arouse friction between drivers and a feeling of frustration which is very often reflected, when the congestion is passed, in faster driving than would otherwise be necessary. In the case of road transport the delay is more serious nationally. The driver working to schedule either conforms strictly to the speed limits, in which case he falls behind time, or he increases his speed. If behind schedule, he may either fail to deliver a consignment in time (which is particularly serious if for export, or for a factory short of a particular material), and if he increases speed he not only breaks the law but increases the cost of running and the cost of maintenance. Places such as Stamford, on the Great North Road, in aggregate, add thousands of pounds to the cost of transport which the consumer must pay, and which in the case of foreign competition may mean the loss of contracts.

If it is realized that the delay of only forty lorries for a quarter of an hour *en route* is equivalent to one lorry being off the road for a whole day, some idea of the expensive nature of these delays may be obtained.

The only answer is by-passes, which in many cases could be so designed that they would later be incorporated in a trunk-road system which avoided intermediate towns and villages with great benefit to the latter. Such by-passes would simplify local distribution by the absence of through traffic, and would greatly facilitate access to local shops and offices.

In conclusion, the Author wishes to point out that the Paper was submitted in its present form with the aim of dealing with the situation as it is today and to make suggestions which could, if acceptable, be adopted at once.

Other alternatives were, first, to generalize on the value of major works and demonstrate their value by reference to results in other countries, or secondly, to examine the variety of electrical, mechanical, and other fitments available as aids to traffic. It was concluded that in the first case much excellent information has already been disseminated in the Press to the public, and in the second case the Road Research Laboratory would be in a better position to supply the subject matter.

The Paper is accompanied by eight photographs, from which the half-tone page plates have been prepared.

Discussion

Mr A. J. H. Clayton said that it was interesting to have a Paper written from the point of view of the user rather than that of the road engineer, although he would assure the Author that road engineers did take lorries into account in their designs.

He did not agree that the Author had ignored the present economic situation. The present Treasury policy had of necessity been ignored: no road improvement work was being done at the present time. The

Author had taken into account the present economic situation, in that he had made suggestions not involving a great deal of expenditure and which might do some good, whereas in previous Papers there had been put forward glorious ideals for whose achievement there would not be enough money even if the Treasury provided its share.

Quite properly, the Author had differentiated between built-up areas and the open main roads. For example, the principle of the dual carriageway, in towns, should be applied quite differently in detail from the way it was applied in the country. The essence of a dual carriageway was in having at least two lines of traffic in each direction, not the strip in the middle, and in towns it was sufficient, and perhaps better, if the division was made by means of a sufficient number of refuges.

On p. 417, reference was made to the signposting of alternative routes. He assumed that the Author was not aware of the fact that the London Traffic Committee had had quite a strong programme on those lines in 1926; it had not been very popular with the highway authorities then, and he did not believe that it would be very popular nowadays with the planners because of the routing of traffic through residential streets. That was not necessarily such a bad thing as was supposed. A detailed examination of the accident position in London showed that where traffic was taken through residential streets the accidents per million vehicle-miles were less than when the traffic was taken through shopping streets.

The Author had revived the old fallacy that a road intersection in a town could be improved by driving a tunnel or providing a bridge for one direction (see p. 419). The snag was that there was a lot of turning traffic. A bridge should cater for not less than four lanes—a bridge for two lanes would not handle much traffic. That would require a lot of room, and if the road was already narrow and not handling its traffic adequately, there was not enough room left for the turning traffic.

The Author had mentioned Oxford Circus. That suggestion had been made at frequent intervals in Mr Clayton's experience during the past 25 years. Such a solution there was not out of the question from the engineering point of view, but it was out of the question economically because, in order to carry out the project, it would be necessary to knock down some very valuable buildings. That was an impossibly expensive proposition, to say nothing about the architects' reaction to interference with the four corners of the Circus.

The Author was right to insist on the establishment of principles of roundabout design (see p. 422). Various circulars and books which had been issued had given stock designs for the draughtsmen to apply, but that was very dangerous because draughtsmen tended to apply them without understanding the principles involved, and if the roundabouts were to be built the results would be disastrous.

Mr Clayton thought that the principle of an elongated roundabout had been proposed and subsequently discarded, although there still existed

two elongated roundabouts on the Hampton Court–Esher road and two on Eastern Avenue. One of the principles of roundabout design was that the traffic could only weave if it was brought to the same speed. The elongated roundabout design facilitated the passage of the major-road traffic but did not give the minor-road traffic a chance.

The Author had suggested that the 30-mile-per-hour speed limit was enforced in towns, particularly in London, but Mr Clayton believed that it was not enforced. It would constitute an interesting piece of research to ascertain whether there was any difference in the practice of drivers and in the accident rates, in places where the 30-mile-per-hour speed limit was enforced compared with places where it was not. He was of the opinion that in some towns the speed limit was enforced to a greater extent, or at least obeyed to a greater extent, than it was in London. Perhaps the Road Research Laboratory would care to put that subject on its long list ?

Having been to the United States of America, the Author had suggested that the parking problem there was not quite the same as that in Great Britain. Mr Clayton agreed with that, although Great Britain was approaching the American state of affairs ; for example, something would have to be done about double parking which was now occurring frequently. The idea of having car parks outside the built-up area or the central area had been tried by the London Transport Executive—one had been built, further out than the Author suggested, at Morden—but he did not know whether that car park was fully used now. The people who came up to London in cars were those who did not want to walk to the station or the bus stop at either end, and he doubted whether such car parks would obtain much custom.

The principle that, to be any good, car parks should be within a few hundred yards of the destination of the owner-traveller, was one which was more likely to bring results, although, as in America, it was virtually impracticable economically.

Colonel Sydney Green said that one of his preoccupations was the study of traffic conditions in inner London : he had read with interest the section of the Paper dealing with traffic in congested areas.

Although he did not entirely exclude the possibility of constructing bus lay-bys, and pedestrian and vehicular subways in inner London, he felt that such projects required to be given a good deal of thought. He could assure the Author that a detailed traffic census *had* been taken at Oxford Circus and Marble Arch periodically over the years, and had been studied very carefully. He felt that his colleagues would not allow the occasional sewer, however large it was, to become an impassable barrier to the carrying out of desirable major improvements.

The subsoil of the London streets was full of surprises. To the uninitiated, one of the most attractive sites for a traffic subway was the intersection of Parliament Street and Parliament Square—until it was

realized that the District Railway ran diagonally across the intersection just beneath the surface.

The Author's suggestion for a single-line traffic subway running east to west at Oxford Circus would, presumably, have the sole object of eliminating the effect of the right-hand turn from the west into Regent Street, but that turn could be eliminated in another way. The traffic could be made to turn left before it got to Oxford Circus and the right-hand turn could thus be displaced to the north. Alternatively, the traffic could be made to go straight through Oxford Circus, and then turn left and left again, and so across the Circus from north to south. The Author's proposal for a single-line vehicle subway for east-west traffic, even if it were possible, would have to be balanced against the prohibition of the right-hand turn in the manner described.

Assuming that all the difficulties as to mains and sewers could be overcome—although formidable—the siting of a single-line traffic subway would take up between 18 and 20 feet (allowing for kerbs and the construction of retaining walls) out of a carriageway width of 48 feet. That would leave carriageways on either side of the vehicle subway of 14 to 15 feet, which would be barely wide enough to take one standing line and one moving line of traffic, and it had to be remembered that through the bottleneck created by that restricted carriageway had to pass the whole of the east-bound traffic which contained the right-hand-turn traffic.

The Author had suggested a similar traffic subway passing from east to west at Marble Arch. Only about a third of the west-bound traffic in Oxford Street was proceeding directly west, the remainder proceeding into Park Lane, Hyde Park, and Edgware Road. That third of the west-bound Oxford Street traffic represented only about 6 per cent of the total traffic circulating at Marble Arch, and therefore about 94 per cent of the traffic would still be left circulating on the surface. Apart altogether from the problem of having a bottleneck in Oxford Street, it would be preferable, Colonel Green suggested, to apply the available resources to the enlargement of the roundabout system on the surface, as was proposed in the Boulevard Scheme included in the County of London plan, than to use them for the provision of such a subway.

The suggestion that traffic-subway entrances and exits need not be at coincident points, but in line ahead, suffered from the same disadvantages in that bottlenecks were created. Moreover, in the case of Oxford Circus, to have two subway entrances and exits on each side of the intersection in line ahead meant that the restricted area would extend about 350 yards on either side of the Circus. Two-thirds of the carriageway over that distance would have to be stripped of its mains and other services—a formidable task. Another important point was that the buses which constituted about 23 per cent of the traffic using Oxford Circus would, if constrained to use such a subway, have to drop their passengers about 350 yards away from that busy intersection.

On p. 417, the Author had referred to the obstructive effect of bus stops near traffic lights. *Any* stationary vehicle near a controlled intersection had that effect, and Colonel Green would draw attention to the Report entitled " London Traffic Congestion " produced by the London and Home Counties Advisory Committee in 1951. On p. 32 of that Report, reference was made to an experiment which had been conducted by the Ministry of Transport, and followed up by the Road Research Laboratory, on the effect of standing vehicles at various distances from intersections. In the conditions of that experiment it had been found that a standing vehicle about 100 feet from an intersection reduced capacity by only 7 per cent, whereas a standing vehicle 15 feet away from the intersection reduced capacity by 29 per cent.

The elimination of standing vehicles of all kinds near intersections, either by regulation or widening for them (by arcading where practicable) seemed to be a sounder proposition than the construction of bus lay-bys, particularly between intersections.

He could not understand why the Author had chosen 4 feet as the distance for recessing pavements, particularly when one considered that some of London's buses were now 8 feet wide, and the principal traffic streets seldom provided for more than two bare lanes of traffic in each direction.

Mr H. N. Ginns said that no other country offered so wide a choice of routes, but alternatives were generally inferior to the popular one, which was the most used simply because it was the best. Colour indication of routes failed because of the wide choice of routes and because colour combinations were limited and advance signing was cumbersome. Number combinations were not limited and advance signing of them was simple ; hence route numbering was the only practical method.

Forcing traffic on to less suitable routes would mean spending money on them, thus dissipating resources. The Maidstone alternative route quoted illustrated that ; it was a series of country lanes passing over a bridge 10 feet wide, and through a cutting 14 feet wide, and disturbed four peaceful villages. Money spent on it would be wasted because plans already existed, and land was already bought, for a proper by-pass to the town.

Alternative routes were doubtful expedients and, if the economic factors were to be ignored, ought not engineers to forget expedients and to urge the provision, by improvements and new construction, of roads fit for modern traffic ?

It should become a legal requirement that every new building should absorb the traffic it attracted. Floor space would have to be allotted, and car ramps and lifts installed, and owners would have to accept the extra cost just as they already accepted extra costs resulting from height, structural, fire, and sanitary by-laws. Local Authorities had some powers under Section 17 of the Ribbon Development Act, 1935, regarding

buildings, and a few buildings were dealt with under them. Would it not be sound policy to seek wider powers on those lines ?

Parking on main streets could only be stopped if sufficient free parking was available. Police could not and would not force motorists off main roads into car parks where charges were made. As the law stood, it was essential that car parks should be free.

He suggested greater use of suitable advance signs for car parks where conditions allowed, the signs commencing on the outskirts of small towns and being repeated at intermediate points in large towns.

Could the Author quote evidence that white lines made drivers tired, and give details of the percentages and types of drivers ? That discomfort was surely outweighed by advantages to many, especially at night and in fog. " Keep to near side " boards warned slow-moving traffic on multi-lane roads, but lines helped all traffic and were essential for the driver who never knew quite where he was on the road.

Statistics would confirm the Author's opinion as to the dangers of junctions. For example, 48 per cent of the accidents in Kent in 1951 occurred at junctions. Mr Ginns agreed that where right-turning vehicles left a main road there should be space for them to wait and also for moving vehicles to pass. Acceleration and deceleration splays, recommended in various publications, helped, and at T-junctions the main road could be widened opposite the side road to allow following vehicles to pass to the left of right-turning vehicles. In his experience, even a 30-foot carriageway was too narrow for safe turning on high-speed roads.

Work had been, and was being, done in providing lay-bys on particular routes in many areas. It was his view that there should always be lay-bys at telephone kiosks, including A.A. and R.A.C. boxes, especially on commercial routes, and that they should be signposted.

The word " may " in Ministry of Transport Memorandum No. 653 (. . . " Splayed and sunken kerbs may be provided. . . .") was put in deliberately because such kerbing was not desirable everywhere ; it depended upon subsoil and drainage. In Kent, flush kerbs were satisfactory ; on Bedfordshire clay they were not. As to high kerbs, foundations were often left to consolidate under traffic, and the final surface when applied left a normal kerb face of 4 inches. The raised kerb in *Fig 5* was necessary for drainage and also because a footway was to be added.

There was evidence to show that the introduction of speed limits in Great Britain in 1934 had resulted in reduced accidents, and any wholesale revision of the present system, or its abandonment, would seem politically impossible. Opportunity for studying the effect of removing restrictions occurred in West Germany where general speed limits had recently been abandoned. There was also a field of study in Northern Ireland and some Continental countries where there were no general limits. Was a comparison between accidents in those countries and in Great Britain practicable, and had such an investigation ever been made ?

In advocating by-passes, engineers should not overstress time saved by individual vehicles—it might prove very small. In one case over a 10-mile length, including a bottleneck town, the time gained was no more than 4 minutes for lorries and 6 minutes for cars. But, expressed in terms of total traffic, the saving was important; that by-pass would save about 1,000 commercial-vehicle-hours per week and 6,000 car-hours per week.

Finally, the effect of by-passes on accidents should not be overlooked. In one typical market town Mr Ginns had investigated, a by-pass might save 56 accidents per annum. It had been said that accidents could be reduced by the three E's—education, enforcement, and engineering. Of those, the last had never been adequately applied, and road engineers had not been able to make the full contribution to road efficiency and safety of which they were capable.

Colonel G. T. Bennett observed that the Author had said that he was making due allowance for the economic conditions in Great Britain today. The proposals which he had put forward did, however, include adequate parking facilities in large cities and by-passes, and both those would, no doubt, cost a lot of money. For the most part, the rest of the Paper dealt with detail.

Colonel Bennett thanked the Author for the complimentary remarks concerning himself and his work on road junctions, but he wished that the Author had nevertheless included in the Paper all that he thought about junctions. What Colonel Bennett had done had been most tentative and a beginning only, and such conclusions as he might have reached were by no means yet agreed by others. There was still much to be done.

The Author had suggested that it might be advisable that the traffic should be slowed down at road junctions by using small radii of curvature. Colonel Bennett said that on the whole there was a tendency today to depart from that view; in fact, sometimes it seemed that free flow should be given at a junction, although in other circumstances it should not, and the whole matter was complicated.

It had been suggested in the Paper, which was meant to be read by highway engineers, that if landowners were approached politely, they would allow the highway engineers to pull down their garden walls and build them back 20 feet or so. That had not been his experience, unless the wall was already falling down and likely to become a liability to the landowner. Usually the highway authorities had to build the wall back at their own expense and pay for the land, and when they took a tentative agreement of that sort to the district valuer, he probably thought it was not a very good bargain. Highway engineers knew how difficult were the problems involved in trying to set back corners by acquisition of land, and if all corners were not yet set back for vision, it was not because they did not know it should be done.

He agreed with the Author that kerbs on rural roads should as a rule

be splayed, being cut back at an angle of 45 degrees or so, so that traffic in any trouble could get off the road, and that became more necessary the narrower the carriageway was. He also agreed with the Author as to the great value of lay-bys. He had provided many in the course of his career on various important roads, and it was a source of gratification to see how much they were used by the traffic. It was quite clear that the heavy traffic in particular appreciated lay-bys, especially if they were provided at uniform intervals, so that if one was found to be full it would be known when another might be expected.

Colonel Bennett said that there was no doubt about the need for extra traffic lanes on long gradients. In the case of narrow roads, the widening of several straight lengths in order to give an additional traffic lane, even though it might not be a continuous widening, would give the slow and fast traffic a chance to sort itself out, and congestion would thus be relieved. That expedient ought to be borne in mind in cases where a project to widen the whole length of a road could not be afforded.

However, it was not much good thinking of any expedients at the present time. Even the Author's smaller suggestions—quite apart from his two larger ones—could not be carried out because nothing at all could be carried out at the moment It was a most unfortunate position, but it was to be hoped that it would soon be remedied.

Dr G. Charlesworth said that the Author had stated in the Paper that he aimed at dealing with the situation on the roads as it existed today and at putting forward suggestions which could be adopted at once. That approach to the traffic problem was a useful one for, with the present restriction on capital development, the role of minor improvements in the efficiency of existing roads became much more important; there was no doubt that much could be done by those methods and that some ideas put forward by the Author were worthy of trial. However, it was fairly certain that many of those minor improvements could be better planned if there were available more information about the travelling habits of the public; for example, where people wanted to travel, why they travelled, and how they travelled. Information of that kind was needed when alternative routes were being considered, when deciding on schemes for parking accommodation, and when estimating the economic returns of particular improvements.

The Author had referred to research and the need to reduce the time lag between the start of an investigation and the introduction in practice of the results of the research. The Road Research Laboratory was constantly trying to increase the rate at which research could be completed, but, as in so many things, a major difficulty was shortage of staff. There were only about sixty people engaged on research in the Traffic and Safety Division, and that Division dealt with investigations on skidding, lighting, vehicle and road-user characteristics, as well as on traffic and road lay-out.

Referring to the limits of research, Dr Charlesworth believed that the Road Research Laboratory was unique, considering the very wide range of road research it covered in one organization. The Author had recommended that any authority should be allowed to undertake an experiment. Some, of course, did so, and Colonel Bennett's work on junction design in Oxfordshire was a case in point. At the Laboratory it was desired to encourage engineers to make their own investigations, but the Laboratory would, of course, like to know the results obtained. By collecting together the results of experiments in different localities, it might be possible to arrive at more generally useful conclusions.

It was, of course, important to link research and practice. The Laboratory was trying to evolve practical solutions to road problems, and it worked in close touch with the Ministry of Transport and other authorities. Also, through the Road Research Board and its committees, the Laboratory obtained advice on its work from people of wide experience in matters connected with roads and traffic.

In discussing pedestrian crossings, the Author had referred to the impedance to flow at zebra crossings. It was to be expected that delay to drivers would increase if more of them gave right-of-way to pedestrians on zebra crossings, but it should be noted that accidents to pedestrians had decreased markedly since the zebra crossings had been introduced. Furthermore, since the number of crossings had also been reduced, it did not follow that delay in the aggregate had increased; indeed, it could have decreased. The Road Research Laboratory was looking into matters of delay and was investigating the conditions under which zebra crossings, light-controlled crossings, and subways were justified.

Mr J. T. Duff observed that the Author had advocated the use of pedestrian-operated lights. That idea had been tried, but the number of sites where the vehicular and pedestrian flow was so continuously heavy as to ensure success was very few. The difficulty at the majority of sites, and even at those sites which were heavily trafficked during off-peak hours, was that pedestrians were not subject to the same laws as were drivers, in that they were not compelled to obey the signals. After the button had been pressed, they were apt to cross at the first gap in the traffic, and when the " cross now " signal appeared, all the vehicles were held up for no apparent reason. That was very irritating to drivers, and the result was that greater delays were imposed than in the case of the zebra crossings.

To make pedestrians more visible at night, a light-coloured background on the far side of the junction was required, and not a narrow strip under their feet. There were two objections to the proposed line 10 feet from the crossing. First, a line of reflectors across the carriageway gave the appearance of an obstruction, which could be most confusing to drivers; secondly, a stop line in advance of the crossing would impose a legal obligation which drivers would find it very difficult to obey. A vehicle

could not be stopped instantaneously, and it was not easy to anticipate the movements of pedestrians.

He agreed with the Author's remarks on p. 421 about the importance of good street lighting. The requirements suggested would be found to be met by the recommendations contained in the final Report of the Departmental Committee on Street Lighting, which had been issued in 1937.

The proposal, on p. 422, to cut back the central reservation on a dual carriageway for 100 yards on either side of a junction would give rise to the wide open spaces which were so confusing to drivers.

He agreed that many existing roundabouts were far too small, but disagreed with the suggestion that islands should be elongated in the direction of the heavier flow. As Mr Clayton had pointed out, that had been tried before the war, but so far from making weaving easier for the minor stream, it made it much more difficult, and it increased the dangers by making the speeds of the two streams different. Equality of speed of all the vehicles in the stream was the essence of successful roundabout working.

On p. 423, the Author had referred to the use of infra-red radiations. They were invisible to the human eye, and the Author did not explain how they were to be employed to light a roundabout. Did he propose that all vehicles should be equipped with infra-red image-convertors? If so, would it not be better to equip them also with infra-red headlamps so that other obstructions besides roundabouts could be seen in fog? But why bother with infra-red radiations when the technique of radar was so far advanced?

He could not agree with the Author's suggestion, on p. 428, that a "Danger—Major Road Ahead" sign should be used. That would be contrary to the recommendations of the 1944 Traffic Signs Committee. It would be illogical if there was no vehicle near the junction on the main road, for then there would not be any danger. The present system gave the driver the credit of being a rational creature who, in general, merely needed to be told that a major road was ahead. The word "slow" was perhaps superfluous. However, at a smaller number of junctions the driver required to be told that the visibility was so limited that he could not emerge safely without first coming to a stop in a position where it was just possible for him to see the major-road traffic, and hence the need for the "Halt" sign.

Mr E. T. T. Hussell said he presumed that the object of the Paper was to provoke discussion on the existing aids to traffic flow.

In spite of what he considered to be inconsistencies, he believed that the Paper would achieve its object. Anyone who read it would surely at some stage ask himself: "Are we too conservative in our approach to this subject?" Few would be prepared to give an emphatic "no" or an unqualified "yes" to that question. Present aids to traffic flow had been developed over a long period of years, and many of them had

been in use for so long that there was perhaps a danger of their being accepted because everyone was used to them. Therefore, perhaps it was a good thing that someone should come along and ask such a question as: "Are speed limits really necessary?" After all, it was for engineers to find an answer to the question, and the exercise might be good for them.

The Author had said that legislation which was based upon guesswork should not be imposed. Although the speed limit had been fixed in 1934, it still had to be confirmed each year in Parliament, and to that extent it was still on trial. On the last occasion the Minister of Transport had said that he proposed to introduce legislation to make the speed limit permanent, and that was after 20 years of trial. He felt that the Author had scored a point there about the time taken in trial and research; but he lost it again on the charge of lack of thought. Incidentally, it was significant that the number of pedestrians killed after the introduction of the speed limit in 1934 fell almost at once from 3,500 to 3,000 a year, and in 1951 the figure was about 2,400. Therefore, that had been quite a good piece of guesswork.

In 1952 the Minister had decided to introduce what were now commonly known as "flashing beacons" at pedestrian crossings. If any innovation cried out for universal rather than partial adoption, that was surely it; but the Government had made it optional, and it was understood that the Westminster City Council, in the heart of London, had refused to install them. If some pedestrian crossings were to be lit and others were not, there was bound to be trouble, and, indeed, the last state might well be worse than the first.

Referring to place name-signs, Mr Hussell said that, broadly speaking, the sign with the mileages was used for towns which could be found on small-scale maps. The smaller sign was rather more for the interest of the traveller than for the purpose of assisting him on his way. Graveley was a hamlet on the Great North Road between Baldock and Stevenage, and in his opinion it would be quite wrong to attempt to include it or similar places in the mileage system. The question of cheapness was not really the dominating factor.

The Author had referred to maps only once, and then only very casually, although he had said a lot about routeing of traffic. Mr Hussell wished it were more generally recognized that direction signs were only half the story—the other half must be obtained from maps. That was a field for more intensive propaganda.

Mr S. B. Thomas said that a principal object of the planning and designing of roads was to provide for free and safe flow of traffic, and he used the word "traffic" in its widest sense, including pedestrians as well as all forms of wheeled vehicles. It was clear that the measure of success which attended the endeavours to promote free and safe movement of the traffic, would be indicative of the efficiency of the road system and show an economic return for the money invested in it.

The ideas expressed in the Paper seemed to him to accord with such a thesis and were not in dispute. They found expression in the terms of reference of the Departmental Committee set up by the Minister of Transport during the war years whose report on the " Design and Lay-out of Roads in Built-up Areas " would be well known.

Whether traffic movement was examined from the mathematical aspect of Newton's laws of motion or from the hard-won experience of a school playground with its free-for-all disorder, the conclusion would be that turbulence begot bumps and free flow was short-lived. The ideal was, patently, orderly stream-lined movement devoid of conflict, and that should always be kept well in mind. That ideal could hardly be achieved if obstructions were condoned, and the Author had drawn attention to the various ways in which obstruction could occur.

Restriction of movement as a means of securing safe and free flow was a commonplace ; the use of kerbing to confine vehicles to the carriageway, but, strangely, not pedestrians to their footpath, was an obvious example. There were other forms of restriction imposed to aid traffic movement which were more irksome—he had in mind " No Waiting " orders. Their sign was a yellow-banded post, and it was as irritating at times as that insect with corresponding markings which buzzed around the jam dish on summer picnics !

The Author had made some suggestions for removing the waiting or parked vehicle ; it would have been useful if he had pursued the subject further. The waiting vehicle was evidence of inadequate use of the land adjoining the carriageway or fronting the road, and an attempt should be made to remedy that through control of development. It could equally well be regarded as misuse of a road.

The function of the road was clearly defined in paragraph 144 of the Interim Report of the Committee on Road Safety, published in 1944. The attempt to use the road to provide access to land fronting on to it as well as for the needs of through traffic was a prime cause of the turbulence of movement already mentioned, and that meant obstruction and accidents. It was necessary to determine which of those two functions a road was to serve. Even if the road had, unfortunately, to try to do both jobs with indifferent success, the inherent difficulties could be eased and traffic movement facilitated by intelligent control of development.

That was essentially a long-term approach to the problem, but it had been a long time building up and it would take a long time to resolve. At the least, the New Towns had had a chance, by their new start, to achieve a degree of success barely possible in congested, ill-planned cities.

A moment's reflection on the inevitable concomitants of development would make the point clear. The daily activity of inhabitants and workers required the attendance of tradesmen, municipal services, travellers, and business callers each with a waiting vehicle ; there were stray dogs and bus stops, vehicles making turning movements across the

road to get into and out of premises, and the inevitable presence of children, apart from adult pedestrians. All contributed their quota of interference with traffic movement and introduced hazards where none should be. Prevention of that would indeed aid traffic movement.

Mr G. P. Manning said that the term " speed limit " had been referred to. He remembered the time when several manufacturers of cars guaranteed that their vehicles would exceed 60 miles per hour; at the same time, the law absolutely forbade any vehicle to proceed at more than 20 miles per hour. Had there been any progress from those ridiculous days ? He was told that the Government now confirmed the speed limit of 30 miles per hour; it had been stated in the Press—and never denied so far as he was aware—that less than 3 per cent of all private cars and less than 1 per cent of all fully-powered motor-cycles conformed to the 30-mile-per-hour limit. What, then, was the present British speed limit ? It appeared to be a mere fantastic delusion which existed solely in one's imagination. The Author had suggested various experiments; it would be a good experiment actually to have a speed limit, for there never yet had been one in Britain ! How could the observance of such a limit be ensured ? First, the present 30-mile-per-hour signs were not sufficiently distinctive, not sufficiently numerous, and many of them were badly sited.

Next, the present type of police car was quite useless in controlling traffic. What was required was an inconspicuous car driven by a policeman not in uniform. The car required only two articles of equipment—a reliable speedometer and a repeating camera, that was, a camera which had a strip of film and took ten exposures at intervals of exactly one second. When a car overtook the police, the driver would put his finger on a button to operate the camera. The first exposure of the camera would show the speedometer of the police car registering 30 miles per hour and the overtaking car just coming into view in the windscreen. The next exposure would show the overtaking car coming further into view, the speed of the police car still being shown as 30 miles per hour; the exposures would continue to be taken until, finally, the overtaking car would be shown right in front of the police car, the speed of the police car still being shown at the bottom. That not merely established that the overtaking car was exceeding the limit; by measuring the height of the overtaking car in the photograph, one could come very close to ascertaining its actual pace.

With regard to the question of " Halt—Major Road Ahead " signs, Mr Manning thought that it seemed very clear to engineers that if a sign said " Major Road Ahead " anyone should understand what he ought to do. But in fact those signs had to be appreciated by every road user. He recalled a case during the war when a member of one of the women's Services was driving a staff car. She came to a major road where the sign said " Halt—Major Road Ahead." The girl put her brakes on

immediately and came to a dead stop, dropped into low gear, and then proceeded across the major road; a lorry was within 20 feet of her as she came out on to the major road, and its driver was unable to miss her. Yet she had actually halted and obeyed the sign. It had to be realized that one had to cope with drivers of that type. The sign "Danger—Major Road Ahead" was certainly not redundant—not for some types of driver, at any rate.

The Chairman did not agree with Mr Manning's remarks about the police; he thought that police cars should be coloured red and black so that one would always know where they were.

He believed that the speed limit achieved a useful object. It certainly did not keep people down to 30 miles per hour, but it certainly made them drive more slowly. An average speed of 40 instead of 60 was a help in built-up areas.

He was surprised that no one had mentioned, as a factor in checking traffic flow, the insularity of the British which discouraged the adoption of the Continental style of road signs. Living in a sea-board county, he had had experience of what happened to motorists from the Continent who came to Britain; they were frequently found stopping on the road and asking what the signs meant. Of all the countries in Europe, Britain had a separate set of road signs. That was no fault of the Ministry of Transport; it had come about because one of the *ad hoc* committees which sat from time to time had advised the Ministry that Great Britain should have different road signs from those on the Continent. The result was that motorists from the Continent did not understand the British signs, and British motorists visiting the Continent did not understand the signs in France or Germany.

*** **Mr T. S. Sinclair** referred to the Author's comments (on pp. 424 and 425) on the Report of the Committee on the Design and Lay-out of Roads in Built-up Areas.

That Committee, upon which Mr Sinclair had served, had been a strong one so far as highway engineering and traffic was concerned, and its terms of reference had gone further than to make recommendations on the free flow of road traffic—they had specified safety, economy, and the requirements of town planning.

With reference to Plate 1 of the Report, there were two schools of thought on a design for waiting-bays. One was to design them as shown in *Figs 4* and *6*, whilst the other, and the minority view, was to introduce a tapering acceleration lane for the bays. Those points had been debated at some length by the Committee and a preference had eventually been indicated for the first type, since the opinion was held that vehicles stationary in any recesses or emerging from any entry should wait until there was a gap in the traffic on the adjacent lane before entering the main

*** This contribution was submitted in writing upon the closure of the oral discussion.—SEC. I.C.E.

carriageway. In fact the design suggested in the Report for that bus bay, or temporary lay-by, was precisely the same as provided on the lay-bys along main roads throughout the country, which were so greatly appreciated by drivers and, so far as Mr Sinclair could see, by the Author.

Plate No. 6 of the Report showed a back access lane where loading of vehicles could take place without interference with the shops along the shopping frontage. Mr Sinclair suggested that it was for the designer of the building and for the occupier to decide whether loading of vehicles should take place at right angles to, or on the skew to the line of the lane, and he could not see that a remark such as the Author's would make any constructive contribution to design of back access roads.

With reference to the pedestrian barriers shown in the Appendix to the Report, those designs had been considered at great length by some very eminent city engineers who had served on the committee, and they had been designed to give maximum protection to pedestrians—one of the major traffic flows which had not been mentioned by the Author—and to show that pedestrian barriers need not be ugly tubular erections. It might be admitted that the solid barriers would probably trap papers, bus tickets, and the like, but in a built-up area where scavenging would be adequate Mr Sinclair thought that the safety of pedestrians would take pride of place. He would mention also that those designs were not shown in sufficient detail for the Author to criticize them on the grounds of lack of openings for surface water.

Just as the Author had made certain presumptions, Mr Sinclair thought he was entitled to assume, despite the Author's remarks that further examination of the Report would reveal similar shortcomings, that the points made were his major criticisms of the Report, and to conclude from that that the Committee were to be congratulated on producing a document of more than a hundred pages and nearly five hundred paragraphs on which only those minor points of criticism arose.

The Author, in reply, said that he had written the Paper deliberately to provoke discussion. It had not seemed to him that he should write about matters in which all were agreed, and he had felt that it would be very much better to offer some thoughts on which there would be differences of opinion.

The greatest amount of opposition to anything that he had said appeared, unexpectedly to him, to come from the Ministry of Transport. He supposed the Ministry had been so dragooned by the economical situation into opposing anything which would involve expenditure that it simply had to take that attitude. He had not in any way criticized what the Ministry had done yesterday or today, but had simply asked it to do something tomorrow.

In recommending that 4 feet should be cut off the pavement width for bus stops, he had not meant that that should be applied everywhere; it would apply to country roads in particular. The Paper applied not only

to London, but to the country as well. Four feet or so would probably just make all the difference on country roads, which were usually about 22 feet wide. It might be that 6 feet in some cases, or 3 feet in others, would be necessary to give two free tracks. What the distance should be was a matter for the judgement of the highway engineer.

He had recently visited the Road Research Laboratory and had seen a good deal of its work, although he had not had time to see all of it. It was obvious that the Laboratory suffered under a great handicap which he had not appreciated. Questions were shot so fast into the Laboratory that it could not possibly tackle them all immediately. Either the Laboratory should have more staff or there should be some form of priority for them. It would be preferable to give the Laboratory more staff.

It was obvious that the flashing-light proposal in connexion with " zebra " crossings was going to open criticism in some quarters. That was a case—he might have to eat his own words—in which action had probably been taken too quickly. The result of an experiment in one street would not necessarily apply everywhere, and so there ought to be some judgement as to whether such a method should be used. He questioned whether it was really necessary that the lighting provided should be a flash, but that was purely a personal opinion. When a number of flashing lights had been installed and it had been proved that they worked, the Ministry could be satisfied that everybody else would want them and that the public would demand them. If they were proved unnecessary or another method seemed preferable, he hoped that the Ministry would then continue their experiments.

With regard to his suggestion for elongated roundabouts, he was not particular about that. If authorities had the land—he thought the complaint was that they had not—then larger roundabouts would accomplish his object in providing more weaving space. All that was wanted was a roundabout when weaving could take place without obstruction.

The difficulty of introducing minor road traffic into an elongated roundabout had been mentioned. It was true that that difficulty had been experienced, but the Author suggested that if the design at the entrance of the minor road had been such as to give a wider sweep, then that difficulty would have disappeared.

The " Danger—Major Road Ahead " sign had been criticized. Mr Duff was happy that there should be a 30-mile-per-hour speed limit, and yet he was willing that motorists should do more than 30 miles per hour at night. That was illogical, and if there were to be road laws, they should be logical. " Danger—Major Road Ahead " warned a driver that there might be danger in front but not inevitably. A sign saying " 30 m.p.h." merely indicated that the driver must not travel at more than 30 miles per hour. A warning sign indicating a built-up area or an accident-prone area equally warned a driver that he should be careful. Such a notice would not necessarily be the only one; there could be others farther on. At any rate, the driver

would know what one was getting at, namely, that he should drive extra carefully. That was worth very much more than a law which all agreed was broken.

There was no mention in the Paper of underground garages and other off-street parking facilities simply because the Author had not wanted to expand the Paper into one dealing with parking, which was a huge subject.

With regard to the subways, also criticized by Colonel Green, the Author readily conceded that an enlargement of the Marble Arch roundabout would meet the situation, but there seemed to be no ground-level solution to that at Oxford Circus and he could not accept entirely the arguments put forward against a subway, it would still appear to him to be possible to design the subway without pulling down buildings and without taking up so much roadway space as was suggested. The majority of passengers did not wish to board or alight at Oxford Circus but only nearby, the position of the bus stop did not, therefore, need to be very close to the Circus. There were many places in the Provinces where a subway such as was suggested could be more easily incorporated and prove of the utmost benefit.

With regard to the waiting or parked vehicle referred to by Mr Thomas, it did not seem likely that the matter could be solved unless there were parking authorities with powers to build and finance from public sources with which to pay for the construction. The suggestion that the cost should be borne entirely by owners of property did not meet with British ideas of justice, and the cost of office space, etc., would rocket.

With regard to Mr Sinclair's comments, the Author agreed that the Report on the Design and Lay-out of Roads in Built-up Areas was excellent, but it did not follow that the improvements were not possible as the result of experience.

The lay-bys provided on trunk roads were a boon, yet it was felt that the tapering acceleration lane would lead to greater safety; some drivers would not wait for a gap or failed to realize that a vehicle was rapidly approaching from just behind just when they were starting off. Nor was a starting off signal always given. That might be bad driving, but why not eliminate the possibility of its having any effect?

The provision of a straight loading bay was the most economical form of construction and was adopted where there was room to manoeuvre, but when the lane was used by several occupants, that space could be made available only by obstructing other traffic.

The Royal Army Ordnance Corps had staggered their loading bays during the war and had gained much benefit thereby, since obstruction of moving vehicles had been reduced to the minimum. The matter of obstructing other people's vehicles might not be sufficiently studied when a loading bay was being constructed along a back street open to the public.

With regard to white lines, the principle of a demarcation of that order was very readily acceptable, but the Author suggested that a line of setts

was equally as effective and required no maintenance; in addition, the eyes of a driver on long distance work did not become fatigued to the same extent as when being continually caught by a white line which appeared to be continually flashing by.

The closing date for Correspondence on the foregoing Paper was the 15th May, 1953. No contributions received later than that date will be printed in the Proceedings.—SEC. I.C.E.
