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g l o b a l k n o w h o w

independent verifier's report

**proposed terminal two
and associated works
dublin airport**

for

department of transport

september 2006

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Appendix A – Scope of Works



Glossary of terms

DAA Dublin Airport Authority

IATA International Air Transport Association

ICAO International Civil Aviation Organisation

CBP Customs and Border Protection



1.0 Executive summary

The verification team was appointed by the Department of Transport in March 2006 to verify the specification and cost of Terminal Two.

The key driver for the project timeline is the approval by Government of the Aviation Action Plan in May 2005. The action plan provides for the building of a Dublin Airport Authority owned new Terminal (Terminal Two) at Dublin Airport to be open in 2009.

In terms of design and planning, the DAA and its consultants have elected to use a gateway process; akin to the gateway process advocated by the Office of Government Commerce (OGC) in the UK (an independent office to the Treasury that works with public sector organisations to gain best possible value for money from procurement). One of the principal advantages of the gateway process is that project reviews are carried out by a team of experienced people, independent of the programme/project team. This multi-stage process is used to examine a programme or project at critical stages in its life-cycle to provide assurance that it can progress successfully to the next stage. It is considered best practice with this process to achieve 'sign off', approval or commitment to each gateway stage at board level and with key stakeholders. In addition, the project directors or leaders of the project team should also provide 'sign-off'.

The phases of the gateway process adopted by the DAA and its consultants are given as:

- ① Gateway 1: Brief development/confirmation
- ② Gateway 2: Design development/option selection stage
- ③ Gateway 3: Architectural treatment/planning submission stage

The approach to sizing of the terminal and key systems follows very closely the guidance contained in the IATA Airport Development Reference Manual. The approach is supported by the interrogation of key operational elements of the terminal against agreed criteria and benchmarks. Moreover, the project team has developed and refined the methodology to understand the likely impact of passenger growth and the relationship between demand and the need for future capital investment.

Stakeholders have been afforded a range of opportunities by the DAA to provide input into the project and consult with the DAA's consultants. Indeed, the DAA has sought to address any stakeholder concerns through the following measures:-

- ① Increased advanced notice of upcoming consultation meetings
- ② One-to-one briefings at the request of stakeholders
- ③ Airline "workshops" based around airline consultation meetings



The approach to consultation follows the guidance within the IATA Airport Development Reference Manual for appropriate consultation between airport planners and stakeholders in the development of requirements for a passenger terminal facility, and therefore accords with best practice.

In the context of the DAA's high level objectives for the project, a key driver for the development of the brief was the requirement for the terminal system to cater for 10 –15 million passengers per annum, whilst offering significant improvements to passenger experience and comfort.

The verification team considers that the methodology, approach and execution of the planning objectives and considerations for passengers adopted by the DAA and its consultants accords with the best practice.

The new terminal is designed to be accessed by vehicles via newly configured landside road systems. The forecourt interfaces with a remote check-in building, separated from the main Terminal Two building to facilitate realignment of the roads network and to provide road access to Terminal 1 between the two Terminal Two buildings. At a strategic level the plan provides for future connections for transport interchanges and future stages of multi-storey car park development.

The structural scheme is consistent with the Gateway 2 (*design development / option selection stage*) report options and has been developed in a logical and thorough manner. It is considered that the development of the structural proposals is in accordance with best practice and the scheme chosen is comparable with that used in similar airport terminal buildings.

The Gateway 3 (*architectural treatment / planning submission stage*) cost plan was examined under the following headings:

- Building elements
- Specialist equipment services
- Enabling works
- External works
- Construction contingencies
- Inclusions / exclusions
- Project contingencies
- Costs

The total estimated cost of the overall project is € 609 million, of which Terminal Two is estimated to cost € 395 million. The cost plan is based on prices prevailing at the 3rd quarter of 2006.



Conclusion

The Gateway 3 estimated cost of Terminal Two on a cost per square metre basis, lies at the mid point range of the UK terminal buildings benchmarking study carried out by the DAA's team of consultants. The verification team has independently verified the benchmarking exercise and the cost plan and concludes that the estimated cost is within industry norms for this type of project in a European capital city.

A handwritten signature in black ink, appearing to read 'Shane Boyd'.

Shane Boyd
Director
Boyd Creed Sweett



2.0 Scope of work

2.1 Verification team

2.1.1 The verification team was appointed by the Department of Transport in March 2006 to verify the specification and cost of Terminal Two

2.1.2 The scope of work for the verification team was set out by the Department of Transport in their briefing document for the appointment of independent verification services for Terminal Two. It outlined the scope of work in relation to the report output as follows:

2.1.2.1 **process:** DAA has appointed its design and cost consultants for terminal two. Accordingly the independent experts to be appointed on behalf of the Minister for Transport should have full access to information prior to finalisation of the specification and cost of Terminal Two (including any clarification required from DAA management and their design and cost consultants or through attendance as an observer at meetings with users) to facilitate the timely production of a verification report following DAA approval of the cost plan.

2.1.2.2 **output:** The experts will provide their opinion in a brief report to the Minister for Transport (which ideally should not exceed 10 pages in length) on the following:

- ① The methodology and approach adopted in the production of the terminal design and cost plan and whether such approach was in line with best practice; and;
- ② In particular, the reasonableness of the overall estimated cost of Terminal Two arrived at through the above process

2.1.3 **timescale:** The experts would be expected to start work around mid February 2006 and to submit their report to the Minister in mid 2006 upon finalisation by DAA (and its consultants) of the design specifications and cost plan for Terminal Two.

2.2 Dublin airport Terminal Two and associated works

An outline of the scope of work is provided in Appendix A and is delineated by the boundary marked on the plan included in the Appendix. Any works outside this boundary are specifically excluded from this report.

3.0 Process adopted by DAA and its consultants

The key driver for the project timeline is the approval by Government of the Aviation Action Plan in May 2005. The action plan provides for the building of a Dublin Airport Authority owned new Terminal (Terminal Two) at Dublin Airport to be open in 2009.



3.1 Gateway process

3.1.1 In terms of design and planning, the DAA and its consultants have elected to use a gateway process; akin to the gateway process advocated by the Office of Government Commerce (OGC) in the UK (an independent office to the treasury that works with public sector organisations to gain best possible value for money from procurement). One of the principal advantages of the gateway process is that project reviews are carried out by a team of experienced people, independent of the programme/project team. This multi-stage process is used to examine a programme or project at critical stages in its life-cycle to provide assurance that it can progress successfully to the next stage. It is considered best practice with this process to achieve 'sign off', approval or commitment to each gateway stage at board level and key stakeholders. In addition, the project directors or leaders of the project team should also provide 'sign-off'.

The phases of the gateway process adopted by the DAA and its consultants are given as:

- ① Gateway 1: Brief development/confirmation
- ② Gateway 2: Design development/option selection stage
- ③ Gateway 3: Architectural treatment/planning submission stage

4.0 Process adopted by verification team

This section provides a high level overview of the process adopted by the verification team and the reason for their selection of this approach:

4.1 Timescale

The format and timing of the verification process was based on aligning the verification team's work, whilst carrying out their verification duties, with the gateway process adopted by the DAA. This approach ensured that the verification team's work did not interfere with the programme or process adopted by the DAA.

4.2 Verification team methodology

4.2.1 It was agreed at the outset of the verification team appointment that data would be transferred through single points of contact at the DAA and its consultants and verification team. A secure web site was utilised to transfer data and information between the teams due to the sensitive nature of the information.

4.2.2 In addition, the DAA, its consultants, and the verification team agreed at the outset that continuous involvement of the verification team in the process, with regular meetings and progress updates would best facilitate the verification process and transfer of information. An 'open' meeting format was advocated by both the DAA and the verification team so that all issues pertaining to the process could be raised and discussed amongst the team members.

It is considered that this approach provided both parties with an increased understanding of the objectives and the range of options available.



5.0 Objectives

5.1 Principal DAA objectives for the scheme

The brief objectives were established by the DAA and its consultants at the outset of the project; as detailed in the updated briefing document issued at the end of March 2006. This document states that the project objectives were developed in “workshops” in the first week of January 2006; i.e. immediately following the appointment of the project manager (ARUP), and were reviewed by the DAA Board on 10th January 2006. The list of objectives detailed in the briefing document is as follows:

5.1.1 High Level Objectives

- ① Development of a new Terminal, Pier and Frontage Road system to cater for 10-15 million passengers per annum, but with a view to enabling the provision of the maximum capacity of the site in due course.
- ① The delivery of sufficient capacity in 2009 to meet (as a minimum) the demands at that time.
- ① To deliver the project through a process that is highly visible, auditable and efficient, that ensures best value and that engages stakeholders appropriately.
- ① Will be delivered at the ‘right cost’ in terms of both capital and life cycle.
- ① Will be delivered safely and in a manner that maintains capacity during construction.

5.1.2 With respect to the terminal, a number of specific objectives were agreed:

- ① Its size should not only meet the required demand, but also remain flexible to change and incorporate US pre-clearance needs.
- ① It should meet the needs of the anchor tenant – Aer Lingus – but also accommodate other airlines to ensure optimal utilisation; providing enhanced efficiency for both airlines and operator.
- ① It should deliver a significant improvement to the customer/passenger experience.
- ① It will include a highly successful retail component.
- ① It will deliver high quality, efficient frontline operation accommodation.
- ① It will utilise appropriate technology, while remaining flexible to ensure ‘future proofing’.
- ① It will be capable of operating independently, though systems will be designed as independent only where this makes good sense.
- ① It will be a sustainable, landmark building.



5.1.3 The following objectives were agreed for the new pier associated with terminal two:

- ① It will be the appropriate size.
- ① It will be an efficient and elegant building.
- ① It will yield prime ramp/stores accommodation.

5.1.4 Finally, the objectives for the frontages were outlined as:

- ① Provide appropriate capacity; reflecting the site environment and configuration.
- ① Reflect the operational preferences of the Airport.
- ① Provide an improved operation for both Terminals 1 and 2.

6.0 Brief (Gateway) development

6.1 Brief development

6.1.1 The project takes as its starting point the master plan work previously undertaken and approved by the DAA. A fundamental premise of this work is that the new terminal will accommodate one anchor tenant with others selected to maximise utilisation of the facility.

6.1.2 The initial estimate for the terminal size, arising from the master plan, indicated that a terminal size of approximately 50,000 square metres would be required to accommodate a capacity of circa 10 million passengers per annum.

6.1.3 Immediately following appointment, the DAA's consultants were tasked to develop a robust determination of the size of the facility taking account of the current and projected user needs, passenger flow and appropriate passenger service levels. A detailed account of the verification of this process is included in Section 6.2 of this report.

6.1.4 It is considered that the process adopted for brief development is well documented; with high-level objectives having been reviewed and approved by DAA Board. Moreover, the project team has sought to establish clear project planning parameters working through to detailed operational and commercial requirements in consultation with stakeholders.

6.1.5 The defining document 'Dublin Airport Authority Terminal Two, Initial Brief Report (ref T2.SW.PM.001)' formed the main deliverable for Gateway 1 (*brief development / confirmation stage*). It sets out a clear basis for the design development of a new terminal buildings, pier and frontage road system to cater for 10-15 million passengers per annum with the flexibility to facilitate maximum capacity of the site.

6.1.6 The generic brief development process of advancing the design from brief development to planning submission stage, as advocated by the Royal Institute of British Architects, was initiated for this project. This process is also supported by IATA (International Air Transport Association).



The project sits within the framework of a strategic masterplan. The masterplan approach is advocated by ICAO (International Civil Aviation Organisation) and is considered to accord with best practice.

6.2 Terminal sizing

6.2.1 The high level assessment of sizing for the terminal and key relationships between functional and operational elements was critical to the initial brief and design process. Through development of the brief and design, the size of the facility has been optimised, by refinement of planning data and development of user and stakeholder requirements.

6.2.2 In line with best practice, the process of terminal sizing was founded on an analysis of traffic predictions, with a translation of the forecasts into detailed planning schedules. To this end, a number of airline scenarios that could potentially yield an annual passenger demand of between 10-15 million passengers per annum, with off-peak operating efficiencies, were appraised by the DAA and its consultants. An understanding of planning or peak hour demand flows was reached from the resultant schedules, and these shaped the requirements for the efficient processing size of facility.

6.2.3 In order to determine the appropriate size of the facility, a generic computer generated “sizing model” was utilised. The model produced a range of peak demand curves based on two projected growth rates (of passenger demand) of 5% and 10% per annum and a mid-range level of service standard. The resultant graphs provided the basis for the initial terminal size. It also provided information relating to any future required expansion of the facility to safe guard against future growth predictions. The graphs were then adjusted to take account of known passenger movement relating specifically to Dublin airport.

6.2.4 The overall results indicated that the project for the terminal will best be secured by a two phase process.

① *Phase one* to incorporate a peak hour passenger through put of 4,200 people per hour: this translates to a terminal size of circa 74,000m² and a pier size of circa 24,000m².

② *Phase two* to accommodate an increase in peak hour passenger throughput to 5,500 per hour: this translates to an additional expansion space to the terminal of circa 13,000m².

This brings added value to the project and is considered to be consistent with best practice.

6.2.5 This approach to sizing of the terminal and key systems follows very closely the guidance within the IATA (International Air Transport Association) Airport Development Reference Manual. The approach is supported by the interrogation of key operational elements of the terminal against agreed criteria and benchmarks. Moreover, the project team has developed and refined the methodology to understand the likely impact of passenger growth and the relationship between demand and the need for future capital investment.



6.3 Stakeholder consultation

- 6.3.1 The involvement of key players and the management of stakeholder input was considered by the DAA as integral to the briefing process and was therefore initiated immediately following the appointment of the DAA's consultants in January 2006. The process included workshops for stakeholders to enable them to understand the scope of the project and included procedures for 'sign-off'.
- 6.3.2 The number of stakeholders and nature of users consulted through the initial stages of the process comprises the majority of main stakeholders including, the anchor tenant, other relevant operational airlines, main external bodies and authorities such as Fingal County Council, the Department of Transport and the Railway Procurement Agency.
- 6.3.3 Stakeholders have been afforded a range of opportunities by the DAA to provide input into the project and consult with the DAA's consultants. Indeed, the DAA has sought to address any stakeholder concerns through the following measures:-
- Increased advanced notice of upcoming consultation meetings
 - One-to-one briefings at the request of stakeholders
 - Airline "workshops" based around airline consultation meetings
- 6.3.4 The approach follows the guidance within the IATA Airport Development Reference Manual for appropriate consultation between airport planners and stakeholders in the development of requirements for a passenger terminal facility, and therefore accords with best practice.

6.4 Infrastructure

- 6.4.1 The impact of the new Terminal Two facility on existing infrastructure was recognised in the Initial Brief at Gateway 1 (*brief development / confirmation stage*). A clear strategy was set out for identifying existing infrastructure and establishing demand for new infrastructure as a consequence of the new facility.
- 6.4.2 It was also recognised that the existing services beneath the Terminal Two footprint will be diverted in an enabling works contract ahead of the main Terminal Two contract and that this work will have to be carefully planned to maintain operation of the existing facilities. This enabling works contract will also need to incorporate the diversion of existing roads, provision of new service routes and a new electrical substation.
- 6.4.3 Bases of design for new infrastructure were established and demand calculated from the size of the new terminal facilities. Information was collated relating to existing infrastructure and a series of site surveys were set in motion to obtain as much definitive information as possible.
- 6.4.4 A strategy was established for the location of new airside services in relation to Pier E and the airside service road around the pier.



6.4.5 It is concluded that the scope, planning and programming of the enabling works contract are clearly critical to ensuring a timely start to the main Terminal Two contract and maintaining operation of the existing facilities. The methodology adopted by the DAA Team accords with best practice.

6.5 Passenger handling

6.5.1 In the context of the DAA's high level objectives stated in section 5.1.1, a key driver for the development of the brief is the requirement for the terminal system to cater for 10 –15 million passengers per annum, whilst offering significant improvements to passenger experience and comfort.

6.5.2 The development of the programme of requirements for a new terminal would, typically, be based on a range of 75-85% of the peak hour rate of passenger throughput. Dublin airport experiences a non-typical high peak hour rate and consequently, the programme of requirements for the new terminal has been based on 95% of the peak hour rate. This is considered a reasonable basis in this instance. The area provision per passenger compares well with other international airports but to meet the demands of the strong morning departures peak, staffing levels will have to be maintained during this period. As with all airports, there will be some under utilisation of facilities off-peak. However, the DAA team has worked with the flight schedules as much as possible to smooth the flows and minimise this effect.

6.5.3 The verification team considers that the DAA and its consultants' methodology, approach and execution of the planning objectives and considerations for passengers accords with the best practice.

6.6 Baggage handling

6.6.1 The gateway one (*brief development / confirmation stage*) report sets out the primary objectives for the Terminal Two Baggage Handling System. It notes that the system should be designed for the anchor tenant with the facility to service additional airlines to maximise the use of the system. It also states that the system is to be robust, cost effective, as well as resilient.

6.6.2 It is good practice in the sizing of terminal systems and sub-systems to smooth out the demand. A balanced baggage handling system requires expertise in respect of analysis and interpretation of the flight schedules, the development of the user requirements and to investigate alternative solutions/ technology. The verification team understands that this work is being led, on behalf of the DAA, by an international expert (who is a contributor to the technical guidance in the IATA Airport Development Reference Manual), and this work follows the IATA methodology closely.

6.6.3 The verification team considers that the process for the analysis and simulation of the peak demand for passengers and bags from check-in, departures, and arrivals flows is in line with best practice.



6.6.4 The DAA and its consultants are aware that EU directives with regard to baggage handling are currently being revised and have recommended that the business and planning case should allow for the new requirements and associated technologies. The DAA and its consultants will continue to determine any effect of updated directives.

6.6.5 The approach adopted follows best practice for IATA standards for baggage handling.

6.7 Retail strategy

6.7.1. One of the principal commercial objectives of the project is to maximise commercial revenues to the airport through providing an appropriate area for commercial/ retail opportunities in the key passenger flow areas.

6.7.2 To this end, the planning objective is to create a departures lounge surrounded by retail, food and beverage outlets and linked, if possible, to the existing Terminal 1 retail areas. The verification team notes that a number of airport operators, including BAA, have successfully adopted this retail model. Also, the IATA guidance supports this approach with the proviso that passenger processing operations are not compromised by retail activities.

6.7.3 Strategic decisions have been made in respect of the location and overall area provision for concessions in the region of 8,500 m² for the terminal and pier at approximately 11% of the terminal area. In addition there is 300m² retail area within the pier. The total provision is within IATA parameters and benchmarking has indicated that it compares well with other international airports.

6.7.4 There is still further market research and work in detail needed to determine the split between retail, food and beverage and servicing requirements. Sign-off of the final departures lounge layout with all major stakeholders will be important to ensure buy-in and operational and security protocols.

6.7.5 To conclude this section, the verification team notes that the approach adopted follows best practice as recommended by IATA.

6.8 Security strategy

6.8.1 The initial DAA project brief states that design objectives in respect of security for the new terminal are to comply with national, EU and international legislation and makes particular reference to the requirements of the Department of Transport. These objectives are generally in line with international guidance and the strategy is programmed for further development during the detailed design stage.

6.8.2 The DAA and its consultants have consulted with the DAA's own security section, the Department of Transport and an IATA security specialist in the course of the Gateway process. The outcomes of the consultation process have been incorporated into the planning application designs for the project.



6.8.3 Terminal Two will offer full segregation between departing and arriving passengers. Terminal 1 is not segregated and there will be some airside connectivity issues to be resolved at the detailed design stage.

6.8.4 In conclusion, the verification team affirms that the consultation process on security strategy adopted by the DAA and its consultants accords with best practice.

6.9 Servicing strategy for building operation

6.9.1 The servicing strategy has been developed with adequate reference to security considerations. There has been careful attention given to control of passenger movement, bags, staff, goods and waste products across the airside landside boundary. In addition, innovative ideas in respect of air locks, access for maintenance and management of deliveries in a restricted environment are apparent in design development.

6.9.2 A detailed development of a trolley management strategy that includes the retrieval of trolleys from car parks for timely delivery to check-in and reclaim halls to service the peak hour demand necessary during the design development stage.

6.9.3 A high level review for the maintenance and cleaning requirements of the building has been incorporated into the current plans. This will be further developed during the course of the design development stage.

6.9.4 Large mechanical and electrical (M&E) equipment has generally been located on roof tops, at the perimeter of the buildings and within the central equipment area. This follows general good practice and should make both maintenance and replacement of major items of equipment easier. In addition to this the use of service corridors has been provided for the main routing of the M&E installations. A general servicing strategy will be required for all major items of M&E equipment as well as any other M&E equipment installed within the buildings.

6.9.5 The objectives and considerations in respect of servicing and maintenance follow the guidance contained within the IATA standards. An overall servicing strategy for maintenance needs will be developed in the design development stage.

6.10 Landscaping

6.10.1 Further consideration will be given to the specification of plants and water features in the detail design development of the landscape strategy for Terminal Two with particular reference to best practice (landscape development guidance contained in the Civil Aviation Policy CAP 680 – Aerodrome Bird Control).



7.0 Design development /option selection (gateway 2)

7.1 Process of option selection and evaluation

- 7.1.1 The project team's key objective for Gateway 2 was the 'preparation of a range of design option concepts for high level evaluation, then selection of a single concept for design development in the next stage'. The selected option would be submitted for planning approval.
- 7.1.2 Their approach was to evaluate option 'families' to identify the areas where the options perform comparatively well or poorly, to identify the risk and performance profile and to capture potential modifications/ improvements to the emerging designs to feed into the next stages of design development. Essentially this is a comparative analysis that rates the performance of the Gateway 2 options for a range of attributes.
- 7.1.3 Eight main criteria categories, weighted in accordance with the DAA's stated high level objectives (section 5.1.1) were identified and the performance of each design option was evaluated against these categories.
- 7.1.4 Three options were designed and evaluated against the objectives and criteria at Gateway 2. One of these options was selected on the basis of the highest ranking performance. Further designs were developed around the selected option to enhance overall performance.
- 7.1.5 The option appraisal process adopted by the DAA and its consultants accords with best practice.

8.0 Design detail

- 8.1 The new terminal is accessed by vehicles via newly configured landside road systems. The forecourt interfaces with a remote check-in building, separated from the main Terminal Two building to facilitate realignment of the roads network and to provide road access to Terminal 1 between the two Terminal Two buildings. At a strategic level the plan provides for future connections for transport interchanges and future stages of multi-storey car park development.
- 8.2 The layout of the buildings is good. There is a clear axis and primary circulation route from passenger set down in the forecourt through the Terminal Two to the pier. Further definition is given by a line of glazing in the roof bringing in natural light, guiding passenger flow through the process of check-in, security control and into the departures lounge.
- 8.3 Accommodation is arranged on three main levels, baggage make up hall (assembly of baggage for transfer to airplanes) at apron level, arrivals and reclaims hall at first floor level and departures at second. The departures route starts at ground floor in the remote check-in facility and then rises to second floor level to the departures lounge and then drops down to the first floor to the pier and gates. From aircraft the arrivals route is via jetties to the pier at a mezzanine level above departures (first floor) in the pier and is at grade with arrivals level in the terminal providing ease of access to the reclaim hall.



The route then bridges across roads infrastructure to Terminal 1 and the passenger set down to Terminal Two, dropping down to ground level to facilitate exit of the passenger terminal site.

- 8.4 Baggage is transferred from check-in to the baggage hall at a mezzanine level between the terminal arrivals level and apron level. The terminal is serviced through a service yard to the east of the terminal. The facility will provide both airside and landside facilities for goods in and waste management with the appropriate level of screening for goods being delivered airside.
- 8.5 The arrangement of and relationship between primary functions is generally correct i.e. functions located correctly with reference to other dependent functions. More detailed work with stakeholders is still required to hone and reconcile Programme Requirements (Appendix D of the Initial Brief), in particular areas and level of facility provision in future stages of the project.
- 8.6 The architectural form is dynamic and appropriate for an aviation terminal and international gateway building. The project team is still evaluating roofing and cladding elements in respect of performance. The generic descriptions for materials to the external envelope and finishes are adequate at this stage for accompanying the planning application.
- 8.7 The cost plan reflects the adoption of a structural steel frame supporting composite in-situ concrete suspended floor, a structural steel truss roof, supported off shallow pad foundations. The verification team suggests that a structural specification is produced as soon as practical and cost checked against the cost plan allowance.
- 8.8 This structural scheme is consistent with the *Gateway 2 (design development / option selection stage)* report options and has been developed in a logical and thorough manner. The scheme is consistent with structural solutions for a number of similar airport terminal buildings.
- 8.9 The foundation proposals have been developed based upon certain assumptions and anecdotal evidence relating to ground conditions. The level of contamination also appears to have been based upon anecdotal evidence. These assumptions must be reviewed when the ground investigations have been completed.
- 8.10 The structural solution will also need to be reviewed and developed in detail against the performance criteria and 'Building Structure design Criteria' specified in the Initial Brief and *Gateway 2 (design development / option selection stage)* reports.
- 8.11 As part of Pier C is designed to be subsumed into the parameters of Terminal Two, the DAA and its consultants are examining its construction to ensure compatibility with the Terminal Two design.
- 8.12 To conclude this section, it is considered that the development of the structural proposals is in accordance with best practice, and the scheme chosen is comparable with that used in similar airport terminal buildings.



9.0 Services

- 9.1 The M&E design detail of the project reflects the level of detail that would be typically expected at this project stage. All schematics for the installations are indicative but the strategy for same is well documented.
- 9.2 It should be noted that the proposal for building in spare capacity (to accommodate future requirements), within the mechanical plant may lead to the plant efficiency initially being lower than anticipated.

10.0 Transportation

- 10.1 The development of the landside highway and kerbside design strategy is the outcome of a logical and well-structured process.
- 10.2 The planning application drawings take account of the transportation issues in terms of segregation of arriving and departing passengers as well as various modes of transport.
- 10.3 The main transportation impacts are considered to be the provision for car parking and location of the proposed metro link to the airport. The proposed metrolink to the airport is outside the scope of this report.
- 10.4 The transportation solution provides a clear and logical access strategy to Terminal two and maintains good, segregated, access to Terminal 1.
- 10.5 The verification team suggests that the implications of a temporary closure of the route between the Terminal Two buildings (see 8.1) should be considered in relation to maintaining access to Terminal One.

11.0 Sustainability

The DAA's team has considered numerous renewable energy and waste systems for installation at the site with most of them noted as requiring further investigation. The provision of any renewable source may have an impact on initial cost outlays and operational costs for the project.

12.0 Flexibility

- 12.1. As previously stated in section 6.2, two growth rates 5% and 10% per annum were applied to a range of peak demand curves and developed through to 2020. The sizing model also provides a useful tool in the understanding of the risk and consequences if the demand differs from expectations. The precise timing and scale of the phase two will be dependent on how demand actually manifests itself.
- 12.2 An area to cater for the expansion of facilities in the event of further passenger growth has been safeguarded to the east of the terminal above the proposed service yard.



- 12.3 Expansion capability for CBP facilities has been identified to the west of the terminal above the apron level baggage hall.
- 12.4 The road systems for Terminal 1 and Terminal Two have been designed to be independent of each other and this will help traffic circulation. However, the need to provide flexibility of traffic routes in the event of blockages at key locations in the road system should be considered as the design is developing.
- 12.5 As previously noted, the infrastructure plan facilitates future nodal connections to the proposed transport interchange and future stages of multi-storey car park development.
- 12.6 From a structural perspective, the chosen option appears to provide the maximum amount of flexibility for the Phase 2 extension since the facilities will be capable of expansion on three separate sides.
- 12.7 In addition, the structural form (in-situ composite floors on steel frame) provides the best compromise for flexibility to incorporate modifications and addition of service holes during and after construction.

13.0 Capital costs

13.1 Key objectives and Process

13.1.1 The key highlighted objectives relating to capital cost are stated as:

- ① the right cost: capital and life cycle
- ① operational efficiency
- ① appropriate technology and future proofing

13.1.2 The DAA's briefing document for consultants' appointments states that "Best Practice Approach" is to be implemented including the use of benchmarking / current industry practice.

13.1.3 The process for defining the capital costs was outlined in the cost consultant's report of March 2006. It included a process for the production of an Outline Cost Plan at Gateway 2 (*design development / option selection stage*), and a Detailed Cost Plan at Gateway 3 (*architectural treatment / planning submission stage*). This process of cost plan development aligned with the gateway process adopted by the DAA.

13.2 The cost plan methodology adopted

13.2.1 Prior to evaluating any options, benchmark costs on a cost per metre square basis for comparable UK airport developments were independently developed by the DAA's cost consultant. The costings were analysed and adjusted to ensure that they were presented on a like-for-like basis.



- 13.2.2 The resulting benchmarking report was presented to the DAA and other members of the project team in order to provide a benchmark for the outline cost plans for the various Gateway 2 (*design development / option selection stage*) options, and to assist in the evaluation thereof.
- 13.2.3 Gateway 2 encompassed a cost review of the following areas:
- ④ the Terminal Two building
 - ④ associated kerb / infrastructure work
 - ④ pier E and associated apron works
 - ④ phasing and temporary works
- 13.2.4 A series of options were proposed and these were each evaluated under the following cost headings to enable ranking of the best performing option
- ④ capital costs
 - ④ operational and life cycle costs
 - ④ asset write off
 - ④ retail and concessions revenues
- 13.2.5 Capital costs were developed for each of the various options based on:
- ④ building plans and areas schedules
 - ④ site locations
 - ④ kerbside, roads and infrastructure
 - ④ phasing and temporary works
 - ④ indicative plans for works to / interfaces with existing buildings
- 13.2.6 The resultant estimated capital cost was included in the “commercial” segment of the option evaluation matrix and scored in a range from “performs well” to “performs poorly” against the benchmark of the best performing option.
- 13.2.7 Operational and life-cycle costs were assessed under the headings of “payroll” and “non payroll”. Items such as security costs, terminal management and insurances were not included as they were not considered to be materially different for each option.
- 13.2.8 The resultant estimated operational and life cycle costs for each option were included in the “commercial” segment of the option evaluation matrix and scored in a range from “performs well” to “performs poorly” against the benchmark of the option with the lowest identified cost. This forms the basis of a qualitative assessment.



- 13.2.9 A full life cycle cost analysis would be expected to take into consideration the performance of any given options / materials and their possible alternatives in terms of:
- ① capital costs
 - ① periodic maintenance costs
 - ① running costs
 - ① replacement costs
- 13.2.10 This analysis is typically undertaken during the design development stage and we would expect it to be continually updated, refined and evaluated through and after Gateway 3 (*architectural treatment / planning submission stage*).
- 13.2.11 The analysis of “asset write off” deals with the effect of any given option or part of an option on the existing DAA building assets in Dublin Airport particularly Pier C. For example, option 6 proposed the complete demolition of Pier C and therefore the complete asset value of Pier C would have to be written off in this option.
- 13.2.12 The estimated asset write off costs were included in the “commercial” segment of the option evaluation matrix and scored in a range from “performs well” to “performs poorly” against the benchmark of zero effect.
- 13.2.13 The DAA has stated that retail and concession revenues are one of the main generators of income for the DAA, as the current operator of Dublin airport. Therefore, “retail revenues” was assigned an individual category under the commercial analysis segment of the option appraisal.
- 13.2.14 Each option was assessed on the basis of the area of retail and concession space contained therein, compared against the brief and each other, and scored on the option evaluation matrix against the benchmark of highest area provided.

13.3 The detailed cost plan

- 13.3.1 The Gateway 3 (*architectural treatment / planning submission stage*) cost plan is based on the scheme submitted by the DAA for planning approval on 31st August 2006 and covers the following areas:
- ① Enabling works, site logistics & phasing / temporary works (1.50%)
 - ① Pier C refurbishment works (3.00%)
 - ① Terminal Two (65.50%)
 - ① The energy centre (1%)
 - ① Pier E and apron remodelling (23.50%)
 - ① External works (5.50%)
- 13.3.2 The percentages in brackets indicate the percentage of the total estimated construction cost that each area represents.



- 13.3.3 The cost plan for the enabling works, site logistics & phasing / temporary works, the Pier C refurbishment, the energy centre and the external works (combined 11%) are largely based on an estimated cost per metre square of gross internal floor area or estimated lump sum allowances.
- 13.3.4 Strictly speaking this does not accord with best practice. However, it is not unusual to estimate the costs for these items on this basis at this stage of the project, on the basis that they represent a small portion of the overall total.
- 13.3.5 The cost plan for Terminal Two and Pier E (combined 89%) is based on detailed quantities and rates. The cost plan is broken down into sections reflecting the proposed works packages for future tendering and this should simplify the comparison of budgets and tenders on a package by package basis.
- 13.3.6 The cost plan was examined under the following headings:
- ① Building elements
 - ① Specialist equipment services
 - ① Enabling works
 - ① External works
 - ① Construction contingencies
 - ① Inclusions / exclusions
 - ① Project contingencies
 - ① Costs

13.4 Building elements

The cost plan is broken down into logical sub sections of cost headings for the building elements. An examination of the estimated construction cost rates employed revealed them to be realistic and the DAA's team has confirmed that the rates for major cost centres have been market tested.

13.5 Specialist equipment services

A separate section of the cost plan is devoted to specialist equipment services which includes such items as check-in and baggage handling systems.

13.6 Enabling and external works

- 13.6.1 The cost plan is broken down into logical sub sections of cost headings for the anticipated and site logistic works.
- 13.6.2 As considerable amounts of the projected costs of these elements are included by way of lump sum allowances, these figures will need to be checked against the specific detailed design proposals as they emerge.



- 13.6.3 The verification team recommends that this section of the cost plan is reviewed on a regular basis by the DAA and its consultants throughout the design development stage to ensure that the current allowances are adequate.

13.7 Inclusions / exclusions

- 13.7.1 The cost plans highlights an extensive list of inclusions and exclusions, on a section by section basis.
- 13.7.2 The verification team received confirmation from the DAA and its consultants that the exclusions list is the result of collaborative consultation and that the DAA are fully aware of the contents of the exclusions list.

13.8 Construction and project contingencies

- 13.8.1 The cost plan includes two distinct types of contingency; (1) construction / design contingency, (2) project contingency.
- 13.8.2 Each separate section of the cost plan includes its own construction contingency; which stands at approximately five per cent of the estimated construction cost. This level of contingency is deemed appropriate for this stage.
- 13.8.3 The project contingency is included to cover the financial implications of potential additional costs that cannot be wholly identified and quantified at that stage but which have a realistic potential to occur during the course of the project.
- 13.8.4 The identification, likelihood analysis (low, medium, high) and potential financial implications are analysed and quantified in the risk register.
- 13.8.5 The risk register produces an estimated cost and this in turn becomes the project contingency.

13.9 Costs

The total estimated cost of the overall project is € 609 million of which Terminal 2 is estimated to cost € 395 million. The cost plan is based on prices prevailing at the 3rd quarter of 2006.

13.10 Conclusion

The Gateway 3 estimated cost of Terminal Two on a cost per square metre basis, lies at the mid point range of the UK terminal buildings benchmarking study carried out by the DAA's team of consultants. The verification team has independently verified the benchmarking exercise and the cost plan and conclude that the estimated cost is within industry norms for this type of project in a European capital city.



Appendix A

Scope of Works

