

distribution by stations can best be studied by examining Figs. 3 and 4. Figure 4 shows the frequency distribution between stations, and Fig. 3 shows the actual number of shifts in any 100 feet of the hill.

It is planned to continue this study of the By-Pass on beyond the top of the hill by determining the rate of increase in speeds of trucks after they have traversed the hill and are on level highway.

Since the development of the Photo-Velaxometer, sufficient data have been obtained to show that the machine can be operated accurately, efficiently, and economically.

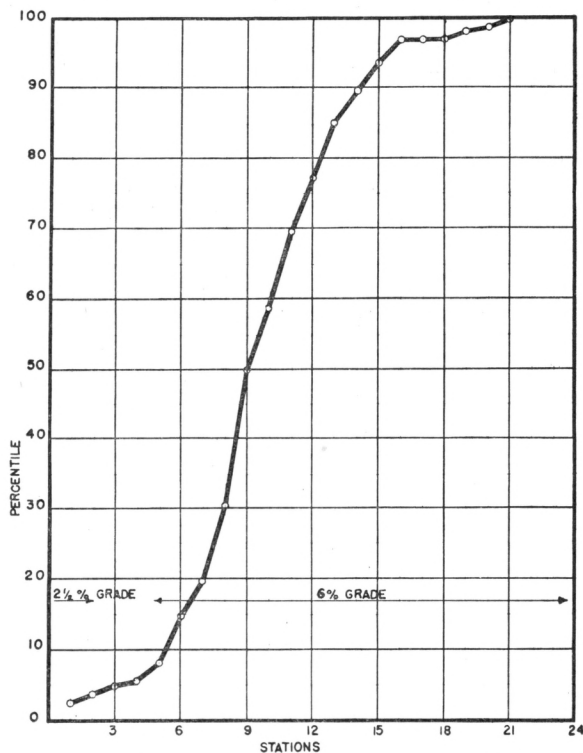


Fig. 4. Accumulated truck gear shifts by stations on U. S. 52 By-Pass Hill, Lafayette.

TRAFFIC STUDIES IN METROPOLITAN AREAS

William J. Mortimer,

Assistant to the Superintendent, Cook County Highway
Department, Chicago, Illinois

Many traffic counts have been made in the metropolitan area of Chicago by the separate road-building agencies. They have been taken with a high degree of accuracy and have proved of great value in the design, construction, and location

of traffic facilities. In planning and locating a system of express highways, however, we felt the information was inadequate, and with this in mind an origin-destination traffic survey was planned with all road-building agencies in the Chicago district participating.

The aid of the Boy Scouts of America was enlisted, and some 8,000 scouts were furnished to record the data in the field under the supervision of the engineers of the Illinois State Highway Department of Cook, DuPage, Kane, Lake, and Will Counties. In addition, the State of Indiana participated by using traffic engineers and special personnel employed for that day.

The district studied extends approximately 50 miles north, west, and south of the central business district, and 50 miles east and west to the City of Gary in Indiana. Within its borders lie a portion of the Counties of DuPage, Kane, Lake, and Will, all of the City of Chicago, the Chicago Park district, the County of Cook, and a part of the State of Indiana. In this area are 160 cities and villages, with a population of some five million people.

The motorist whose destination is the central business district of Chicago must pass through innumerable villages with attendant business and residential districts that never fail to be a source of congestion.

In planning the origin-destination survey several methods were investigated. The one chosen was the recording of the last four digits of the state license plates as the vehicle passed through a recording station. In addition to recording the last four digits of the state license, the time of passage, the type of vehicle, and the direction of travel were noted. These data were recorded on field report forms at all stations, with the exception of 10 stations in the Chicago Park District where the concentration and speed of traffic necessitated the use of dictaphones. The survey was planned for 12 hours—7:00 A.M. to 7:00 P.M.—on September 9, 1941. In addition, 12 stations were operated for 24 hours—the last 12 hours being devoted to volume counts.

TRAFFIC-RECORDING STATIONS

Three hundred and eighty traffic-recording stations were located in the district; of these 180 were in the City of Chicago.

The stations were located to form cordons so that the vehicles moving along the principal highways throughout the area would necessarily pass through one or more stations en route to their destination. The first cordon bounding the central business district was formed by placing a station at every street entering that district; all other cordons, by stations located on the principal streets.

In addition to the cordons, stations were located laterally across the district to intercept the movement of traffic whose

destination was other than the central business district. This pattern of stations formed zones by which the origin and destination of a vehicle were confined to a definite area.

To illustrate: in the event a vehicle was recorded first at one station, its origin would be within that zone; and if the vehicle was found to have passed this station at the last recording, its destination would be in that zone.

Because of the participation of the State of Indiana, all Indiana cars were marked (X-1). No effort was made to identify the cars from other states.

The data collected by the boy scouts were recorded on field reports.

Before the actual survey was made, two practice counts were taken, both in the Calumet area. Some 50 stations were located and manned by boy scouts and engineers of the highway department. The experience obtained in making these counts not only showed this method to be practicable but eliminated a number of "bugs" in our set-up, and I recommend the practice count as a "must" for any agency preparing to make an O-D survey.

The boy scouts used in the O-D count were instructed by engineers of the Cook County Highway Department. These instructions were given in the evening at the local troop headquarters, and the boys were then given a half-hour test at the station they were to man on the big day. This procedure proved very helpful and gave definite proof that the boys could and would do a fine job.

In addition to the verbal instructions given by the engineers, instruction books were distributed to each scout participating. These charts proved of tremendous value in explaining to the boys their job on September 9, 1941.

I cannot express the appreciation of the highway department for the assistance of the boy scouts. I doubt, sincerely, whether the survey could have been made without their aid. The fine spirit of co-operation shown by the boy scout officials and the boys themselves made this rather difficult task much easier.

ANALYZING THE DATA

In analyzing the data gathered, business machines were used. A card was punched for each vehicle movement. This card contained the last four digits of the license plate, the time of passage, the type of vehicle, and the direction of travel.

After the cards were punched, they were placed in sorting machines and identical license numbers grouped. With this information we are able to determine:

1. The origin of the vehicle; that is, the first time the vehicle was recorded as established by time.
2. The route, by locating the stations it passed through.

3. Its destination; that would be the last station recording the vehicle.
4. The approximate time for the trip.

To simplify the analysis, we propose to analyze by zones. The first job to be undertaken was the movement of vehicles from their zones of origin to and through the central business district.

To apply it further to our specific problem, these zones were placed in areas of influence. The areas of influence were determined in a manner similar to that of determining a watershed area. The center of the area or streambed would be that of the heavily-populated districts and then the area extended to the top of the watershed or the sparsely settled sections. Five such areas were established in addition to the central business district, which is an area in itself.

Up to the present time we have analyzed the Calumet area. We have available, now, the movement of vehicles originating in the different zones throughout the Calumet area and bound to or through the central business district. It is our intention to follow this procedure for the other areas in the district.

The information that can be obtained from this survey is boundless. You may analyze the movement of traffic from station to station, zone to zone, area to area, and from all areas to the central business district area.

The outer drives, north and south, are the only limited access highways in the City of Chicago, and the tremendous amount of traffic carried is an indication of the desire of the motorist to use a route eliminating cross traffic, stop-and-go lights, and left turns, thereby providing for a freer movement of through traffic.

There is very little traffic on roads in the northwest section of the city, in spite of the fact that there exists a heavy concentration of population in that area and these roads furnish the shortest route to the central business district. This situation is also found in other sections of the city and county.

EFFECTIVE-PAVEMENT WIDTH

One answer to this problem is revealed by the effective-pavement width of the principal highways in the City of Chicago. By effective-pavement width is meant the amount of pavement available to the motorist for free movement of vehicles. To illustrate, on the city streets where parking is permitted, an 8-foot strip on each side is deducted from the width of the existing street; should there be street-car facilities, an additional 18 feet is deducted; should parking and street car facilities be permitted on a 38-foot street, there remain but four feet of free pavement for the motoring public. It is not so difficult to imagine a 4-foot highway after driving

behind the slow-moving street car for a mile or two, unable to pass because of the parked vehicles.

The streets in the northwest section of the city appear to have narrow effective-pavement widths, which may be the answer to our problem.

The minimum effective-pavement width in the country areas outside Chicago is 18 feet. This, of course, is the result of street-car tracks' and parking on the pavement's not being permitted in the country. While this condition provides for a free movement of vehicles and a higher rate of speed in the country areas, it is far from satisfactory, as any week-end driver will testify.

CONGESTION

We made a study of congestion on the highways in the City of Chicago, comparing traffic volume with effective width of pavement. Congestion was greater on streets that carry very little traffic. This appears to be caused by lack of traffic accommodation along streets crowded with street cars and parked vehicles.

Congestion was excessive on the streets in the northwest area, thus accounting for the tendency of traffic to avoid these arteries. It is not necessary to use a road map to find this point of greatest congestion. Merely drive routes 12, 20, and 41; and when your fender is nicked, your temper is gone, and your English is unprintable—brother, you're there!

To analyze this congestion in detail, a study of a typical highway was made. The plan of this highway shows the type of development the highway passes through, the effective-pavement widths, the traffic volume, and the congestion. As the highway reaches developed sections and through traffic mixes with local traffic, congestion follows. These factors are definite arguments against locating a highway to carry express traffic through the heart of an incorporated community.

No attempt has been made by our department to draw conclusions for traffic solutions for the entire Chicago district. It is our thought that the individual agencies, with this information available, are better fitted to arrive at conclusions for their own particular problem. It is one of the problems of the Cook County Highway Department to design and locate a system of express highways in the country areas. Through this O-D count we shall be able to determine with a great degree of accuracy the location of express highways that will serve the greatest number of motorists. We can also anticipate the number of motorists that would use this system of highways.

This count will aid very materially in the location of feeder routes to these highways, and can be so adapted as to furnish traffic information for a number of highway problems. It is

our plan to continue to study traffic along these lines and supplement the existing data with spot counts from time to time, thereby keeping our traffic information up to date.

We plan to publish a series of reports describing the method and the results obtained. If you desire a copy of these reports, write to the Cook County Highway Department and we shall be very pleased to furnish you the information as soon as it is ready.

ORIGIN-DESTINATION SURVEYS

J. B. Moriarty,

Traffic Engineer, Indianapolis

Rather than launch into a general discussion of Mr. Mortimer's paper, or of origin-destination surveys, I will limit my remarks to several points that he has presented or suggested.

He has recommended that a practice count be a "must" for any agency planning an O-D survey. To this "must" I should like to add at least two others. The first is, determine exactly what you're shooting at and set your sights accordingly. This "must" may seem rather trite and obvious; but in my limited experience I have seen surveys whose results and conclusions have been of such a general nature that my personal reaction has been, "So what!" Use originality. Let's not follow the exact procedure that was used by our neighbor, merely because that procedure is established and easy to follow.

The second "must" I would add is a "practice analysis," as well as a practice count. Field data may be perfectly recorded and assembled but defy analysis. A practice analysis may show the need for additional data, or it may show that the elimination of certain items will facilitate the final analysis without influencing the results.

These remarks apply particularly to surveys of large scope. No large survey should be an experiment. Experiment first—and by streamlining the survey itself on the basis of these experiments much time, effort, and money can be saved.

The field data from the 26 Indiana stations of the O-D survey described by Mr. Mortimer are being analyzed for our own use by the Highway Planning Department of the State Highway Commission. In the analysis of these data it has been found that many more duplications have resulted than would normally be anticipated by using the last four digits in recording license numbers. These duplications cause much additional work in tracing the vehicles through the various zones, and in some cases make it impossible to trace them accurately.

At present the Highway Planning Department is making a limited O-D survey to determine the probable use of a pro-