



**Review of Dublin Airport Authority
Capital Expenditure Programme
(CIP 04)**

For

**The Commission for Aviation
Regulation**

**Response to Issues raised in
Public Consultation Process**

(RR&V Reports 1, 2 & 3)

16th July 2007

[Redacted Version]

rogersonreddan
project, construction and cost managers



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Appendix A – [.....]

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Note: Reductions from original report indicated thus [.....]

Note: This document has been prepared by Rogerson Reddan & Associates Ltd, in conjunction with Vector Management Ltd., (RR&V), in accordance with the terms of RR&V's appointment to the Commission for Aviation Regulation. This document is prepared for the sole use and reliance of the Commission for Aviation Regulation. RR&V accepts no liability for any use of this document other than by its Client, and only for the purposes for which it was prepared.

Job Nr.	Rev	Status	Date Issued	Drafted	Team Leader	Changes since previous revision	Issued to
0651	1	Initial Issue	16 th July 2007	JH/PW	JH	None	CAR

1. Introduction / Basis of Report:

In May 2007, Rogerson Reddan & Associates, in conjunction with Vector Management Ltd. (RR&V) issued four reports on separate aspects of the Dublin Airport Authority (DAA) Capital Investment Programme 2006 – 2009 (the CIP), for the Commission for Aviation Regulation (CAR) in the context of the Commission’s Interim Review of the determination of airport charges at Dublin Airport.

These RR&V reports were published by the Commission as part of the Commission’s public consultation process. Comments were received by the Commission from various parties on various aspects of the Commission’s Draft Determination. This report deals specifically with comments from the DAA and Ryanair, on various aspects of the first three RR&V reports, as follows:

- RR&V Report 1 – Review of DAA Cost Benchmarks, 10th May 2007
- RR&V Report 2 – Review of Terminal 2 Non Construction Costs, 10th May 2007
- RR&V Report 3 – Review of DAA Capital Investment Programme, 10th May 2007

This report specifically responds to comments made in the following documents:

- DAA document entitled “Response to RRV Review of DAA Capital Expenditure Report 1 – Review of DAA Benchmarks” dated June 2007.
- DAA document entitled “Response to RRV Review of DAA Capital Expenditure Report 2 – Review of T2 Non Construction Costs.
- DAA document entitled “Response to Rogerson Reddan Report 3 – Review of DAA Capital Investment Programme (CIP-04)” dated June 2007.
- Ryanair document entitled “Ryanair Response to Draft Decision on the Interim Review of 2005 Determination on Maximum Levels of Airport Charges at Dublin Airport. Comments on Commission for Aviation Regulation Paper 5/2007”

Issues arising in relation to RR&V report 4 will be dealt with separately.

This report is subdivided into three sections, corresponding with each of the three reports. Each section is further subdivided as follows:

- An initial section responding specifically to those queries raised by the Commission in their letter dated 29th June 2007.
- A Further section dealing with other issues raised in the DAA and Ryanair documents, which RR&V believe require a response.

2. RR&V Report 1 – Review of DAA Cost Benchmarks:

2.1 RR&V Response to Queries raised by CAR

DAA Comment regarding inclusion of Contingency Provision in Benchmark Cost Comparisons

The DAA response disagrees with RR&V's argument that the stated costs for T2 and Pier E as used for comparison with the relevant benchmark projects should include their relevant proportion of the overall project contingency as estimated by the DAA's consultants. RR&V have considered the arguments put forward by the DAA in this regard, but remain of the view that for proper comparison with historic benchmark costs, the estimated project costs should **include** the appropriate proportion of any contingency sum allocated to that project. In this regard we would note:

- The DAA benchmarking report did not specify the status of contingency in terms of the benchmark figures quoted. However, this point was clarified during the consultation with DAA & their consultants. It was specifically confirmed that *"the quoted benchmark costs are inclusive of contingency (where appropriate)"*.
- When comparing the out-turn cost for any project, it is normal and reasonable to expect that out-turn cost to include the final cost of completing the facility. By definition, to the extent that issues which might originally have been the subject of a contingency allowance have occurred during the course of the project, the costs associated with these issues will be included in the out-turn costs. It is therefore reasonable that any proposed project should, when compared to historic benchmarks, include the estimated contingency expenditure identified against that project.
- The DAA note that the T2 and Pier E construction cost plan figures (used by the DAA for benchmark comparisons) include 5% "contingency on construction costs to cover design development", and argue that this is the only element of contingency which should be considered for comparison with benchmark projects. In our view, a project's out-turn cost will include costs incurred in relation to risks other than "design development". In the case of T2, specifically, the DAA argue elsewhere in their response to the Draft Determination that the

full extent of the overall project contingency remains “the best estimate of a prudent and appropriate provision for project contingency”. This would suggest that the DAA expect the out-turn cost for this project to require the expenditure of a level of contingency broadly consistent with that included in the overall Cost Plan. Therefore we do not see the logic for then omitting this component of the estimated project costs from benchmark comparisons.

- The DAA response introduces the concept that the €74m contingency included within the €609m T2 & Pier E Cost Plan is in fact significantly “**Programme Contingency**” dealing significantly with “**non-terminal related risks**”. However the DAA do not provide any definition of this classification of risk. In this regard, our interpretation remains that the contingency is substantially “**project**” contingency dealing with project specific risks. The contingency is clearly referred to as “project contingency” within the DAA’s consultant’s cost plan. We have reviewed the individual risks noted on the risk register provided by the DAA, and are satisfied that the significant majority of risks included therein could only be classified as project specific risks, as opposed to wider “programme” or “non terminal” risks.
- The DAA state, in the context of the inclusion of contingency in the benchmark comparisons that “**none of the costs used for comparison would include any expenditure on the items identified**”. The DAA do not present any evidence in support of this statement. While we do not have access to the source data involved, it seems to us to be highly unusual, that benchmark out-turn costs would not include the relevant expenditure on such items as “uncertain ground conditions”, compliance with planning conditions, and other items normally covered by contingency provisions.

Based on all of the above, we remain of the view that the costs quoted for T2 and Pier E, should, for comparison with historic benchmarks, include the full extent of the approved contingency provision for these projects.

Ryanair Comments on Choice of Benchmarks:

Page 7, paragraph 4, of the Ryanair response states: *“Ryanair is particularly concerned that RR&Vhave based their consideration of costs on the DAA’s own benchmarking reports, which were in turn based on reports for BAA dated 2003. Many of the projects within this benchmarking exercise were the DAA’s own projects,”*. We would clarify as follows in relation to this statement:

- RR&V’s consideration of costs was not based solely on the DAA cost benchmarking reports. RR&V reviewed all cost information provided by the DAA, (which in relation to some projects was significantly more detailed than benchmarks). RR&V’s analysis and comments on costs are based on specific relevant experience of comparable works, within the RR&V team.
- Some (but not all) of the projects referenced in the DAA benchmark report were based on information sourced from a previous report for BAA, prepared (in part) by Turner & Townsend, who act as Programme Managers on behalf of the DAA.
- Of the 27 projects from which benchmark information was used in the DAA benchmark report (excluding car park), only 5 projects are DAA own projects.

Page 7, paragraph 4 of the Ryanair report states: *“RR&V report No. 1 notes in the Executive Summary notes that anomalies came to light at a late stage in the process and that some of the lower cost facilities were excluded from the Benchmarking”*. It should be noted that the anomaly referred to was in relation to the information provided by DAA in support of the cost benchmarks for terminals (more fully described in section 2.2 of this report). It had been hoped that the DAA response would clarify and resolve this anomaly. However, as noted below, the DAA appear to have partly misunderstood this section of the report and their response does not assist in clarifying the position.

Page 8 of the Ryanair response states: *“the costs proposed by RR&V appear extraordinarily high”*. Separately, page 8, paragraph 4 states *“.....is 46% less than RR&V’s suggested benchmark costs”*. We would clarify that no costs were “proposed by”, or “suggested by” RR&V. RR&V’s brief was to review the costs and benchmarks proposed by the DAA, and this review of costs is set out in our reports 1, 2 & 3.

2.2 RR&V Response to other issues noted in DAA response:

Benchmark Rates for Terminal Buildings.

Section 3 of the DAA report states that RR&V analysis of terminal benchmarks produced a mean benchmark rate of €3,546/sqM (11% lower than the DAA report), by **“including Southampton, Luton, and omitting [Heathrow] T4.”** This DAA statement is incorrect. The document provided by DAA on 26th April 2007 (in response to our queries requesting supporting information) included benchmark costs for twelve projects, including those noted above. The mean benchmark rate for all twelve project is noted on the DAA document as Stg £2,414. When updated for inflation and currency exchange rate (using the DAA methodology) the benchmark rate is €3,546. However, significantly, this includes all twelve projects. RR&V did not at any point in our report include an interpretation of what a benchmark rate would be using the selection of projects noted by the DAA response quoted above, (which would have resulted in a benchmark rate of €3,351), as we do not see any logic for such a comparison.

RR&V's report notes that the DAA in compiling their original benchmark report appeared to have omitted Luton and Southampton from the original list of 12 projects, for reasons of differing complexity. RR&V's report notes that if this is the case, then our view would be that Heathrow T4 should also be omitted. We remain of the view that this would be a valid adjustment. In this case the mean benchmark rate, (excluding all three projects), would be €3,607/sqM some 9% less than the DAA quoted benchmark rate of €4,018/sqM.

The DAA response noted that in their opinion Heathrow T4 (whose benchmark costs are some 61% above the average of all twelve projects in the DAA source document) is “not fundamentally different to the T2 building”. We believe that the T4 project is fundamentally different in a number of respects, including:

- Heathrow T4 unlike DAA's T2 (Processor with separate Pier) was conceived as, and is an integrated Terminal complete with loading bridges, landside and airside infrastructure.

- BA's decision to occupy T4 as a long haul Terminal was taken very late in the construction process, and involved a high level of varied work, with consequent cost implications.

It is therefore considered that reliance on T4 benchmark costs will require detailed examination of BA's records before its inclusion could be considered appropriate. We are satisfied that we are justified in our view as expressed in our original report, that if less complex projects such as Luton and Southampton are to be excluded from the analysis, then this significantly more complex project outside the normal distribution should also be excluded. It is unfortunate that the DAA's incorrect interpretation of this aspect of our report may cause unnecessary confusion in relation to the core issue.

3. RR&V Report 2 – Review of T2 Non-Construction Costs:

3.1 Response to Queries raised by CAR

DAA Comments in relation to RR&V review of Contingency Provision

The DAA's response makes several wide-ranging comments on this issue. For clarity, the main points are isolated and responded to individually hereunder.

“RR&V are not Risk Analysis Experts”: This statement is included in the RR&V report specifically in the context of a commentary on the risk modelling methodology used by the DAA's team. The DAA have, in their response taken the initial qualification that “RR&V are not Risk Analysis Experts”, and have quoted it out of context, in an attempt to discount our other comments on the general level of contingency provision included in relation to this project.

DAA Risk Analysis Methodology: The DAA note that they have used “best in class” methodologies in quantifying the contingency provision. RR&V does not dispute this. Indeed the RR&V commentary notes that the process used by the DAA is a suitable and appropriate method of risk modelling, but notes that, notwithstanding this, an independent review may be helpful in terms of reviewing how the process was used to generate the out-turn estimated contingency provision. We stand by these comments. The essential point is that the methodology used may indeed be “best in class”, but if the assumptions, estimated costs, and estimated probabilities used as inputs to the calculation are inappropriate, then the output in terms of the estimated contingency allowance may also be inappropriate. We therefore remain of the view that an independent review (including re-examining the inputs to the process) may be an appropriate, and indeed the only credible means of verifying the exercise undertaken by the DAA.

RR&V Views on appropriate level of Contingency: The DAA point to the fact that the RR&V report did not put forward a view of the appropriate level of contingency allowance for a project such as this. This was not done, as our principal recommendation in this regard was that an independent risk review may be appropriate. We remain of this view, but in response to the DAA's comments, we would note that in our experience for projects of this type and scale, the typical level of overall

project contingency (including “design development” allowance) would be in the region of 15% during the early design stages reducing down to approximately 10% for construction. Given that the T2 project is at planning application stage, we would expect the overall contingency provision to be comfortably within this range, at this stage.

“Design Development” versus “Construction Contingency”: We note, and accept the DAA’s point that the items noted in the DAA cost plan as “construction contingency” are in fact “design development contingency allowances”, and that as such these allowances would not cover risks such as uncertain ground conditions. However, we remain of the view that all such items, including “design development contingency” should be considered as part of the overall project contingency, which in this case equates to in excess of 20% of estimated construction costs, being higher than would be expected.

Risk of Legislation Change: Our report noted this as an item on the DAA risk register where in our view, the probability of the risk occurring was low. The DAA disagree with this assessment and note that recent security protocol changes have resulted in a likely increase in spatial requirements. We note this point, but would also point out that the DAA risk register includes seven separate risks relating to changes in security requirements, and a separate risk relating to building regulations, (in addition to the noted legislative change item). Therefore, excluding security related issues, and building regulations issues (identified separately), the scope for other legislative change to have a significant impact on the costs of this project is in our view, low.

Risk of Construction Inflation & CPI Differential: The DAA note that this risk relates to “Hyperinflation” and they reference the recent increases in steelwork costs as an example of this. It is a fact that steel prices experienced particularly high inflation during 2004, which peaked with an annual steel price increase of 56% for the 12 month period to December 2004. However this relates to steel raw material costs only, and it is significant and relevant that during this period of peak steel price inflation, all-in construction costs increased by only 7% per annum. We do not therefore regard this as hyperinflation, and we regard the risk of hyperinflation in the current construction market as remote.

Corbalis House: RR&V noted that The DAA risk register included a risk relating to the cost of “moving / rebuilding Corbalis House”, and noted that this is an example of a risk which “may now be historical”. This comment was on the basis that the scheme which received planning permission from Fingal County Council allowed for the demolition of Corbalis House. DAA point out that An Bord Pleanála has not yet ruled on this planning application. This is correct, and there remains a risk that An Bord Pleanála might overturn this aspect of the local authority decision. Therefore this risk is not entirely historical as suggested by our report.

3.2 Response to other issues noted in DAA response

Public Art

The DAA response mis-quotes the RR&V comment on this item. The RR&V report states that the amount noted “appears low”. The report did not state, as claimed by DAA that the allowance was “too low”. We would note that it is not appropriate to interpolate any implication in relation to the overall budget, from comments on an item representing 0.01% of the project budget, as DAA appear to do in this case.

Design Fees

The DAA response notes that the RR&V report “incorrectly assumed” that the 4.8% allowance for site supervision included in the cost plan related entirely to site supervision undertaken by the project management and design team. Unfortunately the DAA response does not clarify what the correct interpretation of the DAA documents should be.

The DAA note that, as it has been decided to procure the project in a “multi-package basis with upwards of 20 packages...”, that “a budget of this nature is manifestly reasonable”. The response does not clarify what the “budget” referred to is, and notwithstanding the DAA’s comment above, it can only be assumed that the DAA are referring to the 4.8% for site supervision as noted above, together with the 10% for Design Team Fees, (a combined total of 14.8%).

No verification or breakdown of actual fees has been provided, and the DAA response does not provide any additional detail in this regard. Notwithstanding this, it is possible to

confirm that on an overall basis, an allowance totalling c. 15% for Design Team fees and Site Supervision is a realistic allowance, on the basis of a project with “upwards of 20 packages” which would be likely to require the services of a professional Construction Management organisation, and other additional inputs from the Project Management and Design Team to manage the site operations.

Capital Contributions

We have reviewed the DAA response which does not provide any further clarification on the apparent anomalies identified on our original report and therefore our comments in our original report remain valid.

Separately, we would note that notwithstanding DAA’s advice to us at our meeting on 13th April 2007, (as minuted), that the planning contributions were not the subject of appeal, we have, in the meantime noted that the DAA’s own first party appeal to An Bord Pleanala, specifically appeals the level of capital contribution imposed in the original planning permission.

4. **RR&V Report 3 – Review of DAA Capital Investment Programme:**

4.1 **Response to Queries raised by CAR**

CIP 7.002 – Terminal 1 Extension – Inflation Provision

The Cost Plan provided by the DAA in support of this project was based on a range of costs, which included a provision for future inflation. The DAA have now provided an explanation showing how this inflation provision was extracted from the estimated costs, prior to selection of the mid-point of costs, for inclusion in the CIP. We accept this clarification, and consequently are happy to revise our comment on this aspect of the project. The cost included in the DAA's CIP, for this scheme at €54,778,000 does not include an allowance for future inflation, and therefore does not require revision in this regard.

Our original findings in this regard were, in part, based on cost information provided by DAA in relation to this project, as part of our review of the benchmark report. This information was not consistent with the original cost plan, or with the information now provided as part of the DAA response. As noted above, we are happy to accept the most recent clarification provided by the DAA. However, this has the effect of increasing the relevant cost per sqM for comparison with benchmarks to [.....] (some 44% in excess of the mean benchmark for terminal buildings), as opposed to [.....](37% above benchmarks) as per our original report.

The DAA response challenges our original finding that the cost of this project is 37% above the relevant benchmarks. We are satisfied that this comment was valid, and as noted above, costs are in fact some 44% above the relevant benchmarks. The DAA response challenges this finding on the basis that the specific nature of the project differs from the typical benchmarks. In this regard we would note that the DAA cost plan includes an additional amount, over and above the cost per sqM identified above, of [.....] in respect of "abnormal" costs relating to the specific "abnormal" features of the project, covering such items as the location of the work, interfaces with existing building, requirements for maintaining public thoroughfares, out of hours working etc. Given the fact that these items are excluded from our comparison of costs per sqM, we therefore believe the comparison with benchmarks is valid.

We have also reviewed our comments on the validity of the quoted benchmark project, the “6 bay extension” as a comparator with this project. We remain of the view that due to the inconsistencies in the information provided by the DAA for this project (which have not been clarified in the DAA response), it can not be regarded as a valid or reliable comparison with the current project.

CIP 7.025 - Central Immigration Project - Potential duplication of work with Pier D existing building work

Our report identified several discrepancies in relation to the DAA information provided for this project, including:

- No drawings provided, and DAA note that drawings did not exist at time of CIP
- Incorrect title on cost estimate – “Pier D Link Bridge”
- Variances in cost benchmark rate quoted – from [.....]
- Inclusion of programme manager fees in cost model.

Our report also stated that due to the absence of drawings:

- It was not possible to comment on cost relative to scope of work
- It was impossible to confirm that there was no duplication between this project and CIP 7.012 (Pier D work to existing building)

The DAA response now includes two drawings indicating the location of works in this area, (included at appendix A). We have reviewed these drawings in conjunction with the drawings previously provided for the Pier D project, (included at appendix B). While the position is less than clear, the new drawings suggest that while there may be some partial and relatively minor duplication between the projects, there does not appear to be general or overall duplication between this project and CIP 7.012.

The DAA response notes that these drawings “*will not align with the cost model data previously provided*”, but the DAA do not provide any updated cost model data, or any

explanation of the differences in cost (if any). It is therefore not possible to comment on costs, as we do not have corresponding cost estimates and drawings.

The DAA response makes reference to a RR&V comment that “the costs for this project appear credible”. Our report did not state this, but stated that the “rates and costings used in [the DAA cost model] appear credible”. Such a comment is obviously subject to confirmation that the scope and quantities are reasonable, (not possible to verify), and is subject to the anomalies in other documentation identified elsewhere in our review.

CIP 7.027 – Customs & Border Protection

The DAA initially provided the following information in relation to this project:

- A gross floor area of 4,500sqM
- An estimated cost of €30m
- A statement that this cost was derived from “cost benchmarks as per Terminal 2 cost plan”

Our assessment of this project was based on these facts.

The DAA’s response states that “the T2 benchmark figure referred to is exclusive of fees, planning contributions, and project contingency”. This is not correct. Our initial assessment specifically stated that the estimated cost based on the T2 cost plan included for fees and the contingency provision as per the T2 cost plan. The issue of planning contributions was not addressed, but as illustrated below represents a relatively minor adjustment.

It should be noted that our assessment also included a calculation based on the DAA quoted benchmark figure for terminal buildings. We did not speculate at the time of our initial report on what the estimated cost would be on any adjusted benchmark for terminal buildings, as we expected the DAA to respond to the anomalies in the cost benchmarking for terminals identified in our review of the DAA cost benchmarking. However as noted elsewhere in this report, the DAA responses to the cost benchmark report do not change our views, and therefore we feel such a comparison (with the adjusted benchmarks) is now appropriate.

The DAA response makes some general statements to the effect that the costs should also allow for connections to the T2 baggage systems, construction of sterile corridors connecting to Pier E, and alterations to Pier C to provide escape routes. No substantiation or detail is provided in relation to these issues. Without such detail, and having regard to the fact that such items were not identified as exclusions to the stated project gross area at the outset, we are satisfied that these issues could reasonably be expected to be included in any cost estimate based on the cost per sqM rate for Terminal 2, or indeed benchmark rates for terminal buildings generally.

For clarity, we set out hereunder our calculations of the estimated cost for this project:

		Scenario 1	Scenario 2	Scenario 3
		Based on T2 Cost Plan Rates	Based on DAA Benchmark Report	Based on Adjusted Terminal Building Benchmark (1)
A	DAA Stated Gross Floor Area	4,500 sqM	4,500 sqM	4,500 sqM
B	Construction Cost per Sqm	[.....]	[.....]	[.....]
C	Construction Cost (A x B)	[.....]	[.....]	[.....]
D	Add Project Contingency (15.6% as T2)	[.....]	[.....]	[.....]
E	Subtotal Construction	[.....]	[.....]	[.....]
F	Add Fees at 10% (as T2 cost Plan)	[.....]	[.....]	[.....]
G	Add Planning Contributions at 114/sqM	513,000	513,000	513,000
	Total Estimated Cost	[.....]	[.....]	[.....]

Notes: (1) For background to scenario 3 rate of €3,607, see section 2.2 of this report.

4.2 Response to other issues noted in DAA response:

General & Non Project Specific Comments By DAA:

“The RR&V review process was conducted in an excessively hasty manner”. We note that the DAA have presented no evidence in support of this comment. We do not agree with this assertion. All the information provided was reviewed to the appropriate level of detail, having regard to the terms of our brief.

“RR&V do not appear to have reviewed all of the relevant information which was submitted by DAA...”. We note that the DAA have presented no evidence in support of this comment. In particular the DAA have not identified any information provided which was not reviewed. We can not agree with this assertion. All the information provided was reviewed.

“.....majority of the CIP is underpinned by detailed cost plans and tender receipts”. RR&V would note that of twenty-seven CIP projects reviewed in our Report No. 3, a total of six were supported by cost information which could be regarded as “detailed cost plans” or “tender returns” or better.

DAA comment re RR&V statements that “significantly different cost predictions may now be available” and “better value may be obtainable in the current market”. These statements are criticised by the DAA, as not being supported by “data or tangible information”. RR&V set out the basis for these comments in our full report. It should be noted that the DAA are in possession of the relevant data to either prove or disprove these comments. However they have not provided any such data as part of their response. We are therefore happy to stand by these statements, pending any clarification which may be provided by the DAA.

Project Specific Comments by DAA:

CIP 6.018 – Parallel Runway Fees

The DAA response does not provide any additional information, nor does it address the anomalies identified in our report in relation to this project. We therefore have no basis to revise our findings in relation to this project, at this time.

CIP 6.030 – Taxiway bypass for Phase 6 & Other Airfield Projects

CIP 6.030 is the only airfield project for which tenders had been returned at October 2006. Tenders for several other projects were due to be returned in the period from October 2006 to April 2007. The DAA response disputes RR&V's finding that based on the tender for this project, better value may be achieved on other projects at tender stage, relative to benchmark figures on other airfield paving projects. The RR&V original findings included the qualification that "there may be factors such as technical simplification or simpler working arrangements" which may have reduced costs in this case. The DAA response lists a number of such issues, such as "Location", "Specification", "Working Methods", and "Phasing", noting that in all cases this project is simpler than the norm, and therefore, the implication is, would always have been expected to be significantly less expensive than other airfield projects. In this regard we would note the following:

- The DAA have not presented any evidence to demonstrate the relative simplifications and efficiencies applying to this project, as distinct from other airfield projects.
- This project was included in the 2005 CIP at a rate per sqM equivalent to [.....] (at 2006 costs), which was broadly in line with other airfield paving projects in the 2005 CIP. The cost included in the current CIP for this project, based on tenders received in the meantime, equates to an all-in rate of [.....], (34% lower than the original estimate).
- The DAA have not presented any evidence (based on tenders received) to demonstrate that tenders for other paving projects have in fact supported the estimated costs included in the CIP for these other projects.

Based on all of the above, while we accept the validity in principle of the DAA's comments, we have not been provided with any evidence to allow us to revise our original comments.

CIP 7.012 – Pier D – Issues other than those queried by CAR

The DAA, in their response, include some comments on aspects of our assessment of Pier D, other than those specifically queried by the Commission. We deal with each relevant issue hereunder:

Costs for works in existing building: Our report noted that the drawings provided by the DAA in relation to these works made it difficult to accurately ascertain the extent of works included under this heading. We noted that based on the extent of works which could be approximated from the drawings, the stated costs for this project appeared high. We have reviewed this, in the context of the DAA’s response (which did not provide any additional information, or clarification). The drawings provided by DAA, (included at appendix B), would suggest that the gross floor area of the works would be unlikely to exceed a maximum of 700 – 800 sqM. This would suggest a cost per sqM of c. [.....] /sqM, which seems high, relative to what alterations and refurbishment works would reasonably be expected to cost, and in the absence of further information from the DAA.

Possible Duplication of Works Covered by Central Immigration Project: Refer to comments under Central Immigration Project.

Level of Contingency: The DAA make a number of points in relation to this issue. The question of the DAA using “best in class” methodologies is not disputed, but we would refer to our comments under the T2 project contingency, elsewhere in this report, in this regard. The DAA have provided no new information or backup to the contingency provision in their response. In this regard, we remain of the view that the contingency provision at 12% is a relatively high allowance for a project which is fully designed, tendered, and in the course of construction.

Fees for OCTB: The DAA note that it is inappropriate to compare these costs to the costs for the works in the OCTB building only, noting that the works involved developing designs for other works such as the links to the new pier and existing building. This is a valid comment, which we accept. However based on the 2005 CIP, the estimated cost for all of these works was c. [.....]. If full fees equated to 15%, and assuming that (relatively high) 70% fees were payable to tender stage, this would suggest a total fee expenditure of c. [.....], (or [.....] if inflated to 2006 costs). This amount, while

significantly higher than our original estimation, remains substantially less than the DAA quoted cost of [.....]. However all of this is speculation, as DAA have provided no supporting information to allow a more meaningful review of costs under this heading.

CIP 7.020 – Temporary Forward Lounge

Our report queried the inclusion of a contingency allowance of [.....], representing 11% of the overall project budget, having regard to the fact that the project was effectively complete. The DAA's response notes that the final account for the erection [only] of the temporary forward lounge is agreed, but that there was uncertainty at October 2006 regarding the demobilisation and relocation of the phase 1 temporary forward lounge. In this regard we would note as follows:

- The original documentation provided by DAA noted "Agreed final account **including demolition work** yet to be completed" (emphasis added)
- The estimated cost for demolition work is [.....]. The retained contingency would represent 250% of this amount
- There is an entirely separate project – Temporary Forward Lounge Phase 2, with a separate budget of comparable value to the phase 1 project.

We therefore remain of the view that our original comments in relation this project are valid.

CIP 9.004 – Electricity Distribution Enhancements – HV, &

CIP 9.005 – Electricity Distribution Enhancements - MV

The DAA response notes that the information originally provided is sufficient to allow review of the DAA's budget proposal. The DAA project sheets, which represent the only information provided by the DAA state that the costs are "***Provisional sum(s), pending development of proposals***". By definition therefore it is not possible to comment on costs, which are "provisional sums", and for which proposals remain to be developed.

APPENDIX A

[.....]

APPENDIX B

[.....]



**Review of Dublin Airport Authority
Capital Expenditure Programme
(CIP 04)**

For

**The Commission for Aviation
Regulation**

**Report No. 4 – Review of DAA
Terminal Sizing
Phase II Report and Responses**

26th July 2007

rogersonreddan
project, construction and cost managers



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Job Nr.	Rev	Status	Date Issued	Drafted	Team Leader	Changes since previous revision	Issued to
0651	1	Draft Issue	10 th July 2007	RTA/ JA	GM	None	CAR

1. Introduction / Scope:

Rogerson Reddan and Associates Ltd. in conjunction with Vector Management Limited (RR&V) were commissioned by the Commission for Aviation Regulation (CAR) to undertake a review of the sizing for the new Terminal 2 proposed by Dublin Airport Authority (DAA).

This second report provides a more detailed validation of our conclusions from the first report and replies to responses received by interested stakeholders to CAR's Draft Decision. In order to avoid confusion our initial report will be referred to as our Phase I Report from this point forward and this report will be referred to as our Phase II Report.

Our Phase II works and subsequent report focuses on the following key four areas:

- Standards for Sizing Terminal 2;
- Terminal Sizing Bottom-up Analysis;
- Discussion on Pier E requirements;
- Reply to DAA Responses on CAR's Draft Decision.

In our Phase I Report we reviewed the standards for sizing terminal 2 adopted by DAA for the planning purposes. In our Phase II works we have built on our initial Phase I analysis to provide additional justification for our conclusions that IATA Level of Service C and the other planning parameters used are appropriate design standards that do not result in over-provision of terminal facilities.

In order to validate our Phase I conclusions on alternative terminal sizing for T2 CAR requested that RR&V undertake a detailed bottom-up analysis making use of an alternative and tested terminal sizing methodology. To this end Vector has adopted a series of methodologies and formulas developed and validated by IATA and its members.

Our Phase I Report did not consider the requirements for the provision of the proposed Pier E development. In our Phase II report we provide a high-level assessment and discussion on the requirement for Pier E and associated its stands. Our observations consider the following issues:

- On-pier performance standards;
- Demand driven requirements;

- Construction phasing, and;
- Proposed location of T2.

Finally CAR has requested that RR&V provide replies to some of the specific criticisms by DAA of our Phase I Report analysis, assessments and conclusions. In the final section of this report we present our replies to DAA concentrating on the following key areas:

- Designing for Congestion;
- Criticism of Comparators in Figure 1 of Vector's Phase I Report, and;
- Load Factor Analysis.

2. Standards for Sizing Terminal 2

We understand that several stakeholders in their response to CAR's Draft Decision and Vector's Phase I Report stressed concerns that the proposed service standards and planning parameters adopted for T2 were unnecessarily high and that this resulted in an over provision of terminal space. This section of our Phase II Report re-emphasises our conclusions with regard to these standards and provides some additional information in support of our findings in Phase I.

a. Level of Service C

In considering the planning assumptions supporting the sizing of Terminal 2 it is important to consider whether the proposed level of service to be offered within the terminal is appropriate. Following is an assessment of the impact on terminal size as a result of the selected services standard.

The design brief for Terminal 2 has identified IATA Level of Service C as the minimum standard for a the 2013 design year. IATA level of Service C is a measure of principally applies to space standards and is widely accepted as the minimum standard which should be applied to new passenger terminal development. Principally IATA C only applies to in queuing and waiting standards in main processing areas within the terminal. As such elements typically only account for around 20% of the total terminal area , therefore, a reduction in service levels normally results in only marginal overall space saving in passenger terminal buildings.

b. Terminal Planning Parameters

We have reviewed the terminal planning parameters that have been adopted by the DAA for establishing the number, scale and capabilities of individual passenger processing units, required to meet the busy hour flows. It is worth noting that not all of the planning parameters selected for terminal design are linked to IATA level of service C (e.g. processing units, circulation space, operational and staff areas).

Planning parameters for processing units are typically made up of two elements, those standards, such as check-in process times/ queuing standards, which are established and

agreed with the proposed airline tenants and those standards, such as security, which are normally outside the control of the airport and the airlines and established through observation or set by the complexity or mandatory requirements of the process.

Having reviewed all of the planning parameters provided in the Gateway 2 Report we conclude that these are reasonable for the proposed airline tenant mix and do not result in unnecessary or inefficient provision of terminal facilities.

3. Terminal Sizing Bottom-up Analysis

In order to validate our conclusions with regard to the reasonableness of DAA's terminal planning parameters and to confirm our findings on terminal sizing based on a range of alternative busy hours as provided in our Phase I Report CAR requested that we undertake a detailed bottom-up terminal sizing exercise. We have done this using the methodologies and formulas outlined in the IATA Airport Development Reference Manual¹.

The IATA method for calculating passenger terminal size relies on a series of input data relating to passenger numbers, processing times and space standards. We have previously stated² that Vector generally considers the passenger service standards and other planning parameters to be reasonable for the proposed mix of T2 airline tenants and have, therefore, adopted these in for our calculations, (see also Section 2 of this report).

As a base we have analysed a Departure Busy Hour of 2,897, which is consistent with the VML EI 70% figures shown in Table 12³ (relating to 13.2 mppa). Based on this departure busy hour our analysis has confirmed that it is possible to accommodate this level of demand in a terminal of smaller size. On this basis it would be possible to reduce the T2 processor to around 49,000m² which is equivalent to approximately 17.1m²/ busy hour departing passenger. This compares favourably with the 17.6m² identified in Tables 10 & 12⁴ for the DAA 4,200 departure busy hour⁵.

This confirms our assessment that the processing parameters adopted by DAA for sizing the terminal are reasonable and provide for an efficient solution with regard space allowance per passenger. It also validates our conclusions that it is the magnitude of the DAA proposed departures busy hours that drive up the size of the required terminal and not the other planning parameters.

¹ Airport Development Reference Manual, 9th Edition 2004 (the methodologies outlined in the manual are internationally recognised by airports and airlines alike).

² Review of DAA Capital Expenditure Programme (CIP4) Report No.4 Review of DAA Terminal Sizing-16th May 2007: page 26

³ Ibid: page 29

⁴ Ibid: pages 27 and 29 respectively

⁵ The minor differences between area per busy hour departing passengers is as a result of the way in which support areas, such as office space and lounges etc. have been calculated, however, the overall difference in total terminal area will be nominal.

4. Pier E

This section of our report is intended to provide our observations with regard the provision and sizing of the proposed Pier E at Dublin Airport. We would point out that we have not analysed in detail the sizing of the proposed Pier E development at Dublin Airport as this would require a comprehensive study as a result of the complexity of the relationship between Pier E and the other piers. This is currently outside our scope of works, however, we would, however, make the following observations:

- Reducing the level of demand, in line with alternative busy hours could result in a reduction in the size of Pier E. However, to undertake this analysis would require the production of an alternative airport schedule and gating analysis, which, is currently outside the scope of our works.
- Even if no adjustments are made to forecast demand, we believe that it is still possible to reduce the number of gates on Pier E for the forecast level of demand through a reduction in the proposed on-pier performance standard, however, we understand that most airlines operating at the airport have stressed a requirement for high on-pier performance and we have assumed that the total number of stands are broadly justified on this basis;
- As a result of the selected location for Terminal 2 it is necessary, in order to maintain efficient airside operations, to provide sufficient parking positions and reduce walking distances, to service the terminal with a dedicated pier. It is outside our scope of work to consider the alternative locations for the T2 and associated aircraft parking and Pier arrangements;
- As a result of the difficulties associated with undertaking construction works on an operational airport, particularly around aprons, we do not believe it will be possible to easily phase the construction of Pier E;

On the basis of the requirement by all airlines operating at Dublin for high on pier performance, the proposed location of T2 and the difficulties associated with phasing construction in an airside environment we would conclude, without having the opportunity to undertake a more detailed analysis, that it is likely that Pier E is required in its proposed form and size.

5. Reply to DAA Responses on Draft Decision

This section of our report directly responds to a number of the points and issues raised by the DAA with regard to the CAR Draft Decision and Vector's Phase I Report. The following three key issues are considered:

- Designing for Congestion;
- Criticism of Comparators in Figure 1 of Vector's Phase I Report, and;
- Load Factors.

a. Designing for Congestion

Vector strongly refutes DAA's suggestion that Vector is proposing that T2 should be designed to replicate the existing levels of congestion. Vector recommends that T2 should be designed in accordance with service levels that ensure the new T2 is not congested when realistic passenger throughputs are reached. However, we believe that this can be accommodated within a terminal of a smaller size given the timeframe and the annual passenger throughputs proposed by the DAA. Indeed Vector have proposed that the terminal should be designed for a higher annual throughput of 13.2 million passengers compared with 11.4 million passengers quoted by DAA.

The key issue is that Vector do not believe that a design busy hour of 4,200 is realistic for an annual throughput of 11.4 million passengers (or indeed 13.2 million passengers) even if additional peaking is allowed for on the assumption that additional runway capacity is made available. If the DAA had quoted a more realistic annual throughput of at **least** 17 to 19⁶ million passengers in relation to the design busy hour, or a planning horizon of say 2020, then Vector would agree that a busy hour of 4,200 pax /hour is realistic. However, the debate would then focus on whether the terminal construction could be phased in line with traffic growth to ensure a more economic use of capital expenditure.

In general terms it should be stressed that in the long term airport capacity tends to be constrained more by airfield capacity than terminal capacity as it is often easier to add terminal capacity to address short term imbalances between terminal and airfield capacity. We believe that this is currently the case at DUB, where reported congestion in T1

⁶ Please also see IMR response to DAA in its report, "Analysis of DAA criticism of Methodology, Dublin Airport Terminal 2 09th July 2007 page 16. IMR concurs that the realistic annual throughput of the proposed terminal should be far in excess of DAA 11.4mppa in relation to the design busy hour.

and the associated perception of poor service levels are being addressed by the DAA. Vector fully support these improvements and would stress that we are in no way recommending that the current service standards in T1 are a suitable basis for design in the new T2.

As DAA have noted Vector have agreed that IATA C space standards and the other proposed design parameters for T2, including process times, are suitable parameters for terminal design. However, Vector would again emphasise its assertion that the design busy hour of 4,200 pax/hour is not a realistic parameter for a passenger terminal with a stated throughput of only 11.4 million passengers per annum.

Vector fully agrees that DUB capacity will be constrained until new runway capacity is provided. We would stress, however, that up until this point aircraft movement growth will mainly be constrained to off peak periods. In addition to this some additional passenger growth could also take place in peak periods through increased aircraft size and load factors.

Vector agrees that adding additional runway capacity will relax constraints at peak times and that this will allow the shape of the daily profile to change. However, Vector does not consider the magnitude of additional peaking proposed by the DAA to be either realistic or practical for a stated annual throughput of only 11.4 million passengers (or indeed 13.2 million passengers). As previously stated, had DAA had quoted an annual throughput of at least 17 to 19 million passengers in relation to the design busy hour of 4,200, then Vector would accept that a prudent level of additional peaking had been allowed for to take account of the proposed addition of runway capacity.

Contrary to DAA claims, Vector's report does estimate the effect of additional peaking for both the reference year of 2006 and the proposed annual throughputs of 11.4 mppa and 13.2 mppa in tables 8 and 9⁷. These values have then been translated into estimates of terminal size in tables 10 and 12⁸. RR&V's initial report has been written such that CAR and other stakeholders can refer to busy hour and terminal size estimates for a range of peaking from 70% to 80% of EI's shorthaul fleet departing in one hour.

⁷ Ibid: page 21

⁸ Ibid: pages 27 and 28

As stated previously however, Vector does not believe that the degree of peaking proposed by the DAA is either realistic or practical in relation to the stated throughputs. The issue is not, therefore, that Vector disagrees with the concept of additional peaking being likely once additional runway capacity is provided, rather that Vector do not agree that the magnitude proposed by the DAA is either realistic or practical, or that the proposed design BHR are internally consistent with a stated throughput of only 11.4 mppa.

The DAA have misinterpreted Vector's statement in the executive summary⁹ in relation to table 3 where we state that the increasing ratio of BHR to mppa between the reference 2006 schedule and the forecast 2013 schedule is surprising. In the main report we clearly state that, "even allowing for further peak concentration such a rise could be considered to be somewhat surprising". Again the issue here is the magnitude of the increase and this is especially the case given that empirically this ratio tends to reduce with higher throughputs in the long term (not just as a result of capacity constraints as DAA suggest).

It should be noted that in its response DAA state that the 2006 schedule busy hour figure of 2,200 "was not the schedule busy hour projection for 2006, but is simply a notional number of Aer Lingus passengers that would pass through Dublin Airport in 2006 in a busy hour if similar assumptions were applied as were used for the 2013 work. In other words the 2,200 figure is simply a numeric representation of the level of change which the DAA expected by 2013. The 2006 reference of 2,200 has, therefore, already been significantly factored up to take account of additional peaking, which significantly increases the ratio of BHR/mppa. To then further increase this ratio from .063% to .08% for the equivalent of 11.4 mppa passengers represents another huge step change, especially given that this ratio would normally decrease with volume growth (not purely as a result of capacity constraints).

The DAA's 2006 BHR of 2,200 is based on a peaking ratio of 70% of the fleet departing in one hour. If we were to estimate further notional peaking on the same basis for the 2006 reference we could derive values of around 2,357 pax BHR for 75% departure peaking and 2,514 pax BHR for 80% departure peaking, which would relate to ratios of 0.0679% and 0.07242% respectively. Both of these ratios are far lower than the 0.080% ratio for the 4,200 pax BHR for the equivalent of 11.4 mppa. However, if we were to project either of these ratios forwards for 11.4 mppa applying the log10 relationship established by CAA and FAA empirical data we would expect the future ratios to be lower than in 2006 for the respective 75% and 80% departures ratios.

⁹ Ibid: page 5

In addition we understand the resultant peaking ratio for the 4,200 schedule is somewhat lower than 80% as it was derived as an average of several schedules with peaking ratios of 70% and 80%. Taking these two factors into account, for DAA's BHR forecasts to be internally consistent we would have expected the ratio of BHR/mppa to be significantly lower than 0.07242% for 11.4 mppa and for the resulting BHR to be significantly lower than 3,800 pax BHR. As we state in our initial report we find the proposed 4,200 pax BHR to be internally inconsistent for 11.4 mppa even from the starting point of 2,220 pax BHR in 2006.

Therefore, given that we consider the 2,200 pax BHR base as surprisingly high, even allowing for peak concentration, we feel that DAA have not produced a realistic and practical design BHR for a throughput of only 11.4 mppa.

DAA have also misinterpreted our comments in relation to the work of a similar nature we undertook at Barcelona Airport (where incidentally Arup also acted as Structural Engineers on behalf of the architect). Vector's work involved producing the busy hour and capacity analysis for the new terminal which will cater for the additional capacity provided by the provision of a new runway. Some additional peaking was allowed for to enable the tenant airline to develop several hub windows in the day. However, the schedules for 2015 and 2025 that were produced together with the complementary and supporting analysis, had to take into account that even with a new runway, runway capacity would become a constraint shortly after 2015.

It would not have been possible, prudent or realistic to increase peaking to a magnitude that the DAA are proposing. In light of this we would recommend that the DAA would be wise to take into account that runway capacity will still be finite in Dublin when a new runway is eventually added and that even when a new runway is delivered, it is unlikely that air traffic controllers will be able to release its full capacity immediately. Vector suspects that the combined capacity of T1 and T2 could exceed runway capacity for several years even after a new runway is delivered.

Given the possibility of a delay to the delivery of a new parallel runway at DUB, the magnitude of the additional terminal capacity being proposed by the DAA could result in both T1 and T2 being substantially under-utilised for several years as a result of runway capacity constraints. In addition to this, if Aer Lingus do not grow in the manner expected

by the DAA, it may be difficult to use the full terminal capacity developed within the constraints of the proposed runway system.

b. Criticism of Comparators in Figure 1 of Vector's Phase I Report

Vector refutes DAA's suggestion that the comparators used in Figure 1¹⁰ represent a "series of congested or considerably smaller airports" which are therefore "self-evidently inappropriate comparators to T2 in 2013".

Firstly it should be noted that the data series for BAA airports includes values from 1996 onwards and the data series for DAA includes values from 2002. Obviously none of the airports in question were as congested in these earlier years.

Indeed Stansted Airport in particular, which is a base for Ryanair and Easyjet, was certainly not congested in these early years and it is not particularly congested now. Vector would suggest that Stansted would be a particularly good benchmark for Dublin given that it also has two based airlines that are operating as point to point carriers (and of course one of them, Ryanair is common to both airports).

It should also be noted that Dublin Airport was not as constrained in 2002, yet the series for Dublin, Aer Lingus and Ryanair all fit on the graph with a close correlation to the log10 relationship which is a remarkably straight line.

It is also not true that Edinburgh and Glasgow are too small to be considered as comparators. The 2005 throughput at both of these airports is higher than the 2005 EI throughput and higher than the notional DUB T2 2006 throughput. Given that both Edinburgh and Glasgow are unconstrained by runway capacity they represent particularly good benchmarks to compare with the DAA 2006 forecast schedule (BHR 2,200).

When this large set of data is compared with the BHRs for the DAA's forecast schedules for 2006 and for 11.4 mppa the gap with empirical data is of an order of magnitude that could be described as a quantum leap, especially when it is considered that the data has been plotted on a log10 scale. Certainly Vector cannot find any empirical data that would support such a deviation from the relationship demonstrated. It should also be noted that as airports in the sample move from a state of spare capacity to congestion the deviation is not particularly pronounced particularly when plotted on a log10 scale.

¹⁰ Ibid: page 14

We note that DAA have been very ready to criticise such benchmarks in previous studies carried out as well in Vector's Report. However, it would appear that DAA has been unable to provide empirical evidence from other airports that would support its proposed design BHR, or that such a step change in pax BHR relative to annual throughput has accompanied an addition of runway capacity. We would note that previously DAA has referred to the theoretical design BHR at other airports such as Athens, however, it should be noted that these are only forecasts and have not been empirically proven.

In conclusion Figure 1 strengthens Vector's belief that DAA's proposed BHR of 4,200 pax / hour can only be considered realistic if it relates to a considerably higher annual throughput than 11.4 mppa.

c. Load factors

DAA's comment that "VML also assumes that Load Factor does not increase in the next 7 years after it decreased in 2006", again misinterprets Vector's report and also shows a misunderstanding of the methodology used. In general it should be noted that none of Vectors analysis explicitly relies on load factors.

Vector refutes that the Load factor has decreased in 2006 in its own analysis. Vector has made adjustments to the 2006 historic busy hour to estimate notional busy hours for different degrees of departures peaking based on recorded averages of passengers/ ATM around the 95th percentile pax BHR. It should be noted that the value implicit in DAA's busy hour of 157 pax/ ATM and the value of 163 pax/ ATM quoted in their Response are of the magnitude of the values for the absolute peak busy hours of 2006. In addition to this DAA fail to mention in their response that the 95% pax BHR of 1,801 on a clock hour basis relates to a value of only 128.6 pax/ ATM which is very close to the value of 124.7 pax /ATM used by Vector.

Vector also refutes that our analysis makes any assumptions about the load factor not increasing over the 7 year period of the forecast. We believe that this illustrates a fundamental misunderstanding by DAA of the methodology used in Vector's report. The methodology of BHR projection does not rely on any assumptions relating to load factors. It has been empirically shown that the relationship between pax BHR and annual pax closely conforms to a straight line log10 relationship. This is true regardless of load factors rising and as stated previously is related to volume increase (and not simply capacity constraints as

DAA have claimed). If the log10 relationship is applied then the ratio of pax BHR to mppa should actually reduce as volume increases under normal circumstances.

By maintaining the ratio at a constant level Vector has taken a very conservative approach that effectively overestimates the forecast busy hours. This would certainly not support the accusation that Vector's analysis assumes load factors do not increase. It should be noted, however, that the issue of increasing load factors is not particularly material to the overall conclusion that the DAA's forecast BHR is surprisingly high.