Discussion

The Authors, introducing the Paper, said that their aim had been to correlate the services which constituted the modern airport. It was important to view each of those services in its correct perspective, because the uneven rate of technical development might otherwise lead to lack of balance when an airport was brought into use. Any unexpected delay or advance in the development of one particular service would inevitably affect all the interdependent services. That had actually happened in the case of runway-capacities, which had not increased so quickly as had once been believed likely. That meant that some facilities—passenger-handling, freight-handling, fuelling, etc., would have to be reduced in scale if nugatory expenditure was to be avoided.

It should also be borne in mind that the trend of thought on the future requirements of airport lay-outs and services was still very fluid, and was likely to be so for a considerable time to come. The rate of development of jet-propelled passenger aircraft could not accurately be foreseen but was sure to have repercussions on all airport services ; the commercial factors—traffic offering and catering for passenger psychology—were almost unpredictable ; but the most important cause of the present unsettled ideas was the lack of experience of high-intensity operations. The Berlin airlift had so far been the only example from which such experience could be gained and its lessons would undoubtedly assist the crystallization of ideas.

Mr E. C. Hodgson said that some of the foreseeable problems in the ground-handling of traffic at a major airport required further close individual study before conclusions could be reached which would be economic in cost and in movement. It was interesting to note that some of those problems were being approached by the use of operational research methods.

The Authors had assumed, in the Paper, that future air-traffic flow would normally approximate to random rather than non-random conditions. Mr Hodgson suggested that air operations would always be of a random nature because of the variation in wind, changing conditions on the routes, and the type of landing-aids carried on the aircraft. Traffic delays, whether in the air or on the ground, were always irritating and expensive to the air-line operators ; but delays would inevitably be experienced in converting random flow from the air into regular flow on the ground and it would, therefore, be necessary to find ground-operating techniques which would accommodate those conditions whilst consuming no more time than was necessary to maintain over-all regularity.

What distance had the Authors considered in arriving at the approximate average taxying speed of 20 miles per hour ? Mr Hodgson thought that taxying distances would vary with the runways in use and would probably affect the utilization factor, particularly in the hours of darkness or during bad weather conditions.

The Authors' proposals for fuelling deserved very careful consideration in view of the high capital cost which was involved in the provision of piped supplies. The total operation was likely to be considerable but, when assessing the fuelling installation requirements, had consideration been given to the uplift required at the maintenance area as distinct from the terminal area ? Careful consideration of all the fuelling operations necessary at a major airport might show that the uplift required predominated in the maintenance area. Aircraft operating on the longer routes would, of course, take a greater quantity of fuel in individual loads; furthermore, the inspection and checking over of those aircraft might take several hours. It seemed logical, therefore, that the larger aircraft would proceed to the maintenance area for that work to be carried out and would refuel there before returning to the terminal area to pick up their pay-load. Fuelling of the short-haul aircraft, however, presented a different problem. Such aircraft operated several services a day, their turn-round would be much shorter, and their individual loads much less. In those circumstances, it would be necessary to refuel the aircraft at the terminal area and, to meet changes in flight-plans or pay-loads, defuelling arrangements were necessary. Maximum flexibility of the facilities was, therefore, essential in the terminal area.

The various grades of fuel should be completely segregated in order avoid contamination.

Mr Hodgson did not think that the required flexibility could be maintained in the terminal area with the fixed-fuelling-point system ; suitable arrangements using tank-trucks for local distribution—and particularly for defuelling the aircraft—might be required. The vehicles shown in *Figs 11* appeared to provide for fuelling only, and proposals for defuelling had apparently been omitted.

The system of under-wing pressure-fuelling offered numerous advantages when compared with existing methods and, if there were close collaboration between the various parties concerned in its development, it could produce considerably higher refuelling-rates than those mentioned in the Paper. It was largely a question of the development of satisfactory filters and of suitable metering apparatus which was accurate at all speeds and temperatures.

Air Commodore J. W. F. Merer confined his remarks mainly to some of the experiences of the Berlin air-lift which had a bearing on the Paper.

With regard to the influence of cross-winds on operations, he thought that a very low figure had been accepted by the I.C.A.O. There had been an excellent opportunity of testing the safety of the operation of modern heavily-loaded aircraft on the air-lift, since each of the terminal airfields in Berlin had only one directional runway, and a continuous flow of traffic had had to be maintained, despite cross-winds. The flexibility obtained from the use of the nose-wheel tricycle-undercarriage had been well demonstrated. The American aircraft were all equipped with tricycle-

undercarriages, and they had operated, with maximum loading, in cross-winds of up to 35 knots. Aircraft of the Royal Air Force had the conventional tail-wheel-type of undercarriage and had not been able to operate in cross-winds of more than 12 knots. Part of the problem of runway lay-out would be simplified in the future airport if the higher figure were accepted. Air Commodore Merer believed that figure to be perfectly satisfactory, since the aircraft were loaded to their capacity.

The second point he would like to emphasize was related to the question of ground traffic at airports. Unless M.T.-traffic was kept off the taxi-tracks or careful watch was kept upon its movement in the actual hard-standing loading-area, someone would, sooner or later, bump into an aeroplane. On the other hand, the use of motor transport for the various services referred to in the Paper gave very great flexibility, and he himself preferred those vehicles to permanent installations, for that reason. He emphasized, however, the need for watching the traffic very carefully and keeping it off the taxi-tracks. Extensive subways might provide an alternative, but he thought that the overhead cost in damaged aeroplanes was greater than would be the cost of the subways.

Approach and taxi-track lighting had been described in the Paper, but from experience of the air-lift, he considered that harmonization of the airfield lighting as a whole was important. For example, the approach lighting, although extremely effective in itself, might be too bright in relation to the runway lighting, with the result that the pilot would be unable to adapt his vision at the moment he passed over the runway threshold. Equally, with a rapid flow of traffic, where minutes were valuable and an aeroplane had to be reloaded, refuelled, and turned round in the shortest possible time, the effective lighting of the taxi-track and the loading area was of high importance. The harmonization of the airfield lighting had never been completely solved on the air-lift. He noted that the Authors had not touched on that point in the Paper.

Flexibility in the lay-out and organization was essential. He felt that the organization of the average airport might tend to become too rigid. Fixed installations were often used where more flexible arrangements might be preferable.

The next essential was smoothness of the actual operations. The British component of the combined British/American force had suffered severely at one stage from peak loading because, in order to cope with the various types of aircraft, it had been necessary to adopt a time-block system of dispatch based on the turn-round time of the U.S. Skymasters operating from the British Zone. That was later adjusted. He considered that peak loading, from whatever cause, might be one of the greatest causes of inefficiency in the working of an airport. Far higher efficiency could be achieved by smoothing out the load over all the elements making up the organization.

Mr Hodgson had referred to the random arrival of aircraft. It might

be heretical, but Air Commodore Merer thought that too much load was put on the builder of the airport and not enough on the aircraft-schedule planners, in the sense that one should think in terms of a smooth traffic-flow into an apron. It was analogous to a railway station—one would not expect to see a number of railway expresses jostling one another for position at the platform at King's Cross.

On the Berlin air-lift, the aim had been to land one aeroplane every 3 minutes. The pilot had been told, at his base, the exact time at which he was expected to touch down; he had had to work his flight-plan backwards to the take-off time from his base airfield and to act accordingly. That procedure could not be inflicted on civilian passengers, of course, but more might be done to smooth out the flow into the airport.

The Paper gave the impression—which was perhaps inevitable in the consideration of an airport—of trying to cram everything in, in an effort to make the airport complete; for instance, it appeared that an attempt was being made to handle all the traffic for London at one airport. He thought that was wrong—and the Authors had appeared to agree in paragraph (3) of the Conclusions in the Paper. It would be far better to site a number of smaller airports round the city, equidistant, if possible, and try to smooth out the flow into those various smaller airports. It might be argued that that would involve multiplication of individual facilities, but in any case there would be multiplication of the facilities at one single airport with a very large peak-volume of traffic, and it would be as well to ease the air-traffic-control problem by having a series of airfields around the city centre.

Mr J. A. Dawson observed that the Paper had correlated a vast amount of knowledge, which had been accumulated during the past few years, in relation to the design of airports. Had that information been available some years ago, the task of the designers of airports in the past would have been far easier, and the task of the designers of airports now in the course of construction would have been greatly simplified. It might be said that the problem of the engineer designing modern airports was not so much to consider the influence of ground-handling facilities on airport lay-out as to consider the influence of airport lay-out on ground-handling facilities. For instance, reference had been made in the Paper to two types of runway lights in general use, but the engineer had not been, and was not even yet, a free agent in the choice of one or other of those systems. His choice was largely determined by the width of the runway, which had, in turn, been governed by operational considerations. Where the width of the runway was such that two lines of lights along its edges would be too far apart to form a satisfactory guide to the pilot of an aircraft, those lights had to be located within the width of the runway and there was no alternative but to use lights of the " flush " type. That was even more necessary where centre-line taxying was in force (and such a system had great advantages) because, in such a case, it was convenient to have the taxi-lights in the same line as the contact lights and the aircraft had to straddle the lights as it

passed along its route to and from the terminal area. The elevated type of lighting would obviously be unsuitable in such circumstances.

For the ground-traffic-indicator system described in the Paper, coils could be laid in the runway joints; that involved the use of special cable. Where an airport had already been designed, the cable frequently had to fit in the width of the joint, which might be no more than $\frac{3}{8}$ inch and, in order to use a five-core cable, it had to be of rectangular section instead of the more usual circular section. That was a good example of the influence of past practice upon ground-handling facilities.

The Authors had suggested that a control-tower not less than 80 feet above ground-level might be required. It would be essential, on an airport already planned, to ensure that the tower and other buildings, such as hangars, did not form flying obstructions and in particular—since they would naturally be beside the flying approaches—that they did not rise above the line of a slope of 1 in 7 drawn from the edge of the adjacent flightstrip.

Mr Dawson was especially interested in the section dealing with the handling of aircraft in the bays, particularly in relation to the problem of dealing with jet-engines. The Authors had mentioned, in their preliminary remarks, that the future of that problem was incalculable, but it would certainly have to be faced. For the types of aircraft now in general use, the spacing of the bays was much greater than the building frontage required for a passenger-handling channel. It would seem very undesirable, therefore, that the distances should be increased to the extent referred to on p. 26. It would be essential to tow jet-aircraft from the bay to a point where their engines could be started up safely without danger or inconvenience to other users of the airport. Side-tracking gear might be a possible solution, since by that means the aircraft could be pulled into the open. Side-tracking would also enable aircraft to be stowed nose to tail, resulting in a considerable saving of space. In consequence, the aircraft in the end bays could be nearer to the passenger-handling buildings.

The Authors had suggested that the carriages of the side-tracking gear would leave a trough in the surface of the pavement into which other vehicles might drop, but it should not be beyond the ingenuity of an engineer to devise a scheme in which the trough, after the passage of the carriage, was filled by raising a lower platform.

Mr Dawson agreed with Mr Hodgson's remarks regarding the arrangements for aircraft servicing in the bay. In *Fig. 9*, an arrangement was shown of apron services proposed by an engineer in the United States of America, but American conditions differed, of course, very greatly from those in Great Britain. A large proportion of the traffic in America was domestic, the distance between stops being relatively small. It was necessary that there should be quick turn-rounds and that the aircraft coming from, say, the west of the continent towards the east should be

able to carry on the journey quickly. There was, therefore, a very good reason for having those facilities on the apron; that also applied, as Mr Hodgson had said, to short-haul traffic which had to turn round quickly and return, say, to the Continent. None of the long-haul traffic coming from the United States, the Far East, or Africa, had to turn round quickly. Mr Dawson believed that the minimum period of time for which one of those aircraft stood on the airport was about 48 hours. They could not stand in the bay while they remained in the airport; they had to move on to the servicing bay or to the maintenance area, and it would seem better that operations such as main fuelling and servicing with compressed air (but not cleansing) might well be carried out in the servicing area.

Mr A. E. G. Collins considered that the handling of freight on the ground was still inefficient. Much time was wasted in Customs checks, docketing, scheduling, and so on; perhaps that was inevitable in the present world political situation. However, that did not prevent the development of a better organization for moving the goods from the aircraft to the building and from the building in which it was stored to the customer. He had heard a number of complaints regarding the delays which occurred when conveying goods from the freight stores on the airport to the customer, and that was a matter which required attention.

The modern freighter aircraft was, in general, designed to have large holds with wide doors which facilitated the use of conveyors and other mechanical methods of loading and unloading. On the other hand, the Authors had pointed out that about 50 per cent. of the total freight carried was, at present, carried in passenger aircraft, generally in small holds or even in sections of the passenger accommodation; it had to be handled through narrow and inconvenient doors. The solution to that problem would have to be sought in two directions: aircraft design; and some means of speeding up the physical removal of packages from the aircraft to the ground. Mr Collins agreed with the Authors' suggestion regarding special vehicles with loading platforms of variable height. They appeared to think that such vehicles might dispense with conveyors; but that was unlikely, because conveyors were of great assistance when handling bulk consignments of freight from a specially designed freighter aircraft.

The Authors had tabulated three methods of handling freight: first, by the airport authorities or by some common agent; secondly, by each air-line handling its own freight by its own means; and thirdly, by air-line personnel in conjunction with air-freight agents. A development of the third method might be most advantageous, the air-line providing the personnel to pass the packages from the aircraft and the airport authorities providing the vehicles and the drivers. It seemed quite clear that the air-lines' personnel should stow the freight in the aircraft, because the maintenance of the position of the centre of gravity was most important. It seemed reasonable, therefore, to add that the air-lines should provide personnel to pass the packages to the man who actually stowed the freight.

But it would not be economical for each air-line to provide a lot of special apparatus and special vehicles. Such equipment might well be commonly owned and provided by the airport authority.

Mr R. G. Edkins remarked that, in the list of fundamental factors given on p. 4, the Authors had not mentioned the effect of road and rail connexions on airport lay-out.

He thought that that was a fundamental factor, affecting the lay-out of most airports. It was true that London Airport had no rail connexion, but that appeared to have had very little effect on the existing road connexions.

Much emphasis had been laid upon the importance of flexibility in dealing with the problem for which a solution was still being sought—that of loading and unloading the aircraft as rapidly as possible; and also upon the importance of clearing the runways and taxi-ways as quickly as possible and providing any other means which could be invented for handling the aircraft expeditiously in the loading-bay.

The aircraft was an awkward vehicle on the ground. It was extremely large in both of its plan dimensions compared with the load which it carried. He had calculated that an aircraft in a bay required about 6 times the space required by a ship or launch carrying the same number of passengers; about 10 times as much as would be required by a bus; or 12 times that required by a train. The aircraft was, therefore, a very large vehicle carrying a comparatively small load, and it was the function of the airport to collect those dispersed small loads from those large vehicles and compress them into the more efficient surface transport vehicles. The Authors had also, after careful consideration, indicated a preference for handling passengers, particularly at airports where the frequency was very high, by vehicles between the building and the aircraft rather than by bringing the aircraft to within walking-distance of the passenger-handling building. An aircraft was particularly easily damaged in a collision and such damage was liable to cause much more loss than the purely physical damage to the aircraft; it caused delay to services which might run into many hundreds, if not thousands, of pounds. The risk of collision, therefore, should be carefully considered when designing a loading-bay. Mr Edkins suggested that a solution might be the separation of the aircraft from service vehicles. That could be achieved by maintaining the aircraft at a level a little higher than the taxi-ways whilst all the service vehicles were provided with a sunken apron passing below viaducts on which the aircraft would stand. The structural implications involved were not so enormous as might be expected. The viaduct to carry the aircraft would not be so wide as the ordinary taxi-way. The spans would need only to be of sufficient length to pass the largest service vehicle beneath them. The head-room would not need to exceed 12 feet and the grade-separation would be about 15 feet. The structure as a whole would be a simple one and, although it would have to carry loads which might range up to 100 tons on a very small

area, it would be extremely robust. The viaduct lent itself to repetition and could conceivably be constructed of pre-cast—and possibly pre-stressed—reinforced concrete units, of which a large number would be required ; the cost of construction would not, therefore, be excessive, and the structure would be subject to fairly easy demolition and modification. Mr Edkins believed that his suggestion would, if developed, remove all necessity for " building-in " the various services which previous speakers had rightly criticized. A large number of mobile service-units could be employed without risk of collision and with ample room for manoeuvring. The viaduct would carry, say, five aircraft nose-to-tail ; they would taxi on to the viaduct, pause for unloading, proceed to refuelling points, continue to a point where servicing and reloading could take place, and then return to the runway or proceed to the maintenance area, without the need for backing or turning in the reverse direction—awkward manoeuvres for an aircraft. Had the Authors already considered that suggestion and, if so, had they found any major difficulties other than high expenditure ?

With regard to the peak-loading of the airport organization and the suggestion that scheduling might aid in smoothing out the peaks, Mr Edkins thought that that was an optimistic suggestion. Although a smooth flow of aircraft into the airport might be ensured, the number of aircraft arriving at the airport was bound to vary considerably throughout the day. There would inevitably be peak periods which no system of control would be able to smooth out. Scheduling was largely controlled, not by the wishes of the operator, but by physical conditions on the route —such as early morning mists at a point of departure or unsatisfactory weather conditions in the late afternoon—which made it highly desirable, from the point of view of safety, to avoid departures at those times and therefore affected the time of arrival at the next airport. International conditions arose which prevented night landing and night flying ; there were frequently sudden changes of schedule which could be neither foreseen nor circumvented. Airport designers should accept the peak-load as one of the essential factors governing design. They would always have to deal with it, and he did not think that the air-transport operator would ever be able to give much assistance in the matter.

Mr J. A. Robertson thought that the Paper displayed, in some measure, an attitude of examining what had happened in the past and basing future plans on that. He felt sure that there was no direction in which future civil engineering was more likely to see novel developments than in the sphere of airport design and lay-out. He did not pretend to know what the aircraft of A.D. 2000 would look like, but he felt sure, from his study of history and of other kinds of engineering, that London Airport, for example, would be quite unsuitable for the aircraft of that day. It would have to be modified ; and as the aircraft developed, so the handling of freight and passengers, and consequently the ground lay-out, would have to develop with them. To what extent did the Authors feel that planning could be

inspired by vision or by intelligent anticipation of something that was to come, say, in 25 years' time; or should plans, in their opinion, be based only on definite experience?

The Chairman was pleased to note a tendency, as mentioned by Air Commodore Merer, to accept greater cross-wind components. The consequent simplification of runway lay-out was a very important point in the interests of reducing the capital costs of airfield construction. It would appear that similar consideration could also be given to runway-lengths. There was, of course, the operational margin in excess of the normal landing and take-off lengths of a runway. However, if present capital costs had to be balanced against the provision of multiple airfields, as suggested by Air Commodore Merer, the Chairman would like to see a shorter paved length and longer over-runs. It would be possible to have a perfectly safe over-run for emergency and safety purposes as distinct from regular use, which was the purpose of the paved area. He realized that that would not be possible with the obstruction of the present structure of the crossbar approach lighting, which, of course, was a very valuable form of lighting.

Referring to the problem of parking aircraft in bays, he thought that that was an important factor in capital expenditure, both in the magnitude of the area and in paving thickness. The Authors had shown the advantages of the various areas of aircraft-parking, as well as their disadvantages, and it appeared that all forms of self-taxying parking were necessarily extravagant. As suggested by Mr Dawson, further development in side-tracking might be an answer to the problem, and would also deal with one point mentioned by the Authors—the separation of the numerous parking bays from the passenger and freight buildings. If it were possible to shorten the length of parking areas by side-tracking, it would also be possible to have many more aircraft standing nearer to the facilities. It might also assist passengers to reach their aircraft if, by that greater concentration, covered footbridges could be provided from the Terminal buildings to the aircraft standings.

The Authors, in reply, expressed their appreciation of the contributions of those with real experience of the problems involved, since, in introducing the Paper, they had pointed out that thought was in a fluid state because of the lack of practical experience.

Mr Hodgson had referred to petrol-supplies and to the flexibility of vehicular movements as compared with the rigidity of fixed installations. That rigidity was causing real concern, both to airport authorities and to petrol companies, and in nearly all countries a moratorium had been declared on fixed installations. The Americans were, apparently, having second thoughts about the installation of pipe-lines to the bays at Idlewild and at other air stations, and in Great Britain consideration had been given to the problem. The stage had been reached where, in no country, was the cost of installing high-pressure under-wing refuelling being faced. It was

understandable that no authority was prepared, until further technical development had taken place, to face the cost of such an installation in a large number of bays, which might well range from £250,000 to £500,000 on major airports. Mr Hodgson had also referred to the proportion of petrol from terminal areas, maintenance areas, and so on. (That was an excellent example of the fluid state of thought.) It had been estimated in 1948 that, on a major airport, nearly 100 per cent. of the fuel-uplift would take place in the terminal area. In 1949, it had been estimated that the figure would be 60 per cent. in the terminal area and 40 per cent. in the maintenance area. The latest estimate for a long-range airport, and it would probably be applicable to mixed traffic, was 40 per cent. in the terminal area and up to 60 per cent. in the maintenance area. It would readily be understood, therefore, that airport authorities and petrol companies, faced with such a change of thought, were hesitant about putting large installations in terminal-area aprons.

Operating-conditions for refuelling at maintenance-areas differed from those on terminal aprons in that the time factor was not so acute and other operations, such as defuelling the petrol system, checks, and overhaul might be involved. The fixed-type of petrol-fuelling system seemed therefore to be neither necessary nor desirable. It was considered that aircraft should be defuelled into individual tank-wagons.

The taxying-distance over which an average speed of 20 miles per hour could be attained was of the order of 1 mile and assumed straight or gently curved taxi-tracks.

Air Commodore Merer's reference to the necessity for maintaining flexibility in airport lay-out were most important ; the Authors hoped that no airport would be so rigidly planned or operated that a stage would be reached when further development was not possible without first scrapping almost everything that existed.

The Authors agreed with Air Commodore Merer that airport lighting should be harmonized as a whole. However, until the candle-power of the present flush fittings was greatly increased, or operational conditions made possible the full use of elevated fittings, harmonization seemed to be a doubtful possibility.

Extremely large airports might well seem to be outmoded and for cities such as London, New York, and Paris the answer might lie in the provision of a number of smaller airports. The advantages lay not only in making the airport lay-out less complicated but also in the fact that a number of airports would be in regular operation, to which, under adverse flying conditions aircraft could be diverted.

Whilst fully appreciating the advantages of side-tracking, as stressed by the Chairman and Mr Dawson, the Authors suggested that its greatest disadvantage was that space might well be saved only at the expense of speed. On a modern airport, with high rates of operation, it seemed reasonable to think that not more than 1 minute would be available for an

aircraft completely to clear the taxi-track to enable succeeding aircraft to pass. On that basis, the side-tracking gear must be designed so that it would clear the aircraft from the taxi-track, and from the vicinity of the taxi-track, within 1 minute; that would not be easy to accomplish.

Mr Dawson would be interested to know, in view of his remarks regarding the covering-over of the trough for side-tracking gear, that a scheme to overcome that difficulty had recently been proposed by an Australian Engineer, Mr L. F. Liscombe. It was worth noting, however, that one of the claims made in respect of side-tracking gear, namely, that the aprons need not be constructed to aircraft loading, might be exaggerated; if aprons were not constructed to aircraft loading it would be impossible to operate the bays in the event of failure of the side-tracking gear, and for that reason it might be considered preferable to face the extra cost of constructing heavier pavings.

Mr Collins's comments on the organization for the handling of freight in an airport had been most interesting in that they had pointed to the necessity of flexibility of operating methods; that " flexibility " seemed to be the fundamental factor in airport lay-out and operation. When preparing the Paper, the Authors had accepted and studied the lessons of the past, and they had also looked into the future as far as they had been able; but it was almost impossible to predict more than 10 years ahead in aviation. They felt therefore that the answer to Mr Robertson was to maintain flexibility in the lay-out of the airfield and its services and of the buildings on the airport; the handling of passengers might alter completely with changing international conditions, which might require altered internal lay-outs to terminal and other buildings.

They agreed with Mr Edkins that road and rail connexions were of fundamental importance. They had not been referred to directly in the Paper, because they were more a matter of site-selection than of airport lay-out; the problem was dealt with fairly comprehensively in the discussion on a Paper [1] presented to the Institution 2 years ago.

Turning to road accesses within the airport, Mr Edkins's proposal regarding aprons was certainly an interesting one. The Authors had had a similar idea some time previously and, while not investigating it in detail, they had broadly discussed the advantages and disadvantages. The cost would undoubtedly be high and it would, in practice, be necessary to limit the use of one viaduct to one aircraft if full flexibility of operations was to be maintained and movement-rates were to be retained at the maximum. More than one vehicle at a time would have to have access both to the aircraft-level and to the passenger-freight-vehicle-levels, so that neither narrow viaducts for aircraft nor narrow roads under the viaducts seemed to be workable.

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[1] W. J. Cozens, " Problems in the Selection of Sites for Civil Airports and Military Air Stations." Airport Paper No. 8, Instn Civ. Engrs, 1948.

However, the principle of grade separation for traffic segregation was a sound one and whilst the Authors did not consider that it would prove a practical proposition when applied to aircraft and the vehicles servicing them, it might contribute effectively to the solution of separation of passengers from vehicular movements by having sunken roads at the apron-edge for vehicles, while passengers passed over that road to the passenger building direct from the apron or from the passenger vehicle ; the pre-war terminal buildings at Templehof Airport, Berlin, had been, to some extent, designed on that principle and recent development in ship-to-shore gangways, especially at Southampton, opened up further possibilities for the protection of passengers from traffic and weather during their journey from the aircraft to the passenger-handling building.

The Chairman had made a suggestion regarding runway-length which would be extremely valuable in reducing expenditure on airports. That was another example of a point which the Authors had stressed, namely, that so many aspects of airport lay-out were inter-related and that consideration must be given to them as a whole ; the shortening of runways and the lengthening of over-run would result in economy, but it would be disastrous, at the present time, to the safety measures being introduced in the way of lighting, radio aids, and so on. Thus there were two conflicting interests which might, in time, be harmonized : radio aids would change ; lighting would be of a different nature ; and so on.

The Authors had not mentioned the effect of special aircraft, such as helicopters, on airport lay-out, because their operational functions and their requirements in respect of facilities were still too nebulous. Such aircraft might well play an important part in the future of aviation, especially on internal feeder-services, but a great deal more would have to be known of their characteristics and possibilities before they could be seriously considered in relation to airport lay-out as a whole ; nevertheless, in laying-out an airport site, the future possibilities of those aircraft should not be overlooked.

The Chairman announced that the constitution of the Divisional Board for the Session 1950–51 would be as follows :—

Appointed by the Council, in accordance with Rules 1 (*a*) and 1 (*b*) of the " Objects, Constitution, and Rules " :—

Chairman : Sir Arthur Whitaker
Mr A. G. Bonn
Mr G. H. Fretwell
Dr W. H. Glanville
Mr R. F. Lloyd-Jones
Mr J. N. McFeeters

Elected by the Members present at the Meeting, in accordance with Rules 10 to 14 :—

Mr J. A. Dawson
Mr R. G. Edkins
Mr C. E. Foster
Mr Clifford Heyes
Mr K. C. Mann.

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