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FOREWORD

The purpose of the study of airport economics being carried on in ICAO is to assist authorities in the Organization and in Contracting States in their consideration of the complex problems connected with airport charges and finance in the international field. This preliminary report is an endeavour to set forth the main aspects of the problem, together with what statistical information is available to give balance and perspective to the theoretical discussion. Grateful acknowledgments are made to the authors of the study made by the Harvard Graduate School of Business Administration frequently cited in the text and to the United States and Canadian Governments who have made a number of official records available for study.

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C O N C L U S I O N S

It would be premature to reach final or detailed conclusions from a preliminary study of this type, but certain general inferences stand out with sufficient clarity to merit special mention.

a) Most, if not all, international airports are being operated at a substantial loss at the present time. If air transport continues to expand in the future as it has in the past a number of major airports may become self-supporting within a period of from five to ten years but others are likely to remain on a deficit basis indefinitely. The development of concession revenues and increases in airport charges might produce greater revenues at certain airports but have definite limitations and can probably not solve the basic problem.

b) Certain international airports may thus require international support. Further study is needed to establish which airports come in this category, what support is necessary and how it should be organized.

c) The level of landing charges at all international airports cannot satisfactorily be standardized owing to the widely different economic positions of airports of different types. On the other hand the basis of such charges might be standardized with great benefit in simplifying calculation and checking in airline offices.

d) The weight-scale type of tariff for landing charges appears to be the simplest and most suitable for general use. Different unit charges can be made at different airports, but the gradient and steps of the scale could be standardized. Airline payments under a general system of weight-scale landing tariffs

would, however, not be in correct proportion to their earnings per landing. Airlines operating services with long average stage distances would pay less than in proportion to their earnings per landing, while airlines operating services with short average stage distances would pay more. Adjustments to remove this anomaly based on stage-distances flown could be incorporated in the standard tariff system at some sacrifice of simplicity.

CHAPTER I - AIRPORT ORGANIZATION

The Meaning of the Term "airport"

1. The simple word "airport" seems the most satisfactory term to distinguish the landing place for commercial air transport aircraft from landing places for other types of aircraft. The phrase "terminal type airport" used in the United States besides being lengthy for frequent use, contains the misleading suggestion that it refers to an airport at the terminus or end of a route. The word "airport" is analogous to the word "port", and can be distinguished from a military "air station", a club, private, or training "airfield" and an emergency "landing ground" just as a port is distinguished from a naval station and various types of harbour. All classes of "landing ground plus facilities", including airports, can be classed as "aerodromes" if a generic term is required.

2. The word "airport" used in its strict sense then refers to the physical entity consisting of a landing place for aircraft with a number of buildings housing various facilities for the aircraft in question and their passengers, crews and loads. It is convenient, however, to use the word to refer also to the economic entity that comprises the organization and management of the physical entity, that has capital assets and liabilities, incurs running costs and receives revenues. The two meanings of the word are in common use and cause little confusion so long as it is realised that they exist and that at most airports the economic entity does not itself operate many of the airport facilities but merely rents ground or building space to their operators. The activities carried on by the management of an airport are a small proportion of the total activities carried on at an airport by airline operators, maintenance organizations, government agencies and concessionaires.

3. The airport itself normally looks after the landing area, runways and buildings; operates the landing lights, local radio-aids, control tower, and emergency services such as fire tender, ambulance and snow-removal; and, for the rest,

acts as landlord to airline staffs who look after passengers, tickets, loading and unloading, and often aircraft maintenance; to specialist maintenance and fuel supply organizations; to concessionaires running restaurants, shops etc.; to meteorological and telecommunication units and to governmental agencies such as customs, immigration and post office. The variations from this organizational picture are generally in connection with flying control, which in the United States is normally operated by a government agency but elsewhere is more generally regarded as part of the airport organization, local radio-aids, and communications which may be operated partly or wholly by the airport itself, by airlines, by independent private organizations or by governmental agencies.

4. The number of employees at an airport that are actually employed directly by the airport is not large even at major airports as the following table shows:

U.S. Domestic Airports
Civil Airport Employees as of December 1941*

Class[4]	Number of civil airports in operation	Employees				
		Average per airport	Total	Administrative[1]	Maintenance[2]	Operative[3]
I (incl. Sub I)	1,496	3.3	4,936	1,346	2,244	1,346
II	661	4.0	2,644	793	1,190	661
III	169	10.7	1,808	372	642	794
IV and over	43	13.1	563	82	180	301
Total	2,369	4.2	9,951	2,593	4,256	3,102

1 Airport managers, clerks, secretaries, etc.
2 Those employed for repair and maintenance of fields, hangars, grounds.
3 Control-tower operators, guards, gas and oil service men when employed directly by the airport.
SOURCE. - CAA Airports Service Records.
4 The classification is according to size, Class I being the smallest.

* From "Civil Aviation and the National Economy" CAA September 1945.

5. No comprehensive statistics of other employees at these airports are available, but they would certainly be considerably more numerous than the airport employees. Estimates for the future operation of La Guardia, for example, put the number of airport employees at 128 as compared with 10,000 airline and 1,200 concession employees working at the airport.* The number of airline employees at La Guardia is increased by the large airline maintenance organizations established there, but even at airports without such establishments, non-airport employees generally outnumber airport employees.

6. The picture outside the U.S. appears to be similar. At Dorval, Montreal, for instance, the number of people working in the airport is about 3,500, while airport employees total 250-300 according to the season, and here the number of airport employees is increased by special snow-clearance squads in winter and by the fact that the airport carries out its own runway maintenance instead of having it done by the local highways department as is frequently the case.

7. At remote airports such as Gander, airport employees may form a high proportion of those working at the airport, but it may probably be accepted that generally, throughout the world, the great majority of activities at airports are carried on by airlines, independent maintenance organizations, government agencies and concessionaires, with respect to whom the airport is in the position of landlord.

8. Most tenants on airport property are carrying on activities directly connected with aviation. The airport obtains rental revenue from them but this revenue is dependent upon aviation and partly comes out of aviation revenues; it is not wholly additional revenue to air transport in the same way as, for instance the ground rent of a general engineering factory built on railway property near a station is additional revenue to the railway transport system. The day may come when certain specialised industries unconnected with aviation may be prepared to pay high rents to develop plants on or near airports, and the ground on or near an airport may then become a very profitable possession, but at the present time the activities carried out at airports are comparable to those carried out within the actual area of a railway station not to those carried out in surrounding development projects.

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* Summary Proposal for the Development of New York City Airports. The Port of New York Authority, December 1946.

9. Most airport rents are thus paid directly or indirectly by operators of aircraft. The only part of the activities at an airport that can be regarded as bringing additional revenue into the world of air transport are the concessions - restaurant, shops, cloak rooms etc. The revenues of these come from passengers and airport visitors and airport employees, but so long as the prices charged are no higher than elsewhere, they will not affect the public's demand for air transport and hence can be classed as independent revenues.

10. Using the analogy of the railway station, an airport may be regarded as a combined airway station for a number of airlines, publicly or independently owned, but largely operated by the airlines themselves who provide the staff for most of the facilities and rent space for the purpose from the airport.

Hangars, Buildings and Landing Area

11. It has become the practice to break down airport accounts separately for:

a) Hangars, with which generally go work-shops and associated offices and facilities;

b) Buildings, with which usually go the airport offices, control tower, airline and government agency offices, passenger facilities, shops, restaurants etc;

c) Landing area, with which go runways, lights, emergency services, blind landing equipment, local flight control.

12. This break-down accomplishes some simplification of the complicated economics of airports and is followed in this report, but it should be remembered that such divisions are to a large extent purely accounting procedures. Hangars, administrative buildings and landing area are all essential parts of an airport; no airport can operate properly without any of the three and no airline can make regular use of an airport without making use, at least occasionally, of all three. When a government or municipality is considering building a new airport it has to consider the plan as a whole, with the total costs, and the total anticipated revenues. The study of accounting problems may be simplified by separating the revenues and expenses of hangars, buildings and landing area: making the hangar accounts, for example, break

even, and taking whatever profit is calculated on the buildings to reduce whatever deficit is calculated on the landing area. But this is only a tidy method of setting the figures out. All the accounts of an airport are inter-related. The profit on the buildings account is made possible by the existence of the landing area and might be destroyed if landing charges were set so high as to cut down the utilization of the airport. Instances have occurred where it was found desirable to lower hangar rents well below commercial levels to attract airlines to utilize an airport.

13. Nevertheless, although there is interrelation, there is also a certain degree of independence between these accounts. It is possible, within limits, for an airport operator to extend or contract his investment in hangars for example, so that to this extent they are economically independent of the rest of the airport. Moreover, airlines are free to choose between a number of different airports where they shall carry out their maintenance, so that the airport operator is not in as secure a monopoly position in renting hangar space as he sometimes is in providing landing facilities. In some instances also it is possible for an airline to erect its own hangars at that or some other airfield. Competitive factors thus eventually tend to operate on hangar rents in at least some cases and limit them in the long period to approximately the cost of providing them including a return on capital.*

14. The same is not true of office and shop space in airport buildings rented to airlines, government agencies, and concessionaires. Here the airport is in a strong monopoly position with respect to its tenants since they cannot perform those particular services elsewhere. In the case of airline tenants the balance of dependence generally results in their being charged approximately break-even rents for space in the terminal building as they are for space in hangars. Government tenants at airports are also normally charged at break-even levels. Concessionaires, on the other

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* The full description of this process is that where an airport operator can get more than a reasonable return on his investment on hangars he will extend his hangars until he has absorbed the excess demand; where an airline is asked to pay more than this figure it will go elsewhere or build its own hangars. Neither process works either rapidly or universally, so that many rent anomalies will exist. The background possibility of competition, however, supplies a justification for accepting the general principle that hangar rents should be set at approximately the break-even point.

hand, have no special status to assist them in rent bargaining. If one concessionaire turns an offer down when it would yield a reasonable profit to him another will accept it, so that concession rents can be set at a level based on profitability to the tenants. Normally these rents are considerably higher than the cost to the airport of providing and maintaining the space rented, so that there is a net profit to the airport from them and hence from the terminal building as a whole.

Types of Airport Administration

15. Airports may be owned and operated by national governments, municipalities or private enterprise, including airlines and aircraft manufacturers. Some are owned by governments and leased to municipalities to operate, and some are owned by municipalities or governments and leased to private operators. A number of airports were developed as military bases during the war and are still owned or operated by military agencies.

16. The following figures indicate the proportions of the chief types of administration among airports of the United States at mid 1947:-

Types of Airport in the U.S. - June 1947*

Commercial	2,383
Municipal	1,612
CAA Intermediate	189
Military	660
Other	230
	5,074

17. On the whole the larger airports in the U.S. are owned and operated by municipalities and most of the U.S. international airports are of this type. Instances of large privately owned airports do however occur, the Lockheed airport at Burbank, California, being one that is in international use.

18. No comprehensive statistics of this nature are available for airports outside the United States but it is probable that

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* CAA Journal, July 1947.

nearly all large airports on the main world air routes are publicly owned and publicly operated. Outside the United States there are, however, many nationally owned airports. In the United States the only large airport of this nature is the Washington airport. The 189 intermediate landing fields in the Federal Airways System listed in the table above are small landing grounds used chiefly for emergency purposes or technical stops.

19. The United Kingdom is an example of a country where all the airports are owned and operated directly by a governmental department. Before the second world war some municipalities in the United Kingdom had airports of their own, but these were all taken over by the government during the war either for military or semi-military purposes. It appears that the intention is to retain all airports in the United Kingdom under government control.

20. The New York airports are of particular interest from the administrative point of view. These airports are operated by the Port of New York Authority, a special public interstate body set up to operate the port and its facilities, bridges, tunnels etc. As an airport operator this Authority combines many of the advantages of public administration with some of the independence and incentive of private enterprise.

21. From the international point of view it is important to note that while most airports used by international airlines are controlled by the government of the country where they are situated, there are many, particularly in the United States that are operated by municipalities or private enterprise and in such cases a government may require special powers to control operating or financial policy or even to obtain information concerning such matters.

CHAPTER II - AIRPORT FINANCES

Airport Costs

22. It is difficult to discuss airport costs for international airports in general terms at the present time for the following reasons:

a) Few statistics concerning airport construction and operations are available for airports outside the United States;

b) Airport costs vary widely not only between different sizes of airport, but between different airports of the same size;

c) Airport accounting methods vary greatly even within a single country and still more between different countries;

d) Many large international airports now in use were originally constructed or were substantially extended, for military purposes, and the capital expenditures involved are not comparable with civil expenditures.

23. Certain general conclusions can however be drawn from a study of the statistics available for United States airports, and these can occasionally be supplemented by data concerning other airports.

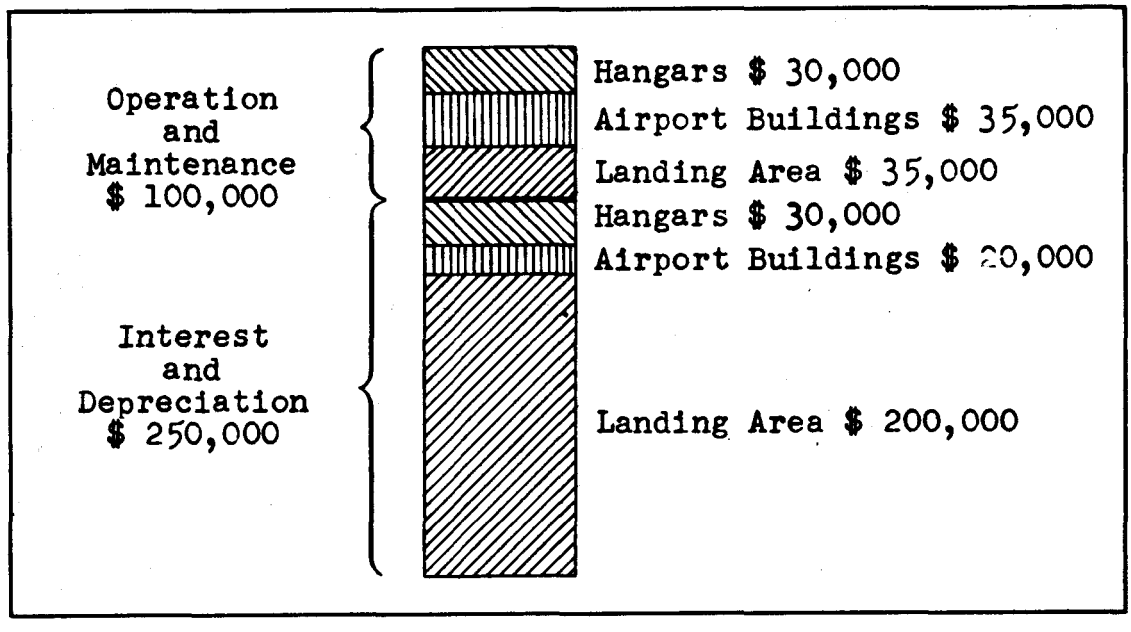
24. In the first place, it is clear that the constructional costs of modern airports are very heavy. Most airports in international use represent investments measured in millions of dollars. In 1944 the total investment in civil airports in the United States was estimated at a 1,000 million dollars and a development programme costing a further 1,000 million dollars was in contemplation. Idlewild airport, when taken over by the Port of New York Authority recently, had cost $62,000,000 and was not yet completed, while the total

capital budget for Idlewild and La Guardia has been estimated at about $191 million. ✡

25. If we accept the view that a reasonable interest and some depreciation rate should be allowed on these heavy capital outlays, such charges would form a considerable proportion of airport expenses. ✡✡

26. Diagram I illustrates the sort of relationship that might be expected between capital charges and cash expenses at a medium sized airport in the United States: †

Diagram I.- TYPICAL ANNUAL EXPENSE PROPORTIONS FOR A MEDIUM SIZED AIRPORT IN THE UNITED STATES



✡ Summary proposal for the development of New York City airports; the Port of New York Authority, December 1946.

✡✡ It is a frequent practice in airport accounting to omit capital charges entirely, no doubt partly because revenues are generally insufficient to cover even the cash expenses of maintenance and operation and leave nothing to go towards a return on investment.

† Harvard School of Business Administration: Terminal Airport Financing and Management, by Bollinger, Passen, McElfresh.

27. For international airports outside the United States, the scale of building and capital investment is generally on a smaller scale so that interest and depreciation although generally substantial do not form such a large part of total costs. At Dorval, for example, an airport of medium size capitalized at $6,841,000 the total expense analysis for 1946/47 was approximately as follows:

	Total Annual Expenses at Dorval 1946-47*
Operation and Maintenance	$ 893,000
Interest and Depreciation (at 5%)	340,000
Total	1,233,000

28. Airports constructional costs have been rising steadily for many years both because runway requirements of length and strength have increased and because the standards of service and safety have risen. In the United States the cumulative total capital expenditure invested per airport was $300,000 in 1944 as compared with $85,000 in 1934.** This increase was probably reflected in the international field.

29. It is interesting to observe that in the United States the increase in the capital cost of airports was only one aspect of the general rapid growth of the airways system as a whole. In the decade 1934 to 1944, when the average investment per airport increased between 3 and 4 times and the total investment in all the airports of the domestic system increased about 5 times, the number of passengers carried by the domestic airlines increased about 10 times, the number of passenger miles flown increased 12 times and total domestic airline revenues probably increased about 4 times. It is probable that international air transport as a whole has

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* Extracted from statistics reported to ICAO by Canadian Government authorities.

** From "Civil Aviation and the National Economy", CAA 1945. There are many theoretical and practical ways of estimating the capital values of airports and for most purposes the straight cumulative total of dollars invested would not be satisfactory. Here however, it is the constant increase in this figure that is being considered and that is contrasted with the general growth of air transport.

similarly grown as fast as the cost of the airports it uses.

Main Items of Operating and Maintenance Expenses

30. Airports vary so widely in their organization and accounting practice, that it is not possible to allocate even approximate dimensions to the various items of cost that go to make up their total operating and maintenance expenses. Many airports do not analyse their costs into separate accounts relating to different types of activity, but merely show such items as total wages and salaries as distinct from the cost of equipment replacements and consumable stores. If, however, the airport expenses of a number of international airports were analysed into the type of cost analysis usual in other businesses, the following items would probably be found to be the chief ones common to a number of airports:

Landing Area: Runways - maintenance and repair.
Field Lighting - operation, maintenance, repair.
Grounds - general upkeep.
Snow removal.
Local Flying Control - operation, maintenance, repair.
Communications - operation, maintenance, repair.
Local Radio Aids - operation, maintenance, repair.

Airport Buildings: Maintenance, repair.
Light, heat, power, water, janitor service.

Hangars: Maintenance, repair.
Light, heat, power, water, janitor service.

31. At particular airports, some of these items may be carried on by airlines or other tenants, or may not be carried on at all; at other airports special additional costs not included in this list may be of great importance. Runway maintenance, for example, is often carried out by municipal highway organizations sometimes without specific charge; in the United States, flying control is normally provided by a government agency; the costs of communications and radio aids are frequently borne by government agencies; all hangar expenses may be borne by their tenants; the hangars themselves may be owned and maintained by airlines or other enterprises.

Airport Cost Variation and its Relation to the Requirements of Aircraft

32. The wide variation between the capital costs of airports of different sizes and also between airports of the same size can be seen from the following table. This table is based on figures collected for United States airports, but omits both the largest ones such as La Guardia and Idlewild and also the very small landing grounds and strips.*

	Range of variation in United States Airport Capital Costs, Omitting Extremes	
	Low Limits	High Limits
	$1,000	$1,000
Small Airports		
Landing Area	507	1,403
Terminal Building	76	162
Hangars	110	385
Total	693	1,950
Medium Sized Airports		
Landing Area	1,723	4,673
Terminal Building	648	1,656
Hangars	660	2,420
Total	3,031	8,749
Large Airports		
Landing Area	3,455	11,953
Terminal Building	2,160	6,000
Hangars	3,850	8,250
Total	9,465	26,203

33. The variation in the capital costs of international airports on the world routes are probably even greater than

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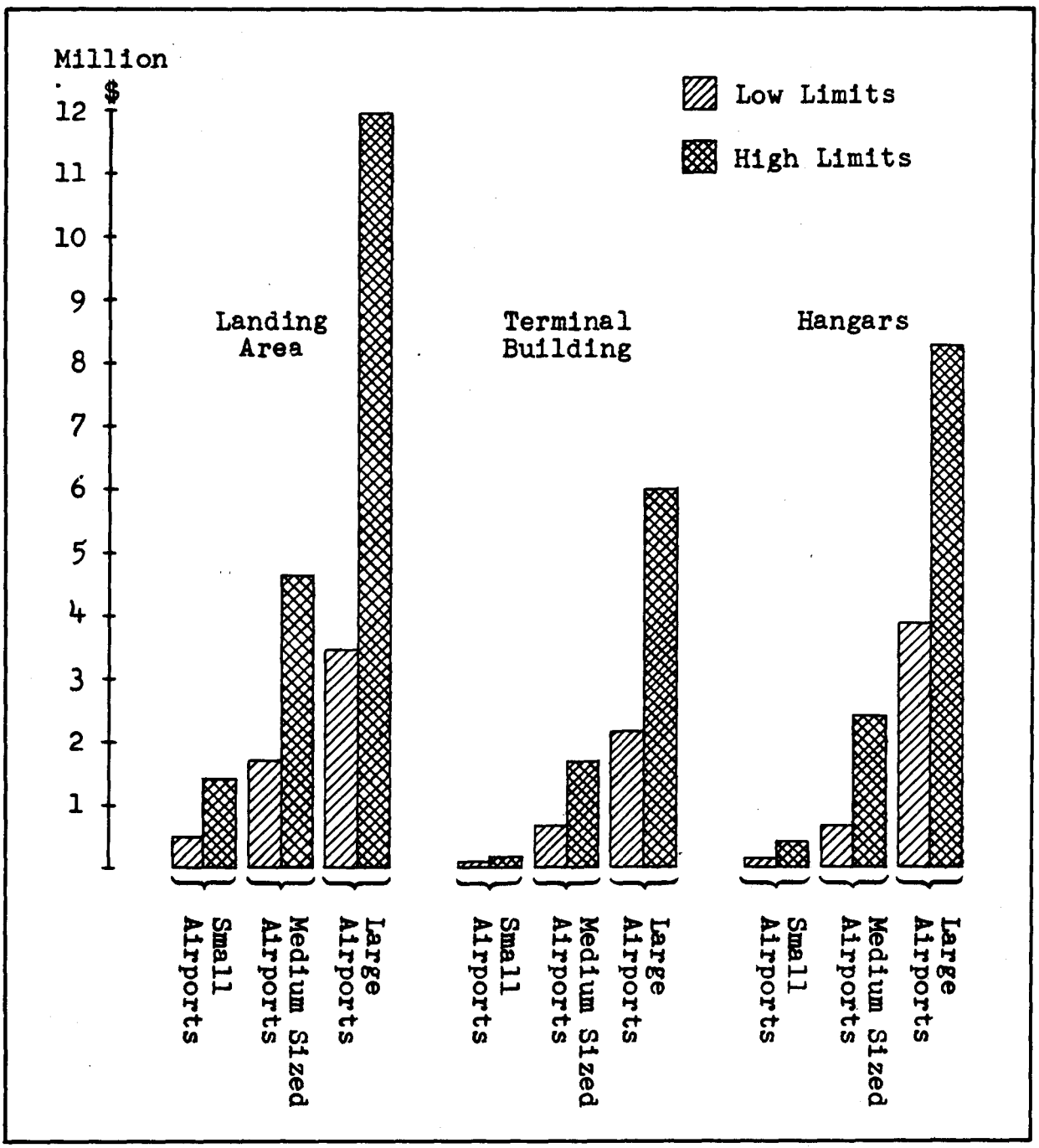
* Harvard study - Op. cit. pages 119 - 121.

Diagram II.- RANGE OF VARIATION IN UNITED STATES AIRPORT CAPITAL COSTS, OMITTING EXTREMES



those shown here since constructional costs, facilities provided and style of construction as well as wages and prices differ more from country to country than within the United States.

34. Operating and maintenance expenses also vary widely between different airports. The Harvard study quotes figures of from 1 to 28 cents per square foot per annum for hangar operation and maintenance at different airports; from 44 cents to $3.33 per square foot per annum for operation and maintenance of buildings; from 0.1 to 2.2 per cent of investment for operating and maintaining the landing area. Greater variation might be encountered at airports outside the United States. Many of the differences here are due to differences in accounting practice or in the scope of operations carried out by the airport, as distinct from those carried out by airlines or others, but such items as snow clearance and differing requirements for navigational aids and communications provide a real basis for differing operating and maintenance expenses.

The Effect of Operational Requirements on Airport Costs

35. The great variation in airport costs due to geographical and other reasons makes it extremely difficult to arrive at any assessment of the way in which these costs vary with operational requirements such as runway length and strength and the maximum number of landings possible per hour. These are, however, the fundamental measures of the capacity of an airport, corresponding to measures of output in other economic spheres, and their importance in connection with the economics of airports is too great to permit their being passed over without some discussion.

36. In the simplest possible case, where land around an airfield is flat and without serious variation in hardness or cost of acquisition and clearance, runway extensions may represent scarcely larger additional expenditure than a proportionate increase in the capital cost of paving. Similarly a difference in runway strength between two proposed airport plans may in the simplest possible cases represent a rather less than proportionate increase in paving cost per square yard. Total paving costs for a large airfield are generally less than half the total capital cost, so that a simple increase of say 20 per cent in runway length or strength would represent a less than 10 per cent increase in total capital investment in such cases.

37. The simple cases, however, are virtually never met with owing to variation in soil textures, gradients and drainage requirements, the proximity of hills, bodies of water or irremovable obstructions. It may be impossible to establish any general relationship between runway length and strength requirements and their capital or maintenance costs, that would be applicable on a world-wide basis.

38. The position with respect to capacity is somewhat similar. The capacity of an airport, in terms of the maximum number of landings that it can handle per hour, can be increased within limits by relatively inexpensive measures such as increasing the control staff or improving the air-ground communication facilities. Since overloading is generally met with first during instrument landing conditions, improved blind landing equipment may also increase the effective capacity of an airport. These increases in capacity will probably represent a less than proportionate increase in running expenses, and little or no increase in capital investment.

39. When such measures have been exhausted, further increases in capacity may be possible with new runways but these in general require big alterations in the design of the airport and frequently it is more satisfactory to build another airport. Where major increases in capacity are involved therefore, as in the case of increases in runway length and strength, the expense that may be incurred is not predictable on any general basis.

40. Certain generalizations can however be made concerning the costs of an airport in relation to the requirements laid upon it, and although these generalizations may seem somewhat obvious they are extremely important when considering the economics of airports.

a) Substantial increases in runway strength, length and landing capacity are always expensive whether the proposition is the alteration of an existing airport or the choice of plans for a new airport. The amount of the extra cost varies widely and is frequently so high as to determine within rigid limits the sort of airport that can be built in a given place.

b) Since the requirements laid upon airports have been steadily increasing, airports are normally constructed to deal with the greater requirements expected in the future and their costs are related to these expectations. Most airports are at present operating at considerably less than their full potential even at peak load times, and this situation is likely to continue for some time.

c) It is only in a somewhat special sense that it can be said that airport costs vary with the landing weight and take-off run of the aircraft that utilize it, or with the number of landings made. As between one airport and another, other things being equal, costs vary according to the maximum requirements for which they were built but these requirements may or may not be subsequently proved necessary. As between two periods at one airport, costs are more likely to reflect vagaries of the weather or changes in airport management policy, than variation in the weight, take-off run or landing frequency of aircraft using the airport. Only when one of the maximum requirements for which an airport was built is exceeded, do airport costs manifest their relation to these requirements and this occurs infrequently relative to the number of landings that do not exceed those requirements.* In the great majority of cases when an operator is negotiating with an airport for permission to use that airport as a landing place, the weight and take-off run of the aircraft in question and even the number of landings to be made per month, will have little if any effect on the airport's expenses.

d) On the other hand an airport operator is deeply concerned when a new aircraft type is adopted by the airlines if that type exceeds the maximum limits provided by his runways in strength or length. An authority responsible for a large number of airports of varying standards utilized by a wide variety of aircraft types will experience a fairly constant pressure for airport improvement expenditure that will be related in a general way to the rate of increase of the requirements of the aircraft utilizing his airports.

41. Virtually all governments appear to be largely responsible for capital expenditure with respect to the airports on their territory since if they do not own them, as in the United Kingdom, they provide substantial grants towards their construction or improvement as in the United States.** In

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* Many landings by aircraft that are near the weight limit may however cause higher maintenance costs on runways.

** The exceptions, which are important in other connections, are in those instances where airports have been constructed or are operated for military or commercial reasons by interests external to the country where they are situated.

their capacity as airport builders, therefore, governments have an interest in preventing any increase in the runway strength and length requirements of the aircraft operating in their territory.

42. Most governments however, have a counterbalancing interest in the development of their own airlines and so far as their domestic airways are concerned, these conflicting interests can be set against each other in various ways according to the national structure of airport finance and regulation. In countries where government owns both airlines and airports, the possibility of being forced to rebuild certain airports may influence the government against adopting a new aircraft type with more exacting requirements. In other countries the airport point of view may not be taken into account in airline decisions over new aircraft types, but the results to the various parties may ultimately affect the public purse or the public good in such a way as to produce something of a balance.

43. In the international sphere, the balance is not so satisfactory. Many governments are more affected by the cost of extensions to their international airports than by the benefits that might accrue to them from the use, by their own or other airlines, of heavier aircraft or of aircraft with longer take-off runs. Countries that provide more in the form of only partially paid-for airport facilities than they receive in the same form from other countries, stand to suffer greater loss if all airports have to be rebuilt or extended.

44. It is not possible with available data to say which countries might thus be logically against the general adoption of aircraft requiring longer and stronger runways. It would depend on the number and size of airports in each country, the number and size of their airlines operating overseas, their financial position and a number of other factors. It can however be stated generally that all airport owners as such, whether government, municipal or private are, on the average and in the long period, interested that aircraft requirements at airports shall rise as little as possible and shall rise only when real financial benefit accrues to the airlines. Moreover, insofar as aircraft requirements do rise, the airport owners will on the average and in the long period have higher expenditure to face.

45. Thus although there is little to justify the view that the cost of providing airport landing facilities is proportionate either to the number of landings made or the weight or take-off run requirements of the aircraft making such landings, nevertheless these factors are important.

factors from the point of view of the airport operator and affect his costs radically in the long run.

The Relation of Airport Costs to Airport Revenues

46. The revenues of most airports throughout the world appear to be less than their operating and maintenance expenses. In the United States a certain number of airports claim revenues exceeding their cash expenses, but they are in the minority. In Canada a government spokesman recently stated that at the 23 main airports of the Canadian domestic airways, total revenues were 33.2 per cent of total running costs, exclusive of any return on capital.*

47. The table in Appendix II shows the financial operating results of 30 United States airports as established or estimated in the Harvard study. The authors observe:**

> ".....among the 30 terminal-type studied 14 failed to meet their annual out-of-pocket operating costs. On the other hand revenues at 16 of the airports covered these annual expenditures and contributed something toward payment of depreciation, interest and in-lieu-of-taxes charge. With the full amount of these latter expenses included, however, it is doubtful if more than one airport in the group can be considered as showing a true "profit". (This one apparently profitable airport is scarcely comparable because of certain wartime activities.)"

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* Public hearing before the Air Transport Board, Ottawa, December 8th 1947.

** Op. cit.

48. Later the same authors suggest the following figures as being representative of expenses and revenues for a medium sized airport in the United States:

Representative Annual Expenses and Revenues for a Medium Sized Airport in the United States

Cash expenses	$ 89,000
Revenue	120,000
Cash balance	31,000
Interest and Depreciation	250,000
Net loss	$ 219,000

49. Figures such as these would be regarded as exceptionally good at many airports outside the United States where there is in general no positive "cash balance" to contribute anything towards capital charges. Dorval airport for example was recently operating at an estimated net loss of half a million dollars a year on running expenses alone, the figures being:

Dorval, Montreal	Year 1946/47*
Cash expenses	$ 893,000
Revenue	344,000
Cash loss	$ 549,000
Interest and depreciation (at 5%)	340,000
Total loss	$ 889,000

Variation in Airport Revenues

50. Landing charges at international airports vary widely, but total revenue from these charges often varies inversely with the amount of the charge since the higher charges are

*Statistics reported to ICAO by Canadian Government authorities.

mostly at the airports with lower traffic densities, and the differences between traffic densities is greater than between the charges. Landing fees at Shannon are, for example, about ten times what they are for similar aircraft at La Guardia, but since La Guardia has about 25 times as many landings per annum as Shannon, La Guardia's revenue from landing fees is about 2.5 times Shannon's.

51. The most variable factor in airport revenues is however provided by the concessions. At large airports the amount of concession revenue per passenger is often greater than at small airports. Since the number of passengers is also greater, large airports tend to have more than proportionately large concession revenues. It is by exploiting this side of their activities that some United States airports succeed in recording an operating profit. The Port of New York Authority proposes to make this operating profit on the New York airports great enough to pay a normal return on capital. Other large airports near big cities may be able to follow this example.

52. Many factors contribute to make concession revenues higher at large United States airports than elsewhere:

a) The United States has a network of airways with high traffic intensities so that the number of landings per airport is high. Many international airways have developed as long line routes rather than networks and these routes do not as yet have high traffic intensities;

b) Passengers on the United States airways are more prosperous and are accustomed to spending money on minor accessories more freely than in most countries;

c) There are more motor-cars per head in the United States than elsewhere so that the distance between airports and population centres raises less of an obstacle to visiting an airport. Many United States airports are popular places to visit for meals or interest; elsewhere there are too few people that can get out to the airport conveniently in their own cars to build up the same sort of patronage;

d) Many international airports outside the United States were built as refuelling stops and the choice of site was based on the geography of the route rather than on the proximity of large towns. Thus

airports such as Gander, Goose, Reykjavik, Shannon, Prestwick and many airports in the Mediterranean and Middle East areas have little hope of developing the local visitor trade that adds so much to revenues at United States airports near large cities.

53. These differences between the position of many United States airports and most airports on international routes outside the United States have been mentioned in detail because of the important part that concession revenues play in airport finance. If by any means this type of revenue could be built up at the airports that now make such heavy losses, those losses might be eliminated and landing charges might be lowered. It has been suggested that as the world economy returns to normal, conditions at the main airports of the world will improve and the energetic exploitation of concession possibilities should then yield better results. It is pointed out that the possibility of developing concession revenues to the extent where they pay the major part of an airport's expenses was only realized recently in the United States and success in this matter appears to depend as much on the management of the airport as on its geographical position. The management must not only be energetic and imaginative, but, above all, must be given effective freedom to experiment with new ideas. Airport managers throughout the world who have not been able to pursue this line of activity for the past ten years, will be quick to learn from their American colleagues, but it will require both restraint and administrative ingenuity on the part of governmental and municipal authorities responsible for airports, to ensure that managerial initiative is given proper freedom of action.

54. One of the difficulties of airport administration is that while on the one hand the enormous capital requirements for constructing an airport and for operating it in its early years make it almost impossible for private enterprise to attempt the task, on the other hand the management of the whole concession side of its activities is peculiarly suited to the qualities of private enterprise and peculiarly unsuited to those of public administration. The Post of New York Authority, which is now responsible for the New York airports, and the administration of the Washington national airport, seem to have found ways of overcoming this difficulty, but many municipal airport authorities in the United States have not been so successful and there is no doubt that the New York and Washington situations were to some extent specially favourable. It is probable that considerable study will be needed before this problem is solved generally throughout the world.

55. Those airports that act as refuelling stops and do not serve any large centre of population are unquestionably in specially unfavourable positions for the development of large concession revenues. It is possible that in some instances revenue might be obtained by exploiting or creating local attractions. It has been suggested that hunting facilities might be developed at remote airports such as Gander while facilities for flying and ground training might be located at or near some of the more accessible airports. In other cases a holiday resort might be developed in close association with an airport. Such schemes should be carefully studied but it is unlikely that they could be made effective for many years except in specially suitable places. It must probably be assumed that for the next ten years a number of international airports will have to rely almost entirely on landing charges for their revenues.

Future Trends in Landing Charge Revenues for International Airports

56. Apart from the possibility of altering landing charges, which will be discussed in the next chapter, future revenue from these charges at an international airport depends on the amount of traffic passing through that airport. Since most international airports charge more for larger aircraft, the steady increase in the size of aircraft operating on international routes must be taken into account as well as their frequency of landing. The extension of air routes into new areas does not directly increase traffic at existing airports and often involves building new ones or extending old ones, but as the world route pattern fills out, new services tend more and more to utilize existing airports and hence to increase the volume of traffic at each airport. Airports are still being built and extended to deal with the expansion of international air services, but the period of maximum expansion of this sort is probably past and future years should see a considerable consolidation of the existing pattern of greater frequencies and more services utilizing existing airports either along existing routes or across them.

57. It is not possible to predict the future trend of world air transport activity with any degree of certainty at the present time. The trend over the last two years seems to have been good. The best available estimates indicate that the total passenger traffic on all the scheduled air services of the world increased from about 9,000 million passenger miles in 1946 to about 11,300 million in 1947, an increase of 25 per cent. On most international routes

the increase was probably greater than this. The number of passengers on the trans-Atlantic air route to and from New York nearly doubled between 1946 and 1947, increasing from 105,000 to 194,000,* and traffic on other international services probably increased nearly as much. These increases between 1946 and 1947 cannot, however, be taken to represent a long period trend which might be repeated in 1948 and future years since they were at least partly the result of the increase in the number of transport aircraft available after wartime shortage and did not reflect a true increase in the demand for international travel.

58. Nevertheless the present trends in world statistics for the scheduled passenger services do not lend support to a pessimistic view of the future and international air cargo services show every sign of extremely rapid expansion. So long as stability and prosperity can be restored in Europe and the Far East there is every reason to expect that most international airports will experience steady increases in traffic frequencies over the coming years particularly if restrictions on international trade and travel can be progressively eliminated. Policy over air fares and freight rates on international routes and over international regulation of air services will also radically affect the volume of traffic. The enormous waste represented by large international airports used to only a fraction of their capacity is an argument in favour of reducing air tariffs and liberalizing regulations whenever possible.

59. Before 1939, statistics of world air transport showed a fairly steady upward trend that resulted in passenger-mileage totals doubling every two or three years. If this trend were to re-establish itself now, international airports might expect their traffic frequencies to increase also, not quite so fast, because some of that increase would represent services at new airports, but at a rate that would perhaps represent a doubling of frequency in four or five years. Such an increase in frequency without a decrease in fees would probably enable some of those international airports that charge landing fees in the higher ranges to become self-supporting with respect to operation and maintenance expenses if not with respect to interest and depreciation.

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* Analysis of trans-Atlantic Passenger Traffic; C. A. B. April, 1948.

60. The prospects for the future self-sufficiency of international airports is therefore not so gloomy as an examination of their present financial position would suggest. In the first place it should be possible to develop concession revenues in certain instances; in the second place the steady expansion of world air transport that may reasonably be expected may make a number of airports self-supporting on landing fees alone within a period of about five years.

61. This will, however, undoubtedly leave a number of international airports whose revenues will not cover their expenses and further study is needed to show:

a) Whether increases in airport charges should be made in these cases;

b) Whether commercial or other advantages accruing to the community in which such airports are situated are sufficient to offset the financial losses incurred by the operation;

c) Whether some form of joint international support should be organized for these airports and if so, how such support should be assessed.

CHAPTER III - AIRPORT CHARGES

Airport Charging Policy

62. In spite of the great variation of cost between different airports in different parts of the world, in spite of many basic differences in administration, ownership and financial management and in spite of the fact that in some countries airports and airlines are in effect but two different branches of government while in others one or both types of activity are privately carried on, there are nevertheless some broad principles in airport charging policy which if not universal are at least generally accepted in most countries.

63. It is generally agreed for example that except where airlines own and operate their own airports, airlines shall pay something for the landing facilities provided at an airport. Australian national airports used to provide an outstanding exception to this rule but recently a comprehensive system of charging both for airports and airway facilities has been adopted in Australia. The proposition that rents of hangars and office space in buildings let to airlines and government agencies should be based on cost (maintenance plus reasonable interest and depreciation allowances) is also widely accepted as a principle although frequently departed from in practice. It is universally agreed that restaurant and shop concessions should be charged rents on a normal commercial basis, that is to say as high as economically possible, and that any profits arising from the fact that such rents will normally be above the costs of providing the concession space will be counted into the total revenues of the airport.

64. In a sense it is nearly universally agreed that airlines shall pay landing charges "per landing", but this generalization requires considerable qualification. Airports in the United States (which cater for more air transport activities than all the rest of the world's airports combined) have a slightly different approach to landing charges. In the United States it is normal for airlines

to sign landing contracts with airports for fairly long periods and although the prices paid are based on the number of landings, it is the number scheduled, not the number carried out that is used. Airline payments to airports in the United States, for landing facilities, are more closely like rents than at other airports.

65. This different approach to landing charges may appear of no great importance, but in fact it has some important implications. United States airlines do not, for instance, normally pay for test flight landings, for practice and training landings or for extra service landings at airports where they have landing contracts. On the other hand, they do pay for landings that are scheduled but cancelled. Policy outside the United States with respect to these extra and cancelled landings varies but in general it appears that test flight landings are not counted while training landings are only carried out where special arrangements have been made for them. On the other hand, extra service landings and scheduled cancellations are generally taken into account.

66. There is fairly general agreement outside the United States that larger aircraft should pay higher landing charges per landing than smaller aircraft. Usually weight is taken as the criterion of size, and maximum gross take-off weight is the most popular measure of weight. In the United States it is not so generally agreed that landing charges should vary according to the size of aircraft but most airports charge private and small charter aircraft either nothing or less than the scheduled airliners, and some airports make a small excess-weight charge for aircraft above a certain maximum weight.

67. There is less agreement as to whether the landing charge should vary directly with the weight of the aircraft or should rise more slowly at the upper end of the scale. The Canadian government recently introduced a scale of landing charges that rose more steeply than the weight scale, justifying this arrangement on the ground that the potential earning capacity of an aircraft rises more steeply than its gross weight. A variety of other relationships between landing fee and weight have been adopted at various airports. The principles involved here will be discussed in a later section of this paper.

68. In the United States and in a few other countries it is customary to give a substantial discount on landing charges to airlines operating a large number of schedules. This practice probably reflects the stronger bargaining position of the larger airlines which has a chance to make

itself felt in the United States where such matters are left more freely to bargaining than in many other countries. It has been criticized as favouring the larger and scheduled operators as compared with the smaller and non-scheduled operator. Over the whole field it probably does so, although at any individual airport a small operator may carry out more landings per month than a large one and hence pay less per landing. On the other hand it is probably not true that such discounts for large numbers of landings provide a great encouragement to the development of air transport since landing charges are seldom a high enough proportion of airline expenses to affect expansion policies in this particular way. Many airline operators appear to feel very strongly that there should be a discount for large numbers of landings, no doubt looking to the future when the effect will be substantial.

69. Where national governments operate airports, as in the United Kingdom, the British Dominions and many other countries, it seems to be the general practice for airport charges to be standardized at all the national airports. Charges at municipal and private airports on the other hand are generally not standardized.

The Level of Landing Charges

70. In spite of these broad measures of agreement on some aspects of airport landing charge policy, there is wide disagreement on the whole question of the level of landing charges both absolutely and in relation to airport costs or airline revenues. A DC-4 airliner flying on a service from Washington to Bombay will have to pay $4 for landing at Boston, $80 at Gander, $12 at Rome and $56 at Athens.* Part of such variation might be accounted for by differences in airport costs, or in the traffic volume over which these costs can be spread, but much is also due to differences in the policy of the various airport authorities.

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* See Appendix I. These rates are calculated from published tariff schedules for 1947 and may be different for 1948 or for airlines with special contract arrangements at these airports. The range of variation is, however, unlikely to be substantially different from that shown.

71. The first basis of disagreement is as to whether airport revenues should cover interest and depreciation on capital. For other types of enterprise, including government and municipal enterprise, all authorities would agree that some allowance should be made to cover these overhead costs. The difference of opinion in the case of airports arises chiefly from three factors:

a) Airports are considered to have substantial public value to State and municipality for commercial, military and prestige reasons. It is felt therefore that some part of airport costs should be borne by the public. The amount or proportion of airport costs that should be paid out of the public purse is however difficult to decide. The proposal that the State should contribute all capital requirements seems to many a reasonable way out of the difficulty;

b) It is simple and convenient to be able to neglect the troublesome problems of assessing capital values and depreciation percentages in public enterprises;

c) Capital appropriations or grants for airports are politically fairly easy to obtain and are needed infrequently; operating deficits on the other hand come up each year and look bad in the annual reports;

d) Many authorities consider that airport revenues cannot in general be made to cover even operating and maintenance costs, and that the question of covering interest and depreciation as well is therefore largely academic.

72. The closest study of this problem to date has been made by the Harvard Business School, dealing with United States airports only.* The authors consider that an assessment of the military and public value of airports can be made and that after allowing for these factors, interest and depreciation charges can and should be covered when an airport has reached maturity. From that time on there should even be a surplus to pay back the deficits previously incurred.

* Harvard School of Business Administration - Op. cit.

73. Their proposal for setting landing charges is briefly:

a) Estimate landing area costs including interest, depreciation, taxes etc., for a future year when the airport can be considered mature, (i.e., when the airport is operating to capacity or when the industry as a whole has ceased to grow);

b) Deduct national contribution to airport finances. (Taken by the authors to be 50% of landing area investment. This is regarded as a national investment partly representing the military value of airport and airline development and partly aid to an infant industry, the latter part to be recoverable at some future unspecified date);

c) Estimate net revenues from concessions, private flying and all activities other than commercial air transport for that year and subtract these from net landing area costs;

d) Divide the remainder between the commercial air transport operators on the basis of the number of landings made, with a weight-scale and discounts for quantity if desired;

e) Put these charges in force immediately and keep them constant until the airport reaches maturity, deficits being accepted for the present by the municipality to be repaid when the airport makes a profit after the maturity point.

74. The authors consider that on this basis most United States airports might be made self-supporting (excluding the item of national aid) by 1954 with energetic development of concession revenues. Representative calculations of landing charges worked out on this basis give $1.25 per landing for medium sized airports, and slightly less for small airports. For large airports the authors calculate that concession revenues would on the same basis eliminate the need for a landing charge by 1954, but suggest that it should be set at the same level as at the medium airports for the present.

75. It is doubtful to what extent this calculation is applicable to airports outside the United States where traffic density and concession revenues are so much lower. The Harvard Business School study calculates what the break-even landing charge would be, without any net income from

concession, without a national contribution, with the airport operated at only half capacity, and with certain other modifications of a similar nature and reaches a required average landing charge of nearly $10 per landing. This landing charge is regarded by the authors as "unduly burdensome to the air carrier, and probably prohibitive", but it does not seem high when compared to the charges at many international airports. A DC-3 pays $45 per landing in the Dominican Republic, for instance, while a DC-6 pays $51 per landing at United Kingdom national airports and $113 at Gander.*

Limitations on the Level of Landing Charges

76. There are, however, limitations on airport landing charges that are likely in the future to prevent their being as high as those quoted. One limitation is provided by the fact that a commercial airline will not schedule a stop at an airport if the total cost of such a stop is greater than the additional revenue gained by the stop. Moreover, the landing charge is not the only cost to an airline of a landing; there is also the cost of the airline staff and offices kept at the airport, the extra fuel and time-loss due to descending, landing and ascending again, and the additional wear and tear on the aircraft.

77. The additional revenue gained by making a stop at an airport may be from passengers or freight loaded or unloaded that would not otherwise be carried (assuming that the space would otherwise go empty, which is not always true) or from the increased load on a long hop made possible by refuelling half-way (in this case assuming that the additional load is available). The additional revenues accruing in these ways from stops at the various international airports vary greatly. A stop at a large airport on a popular route may add as many as 20 passengers to an aircraft's load which at an average of $30 per fare will add $600 of revenue. On the other hand, many scheduled stops average one passenger or less loaded

* Published 1947 rates, subject to subsequent alteration.

per landing, and the revenue generated by these stops is not large.* The financial advantage of refuelling stops also varies. A stop at Gander to refuel on a flight from Montreal to Prestwick may make it possible for an airliner to carry five more passengers on the Atlantic route at over $300 each, but at many stops refuelling adds nothing to potential load capacity.

78. Where the revenue produced by making a landing is large, a second restriction on landing charges may come into effect in the possibility that if an airport's landing charges are too high, airlines will use another near-by airport to serve the same city or to perform the same refuelling, or will choose a different route entirely. Where this sort of competition from another airport near-by existed, municipalities have in the past sometimes charged exceptionally low landing fees in order to attract airlines to schedule a stop at their airports.

79. In general, moreover, governments wish to foster the development of their air transport industry and take steps to keep their own domestic airport charges low. Such steps generally involve providing additional financial assistance to the air transport industry in the form of grants to airports, but this is a form of assistance that is sometimes easier for a government to give than more direct subsidies to the airlines. The low airport charges adopted in one country for its own airlines become applied to visiting foreign airlines (by non-discrimination) and act to some extent as precedents and bargaining figures in neighbouring and other countries. Even in countries where both airlines and airports are government owned and operated, and where therefore airport charges are in the nature of inter-departmental payments, there may be advantages in keeping such charges at a low level in order to improve the financial position of the airlines.

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* The fact that the amount of traffic loaded and unloaded provides a potential limit of airport charges has a bearing on international air transport agreements. The extension of fifth-freedom rights might for instance so increase the loading and unloading at an airport as to enable landing charges to be substantially raised. Landing charges might thus become a method by which a country would recoup itself for the loss of its third and fourth-freedom traffic by agreement to another country.

80. These restrictions on the amount of landing charges operate somewhat unevenly according to the position of an airport in the route pattern, its proximity to large markets for air transport, its proximity to other airports that might compete with it, and the policy of its controlling authority. The resultant variation in the limits to which landing charges can be raised, combined with the wide variation in airport costs, in traffic frequency, and in the available revenues from concessions, makes it extremely unlikely that a standard level of landing charges throughout the world will prove acceptable unless these charges were of a purely nominal nature. This does not however exclude the possibility that a standard basis for calculating landing charges might be adopted, as discussed later in this paper.

International Treatment of Landing Charges

81. It has frequently been observed that the Convention provision, in Article 15, that airports shall not charge foreign airlines more than they charge their own national airlines under similar circumstances, would provide little protection to airlines landing in countries where the national government runs both airports and airlines, or where charges at home airports form a small proportion of the total expenses of the international airline, or in countries that have no international airlines. It may however not be the airlines but the airport authorities that will require protection, if the restrictions on airport charges discussed above are as potent in the future as they appear to have been in the past. At the present time airlines are using airport facilities throughout the world at considerably less than cost price while governments and municipalities accept substantial and regular losses on their airport accounts.

82. A variety of important factors offset these losses or render them more acceptable, but nevertheless some interesting international problems are raised:

a) Should a general international agreement be made to fix airport charges at levels that will not result in such large losses, the extra burden on the airlines being compensated by one of the many methods at the disposal of the governments concerned?

b) If such an agreement were sought what proportion of costs should be met, should concession revenues be taken into account and how much allowance should be made for the military, commercial and prestige values of airports?

c) In view of the fact that most countries' airport landing charges are set at low uneconomic levels, is there a justifiable complaint against a country whose airport landing charges are set at the level that would cover operation and maintenance costs, or alternatively at the level that would cover those costs and also depreciation and interest costs, even if these charges were substantially higher than those at similar airports in other countries?

d) If there is to be a general principle that certain landing charges might be regarded as excessive under certain circumstances, is this principle to be held with respect to the actual charges (which are what airlines are interested in) or to the relation of the charges to the individual airport costs or revenues, e.g. would it be a justification of a high charge to point to high costs of operation, maintenance or construction, or to low traffic volume or low concession revenue?

e) Should there be some planning of international airports with respect to the structure of international routes so as to avoid, where possible, the more destructive forms of competition and the more wasteful forms of duplication that are likely to appear as more airports are built?

83. As airports grow in size and number, these questions become more and more important. Fundamentally they are political questions, but their economic inplications are of considerable if not decisive influence. They cannot be settled without a study of airport economics and organization on a wider basis than has been possible so far.

Landing Charges Compared to Total Costs and Revenues of Airlines

84. No published statistics are at present available to show the relationship between landing charges and airline revenues or expenses. United States airlines do not publish figures of landing charges separately and little data on the subject is available from elsewhere. Since, however, discussions on the subject frequently raise the issue as to whether airlines would be able to pay higher landing charges, an attempt has been made to form estimates of the required figures for a few specific instances, basing these estimates on what statistics are available combined with landing charges published by the various airport authorities.

85. The table in Appendix I is compiled in this way. It shows the monthly landing charges that would be paid, according to the published scales, by a typical international service operated by DC-4's and Constellations from Washington to Bombay. The total expenses incurred on the same service can be estimated by working out the total ton-kilometres made available in the example quoted and applying to this figure an average total expense figure obtained from the published statistics of such an airline. The results are as follows:

	Figures for a typical trunk-line service
Total available ton-miles produced per month by the service	2,750,000 ton-miles
Estimated total airline expenses per ton-mile available	$0.87 per ton-mile
Hence total expenses of services per month	$2,400,000
Total landing charges per month	$ 26,765
Landing charges as per cent of total airline expenses for the route	1.1%

86. In the United States, where landing charges are considerably lower than those on this route, but where more landings are made per thousand miles of route, the Harvard study estimates that their proposed landing charge would represent 1.39% of gross airlines' revenues.

87. Another way of looking at the way in which landing charges fit into the total picture of airline finances is to study the total financial figures of airports and airlines in a particular country. Variation and deficiencies in the published accounts of airports and airlines make figures of this sort difficult to obtain and of doubtful comparability when obtained. The following table gives however a broad picture of airport and airline finances in the United States and Canada; there is considerable doubt whether the figures are comparable in each analysis, but their general relationship is probably fairly close to the truth.

Airport and Airline Finances in the United States and Canada

	United States (1946)	Canada (1945)
Total airport capital investment	$775,000,000 1/	$26,000,000 4/
Airport capital expenses	46,200,000 1/	1,300,000 5/
Airport operating expenses	11,800,000 1/	1,500,000 6/
Total expenses of airports	58,000,000 1/	2,800,000
Total ton-mileage done by scheduled services	792,000,000 2/	19,000,000 7/
Total expenses of airports per ton-mile done by scheduled services using them	7 cents	15 cents
Total airline capital assets	$580,000,000 3/	$18,000,000 8/
Total airline expenses	450,000,000 3/	17,000,000 7/
Total airline revenues	451,000,000 3/	17,000,000 7/
Total expenses of airports as per cent of total airline expenses	12.9%	16.4%
Total landing charges as per cent of total airline expenses	about 1%	about 1%

1/ Harvard Business School Study, page 168.

2/ CAB Report 1946.

3/ CAB Report and ICAO Statistical Reporting Forms.

4/ Canadian Yearbook 1946, page 700.

5/ 5% of the investment.

6/ A round-figure estimate for 1945, based on the 1946 figure of $1,600,000 from a statement made at the public hearing held at the Air Transport Board, Ottawa, 9 December 1947.

7/ Report Department of Trade and Commerce 1945.

8/ Estimated Report Department of Trade and Commerce 1946 and Statistical Reporting Forms ICAO.

88. In this analysis the statistics related to airlines include the international airlines in each case since this probably gives a more significant comparison than to omit them. The complete correction for overseas operations in such an analysis would involve estimating services rendered by the United States and Canadian airports to visiting airlines and by foreign airports to United States and Canadian airlines as well as the operating statistics of United States and Canadian airlines overseas and of foreign airlines in the United States and Canada. It is not possible at present to estimate these figures, but it is reasonable to suppose that the four errors offset each other at least to some extent.

89. The table shows some interesting points:

a) Airport costs in Canada are higher than in the United States when related to traffic volume or airline expenses. This may be partly a reflection of comparative weather conditions in the two countries, but is also related to the lower traffic intensities at Canadian airports than at United States airports;

b) The capital investment in airports is considerably greater than that in airline equipment in each country;

c) If there were no revenues from concession holders and government tenants, and airlines paid the whole expenses of the airports they use in the form of landing charges and rents for hangar and office space, their resultant contribution would represent an additional 10 or 15 per cent added to their total current expenses. Such additional payments would be large enough to eliminate any profits that are likely for some years, or to increase losses substantially.

90. Since airport landing charges, airline revenues and airline costs all vary widely, and not necessarily in the same direction on any particular service, there are many services throughout the world where landing charges form a very much bigger proportion of airline costs and revenues than 1 per cent. It was recently stated for example that landing fees on a certain London to Belfast service amounted to 16.7 per cent of total passenger revenue even with the aircraft full, while on the Cardiff-Weston-Super-Mare Services, landing fees were greater than maximum revenues for each flight.*

* Aeronautics December 1947, Page 39.

Similar conditions may well pertain in other routes where there are high landing charges and short stages between airports.

91. It may be concluded that although the landing charges paid by airlines form a small percentage of airline costs and revenues in countries such as the United States and Canada where such charges are generally low, and also in those international routes where aircraft are large and flights are long, elsewhere landing charges are often a more important item in airline budgets.

How Much Would Landing Charges Have to be Increased to Cover Airport Expenses?

92. It may be of value to consider briefly what sort of increases in landing charges would make airports self-supporting. We have insufficient figures to make this calculation on a statistical basis for international airports in general, and it would of course be different for each airport. It would also be dependent on the degree to which it was assumed that higher charges would reduce the volume of airline traffic.

93. We have, however, some figures on the total expenses and revenues of Canadian airports from a statement by Canadian government authorities, and these may throw some light on the matter. The following figures relate to the main airport used by the Canadian airlines:

	Total figures for chief Canadian airports 1946-47 *
Total airport landing fee revenues	$155,304
Other airport revenues	377,831
Total airport revenues	533,135
Total airport running expenses	$1,601,674

94. It would thus appear that Canadian airports would have had to increase their average landing fees charged in 1946-47 by about eight times to break even against running expenses, even if we assume that traffic volume would be unaffected. A further increase of about nine times (making

* From a statement made at the public hearing held at the Air Transport Board, Ottawa, December 9th, 1947.

a multiplier of 17 in all) would be needed to provide 5 per cent as interest and depreciation on the estimated capital investment in these airports ($26,000,000 in 1945), again assuming traffic volume unaffected.

95. The total landing fees collected by the Canadian airports in the year 1946-47 were about 0.75 per cent of total Canadian scheduled airline revenues, and they were the chief contributors. If they had been given the main burden of increases in landing charges aimed at making the airports self-supporting, as they would probably have had to be, they would thus have been required to contribute about 5 per cent of their revenues to make the airports self-supporting in current expenses, about 11 per cent to provide enough airport revenue to cover depreciation and interest charges, always assuming that these increased fees did not reduce traffic volume.

96. In the case of a governmentally owned airline utilizing governmentally supported airports, an increase in payments for airport charges might be regarded as largely a governmental matter. Private airlines, hard hit by such radically increased charges, would probably need government support to approximately the extent of the total additional expenses laid upon them. It might however be claimed that such a procedure would provide a more correct picture of the costs of air transport than the present method of charging the operators of aircraft less than cost price for the airport facilities supplied and making up the deficit by payments to the airports. While air transport pays less than the full cost of the airports it utilizes it is necessary to make allowances for this fact in a number of ways, including:

a) When comparing the real operating costs of flying boats with those of land aircraft;

b) When assessing the net value to the community of an air service in a new area where airports will have to be built or extended;

c) When comparing the total costs of long-hop with short-hop air services.

97. At most international airports outside North America, current airport charges are considerably higher than at Canadian airports and it would probably not be necessary to increase their charges by as much as eight times to make them self-supporting. Figures are lacking, but it is probable that in many instances international airports could cover their running expenses if they multiplied their landing

charges two or three times. On the other hand the fact that charges at these airports are already relatively high would mean that any increases would be all the more serious from the point of view of the airlines.

The Effect of Increased Landing Charges on Traffic Volume

98. It is difficult to estimate whether traffic volume on international routes would fall off if landing charges were increased enough to enable all airports to become self-supporting with respect to running expenses or with respect to both running expenses and capital charges. It would depend to a great extent on government and airline policy in the matter. If governments made additional payments to their airlines, in the form of mail payments or otherwise, to cover the additional landing charges, so that passenger and freight tariffs could be left unaltered, there would be no reason to expect any reduction in total passenger and freight coming forward to be carried. There would however be a strong incentive to airlines to over-fly intermediate airports and many airports would undoubtedly lose both revenue and service.

99. A compromise procedure that might achieve some of the advantages of "self-supporting" airports without the disadvantages of excessive landing charges would be:

a) Airlines to pay some agreed small charge for each landing for the facility provided, this charge to be graded according to size of aircraft and perhaps also according to the nature of the airport;

b) The difference between this charge and the charge necessary to make each airport self-supporting to be paid partly by the government of the airline and partly by the government of the airport, the proportions to be agreed beforehand.

100. This scheme would amount in effect to joint international support of internationally used airports, with each nation's contribution calculated on the utilization of the airport by its airlines. It could be extended to the support of emergency and little-used airports, (and also of air navigation facilities in some cases) by basing contributions on route utilization instead of airport utilization. It would remain for international action to determine:

a) What would be reasonable landing charges for airlines to pay in various circumstances;

b) An acceptable basis for airport cost;

c) What proportion of the cost of each airport should be borne by the community in which it is located;

d) What emergency and alternate airports are part of the ground facilities of each internationally used route.

Landing Charge Formulae

101. While airport facilities are being provided at as substantial a loss to the owners as they are in many countries, and while landing charges form as small a proportion of airline expenses and revenues as they appear to do for many airlines, it can reasonably be maintained that most of these charges are of the nature of "nominal" charges, and that the basis on which they are calculated is not of great importance.

102. This basis does, however, decide the distribution between the various users of airports of whatever total revenue is to be collected in this, and although charges paid by the users may be small compared to their aggregate expenses, the absolute amounts are substantial. Individual airlines and individual air services may be considerably affected by the method of distribution chosen.

103. As has been noted already, there is general agreement that payment for the use of the landing facilities of airports shall be based on the number of landings made, with certain qualifications of the rule in the case of United States airports where it is the number of landings scheduled that is counted and where there are big reductions in the rate for large numbers of schedules. There are however two main subsidiary ways in which airports collect revenues:

a) Fuel Taxes. Fuel taxes provide an attractively simple method of collecting revenue at airports. Applied over the whole of a self-contained airway system they distribute payments between aircraft operators fairly closely according to the amount each carrier uses the airways, although not according to each carrier's use of airports, since some carriers operate services with longer average stages than others,

and hence do fewer landings per mile flown or per gallon of fuel consumed; they provide a sort of "natural" basis for allocating charges between small and large aircraft; they solve the difficult problem of collecting charges from private owners; they stimulate engine designers to produce economical engines; they have precedents in the many instances where automobile fuel taxes have been utilized as a method of financing roads. At airports whose chief function is to provide a place where aircraft can refuel prior to a long flight, a fuel tax is a type of charge that varies fairly accurately with the value of each landing to the aircraft operator.

The airport fuel tax, however, produces extremely uneven results between airport and airport, particularly at airports where refuelling is not essential, and any operator who operates outside the system where the tax is in force can frequently evade payment by refuelling elsewhere. If the charge became substantial, there might be large-scale evasion by operators refuelling at private airfields since aviation gasoline is not sufficiently distinctive a product to be taxed at source.

b) To charge for each passenger or unit of cargo loaded at, unloaded at, or carried through an airport. A few airports at present favour charges of this nature, generally in addition to charges based on the number of landings. Such "traffic" charges have the advantage of distributing payments more closely according to the value of landings at "traffic-stop" airports.

An interesting extension of this principle consists of relating the landing charge directly to the "revenue generated" by the landing, that is to say to the total additional payments received by the aircraft operator as a result of making the landing. If the conception of "revenue generated" were to include some reasonable calculation of the "additional revenue made possible" by refuelling stops, this basis of charging might enable airport operators to collect substantially more revenues than they do at present, since it would adjust charges almost exactly to "value received". It would not be possible to adopt a standard percentage of revenue generated to be paid as a landing charge at all airports since this would give too high revenues to the major airports and too low revenues to the others but each airport

could work to a different percentage. The clerical procedures involved in this scheme are generally considered too laborious for adoption with respect to scheduled air services, but the scheme has been accepted in some localities for charging non-scheduled operators.

Weight-Scales and Other Bases for Charges per Landing

104. Most airport operators outside the United States relate their charges for the use of the airport to the weight of the aircraft, as well as to the number of landings made, by issuing a scale with different charges per landing for aircraft of different weights, covering private and charter aircraft as well as airliners. The weight chosen is generally the maximum gross take-off weight under standard conditions.

105. In the United States the general practice is to charge one fee per scheduled landing for all large air transport aircraft and either a different charge or no charge for private aircraft. As the new large aircraft are coming into general use on some of the United States lines, however, the practice of making an extra charge for excess weight over a specified limit is spreading.

106. It thus appears that the variation of landing charges according to an aircraft's weight is now widely accepted. Other bases that have been suggested as giving a variation closer to the value received or the costs incurred when different aircraft land at an airport, include the total horsepower of the engines, the span multiplied by the length, the take-off weight multiplied by the take-off run, and the payload capacity.

107. For most of the familiar types of air transport aircraft these alternative suggestions produce similar scales of landing fees since there is considerable correlation between such measurements. The take-off weight multiplied by the take-off run is however an attractive suggestion as a basis for landing charges since its adoption would induce care over increases in these two factors among designers and airline authorities without causing any serious restrictions of new designs that were efficient. At present there are the objections that the "take-off run" is not a recognized and established figure for many aircraft, (although it is likely to be in the future) and that airport charges are in any event too small a proportion of airline costs to affect the decisions of designers or airline authorities.

108. The "weight-scale" type of landing tariff is popular because it is simple in application and it is felt that the resulting payments by airlines to airports vary broadly according to both the "cost" and the "value" of the service supplied. As has already been emphasized, the conception of average "costs" for landings by different types of aircraft is not a clear one, but on the whole it is undoubtedly the larger aircraft that ultimately cause additional expenses to airport operators, and this provides some justification for exacting higher payments from the operators of those aircraft. More accurate relationships between "cost" and "payments" in landing charges can be obtained but only at the sacrifice of simplicity.

109. A completely uniform weight-scale tariff for all international airports would produce extremely inequitable results as between different airports, whose need for revenue from this source varies greatly, but many of the advantages of the system can be obtained by standardizing the system of "weight-scale" landing charges without standardizing the level of these charges. Thus all airports could use "weight-scale" tariffs but with different unit charges for a given weight so as to allow for variations between airports in traffic intensity, costs and concession revenues. There seems no reason why the actual scale of weights should not be standardized by international agreement in order to achieve the maximum simplicity. The actual level of charges to be paid at each airport might be guided by international agreement laying down maxima and minima for different types of airport in order to avoid undesirable competition and those extreme anomalies that tend to give rise to complaints.

The "Weight-Scale" Tariff and "Value" Received

110. The correlation between landing charges under a "weight-scale" tariff and the "value" of the service supplied is not so clear as may appear at first sight. It is true that large aircraft can earn more than small aircraft, and that in general they do so, but the relationship is not so obvious when we consider earnings per landing. Thus if we examine the "value" to the aircraft operators of a number of individual landings at a particular airport, we may or may not find a correlation between this "value" and the gross weight of the aircraft in question. The "value" of a landing to the aircraft operator is the additional revenue he receives as a result of the landing, which may be from additional loads on- or off-loaded or from additional loads

made possible by refuelling.* A large aircraft can earn more per landing than a small aircraft in both of these ways, but whether it does so or not depends partly on the position of the airport in the service pattern and partly on the chance variations of traffic from day to day.

111. If we examine the landing charge payments made by different airlines at a particular airport over a period of time, the day-to-day chance variations will even out, but service-pattern variations will remain and may in some cases have more effect than size of aircraft. Thus a large trans-Atlantic aircraft landing at an European airport towards the end of its route may consistently do less business at that airport than a relatively small aircraft of an European service. Similarly a Constellation on a service from London to New York will consistently derive less additional revenue from refuelling at Shannon than a DC-4 (of about half the gross weight) flying from Berlin to New York, since the benefit of a refuelling stop depends to some extent upon the length of the previous stage as well as on the fuel consumption of the aircraft.

112. It is only when we consider the total payments made by airlines to all the airports they use that we find a good correlation between payments on the "weight-scale" basis and "value" received per landing. In almost all cases, airlines using large aircraft receive a higher average revenue per landing than those using smaller aircraft. If all airports based their landing charges on the weight-scale plan, and if then we arranged all airlines in the order of the average landing charge paid by each one (which would be approximately in the order of the average weight of the aircraft used by each airline), we should find that this order would be almost the same as one obtained by arranging the airlines according to their average revenue per landing. The exceptions would be those airlines that utilize large aircraft on short-hop services or small aircraft on long-hop services, and since both of these arrangements are in general uneconomic, such exceptions would be few.

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* Strictly speaking there is the additional expense of making a landing to be subtracted from the additional revenue obtained. This expense is, however, a fairly constant figure and does not greatly affect the way in which "value" varies with size of aircraft.

113. The fact, however, that average length of hop as well as average size of aircraft affects an airline's earning power per landing means that the relationship between average aircraft weight and average earning power for different airlines is not a simple proportional one. Large aircraft are on the whole used for long-hop services, smaller aircraft for short-hop services, and hence the resultant relative earning power per landing of the airlines using the larger aircraft is more than in proportion to the weight of those aircraft. This can be illustrated by comparing the imaginary air service analysed in Appendix I, with a typical DC-3 service.

114. The service described in Appendix I utilised DC-4's and Constellations on a trans-Atlantic service executing 610 landings and accomplishing 2,750,000 revenue ton-miles in a month. If we assume for the sake of argument that the airline received an average revenue of $1 per ton-mile, this service would bring in about $4,500 per landing. A typical DC-3 service in Europe or elsewhere, averaging say 1.5 tons of payload per trip and with an average stage distance between stops of 300 miles, would receive $450 per landing at the same rate of $1 per ton-mile. Thus the DC-4 and Constellation service, with an average aircraft weight about three times the DC-3 service, would earn ten times the revenue of the DC-3 service per landing.*

Variations on the Straight "Weight-Scale" Landing Tariff

115. The fact that the difference between the earning power per landing of two airlines using different sized aircraft on different routes is in general much greater than the difference between the weight of the aircraft used, has led to the suggestion that landing charge "weight-scales" should have higher unit charges for a given weight at the upper end of the scale. Thus in Canada, the landing charges recently adopted for Dominion Government owned

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* Maximum loaded weights given in Jane's All The World's Aircraft, 1945/46: DC-4, 65,000 lbs; Constellation, 86,000 lbs; DC-3, 25,000 lbs.

airports, were based on the following rising scale:

Gross Weight of Aircraft	Charge
Up to 10,000 lbs.	10 cents per 1000 lbs.
10,001 lbs. to 25,000 lbs.	12.5 cents per 1000 lbs.
25,001 lbs. to 35,000 lbs.	15 cents per 1000 lbs.
35,001 lbs. to 45,000 lbs.	20 cents per 1000 lbs.
45,001 lbs. to 55,000 lbs.	25 cents per 1000 lbs.

[For each stop of 10,000 lbs., add 5 cents per 1000 lbs.]

116. This particular scale of charges would result in the DC-4 and Constellation service paying an average of about $25 per landing as compared with the DC-3 service which would pay $3 per landing. This would be closer to the relationship of the earnings per landing of the two services, but other services with different earnings per landing would be less well fitted. In particular, as was pointed out in the subsequent official hearing of complaints concerning this tariff system, a service using four-engined aircraft on the same route as one using twin-engined aircraft would have to pay excessive landing charges in relation to its competitor. No one scale of charges based on aircraft weights will fit the earnings per landing of all airlines perfectly.

117. Another method of charging the "long-hop" services higher landing charges in recognition of their greater earning capacity per landing, is shown in the new airport tariffs recently published for U.K. airports. These tariffs are based on a straight "weight-scale" but for large aircraft landing prior to trans-Atlantic flights, the charge-scale is increased 25 or 50 per cent according to whether the passenger capacity of the aircraft is under or over 40 persons. These adjustments seem small when compared with the adjustment of about 300 per cent that would be necessary to bring charges based on a straight "weight-scale" into line with the earnings per landing of four-engined and twin-engined aircraft in the illustration above. This, however, is merely because the adjustment factors used are relatively small. If stage-flight distances are taken fully into account in landing charges, as well as aircraft weights, the resultant charges can be made to correlate closely with the earning capacity of different airlines.

118. A fairly simple system of landing charges which would exact payments from airlines closely correlating with their earnings per landing would be one based on aircraft weight multiplied by the distance of the next stage-flight. Such a system would leave many anomalies between different air services at particular airports, and the unit charge would still have to be varied from airport to airport, but the two important factors of aircraft size and stage-flight would be given approximately their correct influence in the calculation. On this basis the DC-4 and Constellation service discussed above would pay landing charges averaging about ten times those paid by the DC-3 service.* Large aircraft and small aircraft on the same route would pay directly in proportion to their weights since the stage-flight distances would be the same for each. The value of refuelling stops would be approximately reflected in the landing charges levied.

119. It is a matter for the decision of the various authorities concerned whether the correlation of landing charges with "value" received is of sufficient importance to warrant complicating the relatively simple "weight-scale" tariff by taking account also of stage-flight distances, in some such manner as that described, or by the more complicated but still more accurate method of basing landing charges directly on the "revenue generated" by each landing. Apart from being generally regarded as equitable, charges based fairly closely on "value" received have the advantage of collecting revenue with the minimum distortion of the economic development of the airlines, and this may be of considerable importance where airport charges are relatively high.

120. When the main system of landing charges for scheduled aircraft at international airports has been decided, attention will still be needed to be given to a number of special problems:-

a) A policy has to be decided over charging for landings connected with extra flights, cancelled flights, test flights, training flights, training approaches (without landing) and emergency landings;

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* Assuming that the airports used by the two services were approximately similar in their economic situations. No charging system that takes into account the differences between the economic situations of airports can charge different airlines using different airports purely according to the earning capacity of those airlines.

b) Landings charges for charter, contract, private* and military aircraft, will require separate decisions;

c) The absolute amount of an airport charge may be the subject of complaint;

d) The question as to whether a rebate on landing charges should be given to those airlines making a large number of landings per month at an airport would still be a controversial one;

e) It appears generally acceptable that hangar charges should be based on the size of the aircraft (span times length) and should be set so as to cover the cost of providing the hangars. Parking charges, coming into effect only if an aircraft is parked longer than a day, can be an agreed fraction of hangar charges. Both these principles would, however, require some discussion;

f) Extra charges such as airport fuel taxes, service charges, charges for passengers loading or unloading etc., require discussion.

* With regard to private aircraft, a strong plea has been put forward by the International Aeronautical Federation (FAI) that within a more or less early period the landing fees for private aircraft should be generally abolished. The income accruing to airports from landing fees of visiting private aircraft is of minor size and the beneficial impetus to private flying by elimination of these landing fees may be considered to be disproportionately greater.

APPENDIX I

LANDING CHARGES IN RELATION TO TOTAL EXPENSES OF A TYPICAL INTERNATIONAL AIR SERVICE

This table works out the total amount of landing charges, as indicated by published tariffs, for a typical international air service and compares this total with estimated total expenses on such a service. The service taken as an example is supposed to have operated between Washington and Bombay with DC-4s and Constellations at the monthly frequencies indicated.

Monthly Landings and Landing Charges Paid

Airport	DC-4			Constellations		
	Charge per Landing $	Number of Landings Per Month	Total of Landing Charges $	Charge per Landing $	Number of Landings Per Month	Total of Landing Charges $
Washington	4 x	6	24	-	-	-
Philadelphia	4 x	3	12	-	-	-
Boston	4 x	17	68	-	-	-
Chicago	7 x	4	28	-	-	-
New York	7 x	26	182	7	22	154
Gander	80	44	3520	85	52	4420
Shannon	72	27	1944	85	44	3740
Paris	27	25	675	38	30	1140
Geneva	20 *	27	540	25	16	400
Rome	12	33	396	15	20	300
Athens	56 *	30	1680	66	10	660
Cairo	24	30	720	29	10	290
Azores	54 *	16	864	72	10	720
Lisbon	21 *	16	336	40	10	400
Madrid	36 *	14	504	66	8	528
Algiers	39 *	9	351	-	-	-
Tunis	40 *	9	360	-	-	-
Tripoli	40 x	9	360	-	-	-
Lydda	41	14	574	-	-	-
Dhahran	47 *	10	470	-	-	-
Karachi	45	5	225	-	-	-
Bombay	45	4	180	-	-	-
Total or average	37.07	378	14013	54.97	232	12752

x Estimated. * Average of night and day charge.

Total available ton-miles produced per month by the service 2,750,000 t-m
Estimated total airline expenses per ton-mile ..... $0.87 t-m
Hence total expenses of service per month $2,400,000
Total landing charges per month .....$ 26,765
Landing charges as percent of total airline expenses for the route 1.1%

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APPENDIX II

FINANCIAL OPERATING RESULTS FOR 21 U.S. AIRPORTS*
(in thousands of dollars)

(Years 1943, 1944 or 1945 as available)

Airport	Total Investment	Total Revenue	Running Expenses †	Balance		Amount needed to cover Interest and Depreciation at reasonable rates
				Operating Loss	Operating Profit	
A	(1416)	48	19	-	29	78.7
B	1895	33	44	11	-	107.2
C	535	9	12	3	-	30.4
D	1070	22	36	14	-	59.7
E	(3570)	8	13	5	-	195.5
F	2118	39	29	-	10	116
G	(4450)	136	164	28	-	243.9
H	(7006)	43	65	22	-	384.6
I	(3073)	171	139	-	32	168.8
J	3659	70	64	-	6	211
K	1967	55	17	-	38	109.4
L	3598	26	34	8	-	195.9
M	(4475)	91	69	-	22	242.3
N	4143	148	115	-	33	232.4
O	(6000)	104	88	-	16	328
P	4936	12	21	9	-	271.3
Q	9750	149	154	5	-	584.7
R	(37000)	769	199	-	570	1968.5
S	2272	315	174	-	141	135.8
T	6211	84	102	18	-	349.7
U	16417	516	515	-	1	969.3

* Harvard School of Business Administration. Op. cit.

† For purposes of comparison, pension expenses, taxes, insurance and control tower salaries were omitted.

Note:- Figures in brackets are estimates.