer has timed his signal system, as Michalski outlines, in favor of the one-way direction and the taxicabs reported they had already reached the point where their business was declining and some of them were losing money. Almost immediately the one-way timing of the traffic signals threw them over into the black again. So there is just the opposite effect in that case.

MR. MICHALSKI: There are 17,000 cabs in New York.

MR. MITCHELL: Referring to Van Riper's question as to "do's and don'ts"--we found in Charleston that, after we made the survey and determined the movement of the various vehicles through the district, we had proof to show the merchants that the one-way streets would not interfere with their business. You have to get the facts and data before you put one-way streets in operation to fortify yourself in case of opposition. We have had one case where the merchants on a certain two-way street, which lies just to the north of the one-way system and which would not be affected by the one-way operation, stated it would ruin their business because we were making a street one-way away from their area and all the traffic that came from the west would have to go around two blocks to get to their places of business. We showed, from our studies of where the people came from and where they wanted to go, that less than 0.5 percent of all the people who came in from the west wanted to go up to that street, and that most of their business came from the other direction where they would have direct access to it. We defeated that objection immediately. So, if you get the facts, you can often knock down some of these objections at the outset.

MR. MICKLE: The various questionnaires show some improvement in the attitude of the business people. You indicated that the results of that questionnaire showed that business people were not the ones who opposed one-way streets. I think that is a rather new attitude on the part of the business people. There are, of course, a few cities have had one-way street operation for a number of years--New York, Detroit, Cincinnati, New Orleans, and a few others, where the pressure has forced them into it early--but most of the cities have had difficulty in getting one-way streets tolerated. Toledo is a good example; it took eleven years to overcome the opposition of the town council and the merchants to one-way streets.

George Fowler of Portland, Oregon, has had considerable opposition from the merchants to the establishment of his plan there, but just in the last couple of years there have been cities which have put in extensive systems of one-way streets without any opposition. You can turn to Los Angeles, Denver, Houston, and several other cities. There are many others where the system was installed without any apparent opposition and it seems to me we are seeing a change in the attitude of businessmen on this question of one-way streets because of the demonstration of their value in many of these places where they have been operating for so long.

CHAIRMAN SMITH: It is just another case of nothing succeeding like success. The more cities that report the success of their one-way operation, the easier it becomes to have others adopt them without strong objections.

MR. MURPHY: A new class of objectors is the people who are living in the fringe areas. They are becoming vociferous about it. In the last one where we installed a one-way street the people in that neighborhood objected and took it to court. They lost their case in the lower court and appealed it. The Maryland Court of Appeals denied that they had any right to any recompense or redress, and held that no harm had been done them.

MR. PORTER: What was their reasoning?

MR. MURPHY: They used an artificial device, an artifice, in presenting their case. It so happened that this neighborhood had been reassessed and they claimed fraud because their assessements had not been reduced. They contended that the assessing officer knew the streets were going to be made one-way and he should have taken that into account, acknowledging that it brought about a reduction in their property values. Of course, the basic issue was whether one-way streets, in the light of experience, did actually decrease property values. If the court had decided that was the case, they might have been in a stronger position.

MR. RICKER: In these residential areas, are bus routes the major bone of contention?

MR. MURPHY: It is like asking yourself whether the one-way streets are helping or hurting business. When you analyze the thing, you do not know whether the people are objecting to one-way streets or to the Diesel busses that operate on the one-way streets or to the trucks operating on those streets - these would be there anyway. There are so many things that it is difficult to say which is the main cause of complaint.

CHAIRMAN SMITH: This question of transit operation has been mentioned. I wonder if Mr. Adams is in the room or whether we could get another transit viewpoint. Is anyone with transit operations present?

MR. BUTCHER: Here in Washington in the Capital Transit Company we look with favor on one-way streets. As a matter of fact we would like to see more of them.

In so far as inconvenience to the patron is concerned, I think they, too, would rather suffer that little bit of inconvenience of walking the extra block or two and get the greater saving in time.

CHAIRMAN SMITH: Unfortunately this may not be a typical reaction, as in Washington we are dealing with an unusually progressive transit company, traffic-wise.

MR. MARSH: Mr. Chairman, at some appropriate time this evening I wonder if you would be willing to ask a question to which I would like to get the reaction of everybody here.

CHAIRMAN SMITH: We would like you to ask it now.

MR. MARSH: I would like to ask the opinion of the people in the room whether, with the passage of time, it is to be expected that there will be a marked trend toward one-way streets in the central districts of American cities. Is that so or not? I would like to find out how many think it is not so.

CHAIRMAN SMITH: Who will say that this is not probable?

(There was no response.)

MR. REEDER: For the last few minutes I have been considering getting up here to ask a question or to say something concerning that same subject. Unfortunately, I was a little late in arriving here and do not know whether this particular thing was covered or not, but, since I have been here, there has been a great deal of discussion of the merits of one-way street systems that have been installed and we have heard very little about the reasons, except public opposition, why they have not been universally installed. It seems to me that we have something that needs to be brought out.

Let me ask: Was there any discussion at the beginning concerning the limitations on one-way street application?

CHAIRMAN SMITH: No.

MR. REEDER: It seems to me there are some things we have to take into account. There are business districts which, I believe, are not especially adopted to one-way operation, largely because street widths between curbs, or street continuity, or street conditions, or the general pattern of the street layout are not adaptable to the things that are required for one-way operation. I am sure that a number of the cities represented here in the discussion tonight are those which have had favorable conditions in that regard, at least to some extent, if not completely. They had the proper pairing of streets for capacity in opposite directions. Also, perhaps the street widths were such that they provided an uneven number of lanes thereby making for greater capacity if converted to one-way movement. This condition is definitely suitable for a one-way street. Continuity of streets is also suitable for one-way movement and eliminates the situation where a two-way street suddenly becomes a one-way street with the consequent difficulties in getting traffic from the one kind of system into the other.

I come from a city that has one-way streets and I know that they are workable where needed. However, it seems to me that we are in danger of feeling that one-way streets are a panacea. We ought to be sure, I believe, that we are not setting up a claim or an inference that one-way streets are universally adaptable and, consequently, that they can apply in all cities, lest we may find ourselves in conditions that may have persisted rather to extremes in some of our traffic problems.

I feel that the system is not universally applicable and that it should be applied where it is necessary but should not be considered a universal panacea for all problems.

CHAIRMAN SMITH: Thank you. Those are very wise words of caution. We will see one-way streets increasingly applied in cities, but we must recognize that there are many situations under which they are not workable and, therefore, in many cities we will not see an extensive application of the one-way plan.

MR. HOWIE: Since no one has spoken about the transportation end of it, I would like to bring up one point. We have the case of a series of parallel streets that are operating at the present time as two-way streets on which our mass transportation is operating at headways that are running very close to capacity during peak hours, approximately 30 seconds. Suppose you transform that

into the one-way pattern and assume that you are going to operate only one lane of mass transportation on each of these one-way streets. You cut in half the number of lanes available to mass transportation and may impose impossible headways on them.

MR. MATSON: May I add one word. How does it manifest itself in the loading situation?

MR. MAIER: In Houston where all transit operation is with gasoline busses, as many as ten lines are operated on a single one-way street. These are divided into groups of five and provided separate bus zones. This requires a large portion of the righthand curb to be set aside for bus loading zones, inasmuch as stops are provided every second block. Busses operate on headways of less than thirty seconds under these conditions without difficulty.

MR. HOWIE: We ran into difficulty with respect to heavy trolley lines.

MR. MURPHY: Is your problem one of finding a return route for your busses?

MR. HOWIE: We worked it out. I brought it up not as an impossible situation, but as a definite objection you will hear with respect to mass transportation.

MR. MURPHY: Your headways would not change if your total route run is fairly long. A bus which leaves the downtown area at the beginning of the peak would not return anyway.

MR. HOWIE: Their objection was that we were forcing them into an area where the passengers did not want to go, by forcing them into streets that they are not using.

MR. MITCHELL: That is one of the disadvantages we have in Philadelphia where we have a great deal of street car operation in the downtown area. Street cars operate on practically every street in the downtown district. It makes it difficult to eliminate street car operation and get streets set aside for motor vehicles to speed up the latter. That is one of the difficulties of our one-way gridiron system in Philadelphia but our streets are so narrow we have to put up with it.

After much opposition we have just eliminated street cars on two east and west streets to the south of the fringe of the central district and put on a shuttle busline. We repaved those streets and turned them over to vehicular operation. It is surprising how much traffic which formerly went through the heart of the central business district now uses these routes. They can go about four or five blocks south, get on these through vehicular streets and make much better time.

MR. MICKLE: In Atlanta recently the traffic engineer for the transit company there was the man responsible for laying out the one-way street system.

As I understand it, the system is working very successfully since they have changed from street cars to busses.

MR. MITCHELL: If you can remove the street cars you can do a lot.

MR. MURPHY: Our transit company is not completely sold because we have not had the benefit of a complete one-way system. You get your greatest return with your most recent conversions. The transit company is now operating on one-way streets up to a certain point and then they are forced to make their loop or operate on a two-way street or return into the general congestion which is the result of not having your inner ring of one-way streets around the downtown area. We are looking forward to next year when we complete that ring and there should be a tremendous benefit over and above what we have already obtained, simply because it completes the system. Then, I think, they will be very much in favor of it.

MR. MICKLE: Mr. Murphy has commented a number of times on the difficulty of one-way streets in residential areas. Aren't there quite a number of one-way streets in residential areas?

MR. ILGNER: In residential areas where the streets are not arterials, there is no disadvantage. We have a large area where all the streets are one-way streets, but none of them is arterial. Most main arterial streets are two-way streets. The people on those streets like the one-way operation very well. However, when we took a street which was formerly an arterial and combined it with the street which was a residential street, nonarterial, then the people on that latter street, the nonarterial, complained very much, and the accidents on that street have gone up tremendously. So we are getting many complaints about pairing up a residential street with a former traffic arterial. Where a whole group of streets in a residential area are made one-way streets, the people like it very much.

MR. MITCHELL: That is our experience.

MR. MICHALSKI: Aren't we in danger of attracting an unusual amount of traffic on residential streets with one-way streets? That is the case in New York where we have large numbers of one-way residential streets. We find these streets are carrying more traffic than we expected a residential street to carry, and the result is that every one of those crosses an arterial and we have a problem. For the present, the solution to that problem has been a traffic signal and that has resulted in an impossible situation on the arterials in New York. You cannot time the signals or do anything now. If a lot of those streets were two-way streets, I do not think they would be very attractive to motorists and would be used only by the residents and people who have some purpose to travel on that street.

CHAIRMAN SMITH: One of the questions that came up before the meeting was: How do we treat the extremities of one-way streets? Are there any typical patterns or have any persons in this room had any unusual experiences in the marking or controlling the ends of one-way streets?

MR. MAIER: In Houston one-way streets were not terminated at a signalized intersection because of the congestion which was found to develop under such conditions. One-way streets extending away from the business district are abruptly changed to two-way operation without difficulty. At these locations, flashing, over-head signals with illuminating base lights and signs indicate on one side "ONE-WAY DO NOT ENTER" and on the other side "END OF ONE WAY." Traffic moves through these locations at speeds up to 30 M.P.H. without difficulty.

CHAIRMAN SMITH: Are there any others of the panel or the audience who have had experience on this?

MR. MICHALSKI: We had a situation in Detroit where we had a difficult problem at one end of a system of one-way streets in that one of the streets came to an abrupt end and the other street continued for several miles. In the extension beyond the one-way street, the street was very wide and capable of handling large volumes of traffic in both directions. The problem there was to take the traffic off the street that ended so abruptly and get it on to the two-way street. We found that the motorists did not like the route we had for them and they filtered through one of the intersecting residential streets. As a matter of fact, the character of this residential street was completely changed from a street that carried no traffic at all to one that carried as much as a thousand vehicles an hour. You can imagine the protests from the people who were living on that street. If the motorist went one block further, he could be turned into a business street where there would not be any objection to high volumes of traffic. The only trouble was that the motorist did not like the traffic signal he had to stop for.

MR. MITCHELL: We cleared up a very bad situation at one end of South Street Bridge by reversing the direction of the two one-way streets which were fed from that bridge. Originally, the street of which the bridge was an extension, South Street, was westbound to the bridge and all the traffic coming eastbound off the bridge was required to make a left turn at the end of the bridge and go over to the next street to the north and then go westbound, which created a three-way intersection at that point. By reversing the direction of traffic and making South Street eastbound and the other street westbound, we have created a straight-through route from the bridge down South Street and the westbound traffic turns to its left and makes a right turn across the bridge and it can make that right turn all the time. We practically eliminated the traffic signal at that point and cleared up congestion by the reversal of those streets.

MR. MURPHY: We have the question of crossing these arterials. That bothered us. So many of these neighborhood streets have been made one-way. With the exception of the stop signs we do not use a system of marking neighborhood streets that are one-way other than the marking we use on our arterial streets. We find quite a few of the streets are intersectional on these one-way arteries and I have been thinking that perhaps we should use something other than a stop sign. I know we are getting oversigned in some instances.

I would like to get the feelings of the people in the room on whether or not something that would be more attractive and catch the eye would indicate to

the driver on the cross street that this is a one-way artery that he is crossing, and not simply a one-way street.

MR. MAIER: Our experience might be helpful. We have adopted a policy of installing no one-way streets on minor residential streets. The reason for that is this very problem you speak of - a motorist making an improper turn in the wrong direction into a minor street. We do not hesitate to carry an arterial one-way into a residential area because there is sufficient volume on that street all the time to indicate to anyone that he would make an improper turn. On the narrow residential streets we have eliminated all one-way regulation and, where it is necessary, we have removed parking on one side to keep the two-way operation.

MR. MITCHELL: What are you going to do when you have only 18-foot roadways?

CHAIRMAN SMITH: Can anyone else help on the differentiation of markings on arterial and other streets?

MR. MICHALSKI: The midblock signal was what we used on our major pairs. That would hardly lend itself to minor residential streets.

MR. MURPHY: We are going to take one street and experiment with an unusual sign.

MR. MARSH: Mr. Maier, you mentioned that some of your one-way streets have 50- to 60-foot roadway widths.

MR. MAIER: Most of them are 52 to 54 and some are 60.

MR. MARSH: Do you lane those?

MR. MAIER: Yes.

MR. MARSH: What about the pedestrian crossings on those streets? What is your experience?

MR. MAIER: In Houston we have 100 percent observance of traffic signals by pedestrians. The pedestrian does not cross the street against the signal in the downtown section.

MR. MARSH: Are all your intersections signalized?

MR. MAIER: Ninety percent of them are. In Houston we have 100 percent observance by pedestrians practically throughout the city, 100 percent downtown and in the outlying districts you seldom see any violations by pedestrians.

MR. MITCHELL: How much of a cycle do you use?

MR. MAIER: Fifty-second cycle. We give them 20 seconds.

MR. MARSH: Have you had any experience as to the pedestrian problem on those intersections that are not signalized?

MR. MAIER: We have very few downtown that are not signalized. We have this problem that the motorists in Houston have an utter disregard for pedestrians. They say, "At no time yield the right of way to a pedestrian either in the crosswalk or in the middle of the street or any other time." But at least the pedestrians walk on the signal.

Our pedestrian accidents were quite materially reduced in the period of the one-way installation.

MR. MARSH: What about the clearance on these streets as far as the pedestrian is concerned? If he starts out in the last second of the green, he has five lanes to cross. What situation does he find himself in then?

MR. MAIER: If he is no more than 10 or 12 feet from the curb, he goes back.

MR. MARSH: Suppose he is a little more, then what?

MR. MITCHELL: He runs like hell.

MR. MAIER: That is essentially true. We use very short ambers, 3 seconds, so that, if the light turns green when you are out in the street, you hustle across. I have seen them caught in the middle of the street and remain there until the light turned green.

MR. RICKER: Or until the ambulance comes?

MR. MITCHELL: There is one advantage as far as one-way streets are concerned in connection with pedestrians. There are always two crossings; they don't have to worry about turning vehicles.

MR. MAIER: I would say that in the downtown district since the one-way streets went into effect, which will be two years in February, we have not had more than one pedestrian fatality.

MR. MITCHELL: They only have to look one way. That is one advantage.

MR. MAIER: And there are two pedestrian crossings where they have no confusion, no conflicts.

MR. MITCHELL: You have more trouble with pedestrians from turning vehicles than straight-through vehicles striking them.

CHAIRMAN SMITH: Have you found it necessary to use pedestrian barriers or physical controls at crossings to prevent pedestrians from interfering with heavy traffic turns?

MR. MAIER: I do not see how you can force anything like that.

CHAIRMAN SMITH: Are there any other questions?

MR. ILGNER: On this matter of special signs on the one-way arterials and through residential areas, what we are doing (and probably a lot of other cities are doing, it too) is this: On all one-way arterials we double-back our stop sign so there is a double-back sign at the near right and at the near left if you are in the center lane. On the other side you have the stop sign in front of you. We double-back all our stop signs on all our one-way arterials and nearly all other important crossings that are not signalized. By doing that we have had no trouble at the nonsignalized intersections on one-way arterials. Both sides are reflectorized.

MR. HOWIE: Mr. Murphy brought up one new crop of opponents. I have another one to suggest. Next month we plan to use reversible flow on a bridge over the Ohio River. It carries 1,400 vehicles per lane per hour in the direction of heavy flow and 800 in the other direction, 17 feet over-all width, curb to curb. Adjacent to it is a paved bridge, with a 10-cent toll, that is carrying 200 vehicles per lane. We propose to reverse that flow and the net result will be to throw 800 vehicles over to the opposite direction and thereby to the pay bridge. It is controlled by the Kentucky Highway Department.

CHAIRMAN SMITH: Mr. Rothrock mentioned he had additional data on the effects of one-way streets on business.

MR. ROTHROCK: I do not have. I suggested here that we make a census of business along our one-way streets and get their opinions. The idea tried in California might be worked by us in West Virginia. We have a license tax and can probably make such comparisons. I might be able to work out something on that.

CHAIRMAN SMITH: I should like to raise one question which probably Ted Holmes might want to answer. Are one-way streets being generally advocated as a supplement or an adjunct to partially completed freeway systems? I mentioned that Houston has used them in that regard. I am wondering if it is a general application of the one-way principle in urban areas where expressways are being constructed.

MR. HOLMES: I do not believe I am a very good candidate to answer that question. I think that there is little alternative to the use of one-way streets under those circumstances and probably there is little alternative to the use of one-way streets paired-up or tripled-up or however they may be used, as substitutes for expressway systems. I kept my hand down when Burt Marsh asked whether we thought there was a trend toward the greater use of one-way streets in larger cities. I believe that it is probably true, but I do not believe it should be stated unconditionally. I do not believe that this trend is desirable. It seems to me, despite the fact that we as traffic engineers can take satisfaction in moving greater volumes of traffic on streets when they operate one way as compared to their previous operation as two-way streets, that it is not necessarily a desirable use of the street. One of the fundamental purposes of the street, especially in residential areas, is to provide access to abutting properties. If we

make them racetracks when they are one-way streets, we reduce their value in connection with abutting property. You cannot measure that in terms of sales tax.

While Baltimorians recognize this greater speed with which they can get around, they think the city is ruined, nevertheless.

We always have to keep in mind that the function of an arterial street is to move traffic and the function of a street that is to serve adjacent property is just that and combining the two can never be satisfactory.

MR. MITCHELL: Burt said business districts.

MR. MARSH: Yes.

MR. MURPHY: I wonder if we are not extending our province into city planning. Maybe we ought to be aware of it, but we will find ourselves embattled by many groups. I feel we ought to fight hard for moving city traffic and let there be a check on us by the city planners so we do not run wild.

MR. HOLMES: The force of necessity will probably bring about one-way street operation. I think you have a good point there. I sometimes wonder if those people, whether they be city planners or businessmen, who are responsible for the architecture of our growing cities, fully accept the fact that the automobile is here to stay.

MR. HOOPER: It seems to me in this discussion we have talked about the one-way street system as being a panacea. We want to watch out that we do not go overboard and fail to plan for expressways and freeways. The day is coming when these one-way streets, with the passage of time and the growth of traffic volume generally, are going to bog down, so we will get no better operation than we do now on the two-way streets.

CHAIRMAN SMITH: That brings up the question of what happens when you build one of these super-facilities. Did the expressway in Houston relieve the problem and make it unnecessary to use one-way streets which they had before?

MR. MAIER: Our basic planning in the one-way street system was developed around the Gulf Freeway which has recently been completed and which at this time is carrying approximately 57,000 vehicles per day. This Freeway brings traffic into the business district in densities never before encountered. If the one-way street plan had not been adopted, these traffic volumes could not have been absorbed as it would have been physically impossible for the two-way streets to accommodate such flows.

We might consider the effect of one-way street operations on business. Many restrictive traffic controls to improve traffic movements have been installed which affect business more adversely than one-way streets. For example, the new Gulf Freeway has diverted up to 50 percent of the traffic from the old arteries leading into the business district which were for almost their entire length business streets. Filling stations have reported business losses of as much as 50 percent and super markets have experienced reductions in their business of as

much as 25 percent. The installation of a traffic signal at an important intersection may affect the business at that location more adversely than one-way regulations. This is particularly true where certain turning movements are prohibited and where the normal delay of traffic may continuously block entrances and exits to drive-in businesses located at such intersections.

It is true that one-way streets may seriously affect businesses of certain types. We do not believe that business has been reduced in the central business district because the one-way streets have improved accessibility and reduced congestion.

More definite effects to business may be experienced by those located on the one-way arteries leading to and from the business district. It is usually desirable to locate a drive-in type of business on the right-hand side of an artery leading away from the business district so that motorists can be conveniently served as they drive home in the evening. Such businesses which might be so located on a one-way street leading into the business district would be immediately and quite seriously affected because of the change in traffic flow as well as the location of the business relative to traffic movements.

In connection with the Gulf Freeway, a rather unusual arrangement of feeder streets has been developed. Four feeder streets leading across the south side of the business district to the Freeway provide for one-way movement in one direction on two of the adjacent streets and one-way movement in the opposite direction on the remaining two adjacent streets. In other words, these are not alternate streets as is the usual practice. On main arteries crossing these feeder streets, it may be necessary to drive as much as eight blocks to reach a location only a few feet away. Some businesses at these locations are now in the process of moving and some filling stations have gone out of business where the traffic movements did not permit easy accessibility.

On feeder streets leading to the Freeway, property is being rapidly converted from residential to business use. Blocks which were selling for less than $100,000 three years ago are now valued in excess of twice that amount. Some property adjacent to the Freeway in the outlying areas which was valued at ten cents a square foot prior to the construction of this artery is now worth one dollar a square foot.

The whole pattern of property and business values has been entirely upset by the construction of the Gulf Freeway and the development of the system of one-way streets. In the downtown business district, it is essential that accessibility be provided and this has been accomplished. Business in this area has not been seriously affected. The city as a whole has accepted and approved the one-way street system and other restrictive controls and there would be no possibility of changing our present pattern of traffic movements.

MR. HOOPER: How is your tax list affected as the growth of value in the downtown district has far exceeded or slightly exceeded the loss of value from the arterial streets?

MR. MAIER: Property values in Houston have increased so much in the last five years there is no comparison.

CHAIRMAN SMITH: Don't these comments suggest that really the problem is such that no one approach, whether it is a constructive or a regulatory approach, is sufficient, and, by having this panel discussion limited to one way streets, we have not meant to suggest an unbalanced consideration of one-way regulation to the detriment of other approaches to our urban traffic problems? We should be careful to remember that, while many advantages have been pointed out for one-way streets, there have been also some disadvantages cited and no one in the panel or in the audience would advocate them as a panacea for urban traffic problems. But it does seem there have been sufficient citations to prove that one-way streets have produced very beneficial results under favorable conditions of application.

It appears that it is one of our important traffic regulations that is not subject to treatment by scientific warrant. We still have to use a lot of rule-of-thumb approaches and we still have to depend on the experiences that have been reported. One of the main reasons for having this discussion was to bring out new experiences; this has been achieved. Perhaps we never will be able to apply a system of one-way streets strictly on a scientific basis, but we hope we will be able to apply objectively many of our other traffic regulations, with continued research and study.

The hour is growing late and, while I am sure there are many other phases of this problem that could be discussed, and many of them would be interesting, maybe more interesting than those we have discussed, I believe it is appropriate that we adjourn the meeting at this time.

Thank you all.

(The meeting adjourned at ten-five o'clock.)

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