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This report is a detailed account of an investigation into Public Safety Zones (PSZs) at Ireland's three principal airports; Cork, Dublin and Shannon.

The investigation was performed by ERM Environmental Resources Management Ireland Ltd on behalf of the Department of Transport (DT) and the Department of Environment, Heritage and Local Government (DoEHLG) between December 2000 and June 2003 ⁽¹⁾ ⁽²⁾.

A technical report was issued for public comment on 23rd June 2003, and three 'public information' days were held in July 2003 at Cork, Dublin and Shannon airports.

Over 130 people attended the information days, and a total of 42 written submissions were received up until 28th August 2003.

In response to the public comments this revised technical report was issued on 30th September 2003.

1.1

STRUCTURE OF THIS REPORT

This report is set out as follows:

- this section, *Section 1*, provides a synopsis of the project team who performed the work and undertook the public consultation, and it also provides background to Public Safety Zones (PSZs);
- *Section 2* outlines the processes undertaken in defining and calculating the PSZs proposed for Cork, Dublin and Shannon airports;
- *Sections 3, 4 and 5* illustrate the calculated PSZs for Cork Airport, Dublin Airport and Shannon Airport, respectively;
- *Section 6* provides ERM's recommendations and conclusions for PSZs at Cork, Dublin and Shannon airports;
- *Annex A* provides a detailed and mathematical explanation of the calculation method;

(1) Environmental Resources Management. Contact: 22 Earlsfort Terrace, Dublin 2.

(2) Department of Transport (formerly the Department of Public Enterprise) and Department of the Environment and Local Government (2000). Terms of Reference for the preparation of Recommendations for Public Safety Zones in the Vicinity of Dublin Airport. Letter of 29th November 2000, from Martina Walsh, Secretary to the Public Safety Zones Working Group, Aviation Regulations & International Relations Branch.

- *Annex B* provides an overview of risk and land-use planning, expert opinions, and the development of criteria and policy for Cork, Dublin and Shannon airports;
- *Annexes C, D and E* detail the assumed aircraft movement data and provide an example risk calculation for Cork Airport, Dublin Airport and Shannon Airport, respectively;
- *Annex F* details ERM's response to the public comments received following issue of the technical report on 23rd June 2003 and the information days held in July 2003 at Cork, Dublin and Shannon airports.

1.2

PROJECT TEAM

Davies, Paul. Dr Paul Davies is a Partner of ERM. He has an honours degree in Mechanical Engineering, a doctorate in Quantitative Risk Assessment, and over 15 years experience in the field. This experience has covered fire, explosion, toxic, and crash hazards in process operations, storage facilities, road, rail, air and pipeline transport, quarrying, offshore platforms, ports and power generation.

With regards to airports and aircraft, Paul has been the project director, manager and/or principal analyst for numerous studies. These include: the investigation of risks to persons 'on-the-ground' from potential aircraft crashes at Manchester Airport (this work was presented as evidence for Queens Council at the Public Inquiry into the Proposed Second Runway at Manchester Airport); a peer review of the assessment of risk to major hazard installations due to runway re-alignment at Liverpool Airport; the assessment of risks presented to aircraft from the blasting of rock during the development of Hong Kong's Chek Lap Kok Airport; methodology development for the investigation of third party risk (land-use planning issues) for the proposed location of a second Sydney Airport; and an assessment of the risks to persons 'on-the-ground' in the vicinity of Farnborough Aerodrome.

O'Riordáin, Seán. Sean is the Managing Director of ERM's Dublin office. He joined ERM from the Institute of Public Administration, Dublin (IPA) in 2000. He continues to contribute to the planning and regional development elements of the IPAs MA Local Government programme. He is also a visiting lecturer in Planning at the University of Dublin, Trinity College.

Sean has widespread experience in liaising with public agencies, including the EU, and has been involved with research into public management issues in Ireland and the European Union generally. This includes undertaking evaluation and assessment of regional policy initiatives in Ireland and elsewhere in the European Union and Central and Eastern Europe. Since joining ERM he has been involved in work addressing the National Spatial Strategy and local and regional planning.

Quinn, Daniel. Daniel is a Senior Consultant with ERM. His principal areas of work include hazard identification, scenario quantification, risk evaluation and mathematical modelling of fire, gas and crash impacts. Projects include the risk assessment of gas compression stations, power stations, underground gas storage facilities, sulphur trioxide/oleum transport, petroleum transport, management factors in the prevention and cause of accidents associated with the transport of hazardous materials by road, rail and inland waterway; and risks profiling of flammable gas storage and delivery systems.

With regards to airports and aircraft, Daniel was the principal analyst for the assessment of risks to persons 'on-the-ground' from potential aircraft crashes in the vicinity of Farnborough Aerodrome.

Williams, Kirsten. Kirsten is a Social Scientist/Social Planner with considerable experience in environmental impact assessment, social impact assessment and strategic planning components of large multi-disciplinary infrastructure projects. Ms Williams also designs, manages and conducts consultation and evaluation processes, is experienced in strategy and policy development, and is a highly experienced Project Manager.

Projects undertaken have covered a wide range of industries including transportation (roads, rail, ports and airports), construction, mining, housing, education, tourism, recreation, public utilities, water resources, forestry, agriculture, pipelines, and foreign aid. In addition to her extensive European and Australian experience, Ms Williams has been responsible for undertaking social and environmental resource assignments in China and Indonesia for a major international donor agency, and more recently for BP in Turkey. Areas of focus have included environmental and social impact assessment, poverty alleviation, community and stakeholder consultation, natural resource management, infrastructure development and institutional strengthening. More recently, Kirsten has been involved in the development Ireland's National Spatial Strategy, revision of Ireland's Nuclear Emergency Plan, and a Strategic review of Ireland's rail network.

1.3

BACKGROUND

The risks to persons 'on the ground' from aircraft crashes have been appreciated for some time. As such, Ireland, as do many other countries, operates 'protection zones' at the end of runways where the risk is greatest.

In Ireland, these zones are currently referred to as 'red zones' and serve to aid safe navigation of aircraft and to protect the public on the ground ⁽¹⁾. This is done by limiting the type and allowable height of buildings and structures within the zones.

(1) In Ireland, a number of terms have been used when referring to the 'red zones', for example safety zones, and even public safety zones. The reason for this, most probably, relates to the (existing) dual purpose of the 'red zones' (i.e. to aid safe navigation of aircraft, by providing an obstacle clearance surface, and to protect persons on the ground by controlling land-use (within the zones)). In this report, the existing zones are referred to as 'red zones' and those zones proposed to protect people 'on the ground' as public safety zones or PSZs.

Advances in modelling techniques have made it possible to quantify the risks to the public (on the ground) from aircraft crashes. These techniques have shown that the risk pattern 'on the ground' bears little relation to the extent and shape of the red zones. Therefore, a set of protection zones, termed Public Safety Zones (PSZs), have been recommended for Cork, Dublin and Shannon airports. If adopted, these PSZs will help protect the public, whilst the red zones will continue to aid safe navigation of aircraft.

Two 'individual risk values' have been assessed in determining appropriate PSZs at Cork, Dublin and Shannon airports. They are 1 in 100,000 per year and 1 in one million per year ⁽¹⁾. An inner and an outer PSZ, corresponding to these risk values, have been set for each runway.

These 'individual risk values' were selected because they are established in the setting of protection zones at airports, for example in the Netherlands and the UK (as discussed in *Section 1.3.1*); and because they are comparable with those used in setting protection zones around chemical installations in Ireland and internationally. Further details are provided in *Annex B*.

Furthermore, in calculating and setting the PSZs for Cork, Dublin and Shannon airports it was recognised that they may impact upon existing and proposed land-use in the vicinity of the airports. As such, the study scope was broadened to investigate the potential land-use implications of the proposed PSZs. It was found that there would be no changes to existing land-use around Cork, Dublin and Shannon airports, and only minor alterations to proposed development plans (i.e. either a reduction in housing density or a variation to a proposed location). Further details are provided in *Annex B*.

In summary, this study has led ERM to propose a two-zone PSZ system for Cork, Dublin and Shannon airports, i.e. an inner and an outer PSZ. The calculation and setting of these zones, and the proposed criteria/policy to apply in operating these zones are outlined in the following sections.

1.3.1 *The Experience of Setting PSZs in the Netherlands and the United Kingdom*

Studies performed in the Netherlands and the UK have drawn similar conclusions to the investigation of PSZs in Ireland. This has resulted in the setting of new/revised PSZs at the end of runways at Schiphol Airport and at all major UK airports ^{(2) (3)}.

The extent of the Dutch and UK PSZs has been based on the individual risk of fatality. The Dutch government has adopted both an inner and outer PSZ set at an individual risk of 1 in 100,000 per year and 1 in one million per year,

(1) Individual risk of 1 in 100,000 per year; i.e. 10^{-5} or a 0.00001 chance of death per year for an individual exposed 24 hours per day, 365 days per year. Individual risk of 1 in one million per year; i.e. 10^{-6} or a 0.000001 chance of death per year for an individual exposed 24 hours per day, 365 days per year.

(2) Ale, B.J.M. and Piers, M. (2000). The Assessment and Management of Third Party Risk Around a Major Airport. *Journal of Hazardous Materials*, 71, 1-3, pp 1-16.

(3) UK Department of the Environment, Transport and the Regions (DETR). (1997). Third Party Risk Near Airports and Public Safety Zone Policy. R&D Report 9636. National Air Traffic Services, London.

respectively ⁽¹⁾. By comparison, the UK government has adopted only a single PSZ set at 1 in 100,000 per year.

Within the PSZs that are set at an individual risk of 1 in 100,000 per year, both the Dutch and UK governments prevent any further building. In addition, the Dutch government plan to remove all existing housing within this zone. This compares with the UK government's decision to allow all existing developments to remain within this zone.

In addition, within the Dutch government's outer PSZ (i.e. set at a risk of 1 in one million per year), no future development of housing, hospitals and/or schools is permitted. However, all existing development is permitted to remain. This compares with the UK's approach of allowing unrestricted development outside the 1 in 100,000 PSZ (in respect of the risk from aircraft).

Annex B provides further details on the zones, criteria and policy adopted in the Netherlands and the UK.

(1) Individual risk of 1 in 100,000 per year; i.e. 10^{-5} or a 0.00001 chance of death per year for an individual exposed 24 hours per day, 365 days per year. Individual risk of 1 in one million per year; i.e. 10^{-6} or a 0.000001 chance of death per year for an individual exposed 24 hours per day, 365 days per year.

2.1

IDENTIFYING AN APPROPRIATE METHODOLOGY

In determining the most appropriate method to use in calculating Public Safety Zones (PSZs) for Cork, Dublin and Shannon airports, a review was undertaken of the methodologies used by the Dutch and UK governments in setting PSZs at their airports ⁽¹⁾ ⁽²⁾.

Both governments' methods have been translated into computer models, with the results used to develop policy and set the size, shape and extent of PSZs in these countries ⁽³⁾ ⁽⁴⁾. The approaches used have drawn upon the work of others during this period, and an overview of some of these methods is given in the UK government's report on third party risk around airports and in a recent paper on the approach adopted in the Netherlands ⁽⁵⁾ ⁽⁶⁾.

The principal difference between the two approaches is the adoption of different crash location models. In the Netherlands, the probability of crash location is related to individual flight paths (known as a curve-linear approach). By comparison, the UK method relates potential crash location to a runway's extended centreline.

Intuitively, a potential crash location is related to an aircraft's flight path, and so the Dutch approach appears to offer improved modelling accuracy. However, in many accident reports no details of an aircraft's intended route are given and hence, compared with the UK approach, fewer accidents are available to form the basis of the Dutch model. Considering the already 'small' set of accidents upon which the UK model is based, it can be argued that the Dutch approach has less statistical basis.

Further support for the UK approach is given by the fact that landing aircraft (half of all movements) tend to align with the extended runway centreline at considerable distances from the runway (e.g. 10 km or more) and that the crash rate for landings is approximately 2½ times that of departures. Hence, landing crashes (which are likely to be distributed about the extended runway centreline) have a greater influence on the overall distribution of crash locations.

With regards to accident consequences, both approaches use the extent of potential crash area to estimate fatal injuries, and relate this area to Maximum

(1) Ale, B.J.M. and Piers, M. (2000). The Assessment and Management of Third Party Risk Around a Major Airport. *Journal of Hazardous Materials*, 71, 1-3, pp 1-16.

(2) Cowell, P.G., et al. (2000). A Methodology for Calculating Individual Risk Due to Aircraft Accidents Near Airports. R&D Report 0007. National Air Traffic Services, London.

(3) Ministerie van Verkeer en Waterstaat, Den Haag. (19-Dec-99). The Future of the National Airport [Schiphol].

(4) UK Department for Transport. (10-Jul-02). Control of Development in Airport Public Safety Zones. Circular 1/2002.

(5) UK Department of the Environment, Transport and the Regions (DETR). (1997). Third Party Risk Near Airports and Public Safety Zone Policy. R&D Report 9636. National Air Traffic Services, London.

(6) Refer to footnote 1, page 6.

Aircraft Weights (MAW) ⁽¹⁾. Similarly, crash rates are based on established accident databases, and modified to reflect so called 'first-world' operations (i.e. eliminating accidents specific to countries where aircraft types and aircraft/airport operations are not comparable to Western Europe and the United States).

With the above in-mind, the model used to calculate PSZs for Cork, Dublin and Shannon airports is based upon the method employed on behalf of the UK government. The method is detailed in *Annex A*.

2.2

IDENTIFYING APPROPRIATE GUIDANCE (RISK CRITERIA AND POLICY)

As stated in *Section 1.3* a two-zone Public Safety Zone (PSZ) system is proposed for Cork, Dublin and Shannon airports; an inner PSZ representing an individual risk of 1 in 100,000 per year, and an outer PSZ representing 1 in one million per year ⁽²⁾.

Within the PSZs the following land-use policy is proposed:

- prevent further development within inner PSZs, but allow existing developments to remain; and
- allow existing developments to remain within outer PSZs, but prevent high density housing development, and the building of schools, hospitals and facilities attracting large numbers of people (for further detail refer to *Section 6*).

These 'individual risk values' (i.e. criteria) and the associated policy on land-use within the PSZs are based upon:

- a review of the established risk criteria used to protect the public from industrial hazards both in Ireland and internationally;
- a comparison of these 'industrial' criteria with those recently implemented at airports in the Netherlands and the UK; and
- a consideration of expert opinions.

The review, comparison and expert opinions are detailed in *Annex B*.

(1) The Dutch and UK approaches refer to Maximum Take-off Weight (MTOW) and Maximum Take-off Weight Authorised (MTWA), respectively. These terms are synonymous with the term used here, Maximum Aircraft Weight (i.e. the maximum weight allowed, to include full load and fuel).

(2) Individual risk of 1 in 100,000 per year; i.e. 10^{-5} or a 0.00001 chance of death per year for an individual exposed 24 hours per day, 365 days per year. Individual risk of 1 in one million per year; i.e. 10^{-6} or a 0.000001 chance of death per year for an individual exposed 24 hours per day, 365 days per year.

The calculation of risks upon which to determine Public Safety Zones (PSZs) in Ireland involved the following stages:

1. identifying the number of annual movements (i.e. landings and take-offs) with respects to aircraft types/classes ⁽¹⁾;
2. calculating an 'all classes' movement-weighted average crash rate (crashes per million movements). This is done by using crash rates for each aircraft class (crashes per million movements) and multiplying it by the proportion of movements for that class, and summing the individual products;
3. calculating average crash areas (within which persons 'on the ground' are assumed to be fatally injured) for 'large' aircraft and 'light' aircraft. These are calculated by determining the average Maximum Aircraft Weight (MAW) for each class, multiplying the average crash area by the proportion of annual crashes for that class, and summing the individual products;
4. calculating the probability that crashing aircraft impact a specified location. For 'large' aircraft, this is performed by integrating probability density functions over the calculated average crash area. A similar calculation is performed for 'light' aircraft;
5. calculating the annual frequency that crashing aircraft impact a specified location (i.e. the individual risk). This is performed by multiplying the annual probability of a crash for the specified location by the appropriate average crash rate and associated number of movements (landings and take-offs) for each runway end;
6. using the individual risk results to determine 'best fit' zones representing specified annual individual risks (e.g. 1 in 100,000 per year and 1 in one million per year for the proposed inner and outer PSZs). The shape of each contour (extending away from the runway end) is very similar to that of a triangle. Therefore, to provide a simple geometric area that can be readily defined and easily reproduced on maps and plans, the risk contours are represented by zones alongside and parallel to the runway and triangular zones extending away from the runway ends.

The principal purpose of the outer PSZ is to minimise the possibility of a multiple fatality accident. For example, to limit the possibility of an aircraft crashing into a school, hospital or other development where large numbers of people can be expected. In relation to the 'size', 'speed' and weight of aircraft,

(1) The extent of PSZs is related to the number of aircraft movements and aircraft types. To minimise the need to periodically revise zone extents the Steering Group agreed that the number of aircraft movements for each runway should be set as either (a) the runway's movement capacity, or (b) the expected maximum number of movements. Similarly, aircraft types have been categorised as either 'large' or 'light', and the proportion of both set to provide a good representation of the expected split.

it is judged that 'light' aircraft have a far lower likelihood of causing a multiple fatality accident than 'large' aircraft ⁽¹⁾. Therefore, the extent of the outer PSZs is based upon large aircraft crashes only.

A detailed explanation of the calculation procedure and input data is given in *Annex A*, *Annex C* (Cork Airport), *Annex D* (Dublin Airport) and *Annex E* (Shannon Airport).

(1) Light aircraft <4 tonnes MTWA, compared with a movement weighted average MTWA of 33 tonnes, 95 tonnes and 54 tonnes for Cork, Dublin and Shannon Airports, respectively. Maximum Take-off Weight Authorised (MTWA).

The dimensions of the Public Safety Zones (PSZs) proposed for the two runways at Cork Airport are described below and illustrated in *Figures 3.1 to 3.5*. The inner and outer PSZs relate to an individual risk of fatality of 1 in 100,000 per year and 1 in one million per year, respectively. Where calculated, the individual risk of fatality of 1 in 10,000 per year is also shown.

3.1 MAIN RUNWAY 17/35

3.1.1 Towards the North – End 17

Inner PSZ

An area with a maximum extent from the end of the runway, along the extended runway centreline, of 3065 m, and a maximum width at the end of the runway of 260 m.

Outer PSZ

An area with a maximum extent from the end of the runway, along the extended runway centreline, of 11290 m, and a maximum width at the end of the runway of 962 m.

3.1.2 Towards the South – End 35

Inner PSZ

An area with a maximum extent from the end of the runway, along the extended runway centreline, of 3055 m, and a maximum width at the end of the runway of 278 m.

Outer PSZ

An area with a maximum extent from the end of the runway, along the extended runway centreline, of 11015 m, and a maximum width at the end of the runway of 1056 m.

3.2 CROSS-RUNWAY 7/25

3.2.1 Towards the West – End 7

Inner PSZ

An area with a maximum extent from the end of the runway, along the extended runway centreline, of 625 m, and a maximum width at the end of the runway of 96 m.

Outer PSZ

An area with a maximum extent from the end of the runway, along the extended runway centreline, of 2615 m, and a maximum width at the end of the runway of 224 m.

Inner PSZ

An area with a maximum extent from the end of the runway, along the extended runway centreline, of 625 m, and a maximum width at the end of the runway of 96 m.

Outer PSZ

An area with a maximum extent from the end of the runway, along the extended runway centreline, of 2300 m, and a maximum width at the end of the runway of 170 m.

Figure 3.1 *Cork Airport – Proposed Public Safety Zones*



Figure 3.2 *Cork Airport – Proposed Public Safety Zones, Main Runway 17/35 (North End 17)*



Figure 3.3 *Cork Airport – Proposed Public Safety Zones, Main Runway 17/35 (South End 35)*



Figure 3.4 *Cork Airport – Proposed Public Safety Zones, Cross Runway 7/25 (West End 7)*



Figure 3.5 *Cork Airport – Proposed Public Safety Zones, Cross Runway 7/25 (East End 25)*



The dimensions of the Public Safety Zones (PSZs) proposed for the three existing runways and the additional proposed runway at Dublin Airport are described below and illustrated in *Figures 4.1 to 4.11*. The inner and outer PSZs relate to an individual risk of fatality of 1 in 100,000 per year and 1 in one million per year, respectively. Where calculated, the individual risk of fatality of 1 in 10,000 per year is also shown.

4.1 MAIN (EXISTING) RUNWAY 10R/28L

4.1.1 Towards the West – End 10R

Inner PSZ

An area with a maximum extent from the end of the runway, along the extended runway centreline, of 3155 m, and a maximum width at the end of the runway of 370 m.

Outer PSZ

An area with a maximum extent from the end of the runway, along the extended runway centreline, of 11455 m, and a maximum width at the end of the runway of 1448 m.

4.1.2 Towards the East – End 28L

Inner PSZ

An area with a maximum extent from the end of the runway, along the extended runway centreline, of 4375 m, and a maximum width at the end of the runway of 352 m.

Outer PSZ

An area with a maximum extent from the end of the runway, along the extended runway centreline, of 15430 m, and a maximum width at the end of the runway of 1394 m.

4.2 PROPOSED RUNWAY 10L/28R

4.2.1 Towards the West – End 10L

Inner PSZ

An area with a maximum extent from the end of the runway, along the extended runway centreline, of 3050 m, and a maximum width at the end of the runway of 378 m.

Outer PSZ

An area with a maximum extent from the end of the runway, along the extended runway centreline, of 11330 m, and a maximum width at the end of the runway of 1462 m.

4.2.2 *Towards the East – End 28R*

Inner PSZ

An area with a maximum extent from the end of the runway, along the extended runway centreline, of 3970 m, and a maximum width at the end of the runway of 344 m.

Outer PSZ

An area with a maximum extent from the end of the runway, along the extended runway centreline, of 15010 m, and a maximum width at the end of the runway of 1383 m.

4.3 *CROSS-RUNWAY 16/34*

4.3.1 *Towards the North-west – End 16*

Inner PSZ

An area with a maximum extent from the end of the runway, along the extended runway centreline, of 1240 m, and a maximum width at the end of the runway of 138 m.

Outer PSZ

An area with a maximum extent from the end of the runway, along the extended runway centreline, of 5645 m, and a maximum width at the end of the runway of 462 m.

4.3.2 *Towards the South-east – End 34*

Inner PSZ

An area with a maximum extent from the end of the runway, along the extended runway centreline, of 1290 m, and a maximum width at the end of the runway of 146 m.

Outer PSZ

An area with a maximum extent from the end of the runway, along the extended runway centreline, of 4370 m, and a maximum width at the end of the runway of 454 m.

4.4 RUNWAY 11/29

4.4.1 Towards the West – End 11

Inner PSZ

An area with a maximum extent from the end of the runway, along the extended runway centreline, of 1655 m, and a maximum width at the end of the runway of 144 m.

Outer PSZ

An area with a maximum extent from the end of the runway, along the extended runway centreline, of 3970 m, and a maximum width at the end of the runway of 438 m.

4.4.2 Towards the East – End 29

Inner PSZ

An area with a maximum extent from the end of the runway, along the extended runway centreline, of 1230 m, and a maximum width at the end of the runway of 118 m.

Outer PSZ

An area with a maximum extent from the end of the runway, along the extended runway centreline, of 5215 m, and a maximum width at the end of the runway of 432 m.

Figure 4.1 *Dublin Airport - Public Safety Zones, Existing Runways*



Figure 4.2 Dublin Airport - Public Safety Zones, Including Proposed Runway 10L/28R

Figure 4.3 *Dublin Airport - Public Safety Zones, Main Existing Runway 10R/28L (West End 10R)*

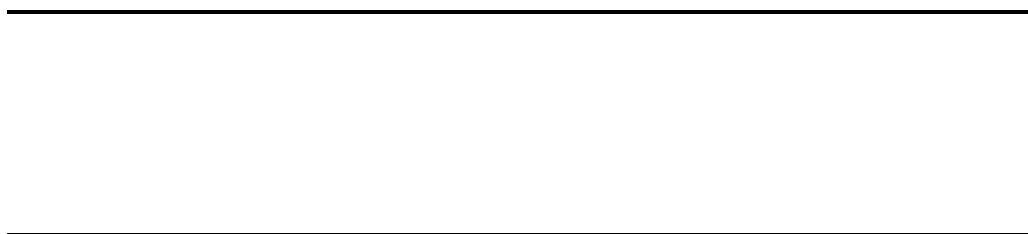


Figure 4.4 *Dublin Airport - Public Safety Zones, Main Existing Runway 10R/28L (East End 28L)*



Figure 4.5 *Dublin Airport - Public Safety Zones, Proposed Runway 10L/28R (West End 10L)*



Figure 4.6 *Dublin Airport - Public Safety Zones, Proposed Runway 10L/28R (East End 28R)*



Figure 4.7 *Dublin Airport - Public Safety Zones, Cross-Runway 16/34 (North-west End 16)*



Figure 4.8 *Dublin Airport - Public Safety Zones, Cross-Runway 16/34 (South-east End 34)*



Figure 4.9 *Dublin Airport - Public Safety Zones, Runway 11/29 (West End 11)*



Figure 4.10 *Dublin Airport - Public Safety Zones, Runway 11/29 (East End 29)*

The dimensions of the Public Safety Zones (PSZs) proposed for the two runways at Shannon Airport are described below and illustrated in *Figures 5.1 to 5.5*. The inner and outer PSZs relate to an individual risk of fatality of 1 in 100,000 per year and 1 in one million per year, respectively. Where calculated, the individual risk of fatality of 1 in 10,000 per year is also shown.

5.1 MAIN RUNWAY 6/24

5.1.1 Towards the West – End 6

Inner PSZ

An area with a maximum extent from the end of the runway, along the extended runway centreline, of 2505 m, and a maximum width at the end of the runway of 307 m.

Outer PSZ

An area with a maximum extent from the end of the runway, along the extended runway centreline, of 9805 m, and a maximum width at the end of the runway of 1161 m.

5.1.2 Towards the East – End 24

Inner PSZ

An area with a maximum extent from the end of the runway, along the extended runway centreline, of 3770 m, and a maximum width at the end of the runway of 295 m.

Outer PSZ

An area with a maximum extent from the end of the runway, along the extended runway centreline, of 13970 m, and a maximum width at the end of the runway of 1,149 m.

5.2 CROSS-RUNWAY 13/31

5.2.1 Towards the North-west – End 13

Inner PSZ

An area with a maximum extent from the end of the runway, along the extended runway centreline, of 600 m, and a maximum width at the end of the runway of 72 m.

Outer PSZ

An area with a maximum extent from the end of the runway, along the extended runway centreline, of 2315 m, and a maximum width at the end of the runway of 225 m.

Inner PSZ

An area with a maximum extent from the end of the runway, along the extended runway centreline, of 665 m, and a maximum width at the end of the runway of 91 m.

Outer PSZ

An area with a maximum extent from the end of the runway, along the extended runway centreline, of 2285 m, and a maximum width at the end of the runway of 199 m.

Figure 5.1 *Shannon Airport - Public Safety Zones*



Figure 5.2 *Shannon Airport - Public Safety Zones, Main Runway 6/24 (West End 6)*



Figure 5.3 *Shannon Airport - Public Safety Zones, Main Runway 6/24 (East End 24)*



Figure 5.4 *Shannon Airport - Public Safety Zones, Cross Runway 13/31 (North-west End 13)*



Figure 5.5 *Shannon Airport - Public Safety Zones, Cross Runway 13/31 (South-east End 31)*



6.1 RECOMMENDATIONS FOR PUBLIC SAFETY ZONES

ERM Environmental Resources Management Ireland Ltd, proposes the following Public Safety Zones (PSZs) for Cork, Dublin and Shannon airports:

- *Inner PSZ (extent set at an individual risk of 1 in 100,000 per year)*
 - prevent further development within inner PSZs, but allow existing developments to remain; and
- *Outer PSZ (extent set at an individual risk of 1 in one million per year)*
 - allow existing developments to remain within the outer PSZs, but prevent high density housing development, and the building of schools, hospitals and facilities attracting large numbers of people.

The permitted developments proposed for these zones are detailed in *Table 6.1* and summarised in *Table 6.2* and *Table 6.3*. Further guidance is given in *Section 6.2* and *Annex B*.

It is important to note that the guidance given in *Table 6.1* is not recommended for retrospective use. This is because the risks to existing developments (within the PSZs) are not so high as to be judged intolerable. The sole purpose of the guidance is to ensure that the risks do not become intolerable/unacceptable by controlling future land-use within the PSZs.

The size, shape and extent of the PSZs for each airport and runway are detailed in *Sections 3, 4* and *5*.

6.2 GUIDANCE ON PERMITTED DEVELOPMENTS WITHIN THE PROPOSED PUBLIC SAFETY ZONES (TABLE 6.1)

Table 6.1 is for guidance, and only applicable to 'safety risks' from aircraft. It should be used in conjunction with appropriate legislative and regulatory controls and guidance, and other guidance, official development plans and objectives.

In some cases, permitted developments are restricted to a maximum density of persons. This density is expressed as the number of persons per half hectare. A half hectare was chosen as this approximates the average maximum aircraft crash area. The maximum density should be applied to any single half hectare within which the proposed development is located.

The guidance for the inner PSZ and outer PSZ applies only to those parts of a development located within the respective zone. The guidance does not apply to parts of a development outside the PSZs.

6.2.1 *What Types of Developments Need to be Assessed Against the Guidance?*

It is not practical to list all development types that may or may not be permitted in the PSZs. However, in general terms, a development should be assessed where people can be expected to be present for all or part of the day.

It follows that developments that need not be considered are those where persons are not normally expected to be present (e.g. normally unoccupied buildings, such as a tool store) ⁽¹⁾.

6.2.2 *Exceptions to Permitted Developments in the Inner PSZ*

The only exceptions for permitted developments in the inner PSZ are:

- developments where persons are not expected to be present;
- long stay car parks (i.e. greater than 24 hours), provided that persons are normally expected to park their car and then immediately leave the car park development. Buildings associated with car parks are subjected to the guidance given in *Table 6.1*; and
- roads and railways where vehicles and passenger trains/trams are not expected to be stationary. For example, road vehicles can be expected to be stationary at major road intersections, junctions and traffic lights. Therefore, major road intersections, junctions, traffic lights and similar should not be permitted in the inner PSZ.

6.2.3 *Exceptions to Permitted Developments in the Outer PSZ*

In most cases, the guidance given in *Table 6.1* will be sufficient to identify whether a proposed development should be permitted in the outer PSZ. However, there may be cases, in exceptional circumstances, where it is judged that a development's socio-economic benefits (etc.) outweigh the 'safety risk', and that it is impractical for such a development to be located elsewhere. An Airport Terminal, as described below, is a good example of such a development.

Airport Terminals

To ensure risks to people are as low as reasonably practicable, it is desirable to locate airport terminals outside PSZs. However, this may not be practicable and there are precedents to accept a greater, but tolerable risk, where persons gain a direct benefit from the activity presenting the risk.

In the case of an airport terminal, all those working and using the terminal would be receiving a direct benefit (i.e. related to employment or travel) and

(1) For chemical sites, it is understood that the UK Health & Safety Executive has judged a building to be unoccupied where the presence of people does not amount to more than 2 hours in one day. Gakhar, S.J. (2000). Assessing Risks to Occupants of Existing Buildings on Chemical Plants due to Hazards of Fire and Explosion. Hazards XV, The Process, its Safety, and the Environment, Getting it Right, pp 433-449. Manchester, 4-6 April.

therefore an annual individual risk greater than 1 in one million (i.e. corresponding to the extent of the outer PSZ) but less than 1 in 100,000 (i.e. corresponding to the extent of the inner PSZ) is considered tolerable. Hence, location of an airport terminal in the outer PSZ is judged tolerable.

Extensions to Existing Developments

Extensions to existing developments are permitted. This is provided the development is of a permitted development type, and the proposed extended development (i.e. original development plus extension) does not result in the density figures listed in *Table 6.1* being exceeded (i.e. the number of persons per half hectare should not be exceeded).

For example, a proposed extension to a house which would increase the occupancy to five would be appropriate, provided no half hectare (i.e. 5,000 m² or approximately 1.24 acres) encompassing the extended development exceeded 60 persons.

Roads and Railways

Roads and railways are permitted in the outer PSZs, including major road and rail intersections, junctions and traffic lights.

Bus and Rail Terminals

Bus and rail terminals are permitted in the outer PSZs provided the density does not exceed 110 persons per half hectare.

Car Parks

Car parks are permitted in the outer PSZs. This is provided that persons are normally expected to park their car and then leave the car park development. Buildings associated with car parks are subjected to the guidance given in *Table 6.1*.

Table 6.1 *Permitted Developments (applicable to new applications for development)*

Permitted Developments	Public Safety Zone (PSZ)	
	Inner PSZ	Outer PSZ
All developments	No further development (existing developments remain)	see below (existing developments remain)
Outer PSZ		
1. Housing		≤ 60 persons/half hectare
2. Holiday Accommodation		≤ 100 beds per development
3. Retail/Leisure Facilities		≤ 85 persons/half hectare
4. Working Premises		≤ 110 persons/half hectare
5. Institutional Accommodation		No further development
6. Sports Stadia		No further development
7. Limited Use		≤ 220 persons/half hectare
No restrictions on development beyond Outer PSZ		
Notes		
1. Housing – i.e. residential accommodation, persons at home.		
2. Holiday Accommodation – i.e. hotels, caravan parks.		
3. Retail/Leisure Facilities – i.e. shopping centres, sports halls, sports grounds, swimming pools, bowling alleys, golf clubs.		
4. Working Premises – i.e. factories, offices and facilities where persons are expected to congregate, such as railway stations.		
5. Institutional Accommodation – i.e. hospitals, schools, nurseries, care homes, prisons.		
6. Sports Stadia – i.e. football/rugby stadia.		
7. Limited Use – use not exceeding (approximately) a maximum of 12 hours in one week. i.e. Sunday markets, car boot sales, day fairs.		

Table 6.2 *Proposed Developments – Summary of Permitted Developments (applicable to new applications for development)*

	Industry ²	Inner PSZ		Industry ²	Outer PSZ ¹	
		Housing	Vulnerable ³		Housing	Vulnerable ³
Ireland	NO	NO	NO	YES	YES	NO
Netherlands	NO	NO	NO	YES	NO	NO
UK	NO	NO	NO	YES	YES	YES
NO – development not permitted YES – development permitted						
1. For the UK, the Outer PSZ refers to land beyond the single PSZ.						
2. Industry – includes offices.						
3. Vulnerable – hospitals, schools and sports stadia, etc.						

Table 6.3 *Existing Developments – Summary of Permitted Developments (applicable to existing development)*

	Industry ²	Inner PSZ		Industry ²	Outer PSZ ¹	
		Housing	Vulnerable ³		Housing	Vulnerable ³
Ireland	Remain	Remain	Remain	Remain	Remain	Remain
Netherlands	Remain	Remove	Remove	Remain	Remain	Remain
UK	Remain	Remain	Remain	Remain	Remain	Remain
Remove – developments to be removed Remain – developments to remain and current use can continue						
1. For the UK, the Outer PSZ refers to land beyond the single PSZ.						
2. Industry – includes offices.						
3. Vulnerable – hospitals, schools and sports stadia, etc.						

It is the Consultant's view that the proposed inner and outer PSZs provide appropriate consistency with established risk criteria and zoning practice around airports, and around chemical installations in Ireland (set by the Health and Safety Authority), whilst recognising the differences between hazards presented by chemical installations and aircraft approaching and departing airports.

Acknowledging that the proposed PSZs might impact upon existing and proposed land-use, the implications of the zones calculated for Cork, Dublin and Shannon airports have been investigated. It is concluded that adoption of the PSZs would not require any changes to existing land-use around the airports, and would only require minimal changes to proposed development plans.

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