The Cost of Delay

The cost of delay is frequently used in the cost benefit analysis of air traffic management projects which are expected to increase capacity and, as a consequence, reduce the levels of delay in the system.

The Westminster Report

The most comprehensive report on the cost of delays in the air traffic management system is the University of Westminster Report[1]. The Report approaches delay costs from two angles. Much of the Report is given to a detailed assessment of the delay costs for 12 specific aircraft types which, together, carry out about 42% of the flying time in Europe but, as a relatively brief supplement, the Report also derives an estimate of the total delay costs for Europe and calculates an average delay cost per minute.

The Report presents a very large number of permutations of delay cost depending on:

- the length of the delay
- where the delay is incurred, eg in the air, either en-route or holding, or on the ground, either at the gate or on the taxi-way
- whether only the initial delay is considered or whether the cost of reactionary knock-on effects is included.

The Report also considers what it calls *tactical delay*, ie actual observed delays and *strategic delay*, ie the buffer built into schedules to allow for an anticipated level of delay.

It should also be noted that the first edition of the Report was produced in early 2003 and it is largely based upon the levels of cost and exchange rates prevailing in 2002.

The €72 value

Despite the large number of permutations of delay considered, one specific value (€72 per minute) was presented as a typical average value. However, this value is only valid for specific circumstances, since it is a tactical ground cost, with the network effect (ie including reactionary costs) and also includes the opportunity cost to an airline of lost passengers.

The composition of the value is as follows:

Delay costs per minute (€)	
Fuel costs	0
Maintenance costs	1
Crew costs	10
Airport charges	0
Aircraft ownership costs (DRL)	-
Passenger compensation	24
Direct cost to an airline	36
Passenger opportunity cost	36
Overall cost	72

[Note: "-" indicates the item is not relevant, whilst "0" means that the cost is less than €½ per minute. The total does not add precisely due to rounding.]

The direct cost to an airline represents actual monetary payments. The passenger opportunity cost represents the loss of potential future earnings *for a single airline* but, when considering the cost of

[1] Evaluating the True Cost to Airlines of One Minute of Airborne or Ground Delay, University of Westminster, May 2004, www.eurocontrol.int/prc/gallery/content/public/Docs/cost_of_delay.pdf

delays for the whole fleet, the loss to one airline would, to a large extent, be a gain to others. However, the opportunity cost may be considered to be a valuation of the cost of delay to passengers.

The value of passenger time

Although the Westminster Report does not address the value of passenger time directly, the passenger opportunity costs represent an estimate of the value which an airline places on the time of its passengers and is the amount an airline would have to spend in order not to lose passengers.

The Report confirms the finding of a previous study[2], which indicated that the cost of delays for passengers is in the region of €46 to €60 per minute of delay and is thus of the same order of magnitude as the direct airline costs.

The passenger value of time may therefore be considered to be implicitly included in the €72 value and should therefore not be added on top of it. If one is only interested in the direct airline costs, a value of €36 would be more appropriate. However, this is based on cost data which is nearly four years old.

Updated values

Authors of cost benefit analyses will find the Westminster Report a valuable source of information for assessing delay costs but must choose the appropriate delay category for their particular study and should also update the cost values to allow for changes since 2002.

Because the Westminster Report presents the results of a complex and highly detailed study, as guidance, the following table presents some typical values which have been revised to late 2006 price levels. However, users must still ensure that the values are appropriate to the circumstances in which they are to be used.

Delay costs per minute (€)						
	Tactical without network effect		Tactical with network effect		Strategic	
	Ground	Airborne	Ground	Airborne	Ground	Airborne
Fuel costs	1	15	1	15	1	15
Maintenance costs	1	1	1	1	-	12
Crew costs	9	9	11	11	12	12
Ground and passenger handling	-	-	-	-	-	-
Airport charges	0	-0	0	0	-	-
Aircraft ownership costs (DRL)	-	-	-	-	10	10
Passenger compensation	14	14	26	26	-	-
Direct cost to an airline	25	40	39	54	22	49
Passenger opportunity cost	22	22	39	39	-	-
Overall cost	47	62	78	93	22	49

In the table:

- tactical delays are actual incurred delays
- strategic delays represent the buffer built into schedules in anticipation of delays
- the network effect is the effect of consequential delay caused either to the aircraft incurring the initial delay or to other aircraft
- ground delays are assumed to be incurred at the gate
- airborne delays are assumed to be incurred whilst holding
- a fuel cost of US$2.16 per US gallon has been used
- an exchange rate of €1 = US$1.27 has been used
- "-" indicates the item is not relevant whilst "0" means that the cost is less than €½ per minute
- column totals may not add precisely due to rounding.

[2] Costs of Air Transport Delay in Europe, Institut du Transport Aérien, November 2000 www.eurocontrol.int/prc/gallery/content/public/Docs/stu2.pdf

The Westminster Report does not determine a passenger opportunity cost for strategic delay as this delay is not visible to the passengers. However, the buffers do represent a disincentive to business or a cost of lost time to the passengers. The value of this is likely to be similar to, but possibly lower than the equivalent passenger opportunity cost for tactical delay.

This cost update does not include any specific assessment of the impact of the new European Commission regulation on the compensation of passengers in the case of air transport delays.

A delay model is available to enable users to make their own delay cost estimates.