CONGESTION CHARGING

COMMISSION FOR AVIATION REGULATION (IRELAND)

February 2007

Discussion Paper

ORIGINAL

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1. INTRODUCTION

This paper describes how congestion charging might be applied at Dublin Airport. The focus is on congestion charging for particular airport facilities – not on congestion charges for any associated road or rail links or for parking.

1.1. Why congestion charging?

Congestion charging is an approach used to determine user charges for capacity constrained infrastructure. Much of the discussion on congestion charging has been on road pricing but it has also been discussed in the context of airport and other infrastructure facilities. The key argument is that, by making users pay a price in congested periods above that previously assessed by the Commission for Aviation Regulation (CAR) as recovering costs on average, it can:

- allocate scarce infrastructure to those users that value it the most;
- reduce congestion; and / or
- raise revenues (depending upon the impact of price upon demand).

In addition, congestion charging aligns costs and prices much more effectively. It therefore provides strong incentives to those who attach a lower value to peak access to move to an off-peak time or, at the limit, to stop their service. By better aligning costs and prices, ex ante assessment of proposed capital expenditures is much improved. This results in a lower capacity requirement over time and much more focused investment targeting.

1.2. What can we learn from it?

Airport infrastructure represents a large lumpy investment that frequently attracts considerable local opposition, so that any decision to expand capacity should be based on sound principles. Ideally one would observe the willingness to pay (WTP) for landing rights or terminal space in a competitive market and then apply a normal cost-benefit test to determine when to expand capacity. Most airports, and certainly Dublin Airport, are regulated at a level that recovers a fair rate of return on the (normally historic) written down value of the assets, which may be below the long-run marginal cost (LRMC) of providing more capacity. Airlines therefore do not directly reveal their full willingness to pay for landing rights or terminal space by their willingness to pay the regulated landing or passenger charges, making expansion decisions problematic.

Congestion charging can provide valuable information about how much consumers value their ability to use a piece of infrastructure and at what time of day/week/month/year. This also reveals its revenue potential and how that varies in each relevant period, which, in turn, provides a much more detailed and reliable guide to its investment worth. It also makes easier the use of scenario analysis to test the sensitivity of projects to variations in their key characteristics as well as in their timing. Ceteris paribus, as demand for a piece of infrastructure grows over time, the congestion will increase, which implies higher

charges and better returns from additional investment. Further, since the capacity of the infrastructure is fixed, by being able to assess the demand for infrastructure at different times it is possible to determine the peak demand that is driving the decision about capacity and ensure that those users determining the peak usage pay for that investment – this is standard in other regulated industries such as electricity and gas.

This approach can be used in two, not necessarily mutually exclusive, ways:

- to determine how a fixed revenue requirement is spread across consumers; and
- to determine the level of revenue required.

The former is the standard consideration within a regulated environment. The latter moves away from the idea of recovering all necessary revenue each year, or over a price control period, and allows the possibility of under-recovery in some price-control periods (those periods when excess capacity exists) and over-recovery in others (when congestion occurs).

1.3. What is our approach?

Congestion can occur in any part of the airport but the areas normally focused on are runways, passenger terminals and aircraft stands[1]. Our approach to estimating congestion charging at Dublin Airport is to examine terminal and runway infrastructure separately, which follows the methodology used by PwC[2]. It also reflects our focus on those parts of the airport for which prices are determined by CAR through the price review process instead of independently by Dublin Airport Authority.

Congestion in both the terminal and the runway can result in significant delays to passengers' journeys and increases in airlines' costs. Further, congestion in the terminal can lead to a lower quality environment for passengers, such as sharing personal space. In addition, runways and terminals have different characteristics in terms of safety, physical limits and incremental investment. Therefore, it seems sensible to analyse them separately.

If airports are congested at certain times of the day and less congested at other times, then efficient pricing suggests that they should be allowed (and encouraged) to set peak and off-peak prices, p and o, say. If the current number of movements in the peak is M and in the off-peak is N, and the current regulated landing charge is a uniform charge of c, then the new charges can be any values p, o, such that

$$Mp + No \leq (M + N)c.$$

This form of tariff basket regulation has various desirable properties (such as improved efficiency and greater cost reflectivity) but for current purposes gives a better indication

[1] Turvey 2000, Infrastructure access pricing and lumpy investment, *Utilities Policy*, p. 209.

[2] PwC (PricewaterhouseCoopers) 2000, *Study of certain aspects of Council Regulation 95/93 on common rules for the allocation of slots at Community airports*, prepared for the European Commission, May.

of WTP for peak or congested times. As demand increases, so the WTP will approach p, greater than the current regulated charge.

1.4. How is this paper structured?

In the sections that follow we set out:

- how congestion charges might work for Dublin Airport's runway (section 2);
- what congestion charges might be for Dublin Airport's terminal (section 3); and
- lessons and implications for the regulation of Dublin Airport (Section 4).

To illustrate the methodology developed for determining congestion charges some initial data is employed. The results presented in this report are illustrative and should not be interpreted as a final recommendation. Rather, if CAR wishes to utilise a congestion charge then further work on appropriate values for the assumptions is needed – especially in relation to the costs of the terminal and runway and assumptions underlying the values. These revised assumptions can then be used with the models developed in this report to establish a congestion charge. However, the approach illustrated is a robust approach that can be utilised.

2. RUNWAY INFORMATION

Dublin Airport has three runways, which together allow up to 48 aircraft movements per hour[3]. However, demand for the runways is beginning to exceed their capacity during peak times of the day. Data from the Airport Coordination Limited indicate runway capacity is currently constrained approximately 2 per cent of the time[4]. Further, Dublin Airport predicts that demand for the runways will increase from approximately 187,000 movements in 2005 (or 18.4 million passengers) to 285,000 movements in 2025 (or 39 million passengers). A new parallel runway is planned for around 2012 that will support a 50 per cent increase in the amount of potential passengers at Dublin airport, from 20 million to 30 million[5].

This section investigates what congestion charging says about the potential value of the existing runways in terms of users willingness to pay for the facilities, which provides one guide about whether investing in another runway is worthwhile.

In theory, airports seem to be well suited to auctioning landing slots, subject to a regulatory requirement to expand capacity when WTP exceeds LRMC to avoid the abuse of a dominant position. The slot value would represent how much airlines would be willing to pay to avoid delays at peak times, with congestion charging providing a mechanism for the airport to capture some of this surplus or reallocate costs between different consumers.

Unfortunately, there are also a number of major problems with auctioning runway slots. For instance, auctioning runway capacity may also require associated auctions of stand and terminal capacity. In addition, auctions involving airlines with complex route networks imply bids for bundles of slots – combinatorial auctions – rather than individual slots. Such auctions are difficult to design and hold so that most discussion of slot auctions has been for *new* airports/runways rather than for existing runways. There is also the vexed question of who actually owns the slots – airport, airlines or government. Finally, at present explicit auctions are not countenanced under various international treaty agreements, and so this direct route to establishing WTP is not available.

In practice, slots are allocated administratively across the world using a grandfathering principle, so that an airline holding a slot in one year automatically gets the right to use or exchange it the following year, which clearly gives an advantage to an incumbent airline. Nevertheless, for some airports there is a secondary market in slots that gives some indication of their scarcity value, which are called 'grey' markets between airlines. These

[3] Dublin Airport 2006, *CIP 2006 – draft*. Note, two of the runways are used for only a small proportion of the time and are the original runways.

[4] Airport Coordination Limited 2006, 'Reports and statistics, Dublin Airport, DUBS06 Start of season, http://80.168.119.219/UserFiles/File/DUB%20S06%20start%20of%20season%20report.pdf (accessed 7 November 2006)

5 Dublin Airport 2006, 'Parallel Runway', http://www.dublinairport.com/about-us/airport-development/Parallel_Runway.html (accessed 7 November 2006) and Dublin Airport 2005, 'Major expansion plans' http://www.dublinairport.com/images/issue_one_your_airports.pdf (accessed 7 November 2006).

so called 'grey' markets allow slots at times of low demand to be exchanged for those at times when demand is high for payment. If airline B currently pays a regulated price *p* for a landing slot and airline A is willing to pay *b* to transfer that slot from B, then A must value the slot at at least *p+b*. If slot trading is sufficiently liquid and there are sufficient willing airlines bidding for slots then one could reasonably confidently infer that the WTP for a slot were equal to *p+b*.

Assuming that slots are not traded at Dublin, then the best one may be able to do is to find values from as many comparable airports as possible, to check that they appear to be giving similar numbers (or at least to estimate confidence intervals for any such estimates). To do that, one needs to know *both* the current regulated charges *and* the slot trading value. These values will clearly depend on the options they provide – so that slots at a major hub which provide access to a large number of destinations are more valuable than slots at an isolated airport in the same country serving few destinations. Similarly, for non-interconnecting airlines (i.e. airlines specialising in simple journeys from origin to a single destination), the value will depend on the range of alternative airports comparably accessible to potential passengers.

Luton in England is a plausible substitute for Stansted, (as is Heathrow), and the value of slots at Luton will depend on charges (and availability) of slots at these other airports. These factors might allow a more accurate estimate of the value of a slot at a particular airport, but as Dublin probably experiences less competition from other airports than most of those for which slot data are available, one may be reassured that other slot pricing data provides a lower bound.

2.1.1. Slot values

As discussed above, one measure of how much airlines would be willing to pay to land at Dublin Airport is the values paid for slots at other airports (in addition to landing charges associated with those slots). However, these secondary markets have only limited flexibility and transparency since trading relies upon bilateral co-ordination while disclosure about prices and volumes depends upon the airlines' discretion. The information we have been able to find is presented in annex 1.

2.1.2. Slot value range

The tables presented in annex 1 show a range of values for runway slots at airports that have excess demand for aircraft movements throughout the day, from €1 million for a slot pair to €10 million. However, given the anecdotal nature of the evidence and the difference in airports, an appropriate range would focus on the lower values although the appropriate lower bound seems to be €2 million for a slot pair since the €1 million seems to be an outlier.

2.2. Inferring a congestion charge for Dublin's Airport's runway

The data presented above and in annex 1 can be used to infer a congestion charge for Dublin Airport, given the assumptions described below.

2.2.1. Assumptions needed

To infer a congestion charge for Dublin Airport from the slot value data of the US and UK, it is necessary to make assumptions about the following:

- The comparability of slot value at Dublin with US high density airports and London Heathrow;
- The extent to which slot demand exceeds capacity at Dublin; and
- The number of slot pairs available at Dublin.

We have assumed that runway slots at Dublin airport during peak periods have broadly the same value as slots at airports that experience excess demand throughout the day. The similar mix of business amongst airports and even shared end consumers, passengers travelling between Dublin and Heathrow or New York, makes slot values comparable. To be conservative, we have chosen the most recent data available from the US high density airports, which implies a slot pair is worth €2 million. The reason for this choice is that US airports seem to be more similar to Dublin than to London Heathrow. In particular, flights to and from Dublin and the US airports have a significant proportion of intra-continental or short-haul flights whereas many airlines use London Heathrow for their transatlantic flights.

As previously mentioned, data about runway capacity and aircraft movement requests from the Airport Coordination Limited (ACL 2006) indicate that demand exceeded runway availability approximately 2 per cent of the time in the summer of 2006. Again, this represents a conservative figure since predictions indicate that this percentage will only increase over time.

To calculate the number of slot pairs available at Dublin Airport, we have assumed that a slot pair allows an aircraft to take off and land 52 times a year or once a week. We have also assumed that the airport operates 17 hours a day and 48 aircraft movements are possible per hour. This gives a total of 2860 daily slots available at Dublin Airport each year (that are then 'grandfathered' between years).

2.2.2. Implied value for the congestion charge

Using the information from the available slot trades to illustrate how a congestion charge would be calculated, it is possible to determine the following:[6]

- a lower bound for the net present value of a congestion charge of €115 million; and
- a charge per passenger of at least:
    - €9.5 for passengers on larger planes; or
    - €16 for passengers on smaller planes.

[6] The detail underlying this calculation is provided in annex 1.

2.2.3. Implication of value

The value of this congestion charge provides limited support for additional runway construction but perhaps more support for peak/off-peak pricing at Dublin Airport. If this were introduced, it would postpone the date at which any new runway were needed and provide a much stronger basis for an economic appraisal of new runway capacity.

A congestion charge provides information about the net present value of potential revenues from the existing runway infrastructure that can be compared to its costs. However, it can also be used partially to infer the potential value of additional investments. Our calculations offer only limited support for the construction of a new parallel runway since they suggest that the net present value of congestion charging revenues from the existing infrastructure is less than the net present value of constructing the new runway, which is approximately €146 million[7].

However, as discussed above, a net present value of €115 million represents a conservative estimate of the congestion charge, which is likely to increase in the future. And there is more support for building the additional runway if the revenues from the congestion charge are combined with those that already exist in a form of peak/off-peak pricing. The existing charges are based on aircraft weight and are at least €230 per aircraft or about €1.5 per passenger[8], which could generate a revenue stream that is approximately the cost of building the runway as long as it results in at least 50,000 extra aircraft movements.

2.3. Summary

It is possible to infer a congestion charge for Dublin's runways using slot value data from other airports. A conservative estimate offers only limited support for the construction of a new parallel runway, since its value is less than the construction costs, although this may change in the future. To determine whether support for a new runway actually existed there would be a need to also consider the value of the existing runways and what recovery from other users is taking place. However, this analysis does support:

- time of day peak/off-peak pricing in conjunction with the seasonal pricing that already exists to recover the costs of the existing runway; and
- a possibility of recovering additional revenue reflecting "excess" value placed on the runway owing to the congested nature which might then make the development of new runway facilities worthwhile immediately..

The latter point does depend, however, on being able to assign a credible value for the existing slot values and, although possible, this is not straightforward.

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[7] If a nominal cost €150 million is credible (see Airline Industry Information 2006, 'Planning approval granted for new Dublin Airport runway', http://findarticles.com/p/articles/mi_m0CWU/is_2006_April_14/ai_n16124941 [accessed 7 November 2006]), the runway is built over two years and the weighted cost of capital is 7.4 per cent.

[8] Assuming an Airbus A320 maximum take-off weight of 77,000 kilos, or 77 tonnes, and winter pricing of €3 per tonne.

3. TERMINAL INFORMATION

Dublin Airport currently has one terminal with a capacity to process between 18 and 22 million passengers per annum[9] - although this will increase as the development of Area 14, Pier D and the new integrated immigration area proceed. In 2006, this terminal will accommodate approximately 21 million passengers, and some studies have suggested that its capacity is already exceeded by the volume of passengers passing through it, especially at peak times of the day[10]. Dublin Airport is planning to build a second terminal for 2009 that will have capacity for an additional 15 million passengers.

3.1. Forms of congestion

Terminal capacity, measured by the time and quality needed for passengers to transit the lounge and board the aircraft, is difficult to value in the absence of a market for a guaranteed transit time. If passengers could pay for an assured or fast-track passage through the airport (i.e. specified in terms of the check-in time needed before the scheduled departure) one would be able to infer the value of increasing such capacity. Some airlines offer such services, but they are usually bundled with a higher class of seat.

The congestion in the terminal of Dublin Airport increases the time spent by passengers passing through it as well as reducing the quality of the time they spend there — not only are these passengers in the terminal for a longer period relative to other airports but they dislike the time spent there more. Data from ACL (2006) show that terminal capacity is exceeded by passenger volume 14 per cent of the time and departures suffer more from congestion than arrivals. The areas of the terminal that are particularly affected include: security, departures concourse, gate lounges and immigration[11]. This congestion has resulted in the lowest service level standards possible for some areas, as measured by IATA in terms of the average floor space per passenger, which is 'F' and equates to system breakdown or congestion. The proposed investment in a second terminal is anticipated to increase average service levels from C-D to B-C.

Estimates of the costs associated with the delay and quality aspects of congestion in the terminal are provided in annex 2.

3.2. Implied value for the congestion

The two sets of data in Annex 2 which estimate the delay and quality costs imply that congestion charges for terminal space could raise additional annual nominal revenues of congestion charge of €78-86 million with a net present value of €1060-1160 million. On a per passenger basis, this implies a charge of €3 off-peak and €10.7-14 peak.

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[9] Commission for Aviation Regulation 2004, *Dublin Airport Capacity Study*, Draft Report, Alan Stratford and Associates. Note, over 21 million passengers used Dublin Airport in 2006.

[10] Commission for Aviation Regulation 2004, *Dublin Airport Capacity Study*, Draft Report, Alan Stratford and Associates and Dublin Airport 2006, *CIP 2006 — Draft* and Dublin Airport 2004, *Aer Ranta Review of Capacity Statement Study Final Report.*

[11] Dublin Airport 2006, *CIP 2006 — Draft* and Dublin Airport 2004, *Aer Ranta Review of Capacity Statement Study Final Report.*

Table 3.1: Congestion charges for Dublin Airport's terminal

	Peak passengers (2 million)	**Off-peak passengers (18 million)**	**All passengers**
Passenger charges			
Time delay	€7.7-11	€0	-
Reduced quality	€3	€3	-
Total	€10.7-14	€3	-
Annual charge			
Time delay	€18 m - €26 m	€0	€18 m - €26 m
Reduced quality	€6 m	€54 m	€60 m
Total	€24 m - €32 m	€54 m	€78 m - €86 m
Net present value			
Time delay	€250 m - €350 m	€0	€250 m - €350 m
Reduced quality	€81 m	€730 m	€810 m
Total	€330 m - €430 m	€730 m	€1060 m - €1160 m

3.3. Implication of value

The NPV of the congestion charge, of €1060 million should then be compared to the capital and operating costs of the new terminal to determine whether building the new terminal is cost effective. The net present value of the capital costs is €640 million (assuming the time profile in CIP 2006, a WACC of 7.4 per cent and a nominal cost of €750 million but excluding any ATC tower associated capital costs). Further work on operating costs is needed, especially as uncertainty exists since it is Government policy to competitively tender the operation of the terminal. However, it is quite possible that they would have an NPV in excess of €400m – annual operating costs in excess of €40m per annum over 20 years yields an NPV in excess of €400m and the life of the terminal is much more than this. As such, the existing assumptions would suggest that the case for terminal 2 is unproven from the congestion charging evaluation (a wider assessment is provided in the separate report on Cost Benefit Analysis prepared by CEPA for the Commission).

Congestion charging could also enhance passengers' experiences of Dublin Airport at peak times, by moving relatively price sensitive passengers travelling at those times to off-peak periods, which may be a small number of relevant leisure travellers.

3.4. Summary

It is possible to infer a congestion charge for Dublin's terminal space using data about cost differentials between budget and standard terminal facilities at the same location and making assumptions about the value of delays to business travellers. It offers some support for the construction of a second terminal at Dublin airport, because the value of the congestion charges is greater than the construction costs.

4. CONCLUSION

This section concludes the previous discussion by summarising what congestion charging implies for Dublin Airport and what a congestion charge might look like.

4.1. What can we learn from congestion charging?

Applying the principle of congestion charging to Dublin Airport facilities may provides tentative support for the construction of a second terminal (but which requires further work on the underlying value assumptions and the operating costs of the terminal) but offers only limited support for building a parallel runway (although this may change in the future).

In addition to raising revenues for proposed investments, congestion charges could enhance passengers' experiences at Dublin Airport by reducing its congestion. The values presented here are averages rather than marginal amounts so it is possible that they could have a significant impact upon congestion, particularly as congestion appears to exhibit a cliff effect once it occurs. Further, the stark differences between peak and off-peak prices could shift passengers from the former to the latter. However, it is unclear how effective this would be in practice, e.g. because of problems of changing route network schedules, business passenger preferences, etc.

4.2. What might a congestion charge look like?

Congestion charging at Dublin Airport could raise annual revenues up to €87 million. The net present value of these charges is between €1.1 billion and €2.1 billion, which translate to passenger charges of €3 for off-peak travellers and €20.2-€93 for peak travellers.

Table 4.1: Congestion charges for Dublin Airport

	Peak passengers (2 million)	**Off-peak passengers (18 million)**	**All passengers (20 million)**
Passenger charges			
Runway	€9.5 - €79	€0	
Terminal			
Time delay	€7.7-11	€0	-
Reduced quality	€3	€3	-
Total	**€20.2 - €93**	**€3**	-
Annual charge			
Runway	€150,000 - €750,000	0	€150,000 - €750,000
Terminal			
Time delay	€18 m - €26 m	€0	€18 m - €26 m
Reduced quality	€6 m	€54 m	€60 m
Total	**€24 m - €33 m**	**€54 m**	**€78 m - €87 m**
Net present value			
Runway	€54 m - €1 bn	€0	€54 m - €1 bn
Terminal			
Time delay	€250 m - €350 m		€250 m - €350 m
Reduced quality	€81 m	€730 m	€810 m
Total	**€385 m - €1.4 bn**	**€730 m**	**€1.1 bn - €2.1 bn**

ANNEX 1: RUNWAY CONGESTION CALCULATIONS

A1.1 Available data on slots

Data about slot values are limited to a few airports that have excess demand throughout the day: London Heathrow and the four high density Airports in the US (O'Hare, Reagan Washington National, John F. Kennedy's International and La Guardia).

Table A1.1: US runway slot values

			Value in 2005	
Airport	**Year**	**US$ (m)**	**US$ (m)**	**€ (m)**
4 High Density[a]	1990	0.9	1.3	1.0
O'Hare[b]	1994	2.0	2.6	2.0
4 High density[a]	1996	2.0	2.5	2.0

[a] Secretary's Task Force on Competition in the US Domestic Airline Industry 1990, 'Airports, Air Traffic Control and Related Concerns'. [b] Secretary's Task Force on Competition in the US Domestic Airline Industry, Airports, Air Traffic Control, and Related Concerns, 1990. b National Transportation Library 1994, 'Airport competition: essential air service slots at O'Hare International Airport – GAO/RECD-94-118FS' http://ntl.bts.gov/DOCS/rc94118f.html (accessed 7 November 2006).

These American data from are relatively dated. However, the data in table A1.2 below indicate that the data in table A1.1 represent conservative estimates of slot values in the US, given that slot values in the UK have appreciated dramatically over time.

Table A1.2: London Heathrow runway slot values

		Value in 2005	
Year	**£ (m)**	**£ (m)**	**€ (m)**
1995[a]	2.0	2.6	3.8
2001[b]	3.0	3.4	4.9
2002[c]	4.3	4.8	6.9
2003[d]	4.4	4.7	6.9
2003[e]	6.0	6.5	9.4
2004[f]	10.0	10.5	15.3
2005[g]	6.7	7.0	10.2

[a] Slots sold by KLM to BA, http://www.iea.org.uk/record.jsp?type=news&ID=130, [b] Virgin Alantic's offer to American Airline, http://www.findarticles.com/p/articles/mi_m0EIN/is_2001_Dec_21/ai_81023543, [c] 7 daily slot pairs sold by SN Brussels to British Airwaus valued at £30m, http://www.luchtzak.be/article4711.html, [d] 8 daily slot pairs sold by Swiss to BA for £35m, http://www.guardian.co.uk/ba/story/0,,1127473,00.html, [e] 2 daily slots sold to BA by United Airlines, http://www.nera.com/MediaCoverage.asp?pr_ID=2041, [f] 2 daily slots http://www.guardian.co.uk/ba/story/0,,1127473,00.html, [g] 6 daily slot pairs sold by FlyBe and Air France to Qantas and Virgin Alantic for £40m.

A1.2 Data caveats

These data are largely anecdotal - they are either based on commentators' estimates or common knowledge in the industry rather than taken from annual reports. In addition, they are effectively the values of (monetised) barter trades between airlines that have a traditional right to slots rather than slot sales which transfer legal as well as customary ownership. Nevertheless, they do provide a useful indication of the potential value of runway slots at Dublin.

A1.3 Calculating a congestion charge

The assumptions and calculations above imply a possible congestion charge with a net present value of €115 million for Dublin Airport's runways. This is set out in table A1.3 below. However, this figure represents a lower bound and the congestion charge could be as large as €1 billion in the future if congestion doubles to 4 per cent and the pair slot value at Dublin Airport becomes closer to that at Heathrow at €10 million.

Table A1.3: Net present value of congestion charge for runways at Dublin Airport

Inputs / output	**Data**
Value of slot pair	€2 million
Slot pair quantity (number)	2,860
Slots pair congested	2 per cent
Net present value	**€114.4 million**

The calculations in table A1.4 suggest that a net present value of €2 million for an airport slot pair translates to a passenger charge of **€9.5** or **€16**, depending on the size of the aircraft. A weighted average cost of capital of 7.4 per cent is used to convert the net present value of the slot pair (€2 million) to an annual amount (€148,000), which is the cost of capital figure used by CAR in its existing determination for Dublin Airport. The slot pair is assumed to be used every week of the year, which yields a charge per aircraft using Dublin of approximately €3000. Further, the cost is assumed to be shared amongst departing passengers, where the aircraft's capacity ranges from 180 to 300. The equivalent passenger charges implied by an overall congestion charge with a net present value of €1 billion are between €47 and €80.

Table A1.4: Passenger charges using runways at Dublin Airport during congested periods

Inputs / output	**Data**
Value of slot pair	€2 million
WACC	7.4 per cent
Annual frequency of use	52
Passengers in aircraft	300 / 180
Passenger charge	**9.5 / 16**

ANNEX 2: TERMINAL CONGESTION CALCULATIONS

Delay

The congestion in the Dublin airport means that passengers have to spend extra time going through pre-flight checks and processes.

Available data

The delay data focuses on departures since this seems to be the main source of delays and gives us a conservative estimate of the impact of all delays (because arrivals are also affected at baggage reclaim and immigration). Data from ACL indicates that there are 2 one hour periods that are congested each day, which tend to be linked to business travel peaks, and which affects at least 6,500 passengers (twice the hourly airport capacity of 3,250 for departures).

A survey in 2003 of passenger flows found that it took passengers two hours to be processed at Dublin Airport, which suggests that passengers had to allow an extra hour for the congestion[12]. The real value of business passengers' time is conservatively assumed to be €11 per hour, given that the average wage in Ireland is between €10.76 and €19.86 per hour according to GoI statistics[13]. An alternative scenario is that these passengers are leisure travellers for whom the real value of time is €7.7 per hour.

There are other potential sources of data too, which could also be used as alternatives. For example, airport car parks differ in their convenience in terms of distance to the departure lounge, and one could possibly infer WTP to save time from car park differential charges. Similarly taxi charges rather than public transport fares give another indication of the value of time wasted before departure, but one that is harder to use (being route specific).

Air travel competes primarily with rail travel on various European routes, where it is clear that there is a high value of time saved, indicated by the success of TGVs from Paris to Lyon and similar routes. Passengers are interested in the total time from leaving the office or home to arrival at the other end, and waiting in airport lounges is time wasted that might have been spent on a comfortable train.

Data caveats

These data are approximate and drawn from a variety of sources and so should only be taken as a guide as to the potential congestion charge at Dublin Airport because of time delays. Further, the assumption is that only customers during the peak hour suffer from delay, this may not be an appropriate assumption.

[12] TNS MRBI 2003, *Dublin Airport Passenger Flow Survey*.

[13] This is a post-tax figure. New data from the GoI, used for cost benefit analysis, suggests that a pre-tax business hour is worth €20 and leisure time at 40% of that, so these data represent conservative estimates again. The basis for these values and a wider discussion of the role of the value of time is provided in the CEPA paper for CAR on congestion charging: *Cost Benefit Analysis of Terminal 2 and Runway 2*.

Assumptions needed

To infer the value of delays to passengers at Dublin Airport, the following assumptions are needed:

- Customers take an extra hour to get through the terminal at peak periods; and
- The value of their time is €11 or €7.7 per hour

The value of the delay to passengers using Dublin Airport at congested periods is the opportunity cost of their time, which is €11 or €7.7. This translates to an annual figure of €18 million or €26 million if 6,500 passengers are affected each day for every day of the year.

Table A2.1: Annual congestion charge for departure delays at Dublin Airport's terminal

Passenger type	**Inputs / Output**	**Data**
Business	Value of time	€11
	Passengers affected each day	6,500
	Days affected in year	365
	Annual congestion charge	**€26 million**
Leisure	Value of time	€7.7
	Passengers affected each day	6,500
	Days affected in year	365
	Annual congestion charge	**€18 million**

This can be converted into a net present value amount of €250 million or €350 million by using a WACC of 7.4 per cent, as shown in table A2.2 below.

Table A2.2: Net present value for departure delays at Dublin Airport's terminal

Passenger type	Inputs / Output	Data
Business	Annual congestion charge	€26 million
	WACC	7.4 per cent
	NPV of congestion charge	**€350 million**
Leisure	Annual congestion charge	€18 million
	WACC	7.4 per cent
	NPV of congestion charge	**€250 million**

Quality of experience

The limited personal space in the terminal created by the congestion will reduce the quality of the passenger experience because it means that passengers are likely to find passing through the airport more stressful, which will also make them less inclined to engage in activities that they might enjoy at the airport such as shopping.

Available data

Unfortunately, there is no reliable direct data about what passengers would be willing to pay to reduce the congestion at Dublin Airport – a survey undertaken by the airport operator suggested consumers are willing to pay between €1 and €3 extra but this was not linked to specific improvements or a rigorous set of costed alternatives. Nevertheless, data does exist about passengers willingness to pay for a higher quality airport experience in terms of the cost differential that exists between standard and budget terminal facilities in the same location. These data are summarised in below.

Table A2.3: Terminal quality cost difference

	Passenger chargers/ Airport tax			
Terminal	**High cost**	**Low cost**	**Difference**	**Euro**
Singapore S$	15	7	8	4
Malaysia RM	45	35	10	2
Marseille Euro[a]	8.25	5.90	2.35	2.35

[a] These data account for differences in charges in relation to security, landing and terminal navigation rather than just the airport tax.

Alternative sources of data include the cost of business lounges. From this cost, it is possible to infer an upper limit for the price that travellers are willing to pay to avoid congestion, given that airport lounges contains more facilities than extra space. At Dublin Airport, some passengers are willing to pay €20 to use the business lounge for 3 hours, which equates to €6.67 per hour[14].

[14] Dublin Airport 2006, 'At the Airport: Lounges', http://www.dublinairport.com/at-airport/lounges/ (accessed 28 December 2006).

Data caveats

These data relate to passenger charges set by government authorities rather than those determined in the market place and so may not be a completely accurate guide to willingness to pay. Nevertheless, they do provide us with a useful indication.

Assumptions needed

To infer the value to passengers of avoiding the congestion at Dublin Airport, the following assumptions are key:

- One IATA service level difference at Dublin Airport is equivalent to the quality difference between budget and standard facilities at the same location i.e. the loss of travellators, escalators and aerobridges; and
- The value of this difference is €3 per hour

Range of values for quality of experience

One indication of value to passengers of the quality of their airport experience is the mid-point of the cost difference between budget and standard terminal facilities, which is approximately €3. However, this value could also be as high as €4 or as low as €2. The value of €3 translates to a nominal annual amount of €60 million if 20 million airport passengers are assumed, as shown in table A2.4. This is arguably a conservative estimate because it assumes no growth in passenger numbers.

Table A2.4: Annual congestion charge for reduced quality at Dublin Airport's terminal

Inputs / output	**Data**
Value of quality difference	€3
Number of passengers affected	20 million
Annual congestion charge	**€60 million**

Table A2.5 converts this nominal annual figure into a net present value of €810 million by assuming a WACC of 7.4 per cent.

Table A2.5: Net present value for reduced quality at Dublin Airport's terminal

Inputs / output	**Data**
Annual congestion charge	€60 million
WACC	7.4 per cent
NPV of congestion charge	**€810 million**