

MINNESOTA AIRPORT LAND USE COMPATIBILITY MANUAL

APPENDICES

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APPENDIX 1: ACRONYMS

LIST OF ACRONYMS

The following is a comprehensive list of acronyms commonly used in aviation land use planning and may serve as a guide for locating the appropriate definition in this glossary.

| | |
|--------------------|--|
| AC | Advisory Circular |
| ACIP | Airport Capital Improvement Plan |
| AGL | Above Ground Level |
| AIP | Airport Improvement Program |
| ALP | Airport Layout Plan |
| APO | FAA Office of Aviation Policy and Plan |
| APP | FAA Office of Airport Planning and Programming |
| ARC | Airport Reference Code |
| ASTM | American Society of Testing and Materials |
| AWOS | Automated Weather Observing System |
| BOA | Bureau of Aeronautics |
| CBD | Central Business District |
| CIP | Capital Improvement Plan |
| COG | Councils of Government |
| dBA | A-weighted Sound Level |
| DNL | Average Day-Night Sound Level |
| DOD | Department of Defense |
| DOT | Department of Transportation |
| EA | Environmental Assessment |
| EIS | Environmental Impact Statement |
| EPA | Environmental Protection Agency |
| FAA | Federal Aviation Administration |
| FAR | Federal Aviation Regulations |
| F&E | Facilities and Equipment |
| FHWA | Federal Highway Administration |
| FTA | Federal Transit Administration |
| GA | General Aviation |
| GIS | Geographic Information system |
| GPS | Global Positioning System |
| HIRL | High Intensity Runway Lighting |
| HUD | Housing and Urban Development |
| IFR | Instrument Flight Rules |
| ILS | Instrument Landing System |
| INM | Integrated Noise Model |
| LCDC | Land Conservation and Development Commission |
| LIRL | Low Intensity Runway Lighting |
| MET COUNCIL | Metropolitan Council |
| MIRL | Medium Intensity Runway Lighting |
| MnDOT | Minnesota Department of Transportation |
| MPO | Metropolitan Planning Organization |
| MSL | Mean Sea Level |
| NAS | National Airspace System |



| | |
|----------------|---|
| NAVAIDs | Navigation Aids |
| NCP | Noise Compatibility Plan |
| NEM | Noise Exposure Map |
| NEPA | National Environmental Policy Act |
| NLR | Noise Level Reduction |
| NPIAS | National Plan of Integrated Airport Systems |
| NPS | National Priority System |
| PFC | Passenger Facility Charge |
| RNAV | Radio Navigation |
| RPC | Regional Planning Council or Commission |
| RPZ | Runway Protection Zone |
| RTP | Regional Transportation Plan |
| SEL | Sound Exposure Level |
| STC | Sound Transmission Class |
| TAC | Technical Advisory Committee |
| TAF | Terminal Area Forecast |
| TDR | Transfer of Development Rights |
| TERPS | United States Standard for Terminal Instrument Procedures |
| UBC | Uniform Building Code |
| UGB | Urban Growth Boundary |
| VFR | Visual Flight Rules |
| WX | Weather |
| YDNL | Yearly Day-Night Average Sound Level |

APPENDIX 2: GLOSSARY

A-weighted Sound Level (also referred to as dBA) – The sound pressure level which has been filtered or weighted to reduce the influence of the low and high frequency noise; designed to approximate the manner in which the human ear responds to sounds.

Advisory Circular (AC) – A document published by the Federal Aviation Administration (FAA) giving guidance on aviation issues, and which becomes binding on those airports receiving federal grant funding.

Acoustical – Relating to the deadening or absorbing of sound.

Aeronautical Study – A study performed pursuant to FAR Part 77 “Objects Affecting Navigable Airspace” concerning the effect of proposed construction or alternation on the use of air navigation facilities or navigable airspace by aircraft. The conclusion of each study is normally a determination as to whether the specific proposal studied would be a hazard to air navigation and/or a determination for marking and/or lighting.

Agricultural and Resource Extraction Uses – A use category that has the following land uses:

- a) Any land used primarily for the production of crops or livestock including irrigated meadows, irrigated and dry pasture, irrigation ditches, stock drive routes, lands used for barns, corrals and storage of crops or agricultural products, but not including lands used primarily for the production of commercial timber; or
- b) Land uses involved in the process of (1) removing or extracting minerals and building stone from naturally occurring veins, deposits, bodies, beds, seams, fields, pools or other concentrations in the earth’s crust, including the preliminary treatment of such ore or building stone; and (2) the extraction, exploration or production of oil or natural gas resources, including oil and gas wells and accessory offices, storage buildings, rig camps and gas transmission lines.

Aircraft Operation – An aircraft arrival or departure from an airport. There are two types of operations: local and itinerant.

Air Carriers – The commercial system of air transportation, consisting of the certified air carriers, air taxis (including commuters), supplemental air carriers, commercial operators of large aircraft, and air travel clubs.

Air Installation Compatible Use Zone (AICUZ) – A land use compatibility plan prepared by the U. S. Department of Defense for military airfields. AICUZ plans serve as recommendations to local government bodies having jurisdiction over land uses surrounding these facilities.

Airspace – Space above the ground in which aircraft travel. Often airspace is divided into corridors, routes, and restricted zones.

Airspace Surface or Imaginary Surface -- The imaginary areas in space and on the ground that are established in relation to the airport and its runways as the basis for regulating obstructions to air travel. See definition of “Airspace Zone,” and Figure 1 below.

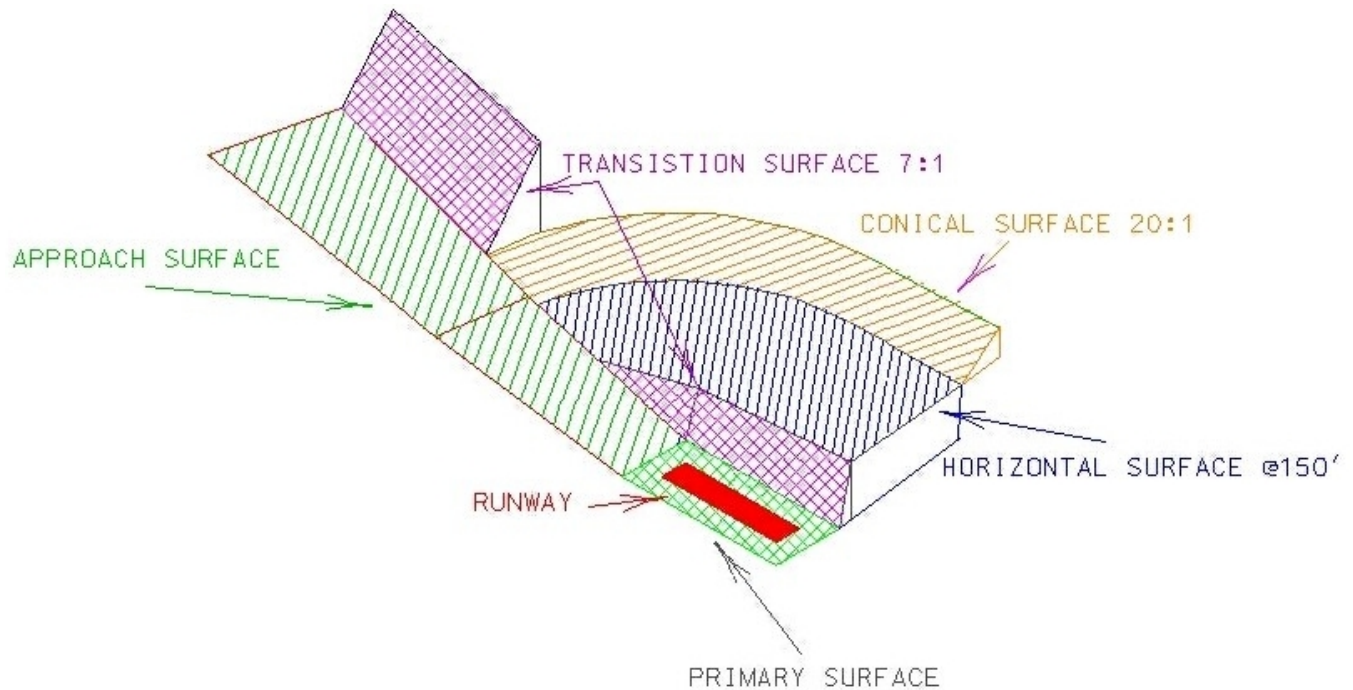


Figure 1: Airspace (Imaginary) Surfaces – Minnesota

Airspace Zone -- The Primary Zone, the Horizontal Zone, the Conical Zone, the Approach Zone, the Precision Instrument Approach Zone, or the Transitional Zone established in Section 8 of this Ordinance. All airspace zones are defined as the airspace surfaces (imaginary surfaces – see Figure 1) and all lands lying directly under the airspace surface. See definition of “Airspace Surface or Imaginary Surface.”

Aircraft Accident – An occurrence incident to flight in which, as a result of the operation of an aircraft, a person (occupant or non-occupant) receives fatal or serious injury or an aircraft receives substantial damage. Except as provided below, substantial damage means damage or structural failure which adversely affects the structural strength, performance, or flight characteristics of the aircraft, and which would normally require major repair or replacement of the affected component. Engine failure, damage limited to an engine, bent fairings or cowling, dented skin, small puncture holes in the skin or fabric, ground damage to rotor or propeller blades, damage to landing gear, wheels, tires, flaps, engine accessories, brakes, or wingtips are not considered substantial damage.

Aircraft Incident – A mishap associated with the operation of an aircraft in which neither fatal or serious injuries nor substantial damage to the aircraft occur.

Aircraft Mishap – The collective term for an aircraft accident or incident.

Air Traffic Control – Control of the airspace by an appropriate authority to promote the safe, orderly and expeditious movement of terminal air traffic.

Airport – Any area of land or water, within or without this state, that is used, or intended for use, for the landing and take-off of aircraft, and any appurtenant areas that are used, or intended for use, for airport buildings or other airport facilities or rights of way, together with all airport buildings and facilities located thereon.

Airport Development Zone – A zone which replaces the existing zoning for the airport property encompassing the land presently owned by the airport and, if feasible, areas identified for future purchase, clear zones and areas with noise levels greater than DNL 70.

Airport Elevation – The established elevation of the highest point on the usable landing area.

Airport Hazard – Any structure, tree, or use of land that obstructs the airspace required for, or is otherwise hazardous to, the flight of aircraft in landing or taking off at the airport; and any use of land which is hazardous to persons or property because of its proximity to the airport.

Airport Improvement Program (AIP) – The AIP is authorized by the Airport and Airway Improvement Act of 1982 (P.L. 97-248, as amended). The act's broad objective is to assist in the development of a nationwide system of public-use airports adequate to meet the current and projected growth of civil aviation. The Act provides funding for airport planning and development projects at airports included in the National Plan of Integrated Airport Systems. The act also authorizes funds for noise compatibility planning and to carry out noise compatibility programs as set forth in the Aviation Safety and Noise Abatement Act (ASNA) of 1979 (P.L. 96-143).

Airport Influence Area - The area in which current or future airport-related noise, overflight, safety, and/or airspace protection factors may significantly affect land uses or necessitate restrictions on those uses.

Airport Layout Plan (ALP) – A scaled drawing of existing and proposed airside and landside facilities necessary for the operation and development of the airport. The ALP shows (1) boundaries and proposed additions to areas owned or controlled by the sponsor, (2) the location and nature of existing and proposed airport facilities and structures and (3) the location on the airport of existing and proposed non-aviation areas and improvements. The ALP may also depict those properties adjacent to the airport ownership that may have legal access to the airport.

Airport Layout Plan Set – This document typically contains a set of drawings which illustrate the existing and future development of the airport. An ALP set may often contain the following: (1) Airport Layout Drawing (Plan), (2) Airport Airspace Drawing, (3) Inner Portion of the Approach Surface Drawing, (4) Terminal Area Drawing, (5) Land Use Drawing and (6) Airport Property Map. The drawings depict existing and proposed airport facilities, land uses, approach zones and other defined areas of airspace, and environmental features that may influence airport usage and expansion capabilities.

Airport Manager – The person authorized by the airport sponsor to exercise administrative control of the airport.

Airport Master Plan – Long-term development plan for the airport adopted by the airport proprietor and local jurisdictions.

Airport Noise Abatement Program – A program designed to reduce noise around an airport through changes in the manner in which aircraft are flown, or changes in the operation or layout of the airport.

Airport Noise and Capacity Act of 1990 – This act required the establishment of a National Noise Policy and a requirement to eliminate Stage 2 aircraft weighing 75,000 pounds or greater operating in the contiguous United States by the year 2000.

Airport Obstruction Zoning Ordinance – A local height restriction ordinance which follows FAR Part 77, implements a local community's comprehensive plan, and provides specific height standards for the area beneath the airport Imaginary surface.



Airport Owner – Any person or authority having the operational control of an airport as defined in the ASNA Act. (See OAR 660-113)

Airport Overlay Zone – A zone intended to place additional land use conditions on land impacted affected by the airport while retaining the existing underlying zone.

Airport Reference Code (ARC) – The ARC is an FAA coding system used to relate airport design criteria to the operational and physical characteristics of the airplanes intended to operate at the airport.

Airport Reference Point – The latitude and longitude of the approximate center of the airport, based upon the runway facilities.

Airport Sponsor – The municipality or authority of the airport allowed to apply for and receive grants.

Airport Vicinity – The land use and people in the areas surrounding an airport which can be directly affected by the operation of the airport.

Airport Zoning Permit – A permit allowing new development or alteration or expansion of a nonconforming use, within the Airport Vicinity.

Airside – That portion of the airport facility where aircraft movements take place, airline operations areas, and areas that directly serve the aircraft, such as taxiway, runway, maintenance and fueling areas.

Ambient Noise – All encompassing noise associated with a given environment, being usually a composite of sounds from many sources near and far.

Amortization – A zoning tool used to control the longevity of nonconforming uses or structures by requiring termination of the nonconforming use or structure after a specified period of time.

Approach Protection Easement - A form of easement which both conveys all of the rights of an aviation easement and sets specified limitations on the type of land uses allowed to be developed on the property.

Approach Zone or **Approach Airspace Zone** – An airspace obstruction zone which lies directly under an imaginary approach surface longitudinally centered on the extended centerline at each end of a runway. The inner edge of the approach surface is at the same width and elevation as, and coincides with, the end of the primary surface. The approach surface inclines upward and outward at a slope of:

40:1 for non-precision instrument runways and visual runways other than utility.

20:1 for _____ visual utility runways.

The **approach surface** expands uniformly to a width of:

4,000 feet for a distance of 10,000 feet, then continues at the same rate of divergence for an additional 4,000 feet to the periphery of the conical surface for non-precision instrument runways having visibility minimums as low as three-fourths of a statute mile.

3,500 feet for a distance of 10,000 feet to the periphery of the conical surface for non-precision instrument runways having visibility minimums greater than three-fourths of a statute mile.

2,500 feet for a distance of 10,000 feet to the periphery of the conical surface for visual runways other than utility.

2,250 feet for a distance of 10,000 feet to the periphery of the conical surface for visual runways utility runways.

Approach Speed - The recommended speed contained in aircraft manuals used by pilots when making an approach to landing. This speed will vary for different segments of an approach as well as for aircraft weight and configuration. (AIM)

Approach Surface – A surface defined by FAR Part 77 “Objects Affecting Navigable Airspace, “that is longitudinally centered on the runway centerline and extends outward and upward from each end of the primary surface. An approach surface is applied to each end of each runway based on the type of approach available or planned for that runway end. *See Figure 1: Airspace (Imaginary) Surfaces – Minnesota*, above.

Attainment Area – An area in which the federal or state standards for ambient air quality are being achieved.

Attenuation – The lessening of the magnitude.

ASNA Act – The Aviation Safety and Noise Abatement Act of 1979, as amended (49 USC 2101 et seq.).

Average Sound Level – The level in decibels of the mean square, A weighted sound pressure during a specified period, with reference to the square of the standard reference sound pressure of 20 micropascals.

Average Day-Night Sound Level (DNL) – Average day-night sound level (DNL) is the FAA standard metric for determining the cumulative exposure of individuals to noise. DNL is the equivalent of noise levels produced by aircraft operations during a 24-hour period, with a ten decibel penalty applied to the level measured during nighttime hours (10:00 pm to 7:00 am).

Aviation-Related Use - Any facility or activity directly associated with the air transportation of persons or cargo or the operation, storage, or maintenance of aircraft at an airport or heliport. Such uses specifically include runways, taxiways, and their associated protected areas defined by the Federal Aviation Administration, together with aircraft aprons, hangars, fixed base operations facilities, terminal buildings, etc.

Avigation Easement – A grant of a property interest in land over which a right of unobstructed flight in the airspace is established; which prohibits any structures, growth, or other obstructions from penetrating the approach surface; and which provides a right of entry to remove, mark, or light any structure or any such obstruction.

Based Aircraft – An aircraft permanently stationed at an airport by agreement between the aircraft owner and the airport management.

Building Codes – Codes, either local or state, that control the functional and structural aspects of buildings and/or structures. Local ordinances typically require proposed buildings to comply with zoning requirements before building permits can be issued under the building codes.

Ceiling - Height above the earth’s surface to the lowest layer of clouds or obscuring phenomena. (AIM)

Circling Approach/Circle-to-Land Maneuver - A maneuver initiated by the pilot to align the aircraft with a runway for landing when a straight-in landing from an instrument approach is not possible or not desirable. (AIM)

Commercial Activities - Airport-related activities which may offer a facility, service or commodity for sale, hire or profit. Examples of commodities for sale are: food, lodging, entertainment, real estate, petroleum



products, parts and equipment. Examples of services are: flight training, charter flights, maintenance, aircraft storage, and tiedown. (CCR)

Commercial Operator - A person who, for compensation or hire, engages in the carriage by aircraft in air commerce of persons or property, other than as an air carrier.

Commercial Service Airport – A public airport that has at least 2,500 passenger boardings each year and is receiving scheduled passenger aircraft service.

Commercial Uses – A use category including land uses or activities involving the production, processing, manufacturing, or sale of goods or services for financial gain, including uses that provide business, personal, medical/personal care, or repair service, or that involve the selling, leasing, or renting of merchandise to the general public. Accessory uses may include offices, storage, food service, or other amenities primarily for the use of employees and parking for employees and visitors.

Commissioner – The Commissioner of the Minnesota Department of Transportation.

Compatibility – The degree to which land uses or types of development can coexist or integrate.

Compatible Land Use – As defined in FAR 150: The use of land (e.g. commercial, industrial, agricultural) that is normally compatible with aircraft and airport operations, or sound insulated land uses (e.g. sound insulated homes, schools, nursing homes, hospitals, libraries) that would otherwise be considered incompatible with aircraft and airports operations.

Comprehensive Plan – Similar to a master plan, the comprehensive plan is a governmental entity's official statement of its plans and policies for long-term development. The plan includes maps, graphics and written proposals, which indicate the general location for streets, parks, schools, public buildings, airports and other physical development of the jurisdiction.

Conditional Use – A land use or development that generally would not be compatible with airport operations, but which a decision-making body may allow with appropriate restrictions and based on findings that the restrictions will either ensure greater compatibility with near-by airport operations or substantially mitigate potential adverse impacts associated with proximity to the airport.

Conditional Zoning – The imposition or exaction of conditions or promises upon the grant of zoning by the zoning authority.

Conforming Use – Any structure, tree, object of natural growth, or use of land that complies with all the applicable provisions of the Minnesota Zoning Ordinance or any amendment to the ordinance.

Conical Zone or **Conical Airspace Zone** – An airspace obstruction zone that includes all land that lies directly under an imaginary conical surface extending upward and outward from the periphery of the horizontal surface at a slope of 20:1 for a horizontal distance of 4,000 feet as measured outward from the periphery of the horizontal surface.

Controlled Airspace - Any of several types of airspace within which some or all aircraft may be subject to air traffic control. (FAR 1)

Day-Night Average Sound Level (DNL) - The noise metric adopted by the U.S. Environmental Protection Agency for measurement of environmental noise. It represents the average daytime noise level during a 24-hour day, measured in decibels and adjusted to account for the lower tolerance of people to noise during nighttime periods. The mathematical symbol is Ldn.

Decibel (dB) – A unit for describing the intensity or level of sound, equal to 20 times the logarithm to the base 10 of the ratio of the pressure of the sound measured to a standard reference pressure.

Deed Notice - A formal statement added to the legal description of a deed to a property and on any subdivision map. As used in airport land use planning, a deed notice would state that the property is subject to aircraft overflights. Deed notices are used as a form of buyer notification as a means of ensuring that those who are particularly sensitive to aircraft overflights can avoid moving to the affected areas.

Displaced Threshold - A landing threshold that is located at a point on the runway other than the designated beginning of the runway (see Threshold). (AIM)

Dwelling – Any building or portion thereof designed or used as a residence or sleeping place of one or more persons.

Easement – A grant of one or more of the property rights by the property owner to and/or for the use by the public, a corporation or another person or entity.

Enplanement – A passenger boarding of a commercial flight.

Environmental Assessment (EA) – A concise document that assesses the environmental impacts of a proposed federal action. The EA discusses the need for and environmental impacts of the proposed action and alternative actions. An EA should provide sufficient evidence and analysis for a federal determination whether to prepare an Environmental Impact Statement or a Finding of No Significant Impact.

Environmental Impact Statement (EIS) – A document that provides full and fair discussion of the significant environmental impacts that would occur as a result of a proposed project and informs decision makers and the public of the reasonable alternatives that would avoid or minimize adverse impacts.

Equivalent Sound Level (Leq): The level of constant sound which, in the given situation and time period, has the same average sound energy as does a time-varying sound.

Established Residential Neighborhood In A Built Urban Area – An area that, if it existed on or before January 1, 1978 shall be considered a conforming use that shall not be prohibited except as provided specifically by Minnesota law.

Euclidean Zoning – A traditional legislative method or device for controlling land use by establishing districts with boundaries and providing for specific uniform regulations as to type of permitted land use, height, bulk and lot coverage of structure, setback and similar building restrictions.

Federal Aviation Administration (FAA) – A federal agency charged with regulating air commerce to promote its safety and development; encourage and develop civil aviation, air traffic control, and air navigation; and promoting the development of a national system of airports.

Federal Aviation Regulations (FAR) – Regulations established and administered by the FAA that govern civil aviation and aviation-related activities.

FAR Part 36 – Regulation establishing noise standards for the civil aviation fleet.

FAR Part 77 – Objects Affecting Navigable Airspace - Part 77 (a) establishes standards for determining obstructions in navigable airspace; (b) defines the requirements for notice to the FAA Administrator of certain proposed construction or alteration; (c) provides for aeronautical studies of obstructions to air navigation to determine their effect on the safe and efficient use of airspace; (d) provides for public hearings



on the hazardous effect of proposed construction or alteration on air navigation; and (e) provides for establishing antenna farm areas.

FAR Part 77 Surfaces - Imaginary airspace surfaces established with relation to each runway of an airport. There are five types of surfaces: (1) primary; (2) approach; (3) transitional; (4) horizontal; and (5) conical. *See Figure 1: Airspace (Imaginary) Surfaces – Minnesota*, above.

FAR Part 91 – Regulation pertaining to air traffic and general operating rules, including operating noise limits.

FAR Part 150 – Regulation pertaining to airport noise compatibility planning.

FAR Part 161 – Regulation pertaining to notice and approval of airport noise and access restrictions.

Federal Grant Assurance – The terms and conditions of accepting Airport Improvement Program (AIP) grants from the FAA for carrying out the provisions of Title 49 United State Code. The terms and conditions become applicable when the airport sponsor accepts a grant offer from the FAA.

Findings - Legally relevant subconclusions which expose a government agency's mode of analysis of facts, regulations, and policies, and which bridge the analytical gap between raw data and ultimate decision.

Fixed Base Operator (FBO) – A business which operates at an airport and provides aircraft services to the general public including, but not limited to, sale of fuel and oil; aircraft sales, rental, maintenance, and repair; parking and tiedown or storage of aircraft; flight training; air taxi/charter operations; and specialty services, such as instrument and avionics maintenance, painting, overhaul, aerial application, aerial photography, aerial hoists, or pipeline patrol.

General Aviation – Refers to all civil aircraft and operations that are not classified as air carrier, commuter or regional. The types of aircraft used in general aviation activities cover a wide spectrum from corporate multi-engine jet aircraft piloted by professional crews to amateur-built single engine piston acrobatic planes, balloons and dirigibles.

Glide Slope - An electronic signal radiated by a component of an ILS to provide vertical guidance for aircraft during approach and landing.

Global Positioning System (GPS) - A navigational system which utilizes a network of satellites to determine a positional fix almost anywhere on or above the earth. Developed and operated by the U.S. Department of Defense, GPS has been made available to the civilian sector for surface, marine, and aerial navigational use. For aviation purposes, the current form of GPS guidance provides en route aerial navigation and selected types of nonprecision instrument approaches. Eventual application of GPS as the principal system of navigational guidance throughout the world is anticipated.

Height – For the purpose of determining the height limits in all airport zones shown on an Official Zoning Map, height shall be measured as the highest point of a structure, tree, or other object of natural growth, measured from the mean sea level elevation unless otherwise specified.

Helipad - A small, designated area, usually with a prepared surface, on a heliport, airport, landing/ takeoff area, apron/ramp, or movement area used for takeoff, landing, or parking of helicopters. (AIM)

Heliport - A facility used for operating, basing, housing, and maintaining helicopters. (HAI)

Hold Harmless Agreement – An agreement which holds airport sponsors or jurisdictions harmless for alleged damages resulting from airport operations. Such agreements are recorded in deeds or permits as a condition of approval of a regulatory land use decision.

Horizontal Zone or Horizontal Airspace Zone – An airspace obstruction zone including all land that lies directly under an imaginary horizontal surface 150 feet above the established airport elevation, the perimeter of which is constructed by swinging arcs of specified radii from the center of each end of the primary surface of each runway and connection the adjacent arcs by lines tangent to those arcs. The radius of each arc is:

10,000 feet for precision instrument runways and non-precision instrument runways having visibility minimums as low as three-fourths of a statute mile.

6,000 feet for all other runways.

When a 6,000 foot arc is encompassed by tangents connecting two adjacent 10,000 foot arcs, the 6,000 foot arc shall be disregarded in the construction of the perimeter of the horizontal surface.

Housing Codes – The codes that usually apply to both existing and future living units. The codes include minimum standards of occupancy, and usually govern spatial, ventilation, wiring, plumbing, structural and heating requirements.

Imaginary Surfaces – *See* definition of “**Airspace Surfaces or Imaginary Surfaces.**”

Incompatible Land Use – The use of land which is normally incompatible with the aircraft and airport operations (such as homes, schools, nursing homes, hospitals, and libraries).

Indemnification – A contract assurance by which one person promises to secure another against an anticipated loss, despite the legal responsibility of the other person for the loss (i.e., a shifting of liability for loss from one person held legally responsible to another person).

Industrial, Wholesale Trade and Storage Uses – A use category including the following use types:

a) Industrial development or uses involved in the research, design, manufacturing, processing, fabrication, packaging, or assembly of goods. Natural, man-made, raw, secondary, or partially completed materials may be used. Products may be finished or semi-finished and are generally made for the wholesale market, for transfer to other plants, or to order for firms or consumers. Goods are generally not displayed or sold on site, but if so, they are a subordinate part of sales (typically 10% or less of the total gross floor area). Relatively few customers come to the site.

b) Industrial, manufacturing, wholesale trade, and warehouse/ storage uses including uses that produce goods from raw or finished materials, uses that distribute goods in large quantities to primarily wholesale customers, or provide for storage or warehousing of goods, either in enclosed buildings or outdoors. Few customers, especially the general public, come to the site. Accessory activities may include sales, offices, parking, and storage.

Infill - Development which takes place on vacant property largely surrounded by existing development, especially development which is similar in character.

Infrastructure – A community’s built elements that establish the community’s foundation for maintaining existing populations, activities, future growth and development. Infrastructure elements include airports, roads, highways, bridges, water and sewer systems, waste disposal facilities, utilities, telecommunications systems, schools, and governmental and community facilities.



Instrument Approach – A series of predetermined maneuvers for the orderly transfer of an aircraft under instrument flight conditions from the beginning of the initial approach to a landing or to a point from which a landing may be made visually.

Instrument Flight Rules (IFR) – Rules by which aircraft are operated without visual reference to the ground. These rules are in effect when cloud ceilings are equal to or less than 1,000 feet, or visibility is less than three miles.

Instrument Landing System (ILS) – The instrument landing system is designed to provide electronic instrument guidance to the pilot to permit exact alignment and angle of descent of a properly equipped aircraft on final approach for landing.

Instrument Operation - An aircraft operation in accordance with an IFR flight plan or an operation where IFR separation between aircraft is provided by a terminal control facility. (FAA ATA)

Instrument Runway A runway equipped with electronic and visual navigation aids for which a precision or nonprecision approach procedure having straight-in landing minimums has been approved. (AIM)

Inverse Condemnation - An action brought by a property owner seeking just compensation for land taken for a public use against a government or private entity having the power of eminent domain. It is a remedy peculiar to the property owner and is exercisable by that party where it appears that the taker of the property does not intend to bring eminent domain proceedings.

Integrated Noise Model (INM) – FAA’s computer model used by the civilian aviation community for evaluating aircraft noise impacts near airports. The INM uses a standard database of aircraft characteristics and applies them to an airport’s average operational day to produce noise contours.

Isolated Low Density Residential Lot – *See* definition of “Low Density Residential Lot” below.

Itinerant Operation – Any aircraft arrival and/or departure other than a local operation.

Land – Ground, soil, or earth, including structures on, above, or below the surface. In addition, the “land” shall include water bodies and water surfaces for the purposes of this Ordinance.

Land Banking – The purchase of property by the government to be held for future use and development either by the government or for resale for the development of compatible uses.

Land Disposal Facility – Any tract or parcel of land, including any constructed facility, at which solid waste is disposed of in or on the land.

Land Use Compatibility – The coexistence of land uses surrounding the airport with airport-related activities.

Land Use Controls – Measures established by state or local government that are designed to carry out land use planning. The controls include: zoning, subdivision regulations, planned acquisition, easements, covenants or conditions in building codes and capital improvement programs, such as the establishment of sewer, water, utilities or their service facilities.

Land Use Density - A measure of the concentration of land use development in an area. Mostly the term is used with respect to residential development and refers to the number of dwelling units per acre. Unless otherwise noted, policies in this compatibility manual refer to gross rather than net acreage.

Land Use Intensity - A measure of the concentration of nonresidential land use development in an area. For the purposes of airport land use planning, the term indicates the number of people per acre attracted by the land use. Unless otherwise noted, policies in this compatibility manual refer to gross rather than net acreage.

Land Use Compatibility Strategies – Land use management techniques that consist of both remedial and preventive measures. Remedial, or corrective, measures typically include sound insulation or land acquisition. Preventive measures typically involve land use controls that amend or update the local zoning ordinance, comprehensive plan, subdivision regulations, and building code.

Landing Area – The area of the airport used for the landing, taking off, or taxiing of aircraft.

Landside – That part of an airport used for activities other than the movement of aircraft, such as vehicular access roads and parking.

Large Airplane - An airplane of more than 12,500 pounds maximum certificated takeoff weight. (Airport Design AC)

Lighting and Marking of Hazards to Air Navigation – Installation of appropriate lighting fixtures, painted markings or other devices to such objects or structures that constitute hazards to air navigation.

Limited Avigation Easement – An easement which provides right of flight above approach slope surfaces, prohibits any obstruction penetrating the approach slope surface, and provides right of entry to remove any structure or growth penetrating the approach slope surface.

Local Operation – Any operation performed by an aircraft that (a) operates in the local traffic pattern or within sight of the tower or airport, or (b) is known to be departing for, or arriving from, flight in local practice areas located within a 20- mile radius of the control tower or airport, or (c) executes a simulated instrument approach or low pass at the airport.

Localizer – The component of an ILS which provides course guidance to the runway. (AIM)

Low Density Residential Structure – A single-family or two-family dwelling or home that was legally in existence on January 1, 1978.

Low Density Residential Lot – A single lot located in an area which is zoned for primarily single-family or two-family residential uses, and in which the predominant existing land use is such type of residences, and where the lot was legally in existence on January 1, 1978.

Maintenance Area – a geographical area which was once designated as nonattainment, but in which the pollution levels have met the National Ambient Air Quality standards for two consecutive years and has an approved maintenance plan that outlines how the geographical area will continue to meet these standards.

Mediation – The use of a mediator or co-mediators to facilitate open discussion between disputants and assist them to negotiate a mutually agreeable resolution. Mediation is a method of alternative dispute resolution that provides an initial forum to informally settle disputes prior to regulatory or judicial intervention.

Minimum Descent Altitude (MDA) - The lowest altitude, expressed in feet above mean sea level, to which descent is authorized on final approach or during circle-to-land maneuvering in execution of a standard instrument approach procedure where no electronic glide slope is provided. (FAR 1)



Missed Approach - A maneuver conducted by a pilot when an instrument approach cannot be completed to a landing. (AIM)

Mitigation – The avoidance, minimization, reduction, elimination or compensation for adverse environmental effects of a proposed action.

Mitigation Measure – An action taken to alleviate adverse impacts.

National Environmental Policy Act of 1969 (NEPA) – The original legislation establishing the environmental review process.

National Plan of Integrated Airport Systems (NPIAS) – A primary purpose of the NPIAS is to identify the airports that are important to national transportation and are eligible to receive grants under the Airport Improvement Program (AIP). The NPIAS is composed of all commercial service airports, all reliever airports, and selected general aviation airports.

National Transportation Safety Board (NTSB) - The U.S. government agency responsible for investigating transportation accidents and incidents.

Nautical Mile – A measure of distance equal to one minute of arc on the earth’s surface, which is approximately 6,080 feet.

Navigation Aids (NAVAIDs) – Any facility used by an aircraft for guiding or controlling flight in the air or the landing or take-off of an aircraft.

Noise – Defined subjectively as unwanted sound, the measurement of noise evaluates three characteristics of sound: intensity, frequency, and duration.

Noise Abatement Procedures – Changes in runway usage, flight approach and departure routes and procedures, and vehicle movement, such as ground maneuvers or other air traffic procedures that shift aviation impacts away from noise sensitive areas.

Noise Compatibility Plan (NCP) – The NCP consists of an optimum combination of preferred noise abatement and land use management measures, and a plan for implementation of the measures. For planning purposes, the implementation plan also includes the estimated cost for each of the recommended measures to the airport sponsor, the FAA, airport users, and the local units of government.

Noise Compatibility Program – *See* “Part 150 Study”

Noise Contours - Continuous lines of equal noise level usually drawn around a noise source, such as an airport or highway. The lines are generally drawn in 5-decibel increments so that they resemble elevation contours in topographic maps.

Noise Exposure Contours – Lines drawn around a noise source indicating constant energy levels of noise exposure. DNL is the measure used to describe community exposure to noise.

Noise Exposure Map (NEM) – The NEM is a scaled map of the airport, its noise contours and surrounding land uses. The NEM depicts the levels of noise exposure around the airport, both for the existing conditions and forecasts for the five-year planning period. The area of noise exposure is designated using the DNL (Day-Night Average Sound Level) noise metric.

Noise Impact – A condition that exists when the noise levels that occur in an area exceed a level identified as appropriate for the activities in that area.

Noise Level Reduction (NLR) – The amount of noise level reduction in decibels achieved through incorporation of noise attenuation (between outdoor and indoor levels) in the design and construction of a structure.

Noise-Sensitive Area – Areas where aircraft noise may interfere with existing or planned use of the land. Whether noise interferes with a particular use depends upon the level of noise exposure and the types of activities that are involved. Residential neighborhoods, educational, health, and religious structures and sites, outdoor recreational, cultural and historic sites may be noise sensitive areas.

Nonconforming Use – Any pre-existing, legally established structure, tree, object of natural growth, or use of land that does not comply with one or more provisions of an airport zoning ordinance or any amendment to the ordinance.

Nonprecision Approach Procedure - A standard instrument approach procedure in which no electronic glide slope is provided. (FAR 1)

Nonprecision Instrument Runway – A runway with a straight-in instrument approach procedure using either ground-based or satellite-based air navigation facilities.

Obstruction – Any structure, tree, plant or other object of natural growth that penetrates an imaginary surface.

Off-Airport Property – Property that is beyond the boundary of land owned by the airport sponsor.

Official Controls – Ordinances and regulations that control the physical development of a city, county, or town, or any part thereof, and which implement the general objectives of the comprehensive plan. “Official controls” may include ordinances establishing zoning, subdivision controls, site plan regulations, sanitary codes, building codes and official maps. For purposes of this manual, “official controls” shall also include a “comprehensive zoning ordinance,” as that term is used in Minn. Stat. 360.064.

Official Airport Zoning Map – A legally adopted map that conclusively shows the locations of the airport boundaries, existing and planned airport runways, elevations, area topography, the airspace obstruction zone boundaries, and the airport safety zone boundaries.

On-Airport Property – Property that is within the boundary of land owned by the airport sponsor.

Other Than Utility Runway – A runway that:

- a. Is constructed for and intended to be used by jet aircraft or aircraft of more than 12,500 pounds maximum gross weight; or
- b. Is 4,900 feet or more in length.

Overflight - Any distinctly visible and audible passage of an aircraft in flight, not necessarily directly overhead.

Overflight Easement - An easement which describes the right to overfly the property above a specified surface and includes the right to subject the property to noise, vibrations, fumes, and emissions. An overflight easement is used primarily as a form of buyer notification.



Overflight Zone - The area(s) where aircraft maneuver to enter or leave the traffic pattern, typically defined by the FAR Part 77 horizontal surface.

Overlay Zone – A mapped zone that imposes a set of requirements in addition to those of the underlying zoning district.

Part 121 Carrier – Part 121 carriers refers to those U.S. air carriers under Title 14, Part 121 of the Code of Federal Regulations, which applies to major airlines and cargo carriers that fly large transport-category aircraft.

Part 135 Carrier – Part 135 carriers refer to those U.S. air carriers under Title 14, Part 135 of the Code of Federal Regulations, which applies to commercial and air carriers commonly referred to as commuter airlines and air taxis.

Part 150 Study – Part 150 is the abbreviated name for the airport noise compatibility planning process outlined in Part 150 of the Federal Aviation Regulation (FAR) that allows airport owners to voluntarily submit noise exposure maps and noise compatibility programs to the FAA for review and approval. See “Noise Compatibility Plan.”

Performance Standard – A zoning standard that permits land uses based on the use’s compliance with a particular set of standards of operation, rather than based on the particular type of use at issue. Performance standards may provide specific criteria limiting glare, dust, smoke emissions, heat, fire or explosion hazards associated with any use of land. Performance standards are imposed on uses in addition to other general zoning regulations, such as specific use restrictions or density/intensity limits.

Person – An individual, firm, partnership, corporation, company, association, joint stock association, or body politic, and includes a trustee, receiver, assignee, administrator, executor, guardian, or other representative.

Planned Development – Refers only to those proposed future airport developments that are so indicated on a planning document having the approval of the Federal Aviation Administration, Mn/DOT, Office of Aeronautics, and the municipality owning the airport.

Practical Difficulty or Unnecessary Hardship – The property in question cannot be put to a reasonable use if used under conditions allowed by an airport zoning ordinance, and the plight of the landowner is due to circumstances unique to the property not created by the landowner, and the variance, if granted, will not be contrary to the purpose and intent of the ordinance. Economic considerations alone shall not constitute a “practical difficulty or unnecessary hardship” if reasonable use for the property exists under the terms of the zoning ordinance.

Precision Approach Procedure - A standard instrument approach procedure where an electronic glide slope is provided. (FAR 1)

Precision Instrument Approach Zone or Precision Instrument Approach Airspace Zone – An airspace obstruction zone including all land that lies directly under an imaginary precision instrument approach surface longitudinally centered on the extended centerline at each end of precision instrument runway. The inner edge of the precision instrument approach surface is at the same width and elevation as, and coincides with, the end of the primary surface. The precision instrument approach surface inclines upward and outward at a slope of 50:1 for a horizontal distance of 10,000 feet expanding uniformly to a width of 4,000 feet, then continues upward and outward for an additional horizontal distance of 40,000 feet at a slope of 40:1, expanding uniformly to an ultimate width of 16,000 feet.

Precision Instrument Runway – A runway with an instrument approach procedure utilizing an Instrument Landing System (ILS), a Microwave Landing System (MLS), a Precision Approach Radar (PAR), a Transponder Landing System (TLS), or a satellite-based system capable of operating to the same level of precision guidance provided by the other indicated systems.

Primary Surface – A primary surface is longitudinally centered on a runway. When the runway has a specially prepared hard surface, the primary surface extends 200 feet beyond each end of that runway. When the runway has no specially prepared hard surface, or planned hard surface, the primary surface terminates at each end of the runway. The width of a primary surface ranges from 250 feet to 1,000 feet, depending on the existing or planned approach system. The elevation of any point on the primary surface is the same as the elevation of the nearest point on the runway centerline. *See Figure 1: Airspace (Imaginary) Surfaces – Minnesota*, above.

Primary Runway – The runway used for the majority of airport operations. Large, high-activity airports may operate two or more parallel primary runways.

Primary Zone or Primary Airspace Zone – An airspace obstruction zone including all land that lies directly under an imaginary primary surface longitudinally centered on a runway and:

- a) extending 200 feet beyond each end of runways having a specially prepared hard surface or planned hard surface.
- b) coinciding with each end of all other runways.

The elevation of any point on the primary surface is the same as the elevation of the nearest point on the runway centerline. The width of the primary surface is:

- 1000 feet for precision instrument runways and non-precision instrument runways having visibility minimums as low as three-fourths of a statute mile.
- 500 feet for all other non-precision instrument runways or visual runways other than utility.
- 250 feet for all other visual utility runways.

Proponent – Any person who proposes to erect or construct any object or structure that exceeds certain minimum altitudes that may be a potential hazard to air navigation and who may be responsible for lighting and marking such object or structure.

Public Airport – Any airport, whether privately or publicly owned, the public use of which for aeronautical purposes is invited, permitted, or tolerated by the owner or person having right of access and control.

Public Assembly Use – A structure or outdoor facility where concentrations of people gather for purposes such as deliberation, education, shopping, business, entertainment, amusement, sporting events, or similar activities, but excluding air shows. “Public assembly use” does not include places where people congregate for relatively short periods of time, such as parking lots and bus stops, or uses approved by the FAA in an adopted airport master plan.¹

Public, Civic and Institutional Uses – A use category that includes uses of a public, quasi-public, nonprofit, or charitable nature generally providing a local service to the people of the community. Generally, these uses provide the service on-site or have employees at the site on a regular basis. The service is ongoing, not just for special events. This use category includes the following use types:

- a) Community centers or facilities that have membership provisions or are open to the general public to join at any time (for instance, any senior citizen could join a senior center).

¹ Source: Oregon Administrative Rules, Rule 660-013-0020 (Definitions), subdiv. (5).



- b) Public assembly uses, such as private lodges, museums, libraries, clubs or halls, educational institutions, and religious assembly uses are also included in this category.
- c) Facilities for the provision of public services, including governmental offices and public safety and emergency response services, such as police, fire and ambulance services. Such facilities often need to be located in or near the area the service is provided.

Referral Area - The area around an airport defined by the planning area boundary adopted by an airport land use commission within which certain land use proposals are to be referred to the commission for review.

Reliever Airport – An airport that meets certain FAA criteria and relieves the aeronautical demand on a busier air carrier airport.

Residential and Accommodation Uses – A use category that includes the following use types:

- a) Residential uses that provide living accommodations, including sleeping, eating, cooking and sanitary facilities, to one or more persons, and where tenancies typically last longer than thirty (30) days.
- b) Accommodation uses characterized by visitor-serving facilities that provide temporary lodging in guest rooms or guest units, for compensation, and with an average length of stay of less than 30 days. Accessory uses may include pools and other recreational facilities for the exclusive use of guests, limited storage, restaurants, bars, meeting facilities, and offices.

Runway – Any existing or planned paved surface or turf covered area of the airport which is specifically designated and used or planned to be used for the landing and/or taking off of aircraft.

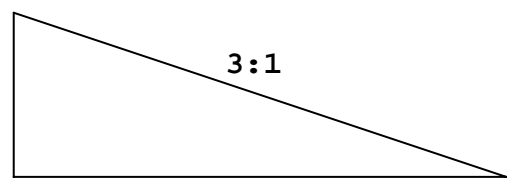
Runway Protection Zone (RPZ) – The RPZ is defined by the FAA as a trapezoid-shaped area centered about the extended runway centerline that is used to enhance the safety of aircraft operation. It begins 200 feet beyond the end of the runway or area usable for takeoff or landing. The RPZ dimensions are functions of the design aircraft, type of operation, and visibility minimums for the particular runway. The depth of the RPZ can vary from 1,000 feet for runways less than 4,000 feet to 2,500 feet for runways 6,000 feet or longer. Minnesota's Safety Zone A also begins 200 feet beyond the end of the runway, but because Zone A's length is a function of the total length of the runway (i.e., equal to 2/3 the length of the runway), for most runways at Minnesota airports, Zone A typically extends beyond the RPZ and includes the RPZ. At turf runways, Safety Zone A begins at the end of the runway.

Safety Zone – The land use safety zones (Zones A, B, and C) established by an airport zoning ordinance.

Single Event Noise - As used in herein, the noise from an individual aircraft operation or overflight.

Single Event Noise Exposure Level (SENEL) - As used in herein, the noise from an individual aircraft operation or overflight.

Slope – An incline from the horizontal expressed in an arithmetic ratio of horizontal magnitude to vertical magnitude.



For example: Slope = 3:1, which is the same as 3 feet horizontal to 1 foot vertical.

Small Airplane - An airplane of 12,500 pounds or less maximum certificated takeoff weight. (Airport Design AC)

Sound Attenuation – Acoustical phenomenon whereby a reduction of sound energy is experienced between the noise source and the receiver. This energy loss can be attributed to atmospheric conditions, terrain, vegetation, constructed features (e.g., sound insulation) and natural features.

Sound Exposure Level (SEL) – A measure of the physical energy of the noise event that takes into account both intensity and duration. By definition SEL values are referenced to a duration of one second. SEL is higher than the average and the maximum noise levels as long as the event is longer than one second. Sound exposure level is expressed in decibels (dB). People do not hear SEL.

Sound Transmission Class (STC) – A number rating of the sound that indicates the amount of noise attenuation in tested acoustical materials.

Special Exceptions – Land uses that are not specifically permitted as a matter of right, but can be permitted in accordance with performance standards and other local criteria. Also known as “conditional uses.”

Special Purpose Airport – A public airport, intended for use by aircraft issued an FAA special airworthiness certificate in the light sport category.

Stage 2 Aircraft – Aircraft that meet the noise levels prescribed by FAR Part 36 and are less stringent than noise levels established for the quieter designation Stage 3 aircraft. The Airport Noise and Capacity Act requires the phase-out of all Stage 2 aircraft by December 31, 1999, with case-by-case exceptions through the year 2003.

Stage 3 Aircraft – Aircraft that meet the most stringent noise levels set forth in FAR Part 36.

Statute Mile – A measure of distance equal to 5,280 feet.

Straight-In Instrument Approach - An instrument approach wherein a final approach is begun without first having executed a procedure turn; it is not necessarily completed with a straight-in landing or made to straight-in landing weather minimums. (AIM)

Structure – An object anchored, constructed, attached, erected, gathered, located, placed, piled, or installed by man, either on the ground or in or over a body of water, either moveable or immovable, and either temporary or permanent. The term “structure” includes, but is not limited to, antennae, buildings, cranes, fences, overhead transmission lines, patios and decks, man-made ponds, signs and sign structures, smokestacks, towers, utility poles, wires, and anything attached to any of the foregoing either temporarily or permanently.

Substantially Alter or Altered – An addition to the footprint of a building or structure, or an addition to the existing maximum height of a building or structure, or a change in use of land, building, or structure.

Taking - Government appropriation of private land for which compensation must be paid as required by the Fifth Amendment of the U.S. Constitution. It is not essential that there be physical seizure or appropriation for a taking to occur, only that the government action directly interferes with or substantially disturbs the owner’s right to use and enjoyment of the property.



Terminal Area – A general term used to describe airspace in which airport traffic control or approach control service is provided.

Terminal Instrument Procedures (TERPS) - Procedures for instrument approach and departure of aircraft to and from civil and military airports. There are four types of terminal instrument procedures: precision approach, nonprecision approach, circling, and departure.

Threshold - The beginning of that portion of the runway usable for landing (also see Displaced Threshold). (AIM)

Touch-and-Go - An operation by an aircraft that lands and departs on a runway without stopping or exiting the runway. (AIM)

Traffic Pattern - The traffic flow that is prescribed for aircraft landing at, taxiing on, or taking off from an airport. The components of a typical traffic pattern are upwind leg, crosswind leg, downwind leg, base leg, and final approach. (AIM)

Transfer of Development Rights (TDR) – The removal of the right to develop or build, expressed in dwelling units per acre, from land in one location to land in another location where such transfer is permitted.

Transitional Surface – An element of the Imaginary Surfaces extending outward and upward at right angles to the runway centerline and runway centerline extended at a slope of 7:1 from the sides of the primary and approach surfaces to where they intersect the horizontal and conical surfaces. *See Figure 1: Airspace (Imaginary) Surfaces – Minnesota*, above.

Transitional Zone or **Transitional Airspace Zone** – An airspace obstruction zone including all land that lies directly under an imaginary surface extending upward and outward at right angles to the runway centerline and centerline extended at a slope of 7:1 from the sides of the primary surfaces and from the sides of the approach surfaces until they intersect the horizontal surface or the conical surface. Transitional surfaces for those portions of the precision instrument approach surface which project through and beyond the limits of the conical surface, extend a distance of 5,000 feet measured horizontally from the edge of the precision instrument approach surface and at right angles to the extended precision instrument runway centerline.

Transportation, Parking & Utility Uses – A use category that includes the following use types:

- a) Mass transit, which means a coordinated system of one or more transit modes providing regular transportation to the general public including, but not limited to, bus or rapid transit but not including charter bus, school bus, or sightseeing transportation.
- b) Public utility uses engaged in providing railroad, airline, bus, electric, rural electric, telephone, telegraph, communications, gas, gas pipeline carrier, water, sewerage, pipeline, street transportation, sleeping car, express, or private car line facilities and services.
- c) Transportation and parking service uses including a variety of facilities generally open to the public, related to the movement of passengers and goods, whether by private auto or public transportation.

Traverse Ways – Roads, railroads, trails, waterways, or any other avenue of surface transportation.²

Tree – Any object of natural growth.

² Source: Minn. Rule 8800.0100, Subp. 31.

Turbojet Aircraft – Aircraft operated by jet engines incorporating a turbine driven air compressor to take in and compress the air for the combustion of fuel, the gases of combustion (or the heated air) being used both to rotate the turbine and to create a thrust-producing jet.

Turboprop Aircraft – Aircraft in which the main propulsive force is supplied by a gas turbine driven conventional propeller. Additional propulsive force may be supplied from the discharged turbine exhaust gas.

Utility Runway – A runway that is constructed for and intended to be used by propeller-driven aircraft of 12,500 pounds maximum gross weight, and which runway is less than 4,900 feet in length.

Variance – Any modification or variation of an airport zoning ordinance’s provisions where it is determined that, by reason of exceptional circumstances, the strict enforcement of the ordinance provision(s) would cause “practical difficulty or unnecessary hardship.”

Visual Approach – An approach to an airport conducted with visual reference to the terrain.

Visual Flight Rules (VFR) – FAA rules that govern procedures for flight under visual conditions.

Visual Runway – A runway intended solely for the operation of aircraft using visual approach procedures, with no straight-in instrument approach procedure.

Water Impoundment – A “Water Impoundment” means wastewater treatment settling ponds, surface mining ponds, detention and retention ponds, artificial lakes and ponds, and similar water features.

Water Surfaces – This term has the same meaning as “land” for the establishment of protected zones.

Wetland Mitigation Banking – involves consolidating fragmented wetland mitigation projects into one large contiguous site. Units of restored, created enhanced or preserved wetlands are expressed as “credits” which may be withdrawn to offset “debits” incurred at a project development site.

Wildlife Attractants – Any human-made structure, land-use practice, or human-made or natural geographic feature that can attract or sustain hazardous wildlife within the landing or departure airspace or the airport’s air operations area. These attractants include, but are not limited to, architectural features, landscaping, waste disposal sites, wastewater treatment facilities, agricultural or aquaculture activities, surface mining, or wetlands.

Wildlife Hazards – Species of wildlife (birds, mammals, reptiles), including feral animals and domesticated animals not under the control, that are associated with aircraft strike problems, are capable of causing structural damage to airport facilities, or act as attractants to other wildlife that pose a strike hazard.

Yearly Day-Night Average Sound Level (YDNL) – The 365-day average, in decibels, day-night average sound level. The symbol for YDNL is also Ldn.

Zone A – A safety zone including all land in that portion of the approach zones of a runway that extends outward from the end of primary airspace zone, as defined in this Manual, a distance equal to two-thirds (2/3) of the planned length of the runway.

Zone B – A safety zone including all land in that portion of the approach zones of a runway that extends outward from the end of Zone A to a distance equal to one-third (1/3) of the planned length of the runway.

Zone C – A safety zone including all land enclosed within the perimeter of the horizontal airspace zone, as defined in this Manual, and which is not included in Zone A or Zone B.



Zoning Administrator – The public official in each affected municipality appointed to administer and enforce airport zoning regulations.

Zoning – The partitioning of land parcels in a community by ordinance into zones and the establishment of regulations in the ordinance to govern the land use and the location, height, use and land coverages of buildings within each zone.

Zoning Ordinance – Primarily a legal document that allows a local government effective and legal regulation of uses of property while protecting and promoting the public interest. The zoning ordinance usually consists of text and official zoning map.

APPENDIX 3: MINNESOTA AIRPORTS – SUPPLEMENTAL INFORMATION

History of Airport Zoning in Minnesota – Key Dates

1925

- Minnesota develops some form of aviation regulatory statutes. Aircraft regulation and registration. The net effect of state law was confusion because of their lack of conformity.

1943

- Minnesota State Department of Aeronautics absorbed the Minnesota Aeronautics Commission which had no departmental organization and no employees other than an executive secretary and a stenographer.
- Four main divisions were established: Administrative, Engineering, Promotion and regulation, and Operations and Management.

1944

- Drafted Model Zoning Act from Civil Aeronautics Administration and National Institute of Municipal Law Officers.

1945

- Minnesota Airport Zoning Act (MS 360.061 – 360.075)

1946

- January 1, 1946 - First Minnesota Model Airport Zoning Ordinance

1958

- Minnesota State Zoning - Established land use zoning in 1958- modeled after recommendations in the Doolittle Report
- Minnesota Regulations 1959 Edition
- 9337 Land Use Zoning Standards
- Zones A, B, C, D

1967

- Metropolitan Council established.



1969 Rules, October 13, 1969 (approved by Attorney General Hartfeldt)

Aero 10

- Change in Land Use Standards to divide airports into two sizes instead of using the term “trunk size airport or larger”
- Zone A uses include agricultural but no housing or place of public assembly. Permitted uses include auto parking areas and light recreational areas without stadia. Approach zone of instrument and non-instrument runways of over 3800’ extends 1½ miles from end of the runway.
- Zone B restricts residential to one-family residences per five-acre lots. Prohibits places of public assembly. Zone B extends out from Zone A to two miles from the end of the runway.
- Zone C: Use restrictions allow only single-family dwellings on one-acre lots.
- Heavy smoke or bright lights which are hazardous to the landing or taking off of aircraft are not permitted in (safety is not yet used in defining zones) Zones A, B, C, and D.
- When runway is 3,800’ or more then Zone C extends a distance of ½ mile from airport boundary, and zone D extends from the airport out a mile.

July 1, 1973

Section 32 Subd 8 of the Appropriations Bill

- Airports are required to zone with due diligence for safety zoning (MS 360.305, Subd 6) and is tied to continued funding

1974, May 29 (approved by Special Asst Attorney General Miller)

Aero 10

- Change in Safety Zone lengths
- Safety Zone A extends outward from the end of the primary surface a distance equal to 2/3 the runway length or planned length.
- Safety Zone B – 1/3
- Safety Zone C – all that land which is enclosed within the perimeter of the horizontal zone defined in Aero 9 and which is not included in Zones A or B.

Restrictions in Land Use

- Zone A – no buildings or temporary structures; permitted uses may include agriculture, non-spectator recreation, cemeteries, and auto parking.
- Zone B – Agricultural and residential purposed, provided there shall not be more than one single-family dwelling per 3-acre lot. Commercial or industrial use shall not create, attract or bring together a site population that would exceed 15 times that of the site acreage. Commercial shall be no less than 3 acres.

1975-76

Aero 10 - Changed Land-Use Zoning Standards to Airport Zoning Standards

- Separated out airspace and land use zoning – Safety Zones titled Land Use Safety Zones
- Changed Restrictions in Land Use Safety Zones to Use Restrictions
- Defined Use restrictions.
- Deleted approach zone size and location criteria because it varies depending on runway development.
- Redefined obstructions.
- Elaborated Zone B uses. As per Myking at the public meeting, “revised to allow for more flexibility with no loss in the zoning intent.”
- Charted Site acres to building square feet
- No comments at the public hearing regarding zoning.
- NSP sent letter requesting the term power lines be removed from the list of land use exclusions in Safety Zone A.
- Findings of Fact – Power lines were changed to “exposed transmission lines.”

1977

Dept of Transportation

- 14 MCAR 1.0001 to 1.0043
- 14 MCAR 1.0010
- Zone A – same
- Zone B – refined but intent same
- Zone C – same

January 1, 1978

M.S. 360.066 Subd. B

- PROTECTION OF EXISTING NEIGHBORHOODS: No airport zoning standards or local airport zoning ordinances or regulations shall be adopted pursuant to sections 360.061 to 360.074 that classify as a nonconforming use or require such classification with respect to any low-density residential building lots existing on January 1, 1978 in an established residential neighborhood.

Rules 8800.2400, Subd 6 E. 3

- No land use in safety zones A or B and in an area designated as having been an “established residential neighborhood in a built up urban area” shall be prohibited by an airport zoning ordinance except as provided in subitem (5). In addition, any isolated low density residential building lot or low density residential structure which existed on January 1, 1978, in an “established residential neighborhood in a built up urban area,” must either be allowed to continue as a conforming use under the terms of the local zoning ordinance or must be acquired, altered, or removed as provided in subitem (6).



Rules 8800.2400, Subd 6 E. 4 a

- In determining what constitutes an “established residential neighborhood in a built up urban area” the governmental unit having zoning powers shall apply and consider the following criteria in relation to the neighborhood as it existed on June 30, 1979: location of the airport; nature of the terrain with safety zones A and B; etc.

1978

March 8, 1978 Notes *From Richard B. Keinz To Zoning File*

- Some homeowners in the approaches to the Crystal Airport perceive this nonconforming designation would be a cloud on the title to their property. Many of the homes in these approaches have existed for over twenty years.
- HF 2052 sponsored by Rep Linda Scheid would: Necessitate a reanalysis of our current zoning criteria 2/3 – 1/3 ratio development. At the very least, some attention would have to be given to the treatment of the existing structures and land uses in the Aero Rules.
- Bill suggests “balancing act” to weigh the alleged hazard against some disruption factors, such as social and financial costs.
- SF 1908: (staff support because it will not weaken airport zoning as a protective measure and will not add to the cost of the protective measures. Author not provided.)
- A recognition of all structures as conforming land uses.
- Recognition that airport zoning is “protective” not “corrective”: to protect the openness of the approach that the airport has at the time of adopting the zoning ordinance. Would stop all further encroachment of all incompatible land uses.
- Zoning is not a means to correct a built-up approach. The mechanism for that is through acquisition through condemnation or negotiated purchase.
- Not in conflict with original intent of airport zoning. Prevents open approaches from being built up. “This then requires less fee acquisition to accomplish the same thing.”

1978

- 14 MCAR 1.3001 to 1.3043
- 14 MCAR 1.3010
- Zones – same
- Legislation (MS Chapter 654) introducing “Established residential neighborhoods in built-up area” was passed. These residential areas will be deemed “Conforming Uses” unless they pose to be a safety hazard and will be bought and eliminated at the expense of the public. Declares that non-conforming uses are not in the public interest and should be avoided whenever possible and consistent with reasonable standards of safety. It is necessary to establish the boundaries of established residential neighborhoods in built-up urban areas.
- Transcript R Keinz, Director of Dept of Aviation regarding cost of non-conforming uses “If sufficient funds were available at least in certain cases, the social and economic impacts to the people affected, would out weigh the public’s perceived value of the airport. Safety considerations must, therefore, be compromised to a point that is deemed to be socially acceptable and economically affordable.”

M.S. 360.062 (Chapter 654)

- Added text “It is also found that the social and financial costs of disrupting existing land uses around airports in built up urban areas, particularly established residential neighborhoods, often outweigh the benefits of a reduction in airport hazards that might result from the elimination of removal of those uses.... and (3) that the elimination of removal of existing land uses, particularly established designation as nonconforming uses is not in the public interest and should be avoided whenever possible consistent with reasonable standards of safety.”
- “...an airport hazard shall be acquired, altered, or removed at public expense.”

1979

- Revised Model Zoning Ordinance

1980

James W. McShane v. City of Faribault, 292 NW 2d 253 (Minn. 1980):

- Where a zoning regulation is adopted for the benefit of a governmental enterprise rather than in furtherance of a comprehensive land use plan, the correct standard is whether there has been a substantial diminution in the value of the affected property as a result of the regulation. Page 260.
- “So long as the ordinance has legitimate comprehensive planning objective, there is no taking unless all reasonable uses of the property have been proscribed.” Page 256, citing *Holaway v. City of Pipestone*, 269 NW 2d 28 (Minn. 1978).

1983

Minnesota Statutes Annotated

- The 1983 amendment [to 360.065], in subd.2, added “unless it demonstrates that the social and economic costs of restricting land uses, in accordance with the standards, outweigh the benefits of a strict application of the standards”.

1984

Keenan v International Falls-Koochiching County Airport Zoning Bd., 357 NW2d 397 (Minn. App. 1984):

- Whether diminution in value has occurred to parcels of land surrounding an airport and the extent of that diminution are questions of fact, whether that change in value is definite and measurable is a legal question.
- Minn. Constitution, Art. 1, s. 13, provides: “Private property shall not be taken, destroyed or damaged for public use without just compensation therefore, first paid or secured.”

1990

- Updated Minnesota Model Airport Zoning Ordinance



2006 Compliance of Minnesota Public Airports with Model Zoning Ordinance Standards

The following **Table 1** summarizes several of the key findings from Mn/DOT’s review of 130 airport zoning ordinances applicable at Minnesota’s public airports. The review was conducted during the Fall of 2004, and presented to the Advisory Committee in January 2005.

TABLE 1: SUMMARY OF KEY FINDINGS FROM SURVEY OF AIRPORT ZONING ORDINANCES IN EFFECT AT MINNESOTA PUBLIC AIRPORTS

(OCTOBER 2004)

Total Number of Ordinances Analyzed = 130

| Date Ordinance Adopted or Latest Amendment Date | # of Ordinances | % of Total (n = 130) | |
|--|--------------------------------|----------------------|--|
| Before 1970 | 1 | .8% | |
| 1970-1979 | 84 | 64.6% | |
| 1980-1989 | 24 | 18.5% | |
| 1990 and later | 21 | 16.2% | |
| Type of Deviation from Provisions in MN State Model Airport Zoning Ordinance | # of Ordinances with Deviation | % of Total (n = 130) | Comments |
| Physical Dimensions of Safety Zones A, B, or C | 4 | 3.1% | 1 of the 4 is a pending ordinance amendment |
| Number of Safety Zones (model includes a minimum of 3 zones) | 3 | 2.3% | <ul style="list-style-type: none"> • 2 ordinances: 4 safety zones • 1 ordinance: 2 safety zones (based on 1969 model) |
| Height of Horizontal Airspace Zone (model specifies a minimum of 150 feet) | 56 | 43.8% | 75 ft. = 3 ordinances 100 ft. = 53 ordinances (All are more restrictive than model) |
| Treatment of Nonconforming Uses | 7 | 5.4% | <ul style="list-style-type: none"> • 2 ordinances: 50% destruction triggers use compliance vs. 80% in model; • 1 ordinance: Amortization of nonconforming uses required • 5 ordinances: Exempts existing residential or otherwise prohibited existing uses from zone restrictions |
| Treatment of Allowed, Prohibited, and Restricted Uses (Including provisions for more/less intensity of allowed uses) | 11 | 8.5% | <ul style="list-style-type: none"> • Several ordinances further restrict Zone B uses by setting 5-acre minimum parcel size vs. 3-acre limit allowed in state model. • 1 ordinance: loosened provisions by allowing additional Zone B uses and intensity and by not limiting assembly uses • 1 ordinance: further restricts Zone A uses by specifically prohibiting bird attracting uses |

**SUMMARY OF KEY FINDINGS FROM SURVEY OF AIRPORT ZONING ORDINANCES
IN EFFECT AT MINNESOTA PUBLIC AIRPORTS**

(OCTOBER 2004)

Total Number of Ordinances Analyzed = 130

| Element of Interest in Ordinance | # of Ordinances with Element | % of Total (n = 130) | Comments |
|--|------------------------------|----------------------|---|
| Include Established Residential Neighborhood (“ERN”) Exemption Provision | 20 | 15.4% | <ul style="list-style-type: none"> • Two ordinances define the term and contain exemption in the text, but do not identify specific lots/parcels as ERNs. • 1 ordinance: Ordinance follows state model, except clarifies that residential uses within ERNs are conforming uses, and explicitly allows new residential development and expansion/alteration of existing residential structures located in an ERN and within Zone B. • 2 ordinances: Do not use or define the term “ERN” but use the same approach and exemption language for specified existing uses. |

The following two tables show the results of Mn/DOT’s analysis of official zoning maps at Minnesota’s 137 public airports to determine whether the mapped safety zones comply with the Model Zoning Ordinance’s minimum required dimensions. **Table 2** shows:

- For 84 of the 136 public airports (about 62%), local zoning authorities had adopted runway safety zone dimensions (Zones A, B, and C) that **exceeded** the model ordinance’s minimum dimensional requirements
- Another 35 of the 136 public airports (26%) **complied** with the model ordinance’s minimum safety zone dimensions.
- Altogether, 88% of the state’s public airports either meet or exceed the state’s minimum dimensions for Safety Zones A, B and C.
- 17 (12.5%) of the state’s public airports, primarily those with turf runways, **did not comply** with the minimum safety zone requirements.



| TABLE 2: MINNESOTA AIRPORT ZONING SUMMARY (2006) | | | |
|--|--|----|------------|
| Number of Public Airports [1],[2]: | | | |
| Exceeding Minimum Ordinance Standards for Safety Zones: | | | 84 |
| Meets Minimum Ordinance Standards for Safety Zones: | | | 35 |
| Subtotal | | | 119 |
| Does Not Meet Minimum Ordinance Standards for Safety Zones: | | | |
| | MAC airports | 6 | |
| | Airports with turf runways (Master plan review required) [3] | 11 | |
| Subtotal | | | 17 |
| Total Airports | | | 136 |
| <p>Note 1: There are 23 airports with zoning in place for future runways that are not constructed to date. These future runways are not included in the totals indicated above.</p> <p>Note 2: A detailed list of airports used to compile this table can be found in Appendix 3.</p> <p>Note 3: Safety zoning for turf runways at public airports will be reviewed during the Master Plan process; Mn/DOT expects all safety zoning for turf runways to comply with Minnesota Statutes, Chapter 360, or else cease operations.</p> | | | |
| <i>Source: Mn/DOT Office of Aeronautics, 2006</i> | | | |

Table 3 below provides a specific listing of the compliance performance of each of the 136 Minnesota public airports reviewed.

| TABLE 3: COMPLIANCE OF MINNESOTA'S PUBLIC AIRPORTS WITH MINIMUM STATE SAFETY ZONE DIMENSIONS | | | | | |
|--|---------------------|---|--------------------------|------------------------------------|-------------------|
| | Associated City | Airport Name | Meets (M) or Exceeds (E) | Master Plan Review (MPR) Requested | Does Not Meet (N) |
| Key Airports | | | | | |
| 1 | Alexandria | Alexandria Municipal – Chandler Field | E | | |
| 2 | Austin | Austin Municipal | M | | |
| 3 | Baudette | Baudette International | E | | |
| 4 | Bemidji | Bemidji – Beltrami County | M | | |
| 5 | Brainerd | Brainerd Lakes Regional | M | | |
| 6 | Duluth | Duluth International | E | | |
| 7 | Ely | Ely Municipal | E | | |
| 8 | Fairmont | Fairmont Municipal | E | | |
| 9 | Fergus Falls | Fergus Falls Municipal Einar Mickelson Field | E | | |
| 10 | Grand Rapids | Grand Rapids – Itasca County Gordon Newstrom Field | E | | |

**TABLE 3: COMPLIANCE OF MINNESOTA’S PUBLIC AIRPORTS WITH
MINIMUM STATE SAFETY ZONE DIMENSIONS**

| | Associated City | Airport Name | Meets (M) or Exceeds (E) | Master Plan Review (MPR) Requested | Does Not Meet (N) |
|------------------------------|----------------------------|---|--------------------------|------------------------------------|-------------------|
| Key Airports | | | | | |
| 11 | Hibbing | Chisholm-Hibbing Municipal | E | | |
| 12 | International Falls | Falls International | M | | |
| 13 | Mankato | Mankato Regional – Sohler Field | E | | |
| 14 | Marshall | Southwest Minnesota Regional – Ryan Field | E | | |
| 15 | Owatonna | Owatonna – Degner Regional | E | | |
| 16 | Park Rapids | Park Rapids Municipal – Konshok Field | E | | |
| 17 | Red Wing | Red Wing Regional | M | | |
| 18 | Rochester | Rochester International | E | | |
| 19 | St. Cloud | St. Cloud Regional | E | | |
| 20 | Thief River Falls | Thief River Falls Regional | E | | |
| 21 | Warroad | Warroad International – Swede Carlson Field | M | | |
| 22 | Willmar | Willmar Municipal – John L. Rice Field | E | | |
| 23 | Winona | Winona Municipal – Max Conrad Field | E | | |
| 24 | Worthington | Worthington Municipal | E | | |
| Intermediate airports | | | | | |
| 25 | Ada | Norman County – Ada-Twin Valley | E | | |
| 26 | Aitkin | Aitkin Municipal – Steve Kurtz Field | E | | |
| 27 | Albert Lea | Albert Lea Municipal | E | | |
| 28 | Appleton | Appleton Municipal | E | | |
| 29 | Bagley | Bagley Municipal | E | | |
| 30 | Benson | Benson Municipal – Veterans Field | M | | |
| 31 | Bigfork | Bigfork Municipal | M | | |
| 32 | Blue Earth | Blue Earth Municipal | E | | |
| 33 | Brooten | Brooten Municipal | E | | |
| 34 | Buffalo | Buffalo Municipal | E | | |
| 35 | Caledonia | Houston County | M | | |
| 36 | Cambridge | Cambridge Municipal Airport | E | | |
| 37 | Canby | Canby Municipal – Myers Field | E | | |



**TABLE 3: COMPLIANCE OF MINNESOTA’S PUBLIC AIRPORTS WITH
MINIMUM STATE SAFETY ZONE DIMENSIONS**

| | Associated City | Airport Name | Meets (M) or Exceeds (E) | Master Plan Review (MPR) Requested | Does Not Meet (N) |
|------------------------------|-------------------------|---|--------------------------|------------------------------------|-------------------|
| Intermediate airports | | | | | |
| 38 | Clarissa | Clarissa Municipal | E | | |
| 39 | Cloquet | Cloquet-Carlton County | E | | |
| 40 | Cook | Cook Municipal | E | | |
| 41 | Crookston | Crookston Municipal – Kirkwood Field | E | | |
| 42 | Detroit Lakes | Detroit Lakes – Wething Field | | MPR | |
| 43 | Dodge Center | Dodge Center Municipal | E | | |
| 44 | Duluth | Sky Harbor | E | | |
| 45 | Eveleth-Virginia | Eveleth-Virginia Municipal | | MPR | |
| 46 | Faribault | Faribault Municipal | E | | |
| 47 | Fertile | Fertile Municipal | M | | |
| 48 | Fosston | Fosston Municipal | E | | |
| 49 | Glencoe | Glencoe Municipal – Vernon Perschau Field | E | | |
| 50 | Glenwood | Glenwood Municipal | | MPR | |
| 51 | Grand Marais | Grand Marais – Cook County | E | | |
| 52 | Granite Falls | Granite Falls Municipal – Lenzen-Roe Memorial Field | M | | |
| 53 | Hallock | Hallock Municipal | E | | |
| 54 | Hawley | Hawley Municipal | E | | |
| 55 | Hector | Hector Municipal | E | | |
| 56 | Herman | Herman Municipal | E | | |
| 57 | Hutchinson | Hutchinson Municipal – Butler Field | M | | |
| 58 | Jackson | Jackson Municipal | E | | |
| 59 | Le Sueur | Le Sueur Municipal | M | | |
| 60 | Litchfield | Litchfield Municipal | E | | |
| 61 | Little Falls | Little Falls – Morrison County – Lindbergh Field | | MPR | |
| 62 | Long Prairie | Long Prairie Municipal – Todd Field | E | | |
| 63 | Longville | Longville Municipal | E | | |
| 64 | Luverne | Luverne Municipal – Quentin Aanenson Field | E | | |
| 65 | Madison | Lac Qui Parle County – Bud Frye Field | E | | |

**TABLE 3: COMPLIANCE OF MINNESOTA’S PUBLIC AIRPORTS WITH
MINIMUM STATE SAFETY ZONE DIMENSIONS**

| | Associated City | Airport Name | Meets (M) or Exceeds (E) | Master Plan Review (MPR) Requested | Does Not Meet (N) |
|------------------------------|-----------------------|--|--------------------------|------------------------------------|-------------------|
| Intermediate airports | | | | | |
| 66 | Maple Lake | Maple Lake Municipal | M | | |
| 67 | McGregor | McGregor – Isedor Iverson | M | | |
| 68 | Montevideo | Montevideo-Chippewa County | E | | |
| 69 | Moorhead | Moorhead Municipal | M | | |
| 70 | Moose Lake | Moose Lake – Carlton County | M | | |
| 71 | Mora | Mora Municipal | E | | |
| 72 | Morris | Morris Municipal | | MPR | |
| 73 | New Ulm | New Ulm Municipal | | MPR | |
| 74 | Olivia | Olivia Regional | E | | |
| 75 | Orr | Orr Regional | M | | |
| 76 | Ortonville | Ortonville Municipal – Martinson Field | | MPR | |
| 77 | Paynesville | Paynesville Municipal | E | | |
| 78 | Perham | Perham Municipal | E | | |
| 79 | Pine River | Pine River Regional | M | | |
| 80 | Pinecreek | Piney-Pinecreek Border | M | | |
| 81 | Pipestone | Pipestone Municipal | E | | |
| 82 | Preston | Fillmore County | E | | |
| 83 | Princeton | Princeton Municipal | M | | |
| 84 | Red Lake Falls | Red Lake Falls Municipal | E | | |
| 85 | Redwood Falls | Redwood Falls Municipal | E | | |
| 86 | Roseau | Roseau Municipal – Rudy Billberg Field | E | | |
| 87 | Rush City | Rush City Regional | M | | |
| 88 | Rushford | Rushford Municipal | E | | |
| 89 | Sauk Centre | Sauk Centre Municipal | E | | |
| 90 | Silver Bay | Wayne Johnson - Silver Bay Municipal Airport | E | | |
| 91 | Slayton | Slayton Municipal | M | | |
| 92 | Sleepy Eye | Sleepy Eye Municipal | E | | |
| 93 | Springfield | Springfield Municipal | E | | |
| 94 | St. James | St. James Municipal | M | | |
| 95 | Staples | Staples Municipal | M | | |



**TABLE 3: COMPLIANCE OF MINNESOTA’S PUBLIC AIRPORTS WITH
MINIMUM STATE SAFETY ZONE DIMENSIONS**

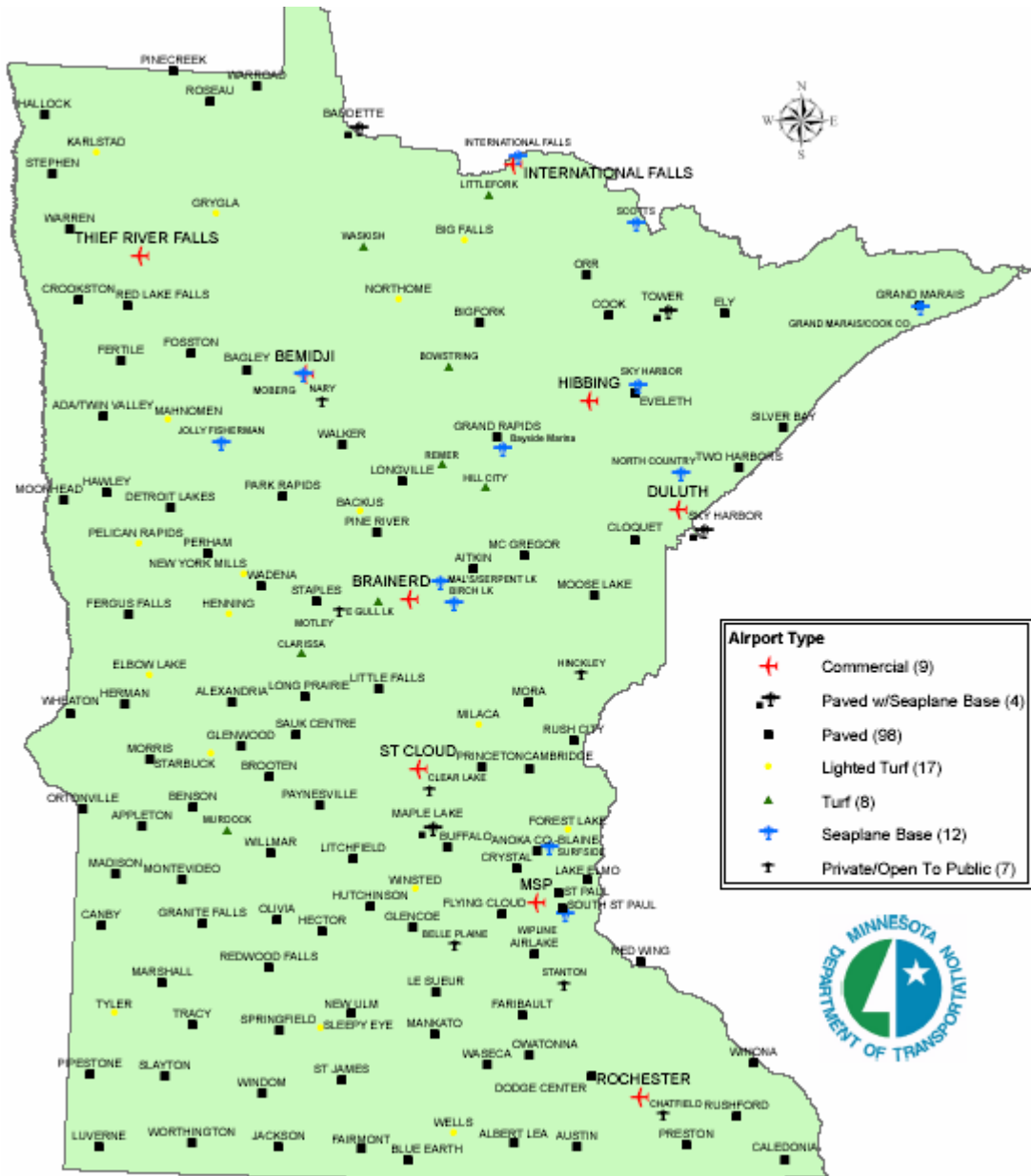
| | Associated City | Airport Name | Meets (M) or Exceeds (E) | Master Plan Review (MPR) Requested | Does Not Meet (N) |
|------------------------------|-----------------------|---|--------------------------|------------------------------------|-------------------|
| Intermediate airports | | | | | |
| 96 | Stephen | Stephen Municipal | E | | |
| 97 | Tower | Tower Municipal | M | | |
| 98 | Tracy | Tracy Municipal | | MPR | |
| 99 | Two Harbors | Richard B. Helgeson | E | | |
| 100 | Wadena | Wadena Municipal | E | | |
| 101 | Walker | Walker Municipal | E | | |
| 102 | Warren | Warren Municipal | M | | |
| 103 | Wheaton | Wheaton Municipal | E | | |
| 104 | Windom | Windom Municipal | M | | |
| Landing Strips | | | | | |
| 105 | Backus | Backus Municipal | | MPR | |
| 106 | Big Falls | Big Falls Municipal | E | | |
| 107 | Bowstring | Bowstring Municipal | M | | |
| 108 | East Gull Lake | East Gull Lake Municipal | M | | |
| 109 | Elbow Lake | Elbow Lake Municipal – Pride of the Prairie | E | | |
| 110 | Grygla | Grygla Municipal – Mel Wilkens Field | E | | |
| 111 | Henning | Henning Municipal | M | | |
| 112 | Hill City | Hill City – Quadna Mountain | E | | |
| 113 | Karlstad | Karlstad Municipal | E | | |
| 114 | Littlefork | Littlefork Municipal – Hanover | | MPR | |
| 115 | Mahnomen | Mahnomen County | E | | |
| 116 | Milaca | Milaca Municipal | E | | |
| 117 | Murdock | Murdock Municipal | | MPR | |
| 118 | New York Mills | New York Mills Municipal | M | | |
| 119 | Northome | Northome Municipal | E | | |
| 120 | Pelican Rapids | Pelican Rapids Municipal – Lyon’s Field | E | | |
| 121 | Remer | Remer Municipal | E | | |
| 122 | Starbuck | Starbuck Municipal | E | | |
| 123 | Tyler | Tyler Municipal | E | | |
| 124 | Waseca | Waseca Municipal | E | | |

**TABLE 3: COMPLIANCE OF MINNESOTA’S PUBLIC AIRPORTS WITH
MINIMUM STATE SAFETY ZONE DIMENSIONS**

| | Associated City | Airport Name | Meets (M) or Exceeds (E) | Master Plan Review (MPR) Requested | Does Not Meet (N) |
|------------------------|-------------------------------|---|--------------------------|------------------------------------|-------------------|
| Landing Strips | | | | | |
| 125 | Waskish | Waskish Municipal | E | | |
| 126 | Wells | Wells Municipal | E | | |
| 127 | Winsted | Winsted Municipal | M | | |
| Metro Airports | | | | | |
| 128 | Airlake (MAC) | Minneapolis Airlake Airport | | | N |
| 129 | Anoka Co. (MAC) | Minneapolis Anoka County / Blaine Airport | | | N |
| 130 | Crystal (MAC) | Minneapolis Crystal Airport | | | N |
| 131 | Flying Cloud (MAC) | Minneapolis Flying Cloud Airport | | | N |
| 132 | Forest Lake | Forest Lake Airport | E | | |
| 133 | Lake Elmo (MAC) | Lake Elmo Airport | | | N |
| 134 | Minneapolis - St. Paul | Minneapolis - St. Paul International Airport - Wold - Chamberlain Field | M | | |
| 135 | St. Paul (MAC) | St. Paul Downtown Airport - Holman Field | | | N |
| 136 | South St. Paul | South St. Paul Municipal Airport - Richard E. Fleming Field | M | | |
| | | Subtotal “Meets” | 35 | | |
| | | Subtotal “Exceeds” | 84 | | |
| | | Totals | 119 | 11 | 6 |
| COMBINED TOTAL: | | | 136 | | |



Map of Publicly Accessible Airports in Minnesota (2006)



MNDOT - Office of Aeronautics

2/21/06

APPENDIX 4: CONTACTS

Mn/DOT Office of Aeronautics

Mn/DOT Office of Aeronautics
 222 East Plato Boulevard
 St. Paul, Minnesota 55107-1618
 Phone: 651-296-8202
 Toll Free: 800-657-3922
 Fax: 651-297-5643
 Email: aeroinfo@dot.state.mn.us
 Website: <http://www.dot.state.mn.us/aero/index.html>

Other Agencies

| | |
|--|---|
| Metropolitan Council | http://metro council.org/index.htm |
| Aviation Planning Activities | chauncey.case@metc.state.mn.us |
| Data Center (general info) | data.center@metc.state.mn.us Phone: 651-602-1140 FAX: 651-602-1464 Mailing address: Metropolitan Council Data Center 230 E. 5th St. St. Paul, MN 55101 |
| Federal Aviation Administration | http://www.faa.gov/ U.S. Department of Transportation Federal Aviation Administration 800 Independence Avenue, SW Washington, DC 20591 1-866-TELL-FAA (1-866-835-5322) |
| FAA Great Lakes Region ³ | http://www.faa.gov/airports_airtraffic/airports/regional_guidance/great_lakes/ |
| FAA Official Airport Wildlife Hazard Mitigation Home Page | http://wildlife-mitigation.tc.faa.gov/public_html/index.html |
| Current USDA Wildlife Services State Director (for the Great Lakes Region) | United States Department of Agriculture Animal/Plant Health Inspection Service Minnesota Wildlife Services State Director Attn: Jason Suckow 34912 U.S. Hwy 2 Grand Rapids, MN 55744 Phone: 218-327-3350 FAX: 218-326-7039 |
| Bird Strike Committee, USA | www.birdstrike.org |

³ The FAA Great Lakes Region includes the following states: Illinois, Indiana, Michigan, Minnesota, North Dakota, Ohio, South Dakota, Wisconsin.



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APPENDIX 5: ADDITIONAL RESOURCES

Documents and Studies

The following is a list of documents, studies and other reference materials designed to assist airport sponsors, state agencies, counties, cities and towns or other interested parties in understanding processes and land use practices utilized to protect and enhance airports as significant local, regional and state facilities. The list represents selected current studies and resources available across the United States. The contents of these documents may not by themselves meet laws or regulations adopted by the State of Minnesota or reflect the views of MnDOT Office of Aeronautics or policies of the Federal Aviation Administration.

Additionally, MnDot Office of Aeronautics offers a technical assistance program to assist local jurisdictions and airport sponsors to protect and discourage incompatible land uses adjacent to public use airports consistent with state law. Where interpretations of law are involved, local jurisdictions, airport sponsors and other should consult their own legal counsel.

- *Airports and Compatible Land Use*, prepared by Washington State Department of Transportation (WSDOT) WSDOT Aviation, 1999
- *Airport Compatibility Guidelines: Compatibility Planning, Height Hazard Zoning, and Compatible Land Use Zones for Texas Airports*, prepared by Texas Department of Transportation, Division of Aviation, January 1992.
- *Airport Compatible Land Use Design Handbook*, prepared by Denver Regional Council of Governments (DRCOG), 1998
- *Airport Compatible Land Use Guidance for Florida Communities*, prepared by Florida Department of Transportation (FDOT), 1994
- *Airport Land Use Compatibility Guidebook*, Oregon Department of Aviation, 2003
- *Airport Land Use Compatibility Plan*, Contra Costa County, prepared by Shutt and Moen Associates and adopted by Contra Costa County Airport Land Use Commission, California, 2000
- *Airport Land Use Compatibility Plan*, Placer County prepared by Placer County Airport Land Use Commission, 2000
- *Airport Land Use Planning Handbook*, prepared for California Department of Transportation Division of Aeronautics by Shutt Moen and Associates, 2002
- *Airport Land Use Planning Handbook*, prepared for California Department of Transportation Division of Aeronautics by Hodges & Shutt, December 1993.
- *Airport Noise Compatibility Planning (ANCP) Toolkit*, FAA, Office of Environment and Energy (AEE), 2000
- *Land Use Compatibility and Airports, a Guide for Effective Land Use Planning*, FAA Airports Division, Southern Region, 1998
- *Land Use Guide*, prepared by Wisconsin Aviation, 2000
- Minnesota Rules, Rule 8800.1100, *Regulation of Structure Height*, Minnesota State Legislation (2005)
- Minnesota Rules, Rule 8800.2400, *Airport Zoning Standards*, Minnesota State Legislation, (2005)



- The Puget Sound Regional Council Regional Airport System Plan, 2001 prepared by PSRC
- The Puget Sound Regional Council Strategic Plan for Aviation, prepared by PSRC, 2000
- Compatible Land Use Planning Resources Bibliography, prepared by the Puget Sound Regional Council

Federal Aviation Administration (FAA)

- *Overview, FAA Compatible Airport Noise Compatibility Tool Kit – Roles and Responsibilities* (pdf 564 kb), FAA Office of Environment and Energy, 1998
- *Land Use Compatibility and Airports, a Guide for Effective Land Use Planning* (pdf 2.4 mb), FAA Airports Division, Southern Region, 1998
- *NASAO/FAA Survey, Cooperative Partnership between the FAA and the State Agencies for Reducing Community Concerns related to Aircraft Noise* (pdf 2 mb), prepared by NASAO and the FAA, 2000
- *Federal Aviation Administration Federal Regulations CFR Title 14 Aeronautics and Space*
- Federal Aviation Administration, Advisory Circulars -
 - AC 150/5200 – 33 Hazardous Wildlife Attractants on or Near Airports
 - AC 150/5200-34 Construction of Establishment of Landfills Near Public Airports
 - AC 150/5020-1 Noise Control and Compatibility Planning for Airports
 - AC 150/5050-4 Citizen Participation in Airport Planning
 - AC 150/5050-6 Airport Land Use Compatibility Planning
 - AC 150/5070-6B Airport Master Plans
 - AC 150/5190-4A A Model Zoning Ordinance to limit Height of Objects Around Airports
 - 7400.2D "Procedures for Handling Airspace Matters".

OTHER HELPFUL WEBSITES

Airport Compliance Requirements

- <http://www.faa.gov/arp/pdf/5190-6a.pdf>

Airport Design 150/5300-13

- <http://www.faa.gov/arp/pdf/5300-13.pdf>

Airport Development Handbook (Wisconsin)

- <http://www.dot.wisconsin.gov/library/publications/topics/air/apt-devel.pdf>

Airport Improvement Plan Handbook

- <http://www.faa.gov/arp/financial/aip/aiphandbookc1.cfm?ARPnav=aip>

Airport Environmental Handbook

- <http://www.faa.gov/arp/app600/505a/504a1.htm>

Airport Owner's Guide to Land Acquisition (Wisconsin)

- <http://www.dot.wisconsin.gov/library/publications/topic/air/landguide.pdf>

Airport Noise Compatibility Planning (ANCP) Toolkit

- <http://aee.faa.gov/noise/lupitoolkit.htm>

California Department of Transportation, Division of Aeronautics, (Prepared by Shutt Moen Associates) "California Airport Land Use Planning Handbook," 2002.

- <http://www.dot.ca.gov/hq/planning/aeronaut/htmlfile/landuse.html>

Land Acquisition and Relocation Assistance for Airport Improvement Program Assisted Project - Change 3 (12/01/00)

- <http://www.faa.gov/arp/app600/49cfr24/ac150/acchg3.doc>

Land Acquisition and Relocation Assistance for Airport Improvement Program Assisted Project - Change 4 (09/07/01)

- <http://www.faa.gov/arp/app600/49cfr24/ac150/acchg4.rtf>

FAA Form 7460-1, Notice of Proposed Construction or Alteration

- <http://www.faa.gov/arp/forms/f7460-1.doc>

Land Acquisition and Relocation Assistance for Airport Projects index

- <http://www.faa.gov/arp/app600/49cfr24/index51.htm>

Land Acquisition and Relocation

- <http://www.faa.gov/arp/app600/49cfr24/ac150/ac150.htm>

Landfills 150/5200-34

- <http://www.faa.gov/arp/pdf/landfil2.pdf>

Model Zoning Ordinance 150/5190-4A (Airport Noise)

- <http://www.faa.gov/arp/pdf/5190-4a.pdf>

Oregon Department of Aviation, (prepared by Mead & Hunt, Satre Associates), "Oregon Airport Land Use Compatibility Guidebook," 2003.

- <http://www.aviation.state.or.us/resources/landuseguidebook.shtml>



Protecting Your Airports: Your Role and Your Tools (Wisconsin)

- <http://www.dot.wisconsin.gov/library/publications/topic/air/protect-airport.pdf>

Sponsor Grant Assurances

- <http://www.faa.gov/arp/pdf/assrnep.pdf>

Wildlife Attractants 150/5200-33

- <http://www.faa.gov/arp/pdf/5200-33.pdf>



APPENDIX 6: METHODS FOR DETERMINING CONCENTRATIONS OF PEOPLE⁴

One criterion used in many compatibility plans is the maximum number of people per acre that can be present in a given area at any one time. If a proposed use exceeds the maximum density, it is considered inconsistent with compatibility planning policies. This appendix provides some guidance on how the people-per-acre determination can be made.

The most difficult part about making a people-per-acre determination is estimating the number of people likely to use a particular facility. There are several methods which can be utilized, depending upon the nature of the proposed use:

Parking Ordinance

The number of people present in a given area can be calculated based upon the number of parking spaces provided. Some assumption regarding the number of people per vehicle needs to be developed to calculate the number of people on-site. The number of people per acre can then be calculated by dividing the number of people on-site by the size of the parcel in acres. This approach is appropriate where the use is expected to be dependent up on access by vehicles. Depending upon the specific assumptions utilized, this methodology typically results in a number in the low end of the likely intensity for a given land use.

Maximum Occupancy

The Uniform or California Building Code can be used as a standard for determining the maximum occupancy of certain uses. The chart provided as Exhibit C -1 indicates the required number of square feet per occupant. The number of people on the site can be calculated by dividing the total floor area of a proposed use by the minimum square feet per occupant requirement listed in the table. The maximum occupancy can then be divided by the size of the parcel in acres to determine the people per acre. Surveys of actual occupancy levels conducted by various agencies have indicated that many retail and office uses are generally occupied at no more than 50% of their maximum occupancy levels, even at the busiest times of day. Therefore, the number of people calculated for office and retail uses should usually be adjusted (50%) to reflect the actual occupancy levels before making the final people-per-acre determination. Even with this adjustment, the UBC-based methodology typically produces intensities at the high end of the likely range.

Survey of Similar Uses

Certain uses may require an estimate based upon a survey of similar uses. This approach is more difficult, but is appropriate for uses which, because of the nature of the use, cannot be reasonably estimated based upon parking or square footage.

The following shows sample calculations.

⁴ Source: *California Airport Land Use Planning Handbook* (January 2002), Appendix C



| APPENDIX 6 TABLE 1: OCCUPANCY LEVELS - California Building Code | | |
|---|--|---|
| | Use | Minimum Square Feet per Occupant |
| 1. | Aircraft Hangars (no repair) | 500 |
| 2. | Auction Rooms | 7 |
| 3. | Assembly Areas, Concentrated Use (without fixed seats) | 7 |
| | Auditoriums | |
| | Churches and Chapels | |
| | Dance Floors | |
| | Lobby Accessory to Assembly Occupancy | |
| | Lodge Rooms | |
| | Reviewing Stands | |
| | Stadiums | |
| | Waiting Area | 3 |
| 4. | Assembly Areas, Less Concentrated Use | 15 |
| | Conference Rooms | |
| | Dining Rooms | |
| | Drinking Establishments | |
| | Exhibit Rooms | |
| | Gymnasiums | |
| | Lounges | |
| | Stages | |
| | Gaming | 11 |
| 5. | Bowling Alley (assume no occupant load for bowling lanes) | 4 |
| 6. | Children's Homes and Homes for the Aged | 80 |
| 7. | Classrooms | 20 |
| 8. | Congregate Residences | 200 |
| 9. | Courtrooms | 40 |
| 10. | Dormitories | 50 |
| 11. | Dwellings | 300 |
| 12. | Exercising Rooms | 50 |
| 13. | Garage, Parking | 200 |
| 14. | Health-Care Facilities | 80 |
| | Sleeping Rooms | 120 |
| | Treatment Rooms | 240 |
| 15. | Hotels and Apartments | 200 |
| 16. | Kitchen – Commercial | 200 |
| 17. | Library Reading Room | 50 |
| | Stack Area | 100 |
| 18. | Locker Rooms | 50 |
| 19. | Malls | Varies |
| 20. | Manufacturing Areas | 200 |
| 21. | Mechanical Equipment Room | 300 |
| 22. | Nurseries for Children (Day Care) | 35 |
| 23. | Offices | 100 |
| 24. | School Shops and Vocational Rooms | 50 |
| 25. | Skating Rinks | 50 on the skating area; 15 on the deck |
| 26. | Storage and Stock Rooms | 300 |
| 27. | Stores – Retail Sales Rooms | |
| | Basements and Ground Floor | 30 |
| | Upper Floors | 60 |
| 28. | Swimming Pools | 50 for the pool area; 15 on the deck |
| 29. | Warehouses | 500 |
| 30. | All Others | 100 |



EXAMPLE 1

Proposed Development: Two office buildings, each two stories and containing 20,000 square feet of floor area per building. Site size is 3.0 net acres. Counting a portion of the adjacent road, the gross area of the site is 3.5± acres.

A. CALCULATION BASED ON PARKING SPACE REQUIREMENTS

For office uses, assume that a county or city parking ordinance requires 1 parking space for every 300 square feet of floor area. Data from traffic studies or other sources can be used to estimate the average vehicle occupancy. For the purposes of this example, the number of people on the property is assumed to equal 1.5 times the number of parking spaces.

The average usage intensity would therefore be calculated as follows:

1. 40,000 sq. ft. floor area x 1.0 parking space per 300 sq. ft. = 134 parking spaces
2. 134 parking spaces x 1.5 people per space = 200 people maximum on site
3. 200 people ÷ 3.5 acres gross site size = 57 people per acre average for the site

Assuming that occupancy of each building is relatively equal throughout, but that there is some separation between the buildings and outdoor uses are minimal, the usage intensity for a single acre would be estimated to be:

1. 20,000 sq. ft. bldg. ÷ 2 stories = 10,000 sq. ft. bldg. footprint
2. 10,000 sq. ft. bldg. footprint ÷ 43,560 sq. ft. per acre = 0.23 acre bldg. footprint
3. Building footprint < 1.0 acre; therefore maximum people in 1 acre = bldg. occupancy = 100 people per single acre

B. CALCULATION BASED ON UNIFORM BUILDING CODE

Using the UBC (above table) as the basis for estimating building occupancy yields the following results for the above example:

1. 40,000 sq. ft. bldg. ÷ 100 sq. ft./occupant = 400 people max. bldg. occupancy (under UBC)
2. 400 max. bldg. occupancy x 50% adjustment = 200 people maximum on site
3. 200 people ÷ 3.5 acres gross site size = 57 people per acre average for the site

Conclusions: In this instance, both methodologies give the same results. For different uses and/or different assumptions, the two methodologies are likely to produce different numbers. In most such cases, the UBC methodology will indicate a higher intensity.

EXAMPLE 2

Proposed Development: Single-floor furniture store containing 24,000 square feet of floor area on a site of 1.7 net acres. Counting a portion of the adjacent road, the gross area of the site is 2.0 acres.

A. CALCULATION BASED ON PARKING SPACE REQUIREMENTS

For furniture stores, the county requires 1 parking space per 400 square feet of use area. Assuming 1.5 people per automobile, the average usage intensity would be:

1. 24,000 sq. ft. bldg. x 1.0 parking space per 400 sq. ft. = 60 parking spaces
2. 60 parking spaces x 1.5 people per space = 90 people maximum on site



3. $90 \text{ people} \div 1.26 \text{ acres gross site size} = 72 \text{ people per acre average for the site}$

Again assuming a relatively balanced throughout the building and that outdoor uses are minimal, the usage intensity for a single acre would be estimated to be:

4. $24,000 \text{ sq. ft. bldg.} \div 43,560 \text{ sq. ft. per acre} = 0.55 \text{ acre bldg footprint}$
5. Building footprint < 1.0 acre; therefore maximum people in 1 acre = bldg. occupancy = 90 people per single acre

B. CALCULATION BASED ON UNIFORM BUILDING CODE

For the purposes of the UBC-based methodology, the furniture store is assumed to be consisting of 50% retail sales floor (at 30 square feet per occupant) and 50% warehouse (at 500 square feet per occupant). Usage intensities would therefore be estimated as follows:

6. $12,000 \text{ sq. ft. retail floor area} \div 30 \text{ sq. ft./occupant} = 400 \text{ people max. bldg. occupancy in retail area}$
7. $12,000 \text{ sq. ft. warehouse floor area} \div 500 \text{ sq. ft./occupant} = 24 \text{ people max occupancy in warehouse area}$
8. Maximum occupancy under UBC assumptions = $400 + 24 = 424 \text{ people}$
9. Assuming typical peak occupancy is 50% of UBC numbers = $212 \text{ people maximum expected at any one time}$
10. $212 \text{ people} \div 1.26 \text{ acres} = 168 \text{ people per acre average for the site}$

With respect to the single-acre intensity criteria, the entire building occupancy would again be within less than 1.0 acre, thus yielding the same intensity of 168 people per single acre.

Conclusions: In this instance, the two methods produce very different results. The occupancy estimate of 30 square feet per person is undoubtedly low for a furniture store even after the 50% adjustment. The 72 people-per-acre estimate using the parking requirement methodology is probably closer to being realistic. Local jurisdictions should decide which method or combination of methods is to be used in reviewing development proposals.

APPENDIX 7: THIRD PARTY RISK ANALYSIS AND RESEARCH

*Executive Summary*⁵

The risk to people living and working in the vicinity of an airport varies with several factors. Decision makers implementing zoning are guided by Minnesota State Statutes, but must deal with numerous requests each year to allow development near airports. We have reviewed the research and literature available on Third Party Risk and developed conclusions and recommendations for using the research and expert opinions available on the subject. The following is a summary of the conclusions and recommendations:

CONCLUSIONS

- Most research agrees that Third Party Risk is primarily affected by three factors:
 - Probability of a crash occurring near a specific airport
 - The probable distribution of crashes with respect to the location
 - Size of the probable crash area
- General Aviation flying has more accidents/operation by a factor of approximately eight when compared to Scheduled and Unscheduled Commercial Service Part 121 operations and a factor of five when compared to Scheduled Commercial Service Part 135 operations.
- Accidents by aircraft on approach are tightly concentrated along the extended runway centerline.
- Accidents by departing aircraft are more spread out than for arriving aircraft. The shape is a fan starting at the liftoff point on the runway.
- Arrival accidents exceed departure accidents by almost 3:1.
- Population density is a major factor in estimating a crash consequence. A pilot who has some control capability of a small aircraft can usually avoid human habitations in low density developments. As population density or aircraft size increase substantially the destruction of property and possible loss of life on the ground becomes probable. High density development greatly increases the risk for a catastrophic accident involving people on the ground.
- Occupants in developments such as hospitals, schools, and sports stadiums are more vulnerable in an accident because of mobility problems and probable panic.
- Europeans primarily use “Individual Risk Contours” to analytically display Third Party Risk. They express risk in exposure per year if a person were in a location 24 hours per day, 365 days a year. The desired level of risk exposure for a new development proposal is a risk of death in 10,000 years from an aircraft accident. Individual Risk Contours generally resemble elongated isolates triangles centered on the extended runway centerline with the base at the runway end. This shape is almost a flipping of the approach shape used to protect aircraft in flight.
- Individual risk is not a complete picture of public acceptance. The public accepts a catastrophic event less than a larger number of events affecting one person each.

⁵ This Appendix was prepared by Alan Wiechmann (Carter Burgess, Inc) in association with Clarion Associates, July 11, 2005.



- A starting point for reviewing zoning proposals is the Mn/DOT model zoning ordinance. The factors that affect the Third Party Risk can be presented with ranges for the relative risk.

RECOMMENDATIONS

1. Proponents for development should submit information to the zoning body to include:
 - a. Historical and forecast operational data by type and runway end.
 - b. Accident data about the airport.
 - c. Airport Design Aircraft information to include weight and approach category.
 - d. Development plan information including:
 - i. Population density
 - ii. Mobility of proposed occupants
 - iii. Occupancy time estimates
 - iv. Information necessary for aviation safety determinations like height, electronic or visual hazards to aircraft, bird attractants, etc.
 - v. Information necessary for noise compatibility determinations.
2. When considering a zoning proposal not in conformance with the Mn/DOT model zoning ordinance, a minimum of seven factors should be considered. Tables 6-12 in this report show ranges for the seven factors. These factors are not equally weighted and should not be added or multiplied for “scores.” The tables are designed to show the relative range for each factor. The factors are:
 - a. Number of Aircraft Operations
 - b. Type of Aircraft Operations
 - c. Development Location
 - d. Aircraft Size and Speed
 - e. Development Density
 - f. Occupant Mobility
 - g. Occupancy Time

Introduction

The protection of people on the ground in the event of an aircraft accident has long been a goal of aviation policy makers. Historically the tool used to protect people on the ground has been land use zoning to minimize the number of people residing, working, and traveling through areas where most accidents occur. Because National Transportation Safety Board (NTSB) records indicate that over 61% of accidents occur in the vicinity of an airport, airport safety zoning recommendations have been developed by the FAA and states.

Past model zoning ordinances have a correlation to standards for protecting aircraft operations. The “Safety Zones” used to protect people on the ground have similar shapes to the imaginary surfaces used to protect aircraft in flight, i.e., TERPS, & Far Part 77. The surfaces to protect aircraft operations grow as aircraft size and approach speed increase or approach minimums decrease. Recommended “Safety Zone” sizes typically also grow when planning for larger and faster aircraft or lower approach minimums.

Policies to protect people and property on the ground have been countered by the desire to use land around airports for economic benefit. The development of land generally benefits the community, i.e. growth in jobs, tax base, etc.

As we move into the 21st century, more decision makers want information about the risk being taken with their decisions. A major objective of this study is to analyze third-party risk research compiled during Task 1,



with an eye toward specific recommendations related to factors that affect the safety of persons and property on the ground in the MnDOT required Airport Safety Zones A and B. During Phase 1, seven documents were found with analytical approaches to third-party risk analysis. Two additional documents have valuable statistics and analysis about aircraft accidents in the vicinity of airports.

Document Summaries

ANALYTICAL DOCUMENTS

Public Safety Zones: A Consultation Document, December 4, 1997

The shape of Public Safety Zones (PSZs) in the United Kingdom was adopted in 1958, long before the development of modern risk appraisal principles and risk modeling. In 1994, the UK Department of Transportation (DoT) announced to Parliament a proposed review of PSZs. This report is the result of that announcement. The study addressed two major areas: risk modeling for use in developing PSZ policy and proposals for setting tolerability limits.

Different measures for calculating third party risk around airports (such as crash risk, individual risk, and societal risk) were examined, and it was concluded that individual risk was the most appropriate for PSZ policy development.

The calculation of individual risk contours required three elements:

1. The annual probability of a crash occurring near a given airport (**crash frequency**),
2. The distribution of such crashes with respect to location (**crash location model**), and
3. The size of the crash area and the proportion of people likely to be killed within this area (**crash consequence model**).

Crash frequencies used historical information on crashes and movements by aircraft type. The crash location model utilized was developed by the National Air Traffic Service Ltd. (NATS) for aircraft above 4 tonnes in weight. The location model was based on 354 past accidents. Light aircraft were treated separately using an older location model specific to light aircraft. The crash consequence model used was also developed by NATS.

Individual risk contours were calculated at five example airports including London Heathrow. **The area subjected to a specific level of risk was principally affected by the number of movements at the airport.** The area also increased as aircraft size increased. Both of these findings are very consistent with logical thinking.

The second half of the report dealt with tolerability limits and settled on limits used in other safety critical industries such as chemical manufacturing. The Europeans express risk in exposure per year if a person were in a location 24 hours per day, 365 days a year. The upper tolerable risk level is a risk of death in 10,000 years. Two key policy recommendations from these tolerability limits were:

1. There is no case for removing existing housing outside the 1 in 10,000 contour.
2. There is a case for inhibiting new housing development as far as the 1 in 100,000 contour.

The 1 in 10,000 contour only encompassed a few houses at London Heathrow and none at the other four airports modeled.



The study also concluded that “Societal Risk” for high density land uses, such as schools, hospital, or places of assembly may warrant precluding this development to some point beyond the 1 in 100,000 contour. They found that the large number of injuries and loss of life from an accident even though rare by analytical analysis carried too much emotional cost.

The individual risk contours developed closely resemble an elongated isosceles triangle with a base near the runway end and a point out in the approach near runway centerline. This is an inverse to the PSZ shapes that existed at the time of the study.

Control of Development in Airport Public Safety Zones, October 15, 2002

This document is a Circular from the Scottish Executive, Development Department, Planning Division. It is current policy in Scotland for protecting airports and people and property on the ground in the vicinity of their busiest airports. The policy implementing Public Safety Zones is based on modeling work which determines the size of PSZs. The accepted level of risk is the 1 in 100,000 individual risk contour. Development exists within the 1 in 10,000 risk contour at a few airports. Scottish policy is to empty all occupied residential properties, and all commercial and industrial properties occupied as normal all-day workplaces, within the 1 in 10,000 individual risk contour.

Third Party Risk Contours for 2000 and 2015 Movements for Possible Runway Configurations at Frankfurt Airport, July 2003

This report was produced by the Department of Analysis and Research of NATS under contract to Fraport AG, who is the owner and operator of Frankfurt Airport. The work was part of the studies done to support the proposed new runway at Frankfurt Airport.

The consultants used the methodology accepted in the UK which was developed in the 1997 study, *Public Safety Zones: A Consultation Document*, discussed above. This study used an updated version of the 1997 model. The model techniques are the same but changes were made to include:

- All aircraft crash rates have been changed to include accidents up to and including the year 2000;
- The category of Western Jets Class II-IV has been subdivided into Class II, Class III and Class IV jets, each with their own appropriate crash rate;
- Separate crash rates have been produced for jet and turboprop aircraft, dependant on whether they conduct passenger or non-passenger operations;
- The probability distributions underlying the commercial crash location models were changed to incorporate additional crash location data;
- A new GA crash location model has been developed by NATS to replace the older ACA model;
- The parameters in the crash consequence model have been changed to include additional crashes;
- A separate GA crash consequence model, for aircraft with a Maximum Takeoff Weight Authorized < 4 tonnes has been added.

The crash locations for takeoff accidents are more dispersed right and left of extended runway centerline than for landing accidents; however, because 72% of the accidents are landing accidents, the crash location model heavily favors a distribution closely tied to the runway extended centerline.

The consultants developed 1 in 10,000 and 1 in 100,000 individual risk contours. The contours show that the shape of the risk contour is an isosceles triangle pointing out into the approach area, almost an inverse shape to the Runway Protection Zones in FAA circulars. The study was done for an activity level of approximately



600,000 annual operations. The 1 in 10,000 contour varied from 1250 feet (380 meters) to 2900 feet (880 meters) off the ends of the four runways. The 1 in 100,000 contour was from two to five times longer and varied from 4450 feet (1350 meters) to 16,400 feet (4990 meters) in length. These contours are considered very conservative. The air carrier consequence model pessimistically assumes that for a commercial crash all people in the destroyed area would be killed, whereas for a GA crash 30% are assumed to be killed. The models assume that people occupy their residence or place of work for 24 hours/day, 365 day/year. Both the percentage killed and the 100% occupancy time are extreme limits making the realistic contours smaller.

Annex B – Public Safety Zones: Criteria and Policy, Risk Assessment and Expert Opinions, June 19, 2003

This document is Annex B to *Public Safety Zones: A Consultation Document*, the first document discussed above. It is background information containing the views of experts in the Netherlands and the UK. It also contains an objective look at Societal Risk or “society’s aversion to accidents that harm many people in a single incident.” They describe how society’s reaction to 246 fatalities in 222 automobile accidents from 1/1 to 8/14/2002 is much different than the reaction that would occur if 246 people were killed in a single aircraft accident. They used the PSZ size as determined by individual risk contours, but they utilized the Scaled Risk Integral (SRI) method employed by the Health and Safety Authority to determine the acceptability of various types of development within the PSZ. The main factors utilized are the number of people at the development, the population density, the vulnerability of the occupants, and the proportion of time the development is occupied. Large numbers of people in developments such as schools, hospitals and sports stadiums generally receive scores showing incompatibility in PSZs.

The Risk of Groundling Fatalities from Unintentional Airplane Crashes, 2001

This study updated information in a 1992 study by B.L. Goldstein. The results compared the expected number of groundling fatalities to the U.S. resident population; and developed a groundling risk model. The formulas are an objective tool, however they are very complex and we believe they would be hard to communicate to residents, developers and elected officials. The formulas presented appear to be mathematically correct; however two significant points should be reviewed before using as a Third Party Risk analysis tool.

The first is the accuracy of the groundling fatality data utilized. The author correctly acknowledges that the groundling accident rate decreased substantially in the mid 1980s so they chose to use accident rates from 1987 through 1999. They used three classes of activity each with its own accident rate, i.e., air carrier, air taxi and general aviation. The groundling accident rates they chose are considerably higher than the rate we obtain from reviewing NTSB accident briefs. The data may be based upon different assumptions than we consider as relevant. The author indicates that they did not include groundling accidents that included voluntary exposure or occupational casualties. We concur with this decision but believe that they still have included several accidents that are not relevant to typical land based civil airports. We did not consider accidents involving operations at grass strips, roads, beaches, navigable waters and heliports as applicable to the risk of people living or working near a land based civil airport. Our review of NTSB records shows a significantly smaller number of accidents and fatalities that we consider applicable to analyzing the risk in living or working near an airport.

The second item that should have more review before utilizing the methodology is the “Variability of the Groundling Fatality Risk.” The author states, “*We note that several limitations exist to this approach of determining the spatial variability of the groundling fatality risk. First, the variability is only quantified in the dimension of distance to an airport and variability between busy and less busy airports has been evaluated. A higher resolution of variability could be obtained by considering distance to a runway flight path.*” The formula used does not differentiate between the risk of living under the extended runway centerline and the risk in living the same distance from the runway but perpendicular to the runway. In discussing the model limitations the author acknowledges that, “...the



distance to the runway flight path may account for an additional factor of 100 in the variability of the risk.” Directly applying the formulas in the paper apparently understates the risk in approach areas while overstating the risk in other areas.

HNTB Memorandum to MSP Joint Airport Zoning Board, April 18, 2002

The MSP Joint Airport Zoning Board contracted with HNTB Corporation to answer the question, “Are there empirical data that support the imposition of the Minnesota Department of Transportation (Mn/DOT) State Safety Zone A outside the Federal Runway Protection (RPZ), or State Safety Zone B on the south end of new Runway 17-35 at Minneapolis-St. Paul International Airport (MSP)?”

The HNTB study is based upon national and MSP accident rates for air carriers and the historical distribution of accident locations. They used this information to look at operations on the south end of new Runway 17-35, i.e., Runway 17 takeoffs and Runway 35 landings. They determined a “probable frequency” for an accident to occur in the runway Primary Surface + RPZ, State Safety Zone A outside the RPZ, State Safety Zone B, Area 4, Area 5, Area 6, and an area south of State Safety Zone B extending to eight nautical miles from the runway end. For the New Runway 17-35, they forecast in 2010 a total of 163,000 operations on the south end of new Runway 17-35. Using national average accident rates, 0.2243 accidents per year (one accident every 4.5 years) can be expected in these areas. Using MSP accident history, the accident rate in these areas is 0.12750 accidents per year or one accident every 7.8 years. They also determined an individual “probable frequency” for each of the seven areas listed above.

After calculating the accident rate for operations on the south end of runway 17/35 they compared the rate to the FAA Risk Standard and the UK Risk Standard. The FAA Risk Standard is one fatal accident per 10 million operations. The FAA is continually working to reduce the fatal accident rate and opinions exist that the standard should be raised to one fatal accident per 100 million operations. The accident rate for each of the seven areas listed in the paragraph above was converted to a rate per 10 million operations. If the rate was less than one, they concluded that the risk was less than the FAA standard. The rate for each of the six areas beyond the runway RPZ was less than one so it appears that the FAA Risk Standard was met. However, the total rate for the six areas combined exceeds one, i.e., 1.482, leading one to believe that the risk standard was exceeded. The creation of more zones dilutes the accident rate. The report also does not correlate an accident to probability of death on the ground from aircraft crashes. Several crashes may cause no death while one crash of a large aircraft into a densely populated location can cause a large number of deaths. There is no estimate of the damage that would occur from the one accident every 4.5 years using national averages or one accident every 7.8 years using MSP averages.

The report also compares the accident probabilities to the UK Risk Standard. Table 9 indicates that the UK Risk Standard is One Death on the Ground per 100,000 operations. Table 9 then shows the probability of an accident in each area per 100,000 operations. They assume that an accident results in a death. This assumption is conservative; however, Table 9 and the text discussing the table incorrectly describe the UK standard. The UK Risk Standard is an individual risk contour where the risk of death to any individual is 1 in 100,000 per year. A paraphrase of the standard is “the probability of a person occupying a location 24 hours a day, 365 days a year, and being killed in 100,000 years from an aircraft crash.” This is a different level of safety than “One Death on the Ground per 100,000 Operations.” When applying the UK Risk Standard they also used a probability for each of the six areas outside the runway RPZ. As with the comparison to the FAA standard, each individual area looks better than the rate for the six areas combined.

The Swedish Aviation Safety Authority, *Flying With Unmanned Aircraft (Uavs) In Airspace Involving Civil Aviation Activity*, March 25, 2003

A paper about UAVs obviously has the appearance of a subject totally different than Third Party Risk Analysis. Most of the paper is concerned with UAVs flying amongst manned aircraft; however the risk to



people on the ground is covered. The paper developed a formula for determining the probability per flight hour of a single fatality resulting from a crash. The formula takes into account the population density and the area of a “lethal swath” at an accident site. These two variables are handled in a simple way. When these variables were used in the previously discussed studies, the inputs were complicated. The Swedish formula is a tool to estimate the number of fatalities resulting from a crash, per flight hour. The formula is:

$$N_{\text{fatality}} = \rho_{c/f} (A_{\text{lethal}} * d_{\text{population}})$$

Where:

N_{fatality} - is the number of fatalities resulting from a crash, per flight hour

$\rho_{c/f}$ - is the probability of a “crash-inducing” failure, resulting in an uncontrolled crash of the UAV per flight hour

$d_{\text{population}}$ - is the population density of the area at the crash site; and

A_{lethal} - is the area of the “lethal swath” of the crashing aircraft, that is the area at the crash location within which by-standers would suffer fatal injuries.

The approach appears to be simple and probably accurate. The limitation to our work is that they were calculating the risk to people on the ground for flight in cruise mode over an exact flight path. The risk all along the route is similar. The risk of living around an airport varies with location, i.e. under approach centerline vs. perpendicular to the runway centerline.

Other Useful Documentation

National Transportation Safety Board (NTSB) Accident Briefs for Aviation Accidents Involving Fatalities to Persons on the Ground, 1984 through 2003

As part of our research/literature review we requested “Brief of Accident” reports from the NTSB for aircraft accidents in the United States involving ground fatalities over a 20 year period from 1984 through 2003. Fatal ground accidents involving enroute operations, on-airport operations such as loading or taxiing, seaplane operations, balloon operations, and helicopters dropping lifted object in the vicinity of their work site are not considered relevant to this study. Operations from grass strips, roads and beaches were also not considered to be relevant to this study. During the 20 year period there were 16 applicable accidents involving 21 fatalities to persons on the ground. During 1982 and 1983, the two years prior to this most recent 20 year period, there were three accidents involving 14 fatalities to people on the ground. If the time is expanded to include 1982 and 1983 there were 35 ground fatalities, or 1.59 fatalities per year.

California Airport Land Use Planning Handbook, January 2002

Chapter 8, Aircraft Accident Characteristics, Appendix F, General Aviation Aircraft Accident Location Patterns, and Appendix G, Comparison Between 1993 and 2002 Safety Compatibility Zone Examples have methodology and data applicable to our task.



Page 8-24 discusses accident locations versus runway length. One finding is that the spread of departure accident locations increases with runway length. This is not surprising. Departures fan out after liftoff and the further the aircraft are from the start of takeoff roll the more spread out their flight paths will be. A more surprising fact they identified is that arrival accidents are more spread out for longer runways than for shorter ones. They presented three possible explanations for this phenomenon:

- Almost half (49%) of all accidents on runways of 6,000 feet or more are by twin-engine aircraft compared to only 12% on runways under 4,000 feet.
- Long runways have more IFR accidents – 44% for runways of 6,000 feet or more, 4% for runways of less than 4,000 feet.
- Similarly, for nighttime accidents, more occur on long runways (45%) than on short ones (16%).

Chapter 8 also includes information about the swath of general aviation accidents. The median swath length for all general aviation accidents is only about 100 feet. This is helpful in kinetic energy analysis as we look at third party risk.

Appendix F has 15 plots of accident locations for numerous criteria, e.g. runway length, IFR vs. VFR flight, Daytime vs. Nighttime, Multi-engine vs. Single-engine, etc. These plots are included as Attachment 1.

Appendix G shows arrival and departure accident distribution curves and compares them to Cal Tran's 1993 Safety Zones and Recommended New Safety Zones. Similar to the Individual Risk Contours calculated in Europe, the accident distribution curves and the Recommended New Safety Zones are narrower and longer than the established Safety Zones.

Discussion

Most of the research and application of Third Party Risk agrees that three components are necessary to estimate the risk of people on the ground. The first is the probability of a crash occurring near a given airport. Two components of the accident probability for a given airport are accident rates for the types of users and the current and forecast activity level for the specific airport. The best accident rate resources appear to be FAA records. The activity levels for an airport may be master plans, FAA terminal forecasts, or historical records.

The second component of Third Party Risk is the distribution of crashes with respect to a location. Caltrans documents indicate that several factors affect the distribution of accidents.

The third component of Third Party Risk is the size of the crash area and the population density at the crash location. Two factors in evaluating the destructive potential of an accident are the kinetic energy of the aircraft and the fuel on board that may ignite and cause death or injury. Caltrans information about the swath of accidents for general aviation accidents may be a good starting point. There is also FAA information available about Theoretical Critical Fire Area.

It would appear that the starting point for reviewing zoning proposals is the Mn/DOT model zoning ordinance. The ordinance provides the safety to people on the ground that aviation legislation intended. If development is going to be considered the factors which affect the level of safety should be reviewed. A proponent should provide information so that decision makers can see the relative risk of the proposal. The factors which affect the level of safety can have a range of conditions which positively or negatively affect a specific situation.

In addition to information that affects the individual risk of a person, decision makers should consider Societal Risk. In public policy, perception is also an important factor. Incidents that involve multiple deaths and injuries are usually scrutinized much more than several separate incidents involving only one or two people each. As with individual risk, the factors which contribute to a major disaster can be presented with ranges.

CRASH PROBABILITY

The probability of an accident occurring is directly related to the level of activity. There is also a different probability for different types of activity. Air Carrier activity has a lower accident rate than general aviation flights. NTSB records have been used to develop the accident rates for three major types of flight activity experienced at U.S. Civil Airports. Table 1 shows a 20 year history of “Accident Rates per 100,000 departures” for “Scheduled and Nonscheduled Commercial Service” Part 121, “Scheduled Service” Part 135, and General Aviation.

When comparing the relative statistical accident exposure between airports, actual or forecast operations by type of flight activity is important. The probability of an aircraft accident occurring can be calculated using the following formula:

$$\text{Predicted Accident Rate/Year} = [(0.395 \times D121) + (0.673 \times D135) + (3.22 \times DGA)]/100,000$$

Where D121 - is the annual number of Scheduled and Nonscheduled Commercial Service Part 121 departures

 D135 - is the annual number of Scheduled Service Part 135 departures

 DGA - is the annual number of General Aviation departures

If the airport has more than one runway and we want to review the relative accident rate for each runway or runway end, the actual or forecast numbers inputted would be the departures for a specific runway or runway end.

An accident can occur anytime from start of taxi to the end of the flight. The next section discusses the Crash Distribution.

CRASH DISTRIBUTION

When the California Airport Land Use Planning Handbook (January 2002) was developed, NTSB Factual Reports from accidents were reviewed for the years 1990 through 2000. They found that over two-thirds of both general aviation (68%) and commercial (67%) aircraft accidents take place on an airport. Another 3% of general aviation and 7% of commercial aviation are en route accidents – defined as more than 5 miles from an airport. This left 29% of general aviation and 26% of commercial aviation accidents which could be classified as airport-vicinity accidents.



Table 1. Accident Rates per 100,000 Departures*, 1984 through 2003, For U.S. Air Carriers Operating Under 14 CFR 121, Scheduled and Unscheduled Service (Airlines), For U.S. Air Carriers Operating Under 14 CFR 135 Scheduled, and For U.S. General Aviation

| U.S. Accident Rate per 100,000 Departures | | | |
|---|--------------|--------------|------------------|
| Year | Part 121 | Part 135 | General Aviation |
| 1984 | 0.271 | 0.822 | 5.10 |
| 1985 | 0.333 | 0.703 | 6.11 |
| 1986 | 0.333 | 0.500 | 4.39 |
| 1987 | 0.447 | 1.174 | 3.61 |
| 1988 | 0.389 | 0.619 | 3.84 |
| 1989 | 0.366 | 0.674 | 3.64 |
| 1990 | 0.297 | 0.475 | 4.76 |
| 1991 | 0.333 | 0.816 | 3.93 |
| 1992 | 0.228 | 0.739 | 2.67 |
| 1993 | 0.285 | 0.444 | 2.97 |
| 1994 | 0.279 | 0.279 | 3.45 |
| 1995 | 0.426 | 0.373 | 3.02 |
| 1996 | 0.454 | 0.313 | 2.80 |
| 1997 | 0.476 | 1.219 | 2.65 |
| 1998 | 0.465 | 1.132 | 2.03 |
| 1999 | 0.469 | 1.934 | 2.28 |
| 2000 | 0.489 | 1.965 | 2.04 |
| 2001 | 0.420 | 1.251 | 2.40 |
| 2002 | 0.404 | 1.670 | 2.03 |
| 2003 ** | 0.540 | 0.370 | 2.61 |
| 20 Year Average | 0.395 | 0.673 | 3.22 |

* The number of general aviation departures is not counted nationwide, however the flight hours are known. Flights under FAR Part 121 averaged 1.7 hours/departure in CY 2003. Flights under Scheduled Service Part 135 averaged 0.51 hours/departure in CY 2003. An estimated average of 1.0 hours/departure for general aviation is used for this chart.

** 2003 numbers are preliminary

Part of the research accomplished for *Public Safety Zones: A Consultation Document, December 4, 1997*, was development of a detailed set of data on commercial aircraft accident locations. Separate graphs (See Figure 1) show runway proximity of landing and takeoff accidents in two dimensions: distance from the runway end and distance from the extended runway centerline. Interpolation of the graphs shows that 90% of the accidents occur inside a rectangle that is approximately 2200 feet wide centered on the runway centerline and extending along the runway and 9800 feet beyond the runway threshold. An important FAA standard that uses 90% as a standard for the level of safety is the Runway Safety Area (RSA) Length beyond the Runway End. The standard for faster aircraft, i.e. approach categories C & D, is 1000 feet. Figure A8-1 of Appendix 8 to AC 150/5300-13, Airport Design, shows that 90% of aircraft undershoots and overruns of the runway end stay within the standard of 1000 feet. Ten percent either land short of the standard RSA length or rollout beyond the standard RSA length.

The Caltrans Airport Land Use Planning Handbook discusses a 1990 FAA study, *Location of Aircraft Accidents/Incidents Relative to Runways*, analyzing data from accidents/incidents of commercial aircraft occurring over a ten year period (1978-1987). The majority of accidents/incidents were located in the vicinity of the runway (57%). Among accidents/incidents away from the runway, Caltrans produced a figure showing

location for those where adequate location information was available. The figure (Figure 2) shows that 35 of the 39 accidents (89.7%) occurred within the 2200 foot wide rectangle noted in the paragraph above.

For its Airport Land Use Planning Handbook, Caltrans utilized the University of California, Berkeley, to review NTSB Factual Reports of 873 general aviation aircraft accidents between 1983 and 1992. They produced 15 Figures (Attachment 1) illustrating the location patterns of various subsets of conditions, e.g. arrival accidents, departure accidents, IFR accidents, VFR accidents, single-engine aircraft accidents, multi-engine aircraft accidents, etc.

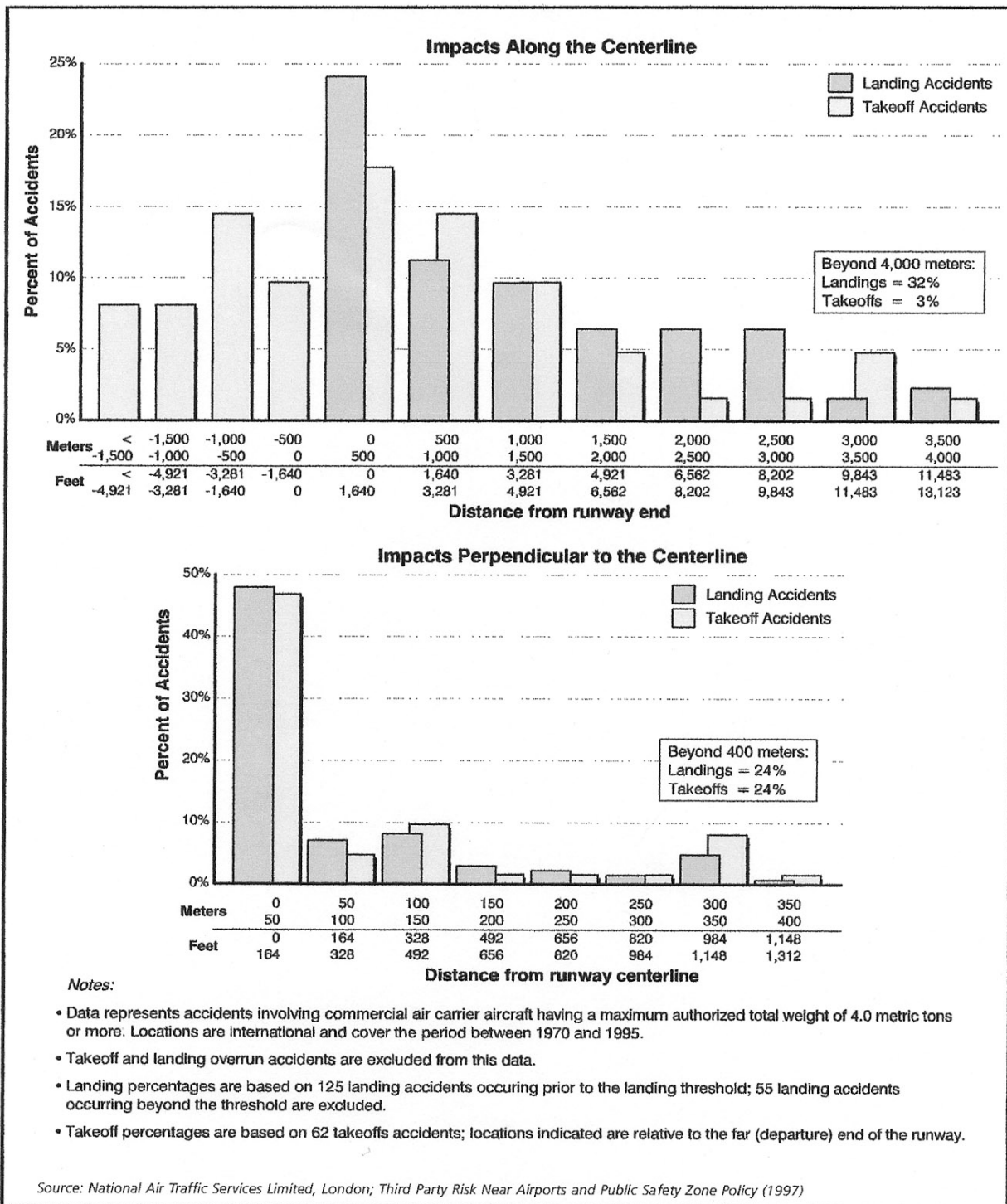
CRASH SIZE/POPULATION DENSITY

To a large extent, the physics of a crash determines the crash size. The energy delivered by an aircraft in an accident is a destructive force. The dominant factor in predicting the devastation potential is kinetic energy. **The kinetic energy of an object in motion is equal to one-half the product of the mass of a body and the square of its speed, i.e. $K = 1/2mv^2$. In analyzing devastation potential, the weight and speed of an aircraft are important.**

People are more aware of the devastation from an automobile accident than an aircraft accident. The destructive force of a Cessna 182 on approach weighing 2800 lbs. is similar to that of a 2800 lb. automobile at Interstate Highway speeds. A Boeing 747 on approach weighing 700,000 pounds has over 1000 times more kinetic energy than a Cessna 182. The mass is 250 times greater and the velocity squared is over four times as great. As an aircraft comes to rest the kinetic energy is primarily dissipated through friction, disintegration of the aircraft, or energy imparted to objects struck, i.e. destruction of buildings, vehicles, fences, terrain, etc. In an accident on flat ground most of the energy dissipates in friction with little if any destruction of property. The other extreme is a direct impact with a large building where almost all of the energy is dissipated through destruction of the building and the aircraft. An exact estimation of the forces involved is difficult because aircraft disintegration varies depending upon what part of an aircraft strikes an object. It is possible to show the relative potential between aircraft types for destruction of objects on the ground.



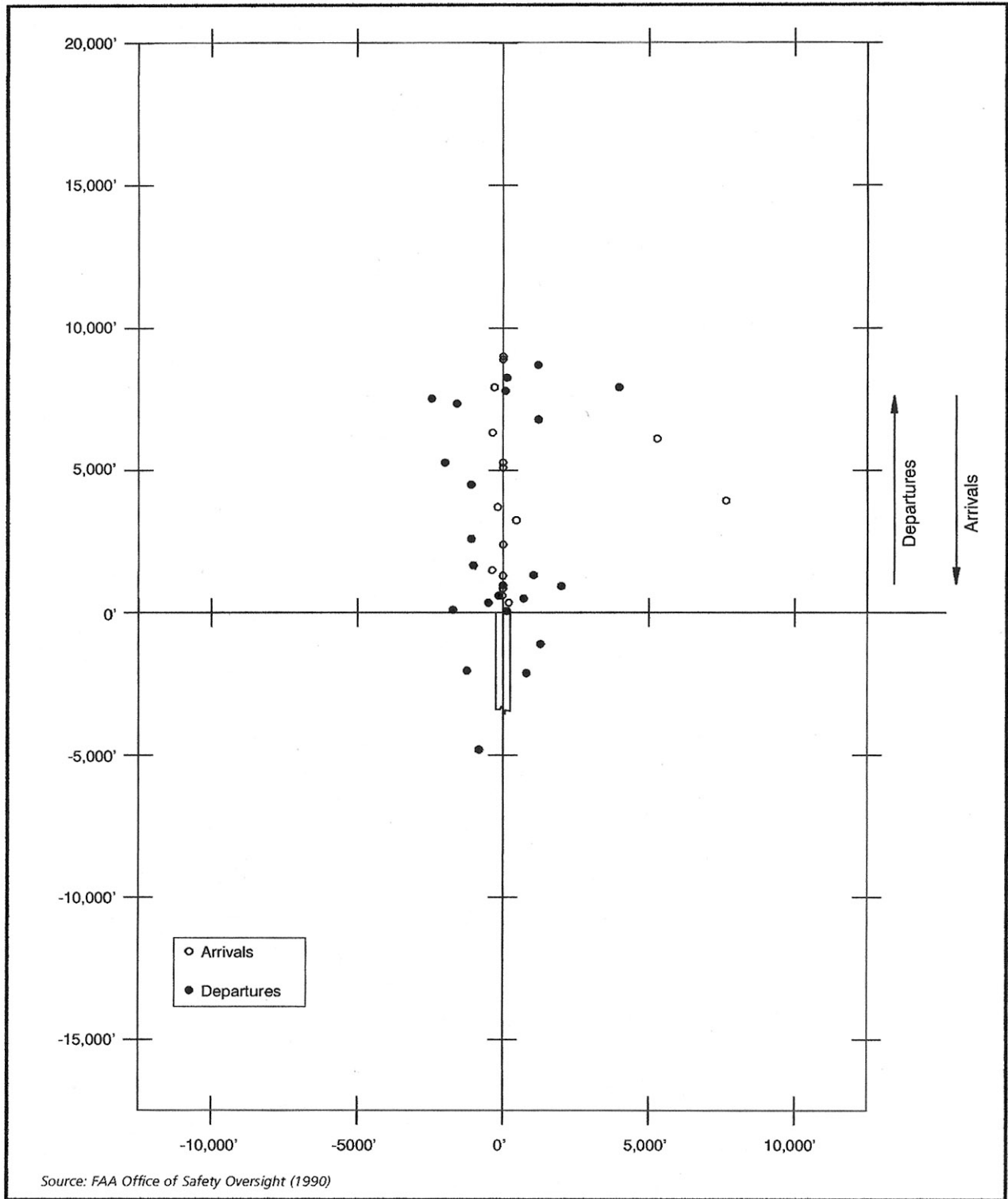
Figure 1



Runway Proximity of Air Carrier Accidents International



Figure 2



Commercial Aircraft Accident Location Pattern



The FAA classifies aircraft in several ways. The two designations which describe the relative kinetic energy in flight are the Maximum Takeoff Weight and the Aircraft Approach Speed at the maximum landing weight. The FAA classifies all aircraft with a Maximum Takeoff Weight of 12,500 pounds and below as “Small Aircraft.” Table 2 compares the relative weight of “Large Aircraft” to the maximum weight of a “Small Aircraft.” The weights chosen are typical pavement design strengths used to accommodate families of “Large Aircraft.”

Table 2 can be used to compare the relative destructive force of the “Mass Component” of kinetic energy. The “Mass Component” of an 800,000 lb. Boeing 747 creates 64 times more kinetic energy than the largest “Small Aircraft.”

The “Velocity Squared Component” of kinetic energy can also be compared between families of aircraft. The typical airport built for “Small Aircraft” has an Airport Reference Code of B-II. The “B” is the Aircraft Approach Category which is defined as “A grouping of aircraft based on 1.3 times their stall speed in the landing configuration at the certificated maximum flap setting and maximum landing weight at standard atmospheric conditions.” The categories are:

- Category A: Speed less than 91 knots (103 MPH).
- Category B: Speed 91 knots (103 MPH) or more but less than 121 knots (138 MPH).
- Category C: Speed 121 knots (138 MPH) or more but less than 141 knots (160 MPH).
- Category D: Speed 141 knots (160 MPH) or more but less than 166 knots (182 MPH).
- Category E: Speed 166 knots (182 MPH) or more.

All civilian aircraft fall in Approach Categories A, B, C, and D. A few military aircraft are Approach Category E.

As discussed earlier, the velocity component of kinetic energy is velocity squared. Table 3 shows the relative energy levels from the difference in approach speed of aircraft. Approach Category B is given a factor of 1.0 because it is the dominant Approach Category used in airport design for General Aviation Aircraft. Table 3 can be used to compare the relative destructive force of the “Velocity Squared Component” of kinetic energy. The “Velocity Squared Component” for Approach Category D aircraft which includes many of the largest air carrier and general aviation aircraft, e.g. B-777, B-747, Gulfstream II, Gulfstream IV, is over twice that for Approach Category B aircraft.

Table 2 Kinetic Energy “Mass Component” Comparison - Relative Weights of Large Aircraft when Compared to the Largest Certificated Small Aircraft, 12,500 Pounds

| Aircraft Weight - Pounds | Mass Component Factor * |
|---------------------------------|--------------------------------|
| 12,500 | 1.0 ** |
| 30,000 | 2.4 |
| 60,000 | 4.8 |
| 90,000 | 7.2 |
| 120,000 | 9.6 |
| 240,000 | 19.2 |
| 360,000 | 28.8 |
| 800,000 | 64.0 |

* Relative Weight Factor = Aircraft Weight / 12,500 lbs.

** Aircraft weight of 12,500 pounds chosen for Factor of 1.0 because it is the typical design weight used at general aviation airports accommodating “Small Aircraft.”

Table 3 Kinetic Energy “Velocity Squared Component” Comparison - Relative Velocity Squared Factor of Aircraft Approach Categories

| Aircraft Approach Category | Mean Approach Speed* Knots/MPH | Approach Speed Squared (Knots) | Velocity Squared Factor |
|----------------------------|--------------------------------|--------------------------------|-------------------------|
| A | 75 knots/85 MPH** | 5625 | 0.5 |
| B | 106 knots/120 MPH | 11236 | 1.0 *** |
| C | 131 knots/149 MPH | 17161 | 1.5 |
| D | 153 knots/174 MPH | 23409 | 2.1 |

- * Mean approach speed of the group, i.e. $B = (91+121) / 2 = 106$ knots
- ** Approach Category A is “Speed less than 91 knots (103 MPH.)” A speed of 59 knots (67 MPH) used as the low end for determining the mean speed of the group.
- *** Approach Category B chosen as Factor of 1.0 because it is the dominant approach category used for General Aviation Airport Design. Other Velocity Squared Factors = (Approach Speed Squared)/11236

Table 4 Comparison of Kinetic Energy on Approach for Common Aircraft

| Aircraft | Approach Speed – V (Knots) | V ² | $\frac{V^2}{11,236}$ * | Max. Takeoff Weight (Lbs.) | Weight/12,500 ** | Relative Kinetic Energy *** A x B |
|-------------------------|----------------------------|----------------|---------------------------|----------------------------|---------------------|--------------------------------------|
| Cessna 150 | 50 | 2,500 | .22 | 1,600 | .13 | .03 |
| Cessna 182 | 65 | 4,225 | .38 | 2,950 | .24 | .09 |
| DHC-6 Twin Otter | 65 | 4,225 | .37 | 10,000 | .80 | .30 |
| Cessna 402 | 95 | 9,025 | .80 | 6,300 | .50 | .40 |
| Beech Baron | 101 | 10,201 | .91 | 6,200 | .50 | .45 |
| Cessna 441 | 100 | 10,000 | .89 | 9,925 | .79 | .70 |
| Comparison Aircraft *** | 106 | 11,236 | 1.00 | 12,500 | 1.00 | 1.00 |
| Beech King Air | 111 | 12,321 | 1.10 | 11,800 | .94 | 1.03 |
| Learjet 28/29 | 120 | 14,400 | 1.28 | 15,000 | 1.20 | 1.54 |
| Beech 1900 | 120 | 14,400 | 1.28 | 16,600 | 1.33 | 1.70 |
| Citation III | 114 | 12,996 | 1.16 | 22,000 | 1.76 | 2.04 |
| Learjet 55 | 128 | 16,384 | 1.46 | 21,500 | 1.72 | 2.51 |
| Canadair CRJ-200 | 140 | 25600 | 1.74 | 53,000 | 4.24 | 7.38 |
| Gulfstream II | 141 | 19,881 | 1.77 | 65,300 | 5.22 | 9.24 |
| Gulfstream IV | 145 | 21,025 | 1.87 | 71,780 | 5.74 | 10.74 |
| Boeing 737-300 | 137 | 18,769 | 1.67 | 135,000 | 10.80 | 18.04 |
| MD-82 | 135 | 18,225 | 1.62 | 149,500 | 11.96 | 19.38 |
| Airbus A320 | 138 | 19,044 | 1.69 | 145,505 | 11.64 | 19.67 |
| Boeing 757 | 135 | 18,225 | 1.62 | 255,000 | 20.40 | 33.05 |
| Boeing 777 | 145 | 21,025 | 1.87 | 380,000 | 30.40 | 56.85 |
| Boeing 747-400 | 154 | 23,716 | 2.11 | 870,000 | 69.60 | 146.86 |

- * $A = V^2$ for aircraft divided by V^2 for mean Approach Category B aircraft, i.e. $V^2/(106)^2$
- ** **B** = Maximum Takeoff Weight divided by Maximum Weight of a “Small” Aircraft, i.e. 12,500 pounds.
- *** Comparison Aircraft is a 12,500 lb., Approach Category B Aircraft, i.e. Generic General Aviation Aircraft.



To compare the relative kinetic energy between aircraft, the “Mass Component” is multiplied by the “Velocity Squared Component.” Table 4 compares the relative kinetic energy of several common aircraft. As an example, a common air carrier aircraft, the Airbus A320 has over 19 times the kinetic energy on approach as a common corporate General Aviation Aircraft, the Beech King Air, $(19.38/1.03 = 19.09)$.

The kinetic energy involved in a crash greatly affects the area of a crash site. The area involved is also dependent upon factors such as terrain, objects, angle of descent, and fuel on board. There is little published information to relate any of these factors to a predicted crash site area.

As part of Caltrans’ development of their Airport Land Use Planning Handbook, they developed an accident location database. The 2002 handbook provides some idea of the crash size for general aviation accidents. Caltrans determined that the median swath length for all general aviation accidents is only about 100 feet. The handbook defines the swath length as the distance between where an aircraft first touched the ground or an object on the ground and where it subsequently came to rest. As the aircraft moved through the swath length it would have impacted objects in its path with significant destruction of property occurring. Persons directly in the path probably were at great risk of injury or death. The handbook does not provide any information about the average width of the swath. The average wingspan for general aviation aircraft is approximately 40 feet. If we assume that the average accident swath width for general aviation aircraft is similar to the wingspan then the average crash site is in the vicinity of 4000 square feet, i.e. 100 feet of length times 40 feet average width.

An aircraft accident also spreads debris in an area generally much larger than the crash size described above. People in the debris area, but outside the accident swath would have some risk of injury or death, but significantly less than in the accident swath.

An order of magnitude estimate of the crash size for various aircraft would be comparing the relative kinetic energy of the aircraft (Table 4) to that of our comparison general aviation aircraft and multiplying by 4000 square feet. This methodology would estimate a Boeing 747 crash site at approximately 600,000 square feet. This could be a 3000’ by 200’ rectangle. Even at 200,000 square feet (1000’ x 100’) the site encompasses over four acres. **It is important to remember that the crash size will vary widely depending upon the terrain and objects impacted.**

The probability of a major fire increases significantly with an increase in aircraft size. AC 150/5210-6C, Aircraft Fire and Rescue and Rescue Facilities and Extinguishing Agents, provides background information for determining the amount of equipment and agent that is required to properly support the appropriate index levels. The amount of firefighting agents that each ARFF index airport is required to provide is determined from calculating the size of a hypothetical fire which, in turn, is based largely on fuselage length. An element of this calculation is the theoretical critical fire area (TCA), the area around an aircraft that must be isolated from fire. Theoretical critical fire area is determined by the following formula:

$TCA = L \times (100' + W)$, when the average aircraft length (L) is more than 65 feet and W is the width of the aircraft fuselage. [TCA = L x (40’ + W) when L is less than 65 feet].

Comparison of two hypothetical aircraft yields the following:

| | |
|------------|--|
| Aircraft A | Fuselage Length = 200’ Fuselage Width = 30’ TCA = 200’ x (100’ + 30’) = 26,000 Square Feet |
| Aircraft B | Fuselage Length = 50’ Fuselage Width = 12’ TCA = 50’ x (40’ + 12’) = 2,600 Square Feet |

Increasing the fuselage length of the aircraft by a factor of four and the fuselage width by a factor of 2.5 yields a ten times larger TCA. The TCA increases faster than a linear relationship, but less than exponentially.

Population density has a major affect on the likelihood of a groundling fatality. In many accidents the pilot has some control of the aircraft and has the ability to avoid some obstacles. If the aircraft is small enough and the population density is low enough, in many cases the pilot can avoid structures, automobiles, etc. A 2000 square foot accident site from a general aviation crash will miss humans in many cases. The United Kingdom NATS crash consequence model for commercial flights assumes that all people in the destroyed area will be killed, whereas the model for a General Aviation crash assumes that 30% are killed. As the probable accident site grows or the population density increases, it becomes improbable that all human habitations are missed. A 100,000 square foot accident site encompasses over two acres. A suburban residential development may have a population density of 10-30 persons/Acre. With a two acre crash site in this residential density, injury or death to humans on the ground becomes more probable than improbable.

SOCIETAL RISK

Society has an aversion to catastrophic events. Generally the larger the loss of life and the less control the individual has over the events the more negatively an event is perceived. While the accepted individual risk in some countries has been set at 1 in 100,000 or 1 in 1,000,000 per year, the accepted risk for a catastrophic event is much less. An accident in the vicinity of an airport that takes one life on the ground every fifty years may be viewed as an acceptable risk. An accident every 50 years that takes 100 lives is probably not acceptable. *Annex B – Public Safety Zones: Criteria and Policy, Risk Assessment and Expert Opinions, June 19, 2003* used a Scaled Risk Integral (SRI) as a means of looking at Societal Risk. This is the only empirical method we found for looking at societal risk. The SRI provides a simple numerical score. For scores above 2400 the Health and Safety Executive (HSE) would advise against development.

$$SRI = (PRT)/A$$

Where

P is population factor $P = (n + n^2)/2$

R is average individual risk in chances per million (cpm), taken as 10 cpm

T is proportion of time the development is occupied by n persons
The proportions reported by HSE are as follows: houses, hotels & hospitals = 1;
retail/leisure = 0.5; warehouses = 0.5; schools = 0.25; offices = 0.3

A is area of development in hectares involved in the crash, taken as 0.5 hectares for movements at the Dublin Airport

n is number of persons at the development modified by $n = n_{max}c$ where n_{max} is the maximum number of persons

c modification factor for population
The factors reported by HSE are as follows: general public = 1; vulnerable population, i.e. schools, hospitals, sports stadiums = 4; working population = 0.25



The use of this formula is in conjunction with individual risk contours so exact calculations relate to each specific situation. Assuming that developments were located at a similar individual risk contour, a comparison can be made for sizes of aircraft and types of developments. To use the Scaled Risk Integral equation we made a crash size estimate for four aircraft, a Cessna 206, a Learjet 35, an Airbus A320 and a Boeing 747. Developments were assumed to be situated on the 1 in 100,000 individual risk contour. Table 5 shows the population densities for three types of development, residential, schools and hospitals using the UK HSE maximum recommended score of 2400. Changing the assumption for crash sizes would change the recommended densities. **The main use of Table 5 is to compare the relative effect of aircraft size and development type on catastrophic risk.** This United Kingdom methodology would limit the recommended density for schools and hospitals to one half and one fourth respectively when compared to residential development. The United Kingdom perspective on catastrophic risk makes Cessna 206 flights over a hospital similar to Boeing 747 flights over low density residential development.

Table 5 Maximum Recommended Population Density Utilizing UK Scaled Risk Integral Model (For Development situated on the 1 in 100,000 individual risk contour)

| Maximum Recommended Density per Acre at the 1 in 100,000 Individual Risk Contour | | | |
|---|---|----------------|------------------|
| Aircraft Type | Residential Including Hotels | Schools | Hospitals |
| Cessna 206 | 43 | 23 | 11 |
| Learjet 35 | 19 | 10 | 5 |
| Airbus A320 | 12 | 6 | 3 |
| Boeing 747 | 9 | 5 | 2 |

Conclusions

- Most research agrees that Third Party Risk is primarily affected by three factors:
 - Probability of a crash occurring near a specific airport
 - The probable distribution of crashes with respect to the location
 - Size of the probable crash area
- Good information about each factor should be utilized in land use decision making.
- Some of the best sources for information include:
 - FAA accident rates for types of operations
 - FAA annual reports
 - NTSB records
 - Historical operations by type
 - Airport records
 - FAA tower records
 - Forecast operations by type
 - Master Plans, State System Plans
 - Caltrans analysis of accident locations in their *Airport Land Use Planning Handbook* is good information on accident location distribution.
 - The type of aircraft is the major factor in estimating the probable crash size and the crash consequence. The destructive force is directly proportional to the aircraft weight and square of the impact velocity. The largest commercial aircraft can have over 1000 times the energy to dissipate in an accident when compared to small general aviation aircraft.

- General Aviation flying has more accidents/operation by a factor of approximately eight when compared to Scheduled and Unscheduled Commercial Service Part 121 operations and a factor of five when compared to Scheduled Commercial Service Part 135 operations.
- Accidents by aircraft on approach are tightly concentrated along the extended runway centerline.
- Accidents by departing aircraft are more spread out than for arriving aircraft. The shape is a fan starting at the liftoff point on the runway.
- Arrival accidents exceed departure accidents by almost 3:1.
- Population density is a major factor in estimating a crash consequence. A pilot who has some control capability of a small aircraft can usually avoid human habitations in low density developments. A crash site of 2,000-3,000 square feet can fit between most structures in low density developments. As population density or aircraft size increase substantially the destruction of property and possible loss of life on the ground becomes probable. A 50,000-100,000 square foot crash site will almost certainly impact some development and its habitants. High density development greatly increases the risk for a catastrophic accident involving people on the ground.
- Occupants in developments such as hospitals, schools, and sports stadiums are more vulnerable in an accident because of mobility problems and probable panic.
- In most research, experts have assumed that in accidents involving large aircraft, all habitants in a crash area will be killed. In accidents by small aircraft, the United Kingdom NATS consequence model for general aviation aircraft assumes that 30% of the habitants in a crash area will be killed.
- Europeans primarily use “Individual Risk Contours” to analytically display Third Party Risk. They express risk in exposure per year if a person were in a location 24 hours per day, 365 days a year. The desired level of risk exposure associated with new development is a risk of death in 100,000 years from an aircraft accident. Individual Risk Contours generally resemble elongated isolates triangles centered on the extended runway centerline with the base at the runway end. This shape is almost a flipping of the approach shape used to protect aircraft in flight.
- Individual risk is not a complete picture of public acceptance. The public accepts a catastrophic event less than a larger number of events affecting one person each.
- The minimal research information about Societal or Catastrophic Risk shows acceptance of a smaller level of risk than with “Individual Risk” models.
- A starting point for reviewing zoning proposals is the Mn/DOT model zoning ordinance. The factors which affect the Third Party Risk can be presented with ranges for the relative risk.

Recommendations

1. Proponents for development should submit information to the zoning body to include:
 - a. Historical and forecast operational data by type and runway end
 - b. Accident data about the airport
 - c. Airport Design Aircraft information to include weight and approach category
 - d. Development plan information including:
 - i. Population density
 - ii. Mobility of proposed occupants
 - iii. Occupancy time estimates
 - iv. Information necessary for aviation safety determinations like height, electronic or visual hazards to aircraft, bird attractants, etc.
 - v. Information necessary for noise compatibility determinations.
2. When considering a zoning proposal not in conformance with the Mn/DOT model zoning ordinance, a minimum of seven factors should be considered. Tables 6-12 show ranges for the seven factors. These factors are not equally weighted and should not be added or multiplied for “scores.” The tables are designed to show the relative range for each factor.



Table 6 Aircraft Operations Factor

| Aircraft Operations per Runway End | Factor |
|---|---------------|
| More than 90,000 per year | 10 |
| 80,001 to 90,000 | 9 |
| 70,001 to 80,000 | 8 |
| 60,001 to 70,000 | 7 |
| 50,001 to 60,000 | 6 |
| 40,001 to 50,000 | 5 |
| 30,001 to 40,000 | 4 |
| 20,001 to 30,000 | 3 |
| 10,001 to 20,000 | 2 |
| 1 to 10,000 | 1 |

A factor of one is the least risk and a factor of 10 is the greatest risk.

Table 7 Aircraft Size and Speed Factor

| Design Aircraft Weight | Weight Factor | Design Aircraft Approach Category | Speed Factor |
|----------------------------------|----------------------|--|---------------------|
| 120,001 lb. and greater | 20 | D | 4 |
| 60,001 to 120,000 lb. | 10 | C | 3 |
| 12,501 to 60,000 lb. | 5 | B | 2 |
| Less than or equal to 12,500 lb. | 1 | A | 1 |

To obtain the relative aircraft and speed factor, multiply the Weight Factor times the Speed Factor.

A factor of one is the least risk and a factor of 80 is the greatest risk.

Table 8 Type of Operation Factor

| Type of Operations | Factor |
|-------------------------------------|---------------|
| General Aviation | 8 |
| Part 135 Scheduled | 2 |
| Part 121 Scheduled and Nonscheduled | 1 |

A factor of one is the least risk and a factor of 8 is the greatest risk.

Table 9 Development Location Factor

| Distance from Runway End | Longitudinal Factor | Distance from Runway Centerline Extended | Transverse Factor |
|-----------------------------------|----------------------------|---|--------------------------|
| Equal to or less than RWY Length | 4 | 500' or less | 4 |
| 1.01 to 1.5 times the RWY Length | 3 | 501' to 1000' | 3 |
| 1.51 to 2.0 times RWY Length | 2 | 1001' to 2000' | 2 |
| Greater than twice the RWY length | 1 | Greater than 2000' | 1 |

To obtain the relative weight of the location, multiply the Longitudinal Factor times the Transverse Factor.

A factor of one is the least risk and a factor of 16 is the greatest risk.

Table 10 Development Density Factor

| Density of the Development | Factor |
|-----------------------------------|--------|
| High Rise Developments | 40 |
| Greater than 100 persons per acre | 20 |
| 51-100 persons per acre | 15 |
| 21-50 persons per acre | 8 |
| 5-20 person per acre | 3 |
| Less than five persons per acre | 1 |

A factor of one is the least risk and a factor of 40 is the greatest risk.

Table 11 Development Mobility Factor*

| Type of Development | Factor |
|---|--------|
| Hospitals | 10 |
| Schools, Churches, Sport Stadiums | 5 |
| General Public, i.e. shoppers, tourists, etc. | 2 |
| Working Population | 1 |

* Mobility includes familiarity with the facility, confined space, age and physical impairment.

A factor of one is the least risk and a factor of 10 is the greatest risk.

Table 12 Development Occupancy Factor

| Type of Development | Factor |
|--------------------------------|--------|
| Residential, Hospitals, Hotels | 12 |
| Retail, Leisure | 6 |
| Warehouses | 6 |
| Offices | 4 |
| Schools | 3 |
| Churches, Sports Stadiums | 1 |

A factor of one is the least risk and a factor of 12 is the greatest risk.



References

1. *California Airport Land Use Planning Handbook – Selected Chapters and Appendices, January 2002*
2. *National Transportation Safety Board (NTSB) Accident Briefs for Aviation Accidents Involving Fatalities to Persons on the Ground, 1984 through 2003*
3. *Public Safety Zones: a Consultation Document, December 4, 1997*
4. *Control of Development in Airport Public Safety Zones, October 15, 2002*
5. *Third Party Risk Contours for 2000 and 2015 Movements for Possible Runway Configurations at Frankfurt Airport, July 2003*
6. *Annex B – Public Safety Zones: Criteria and Policy, Risk Assessment and Expert Opinions, June 19, 2003*
7. *The Risk of Groundling Fatalities from Unintentional Airplane Crashes, 2001*
8. *HNTB Memorandum to MSP Joint Airport Zoning Board, April 18, 2002*
9. *Flying with Unmanned Aircraft (UAVs) in Airspace Involving Civil Aviation Activity – Air Safety and the Approvals Procedure, March 25, 2003*

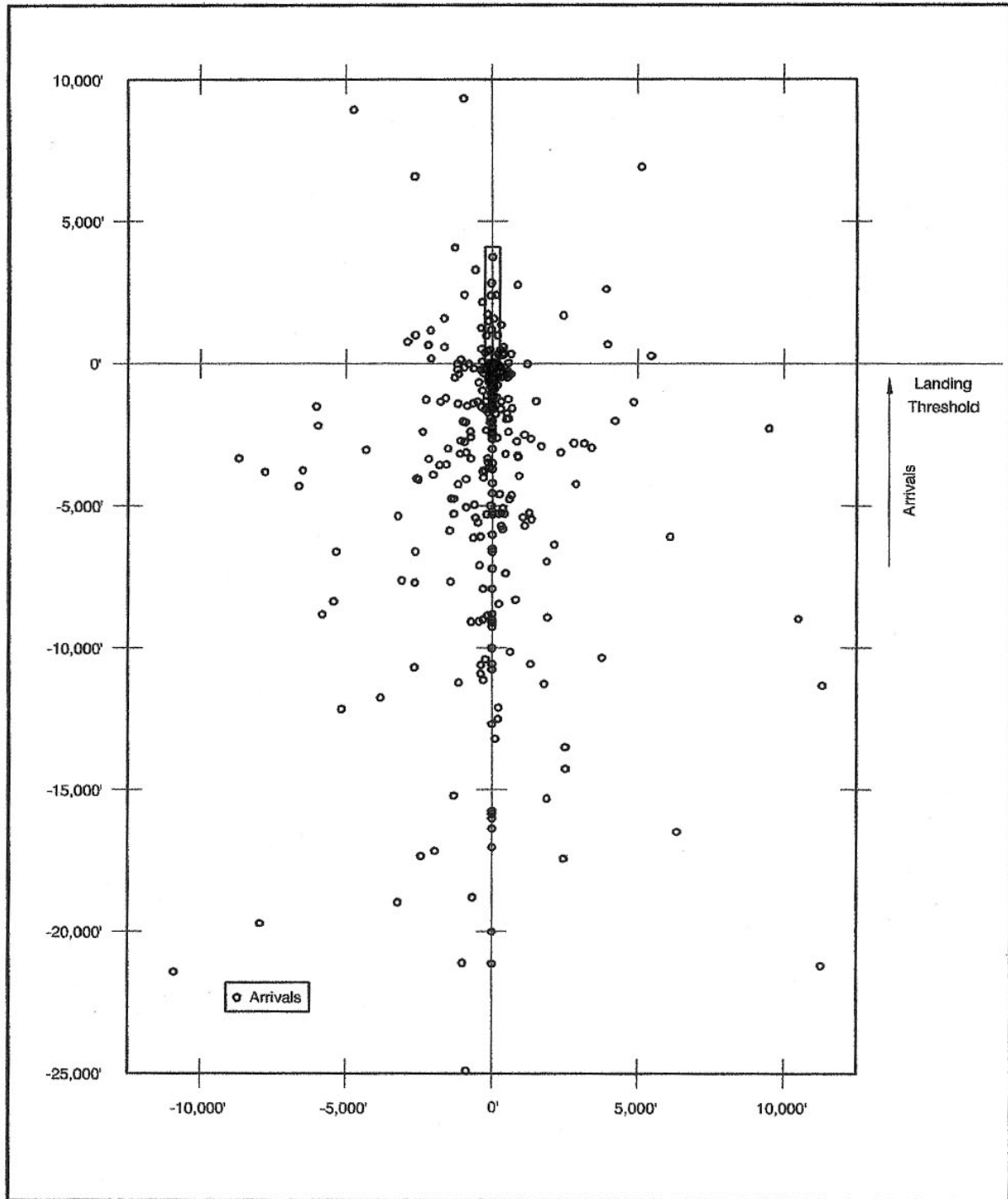
10. Attachment 1

**Accident Distributions Exhibits from
California Airport Land Use Planning Handbook
January 2002**

- Figure A Arrival Accidents
- Figure B Departure Accidents
- Figure C Departure Accidents, Normalized
- Figure D Accidents on Runways of Less than 4,000 Feet
- Figure E Accidents on Runways of 4,000 to 5,999 Feet
- Figure F Accidents on Runways of 6,000 Feet or More
- Figure G Single-Engine Aircraft Accidents
- Figure H Multi-Engine Aircraft Accidents
- Figure I Accidents with Some Pilot Control
- Figure J Accidents with No Pilot Control
- Figure K IFR Accidents
- Figure L VFR Accidents
- Figure M Daytime Accidents
- Figure N Nighttime Accidents
- Figure P Accidents on Runways with Left-Hand Traffic Pattern



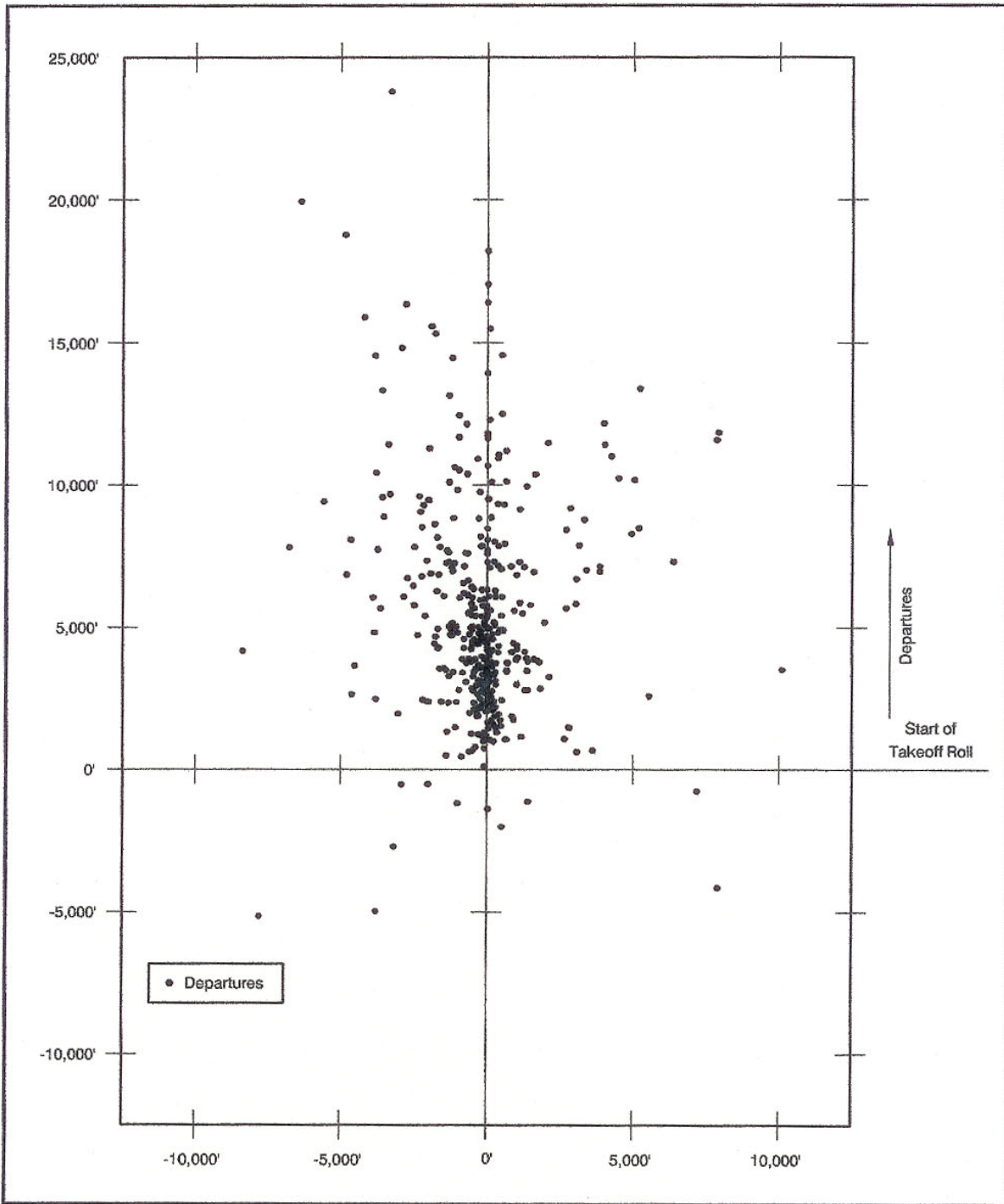
Figure A



Arrival Accidents

California Airport Land Use Planning Handbook (January 2002)

Figure B

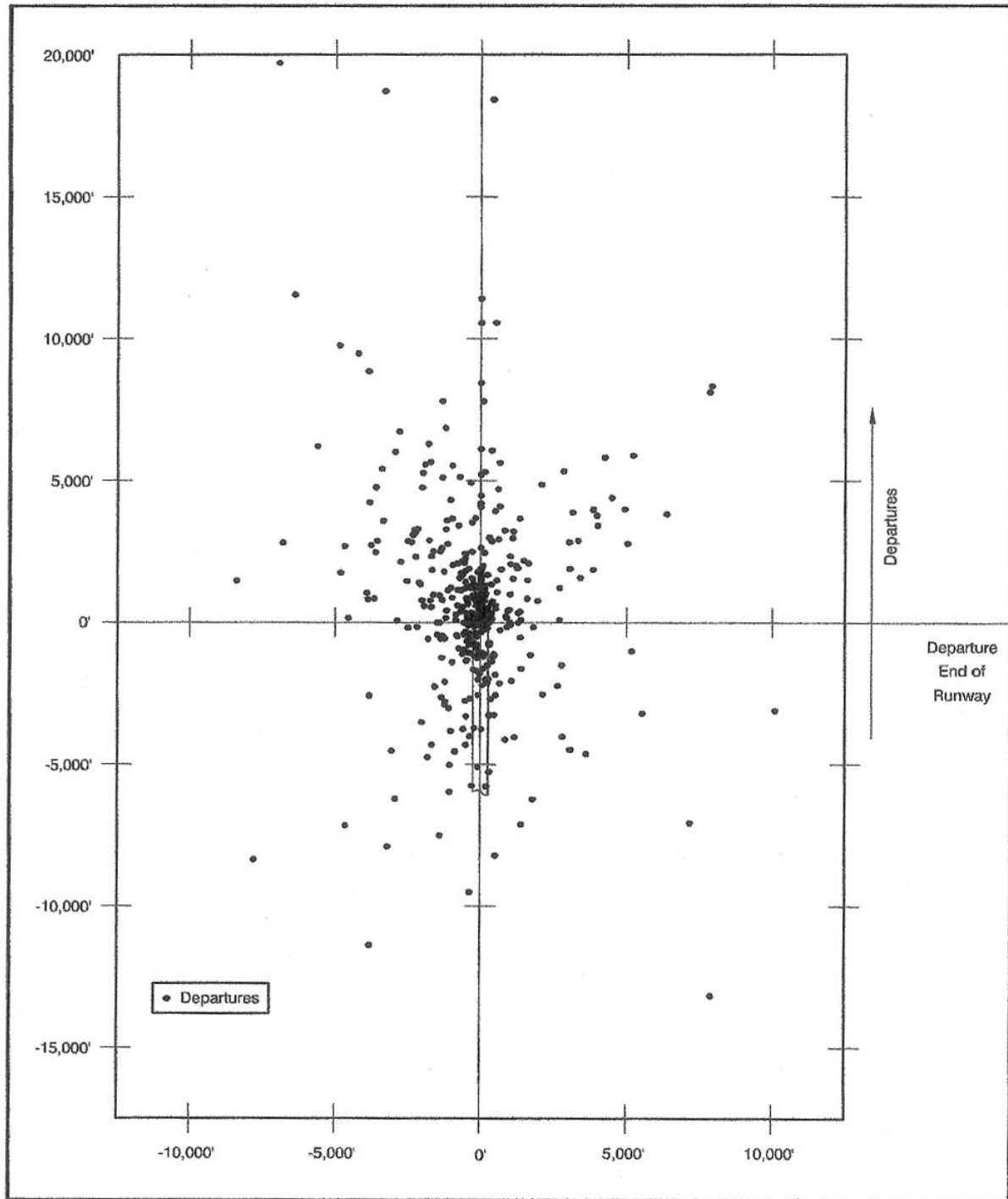


Departure Accidents

California Airport Land Use Planning Handbook (January 2002)



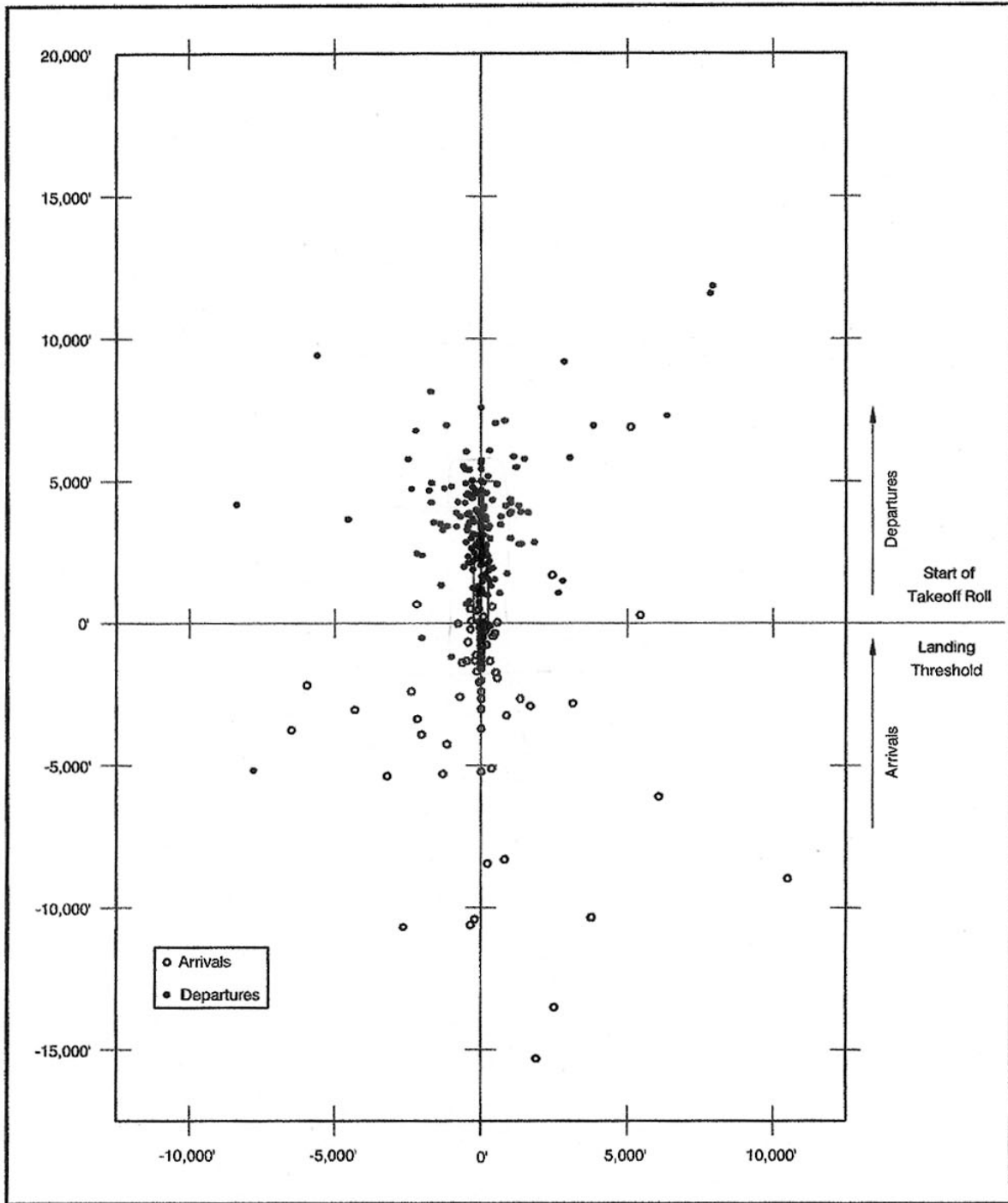
Figure C



Departure Accidents, Normalized

California Airport Land Use Planning Handbook (January 2002)

Figure D

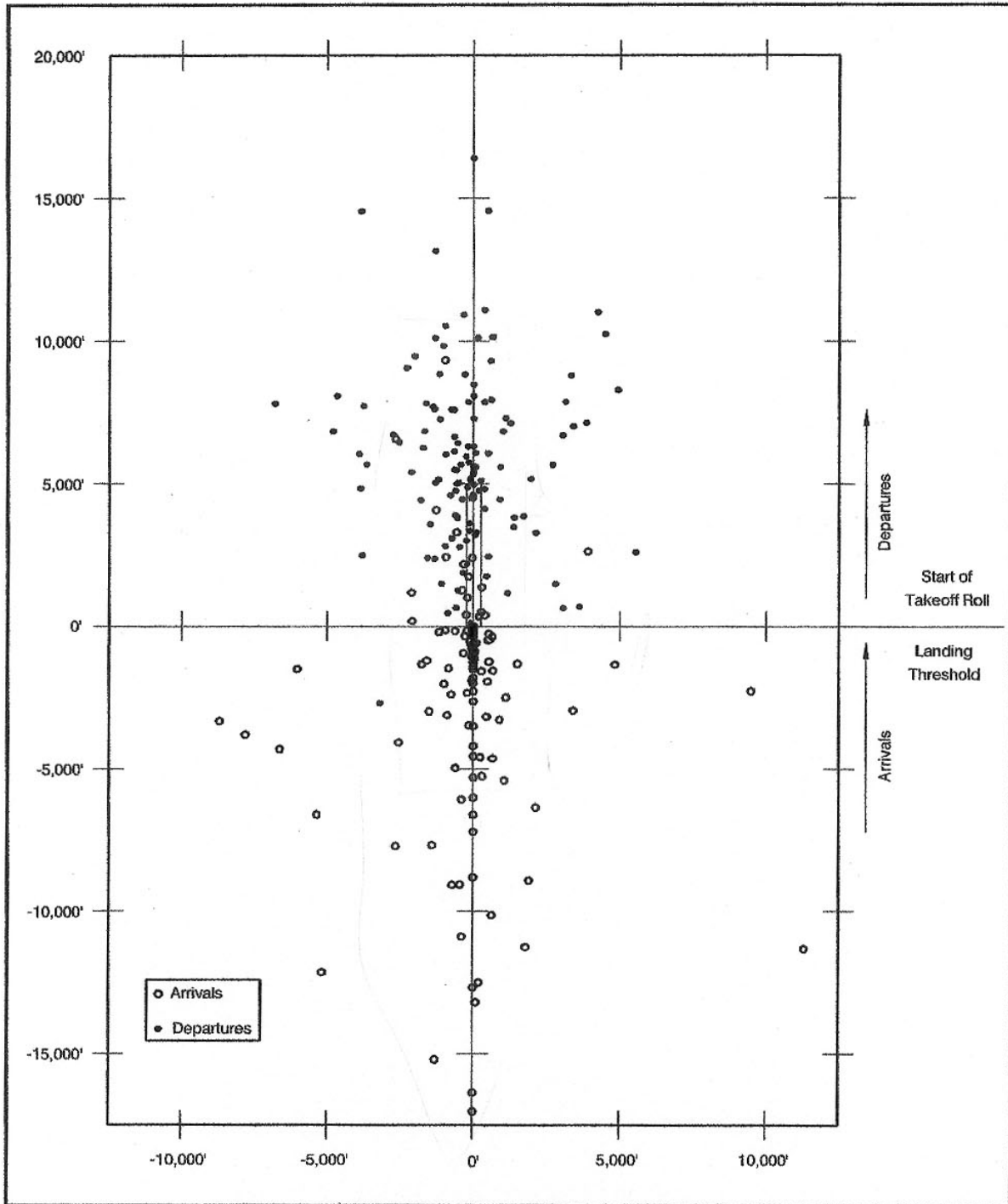


Accidents on Runways of Less than 4,000 Feet

California Airport Land Use Planning Handbook (January 2002)



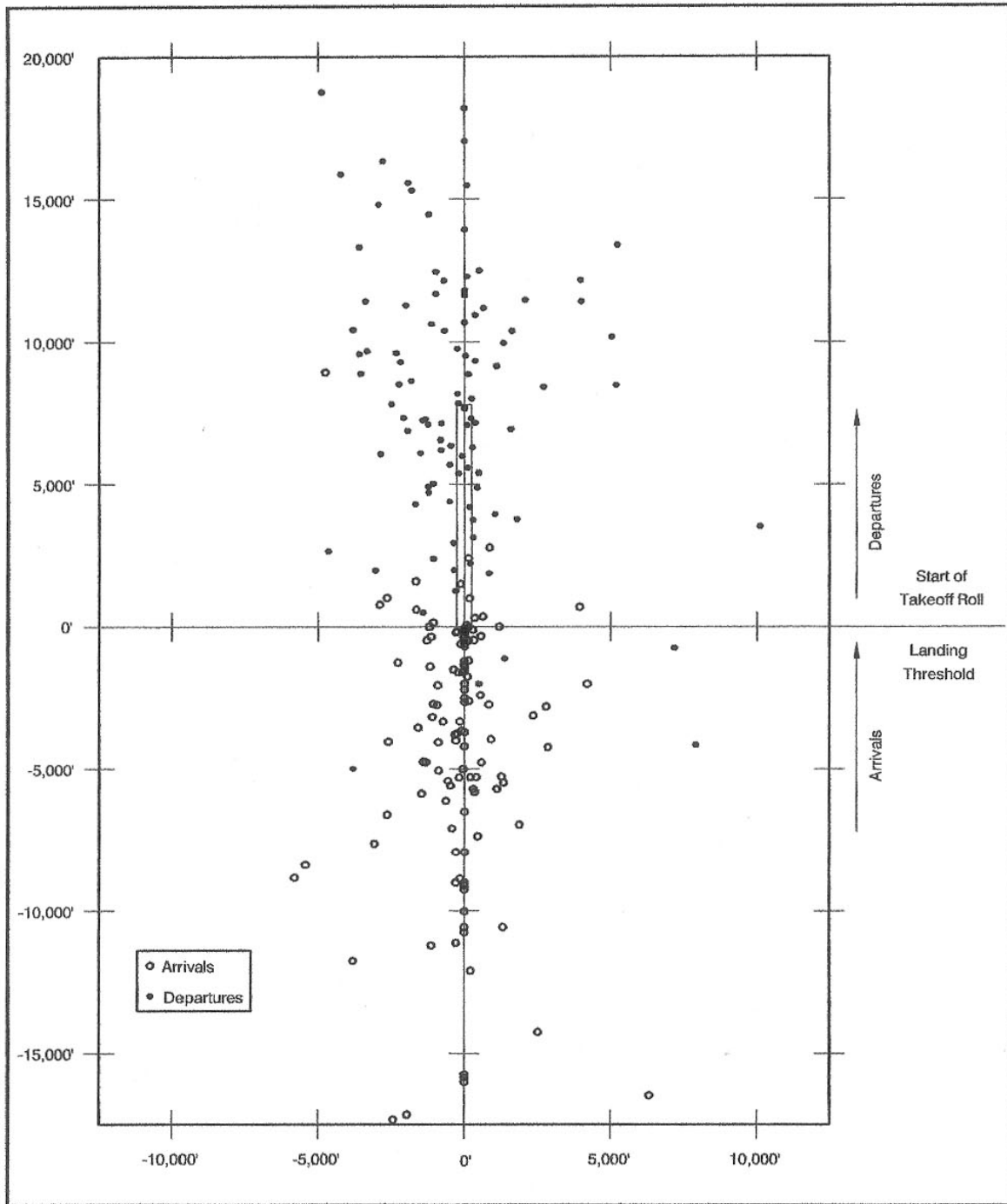
Figure E



Accidents on Runways of 4,000 to 5,999 Feet

California Airport Land Use Planning Handbook (January 2002)

Figure F

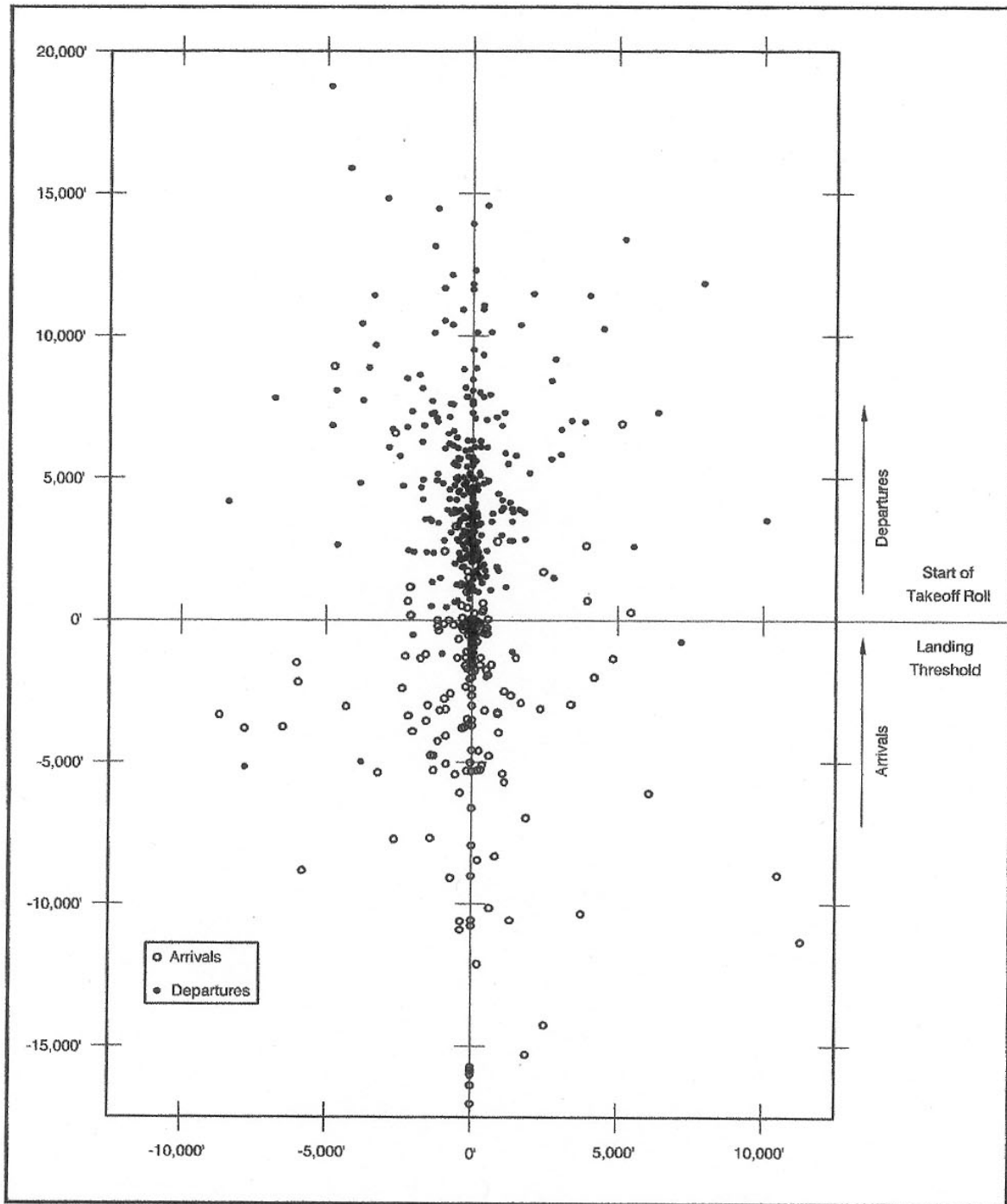


Accidents on Runways of 6,000 Feet or More

California Airport Land Use Planning Handbook (January 2002)



Figure G

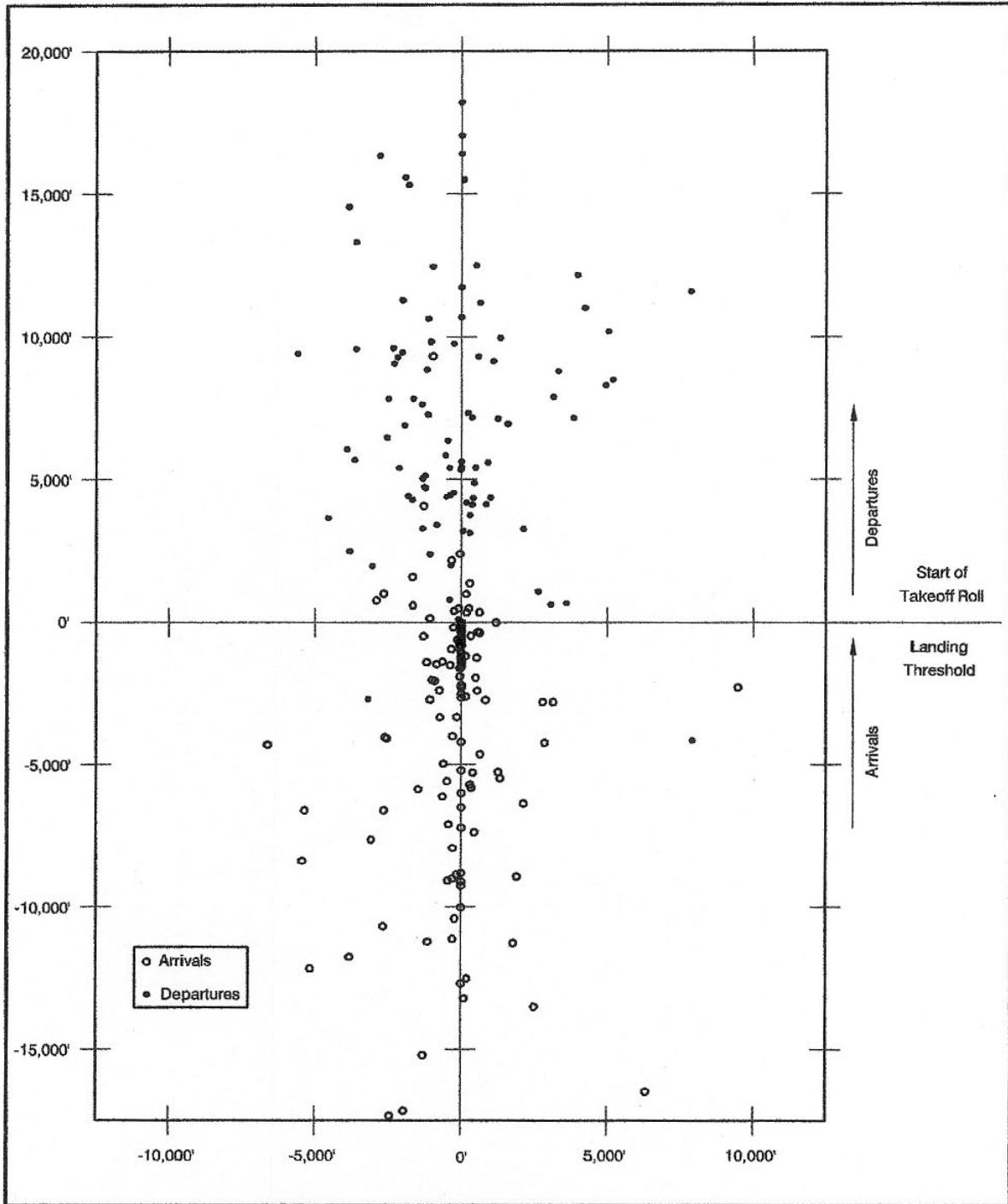


Single-Engine Aircraft Accidents

California Airport Land Use Planning Handbook (January 2002)



Figure H

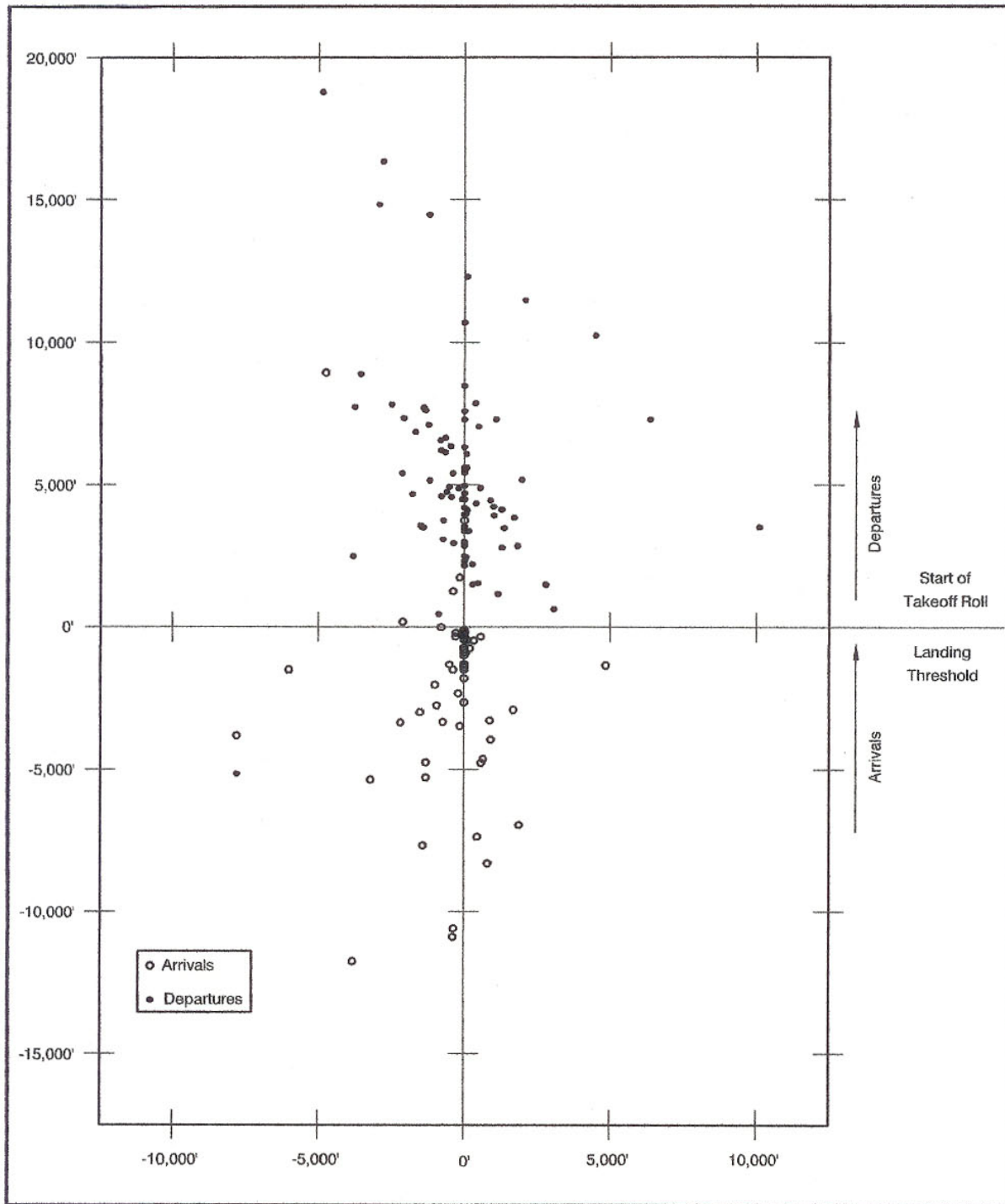


Multi-Engine Aircraft Accidents

California Airport Land Use Planning Handbook (January 2002)



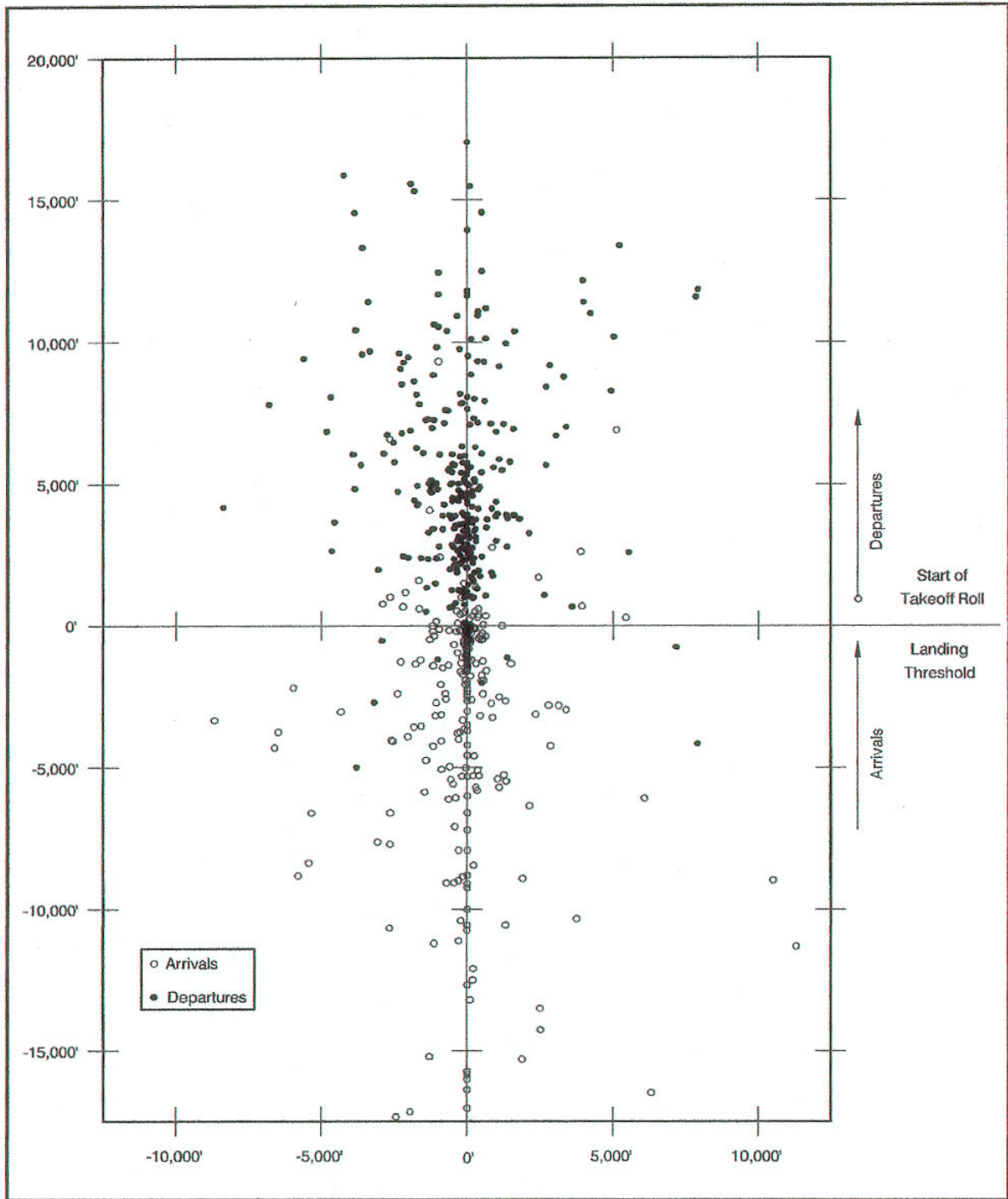
Figure I



Accidents with Some Pilot Control

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Figure J

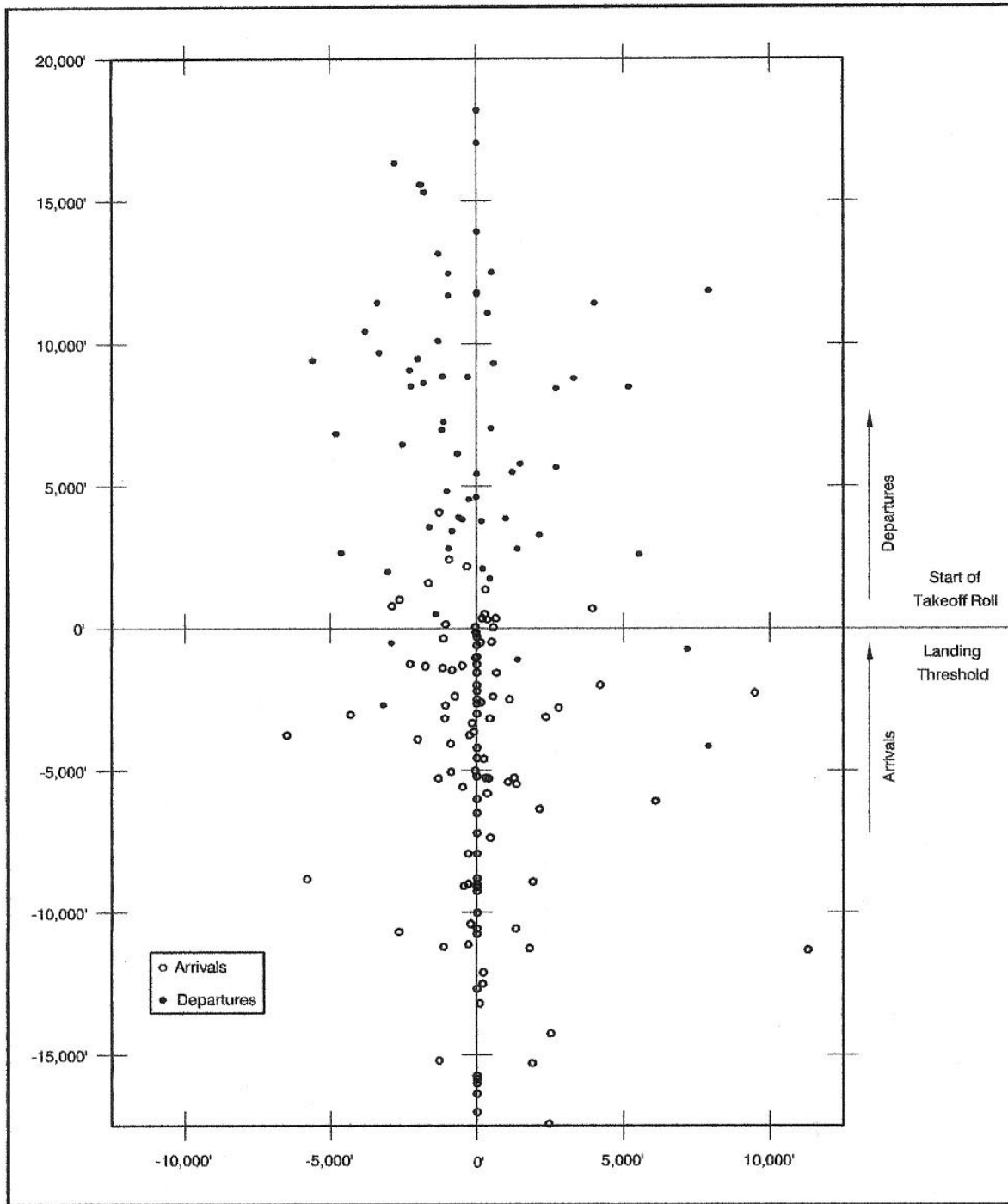


Accidents with No Pilot Control

California Airport Land Use Planning Handbook (January 2002)



Figure K

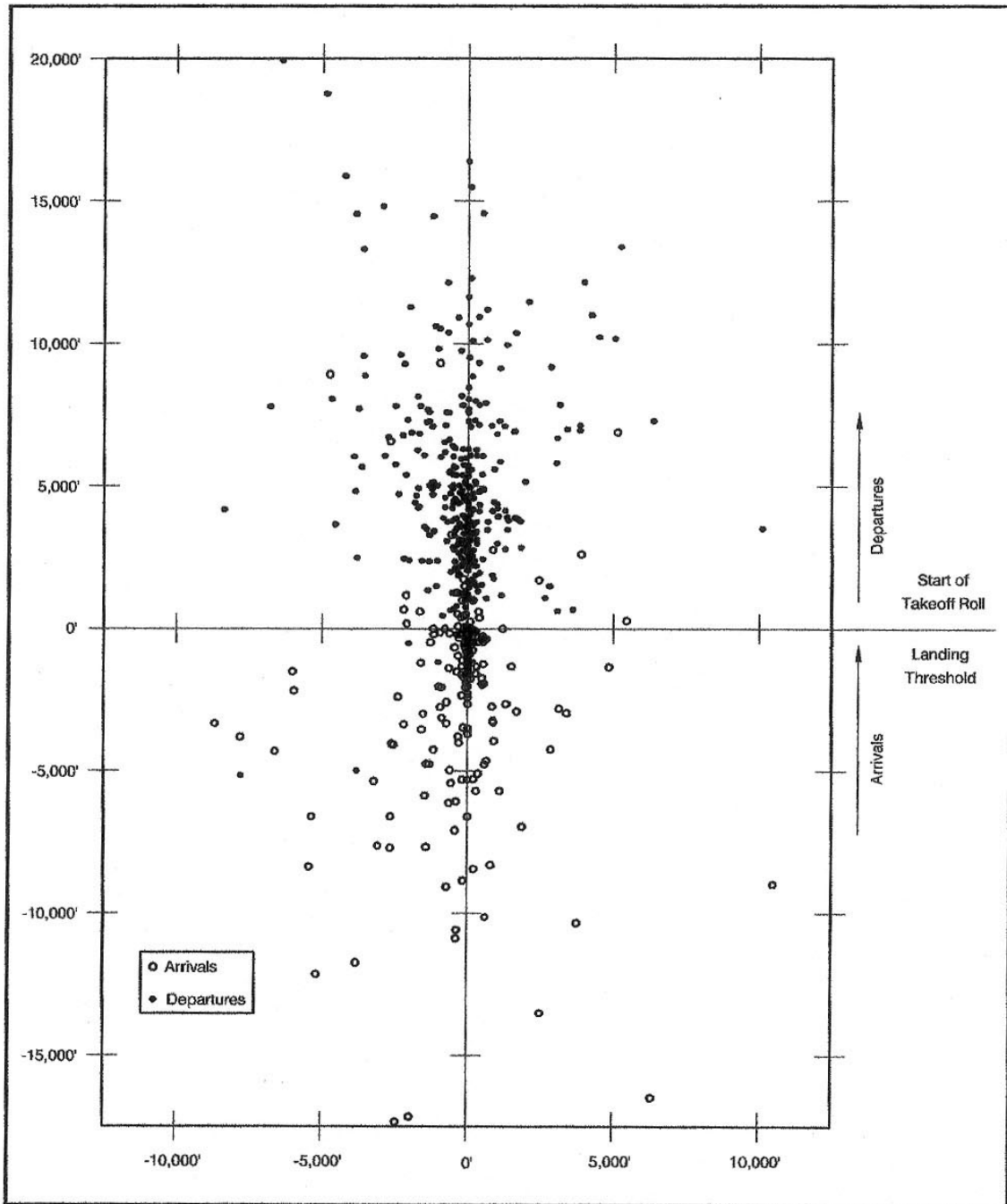


IFR Accidents

California Airport Land Use Planning Handbook (January 2002)



Figure L

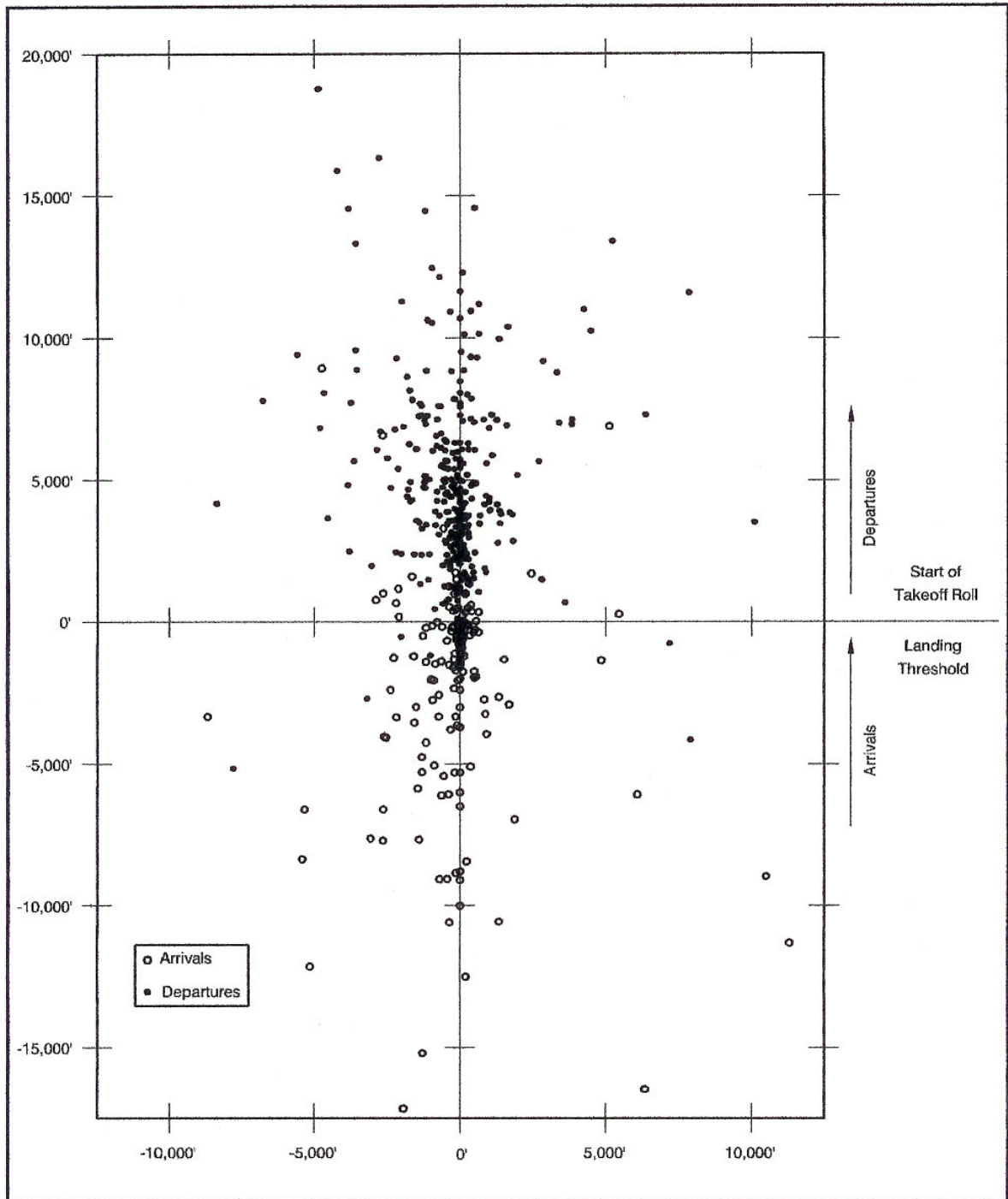


VFR Accidents

California Airport Land Use Planning Handbook (January 2002)



Figure M

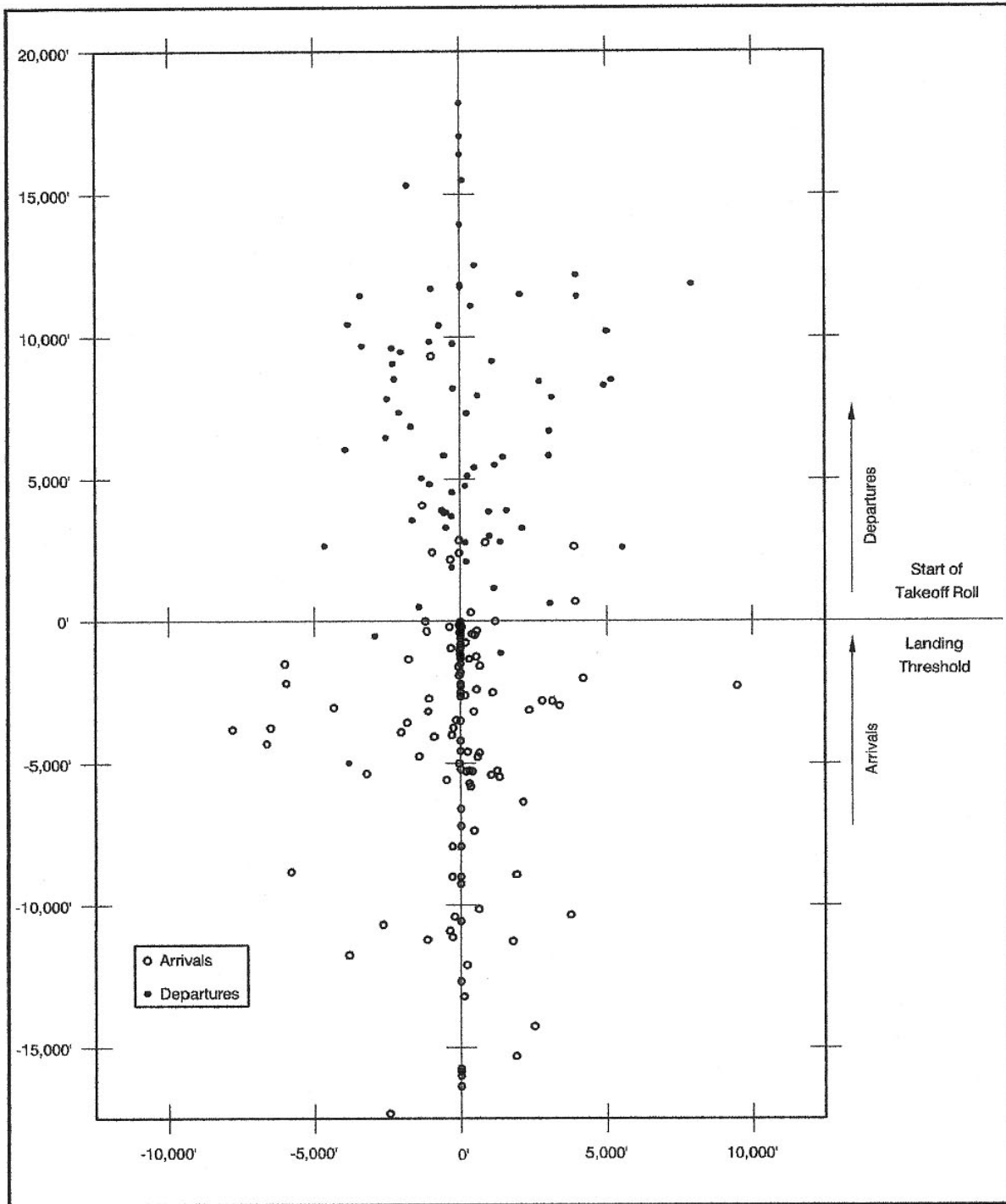


Daytime Accidents

California Airport Land Use Planning Handbook (January 2002)



Figure N

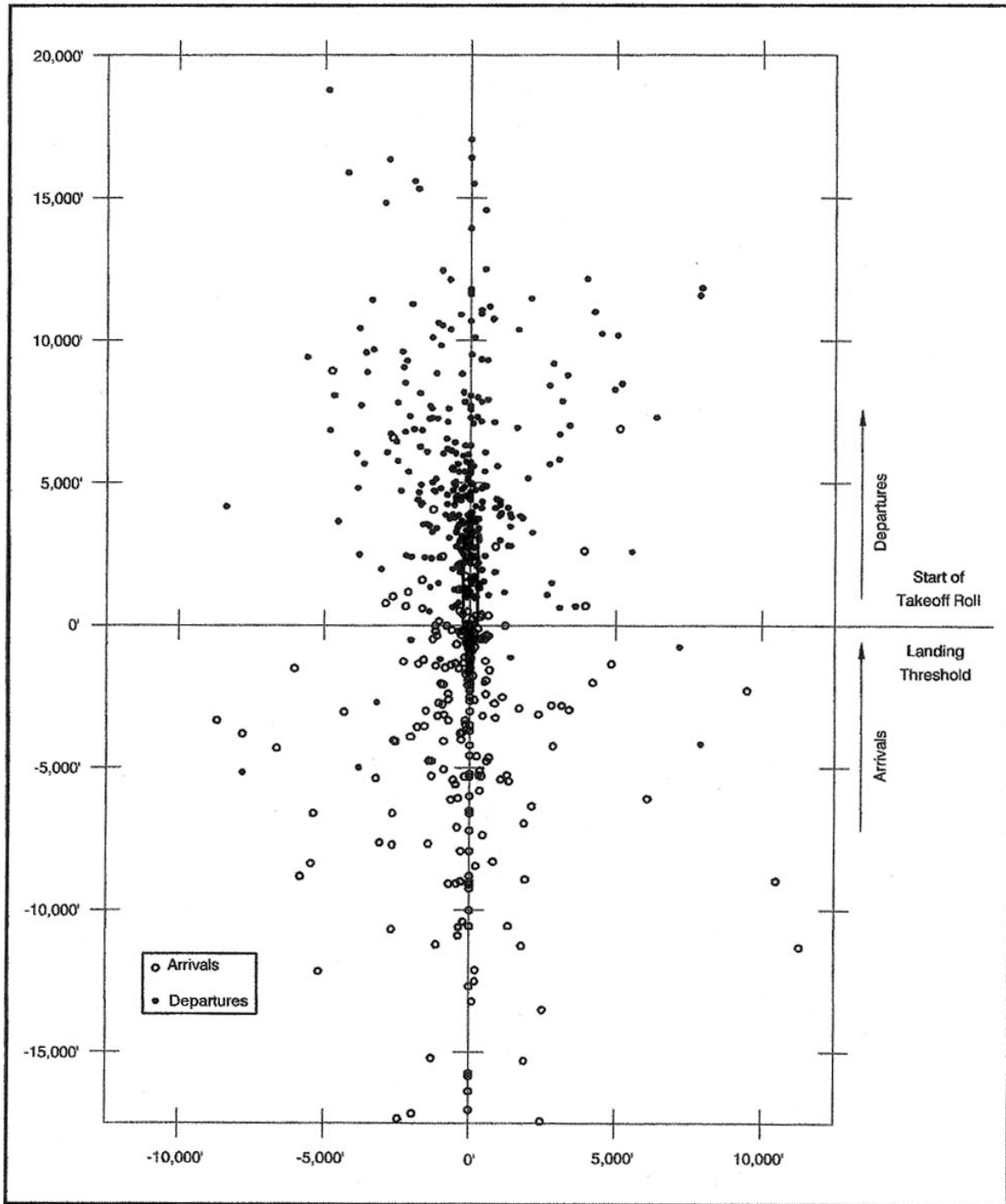


Nighttime Accidents

California Airport Land Use Planning Handbook (January 2002)



Figure P



Accidents on Runways with Left-Hand Traffic Pattern

California Airport Land Use Planning Handbook (January 2002)



APPENDIX 8: DISCUSSION ON THE TAKINGS CLAUSE AND MINNESOTA AIRPORT ZONING

Executive Summary

“DOES AIRPORT ZONING UNDER THE MINNESOTA MODEL ORDINANCE VIOLATE THE U.S. CONSTITUTION’S TAKINGS CLAUSE?”

THE CENTRAL ISSUE

Minnesota has a model ordinance for local governments to use to regulate uses around or adjacent to airports within the state. The model ordinance assures that people on the ground, land uses on the ground, and airplanes using these airports remain safe and protected from unwarranted airplane danger or noise. However, there is a fundamental problem that local governments have with this ordinance. The problem is *McShane v. City of Faribault*, a Minnesota Supreme Court case decided in 1980. *McShane* held that when land use regulations, like an airport zoning ordinance, are designed to benefit a specific “public enterprise,” there must be compensation under the 5th Amendment to the U.S. Constitution (the “takings clause”) to landowners whose property suffers a substantial and measurable decline in market value as a result of the regulations.

As a result of this one case, airport zoning in Minnesota (and really all local zoning efforts) operates under a legal cloud and an assumption of risk. *McShane*’s legacy is the real threat of litigation if a local government adopts the Minnesota Model Ordinance or some variant of airport zoning. After *McShane*, a local government in Minnesota faces a tough choice: it can choose to pay or compensate a landowner whose property will be substantially devalued by the ordinance, or it can not compensate and face a takings claim backed by the *McShane* holding, or it can simply give up on airport zoning all together. None of these choices are appealing.

THE CENTRAL QUESTION

In 2005, 25 years after this case was decided by the Minnesota Supreme Court, should the *McShane* case still be considered good law?

THE COROLLARY QUESTION

In 2005, should Minnesota local governments adopt the Model Ordinance, or variants thereof, without fear of risking successful litigation by affected landowners who might demand and receive just compensation in light of the *McShane* case?

⁶ This Appendix was prepared by Professor Jan Laitos, University of Denver School of Law, on March 28, 2005.



OUR CONCLUSION

McShane has been so distinguished and limited by Minnesota courts that the case (1) in effect, has been overruled, or (2) is certainly ripe to be overruled. It was wrong when it was decided in 1980. Subsequently, it has not been used by Minnesota appellate courts to require just compensation when local airport zoning laws have been applied to landowners. Its rationale has not been adopted by any other state in the United States. Virtually no other modern state in America finds that airport zoning laws, like the Minnesota Model Ordinance, as a general rule require just compensation. Finally, the *McShane* rationale (the “government enterprise” theory) and result (local governments are liable for just compensation if they adopt airport zoning laws that substantially reduce property values) are completely at odds with what the United States Supreme Court has told us about the Takings Clause over the past 25 years. In short, it is time that *McShane* stop being a deterrent to the adoption and use of the Minnesota Model Ordinance. And, as a result, the answer to the question posed in the memo is this: The Minnesota Model Ordinance does NOT violate the Constitution’s Takings Clause.

POSSIBLE STATE RESPONSES

In response to our conclusion, we see two courses of possible state action. One would be legislative amendments to “outlaw” the *McShane* holdings and limits. However, this solution may have only limited effect. While a court will often take notice of a legislative declaration, a state legislature cannot overturn a judicial interpretation of the U.S. Constitution—only the courts can. The other action would be more definitive in the end, although somewhat risky: The state would take a test case to the Minnesota Supreme Court and argue that *McShane* should be overruled.

THE RATIONALE

1. The *McShane* case relies on the “government enterprise v. government arbitration” test to determine government takings liability. No other state in the country now uses this test. Even the test’s originator, a noted law professor and scholar, has repudiated it as unworkable and incorrect. Subsequent appellate Minnesota airport zoning cases also confirm the test is flawed. Since *McShane*, no other reported appellate case in Minnesota has found that airport zoning laws have worked an uncompensated taking. These subsequent cases either found that *McShane* was “inapplicable”; or that the facts presented did support finding a taking. While the Minnesota courts have not yet overturned *McShane*, these recent cases suggest that its underlying theory—the government enterprise test—is no longer viable. For example, *see Olsen v. City of Ironton*, 2001 WL 379010 (Minn. App., unpublished opinion) (“We question whether a land-use regulation adopted . . . contemporaneous with the preparation of a . . . comprehensive plan could be considered a land-use regulation adopted to benefit a specific governmental enterprise.”).

It is important to realize that the state courts have never found that Minnesota’s model ordinance, and more specifically local zoning ordinances based on that model, are unconstitutional on their face. There is only one reported appellate case—*McShane*—where the local government was found liable for just compensation, and that was where the government conceded their airport zoning laws, as applied to Mr. McShane’s property, resulted in a “substantial and measurable” decline in the property’s market value. Since *McShane*, landowners typically have not been able to meet their burden to show this same loss of market value—Minnesota courts have announced this is a “difficult” burden to meet. *McShane* has thus had inordinate and inappropriate influence on assumptions about local government takings liability for the past 25 years.

2. Outside Minnesota, takings law has taken a different direction. Virtually every modern court case dealing with takings liability for airport zoning laws has concluded that laws very similar to the Minnesota Model Ordinance are proper exercises of the police power and NOT unconstitutional uncompensated takings of property. These cases are cited and discussed at length in the legal memorandum.



The theme that emerges from the non-Minnesota cases is a simple one: *McShane* was, and still is, wrong. The overwhelming authority from other states is that airport zoning laws, like the Minnesota Model Ordinance, are not unconstitutional uncompensated takings when applied. Instead, courts generally uphold them as valid and necessary exercises of the police power. They are tested as more generic land use laws are normally tested, by simply asking: What was the underlying reason for the law? Does it benefit the public interest in safety and orderly land use planning? If the answers to these questions are “yes,” then the courts almost always find the laws constitutional, unless their application to a specific piece of property virtually wipes out all of the land value (a total taking).

3. *McShane* is also completely inconsistent with the direction found in the United States Supreme Court’s recent takings cases. These cases reveal that courts will test land use laws like the Minnesota model ordinance by whether: (1) the law produces a public benefit and (2) whether the law take away essentially ALL of an affected property’s remaining value. Minnesota local governments that adopt the model ordinance, or a variant, would almost certainly meet the U.S. Supreme Court’s takings test if challenged. Airport zoning laws are adopted for important public benefits, and rarely will remove all the value of affected land.

This combination of Minnesota case law since *McShane*, case law from other states, and United States Supreme Court recent holdings, suggests the time is ripe to overturn *McShane* and align Minnesota with the rest of the country.



I. INTRODUCTION AND SUMMARY

The State of Minnesota must address a problem all states face: How to provide for the public safety around public airports by placing restrictions on the surrounding land without those restrictions constituting a taking of property. In 1945, the Minnesota legislature attempted to solve this problem by enacting a model zoning ordinance that outlines height and use restrictions local governments should incorporate when maintaining an airport. This model ordinance is consistent with traditional land use planning practices; governmental entities typically place restrictions on land, such as residential, commercial, or agricultural uses as an exercise of the police power. Under well and long established land use law, a local government's use of zoning restrictions on private property pursuant to the police power is not considered to be a taking of property unless the restrictions go too far. In America, virtually all land use restrictions on property are **not** considered to have "gone too far."

Minnesota, however, has a unique problem. In 1980, the Minnesota Supreme Court, in *McShane v. Faribault*, 292 N.W.2d 253 (Minn. 1980), held that all zoning restrictions are not the same. The Court distinguished between regulations that "arbitrate" between competing land uses, and regulations that serve a "governmental enterprise." The consequence of this classification is staggering. Regulations that arbitrate between competing land uses, such as residential and commercial uses, are an appropriate exercise of the police power. Regulations that serve a governmental enterprise, on the other hand, constitute a per se taking of property which must be compensated. This distinction is referred to as the enterprise/arbitration test, first promulgated by Professor Joseph Sax.

The court in *McShane* held that Minnesota's model airport zoning ordinance served a governmental enterprise (the operation of an airport). Therefore, the ordinance as applied to the plaintiff's property, constituted a taking of property. However, we believe that the Minnesota model airport zoning ordinance could be upheld today under similar circumstances, despite the 1980 *McShane* holding. First, Minnesota courts have begun to uphold most zoning ordinances against takings claims, including some airport zoning cases. Second, developments in Minnesota case law since *McShane*, and rejection of the enterprise/arbitration theory by other states and authorities, suggest that the enterprise/arbitration test is no a viable test. *McShane* would therefore likely be overruled if the same circumstances were challenged as a taking today. Finally, takings jurisprudence nationwide (including United States Supreme Court case law since *McShane*) has shifted by upholding virtually all zoning ordinances against takings claims. The vast majority of courts now find that airport zoning ordinances do not constitute takings of property. Minnesota municipalities should be able to promote public safety around airports without fear that the restrictions will constitute a taking of property.

II. THE MINNESOTA MODEL AIRPORT ZONING ORDINANCE

The Minnesota State Legislature and Department of Transportation promulgated regulations and minimum standards, including the model airport zoning ordinance, to guide local regulation of land uses near public airports. Municipalities and counties that choose to adopt an airport zoning ordinance under the authority granted in Chapter 360 of the Minnesota Statutes must, at a minimum, comply with the provisions of the model zoning ordinance, unless the State approves a deviation. See Minn. Stat. §360.065. The model ordinance imposes restrictions on the height of structures and uses of land near airports. Under *McShane*, the model ordinance serves a "governmental enterprise;" thus, a plaintiff need only show a substantial and measurable diminution in market value of their property in order to prove an unconstitutional taking of property and force the government to pay compensation. The model ordinance in question is outlined below.

There are 136 public airports in Minnesota. The airports are controlled by towns, cities, and counties, either individually or in conjunction with one other. Understanding the inherent safety dangers created by air craft



landing and take-offs, the Minnesota legislature enacted Minnesota Statutes §360.062 *et. seq.* (1945). The purpose of the statutes is to promote the interest of public health, safety, and general welfare by preventing the creation of airport hazards. Minn. Stat. §360.062. In enacting §360.062, the Minnesota legislature hoped to alleviate potential dangers by enabling municipalities to restrict land surrounding an airport, especially land that extends out from the ends of the runways lying under the aircraft take-off and approach paths.

Pursuant to §360.062 the Minnesota Department of Transportation, Office of Aeronautics (“MnDot”), created the Model Zoning Ordinance for Minnesota Airports (“Model Ordinance”). [Exhibit A]. The Model Ordinance establishes the minimum criteria to be followed when municipalities zone for and around an airport. The model zoning ordinance establishes minimum standards; a municipality may establish more restrictive limitations if desired. The Model Ordinance establishes six height restriction zones and three safety zones. [Exhibit A, pp. 8-12]. The height restrictions and safety zones are designed to limit any hazards associated with operating an airport, while at the same time allowing for the safe use of surrounding lands.

A. THE ORDINANCE PLACES HEIGHT RESTRICTIONS ON NATURAL OBJECTS, BUILDINGS, AND OTHER STRUCTURES LOCATED WITHIN THE SIX HEIGHT ZONES

The Model Ordinance establishes six different zones relating to height restrictions. These zones create imaginary airspace surfaces above which no building, tree, or other structure may protrude. [Exhibit A, p. 11]. Where zones overlap, the more restrictive limitation prevails. [Exhibit A, p. 11]. The six **height** restriction zones include: the primary zone, horizontal zone, conical zone, approach zone, precision instrument approach zone, and the transitional zone.

1. PRIMARY ZONE

The primary zone has the most restrictive height limitations. The primary zone protects the runway and therefore must be very restrictive in order to protect the safety of airplanes landing and taking off. The primary zone is centered on the runway and is located entirely within the airport boundaries. The length of the primary zone is equal to the length of the runway and extends 200 feet beyond each end of the runway. The primary zone can be 1000 feet, 500 feet, or 250 feet wide depending on the type of runway. To prevent interference of aircraft in the primary zone no structure or tree may extend above ground level, understandably, no structure or tree may be placed in the primary zone. [Exhibit A, p. 8].

The primary zone restrictions are not subject to takings claims. The primary zone constitutes the runway and a small buffer and lies entirely within the airport boundary. Since the primary zone lies entirely within the airport boundary, the restrictions imposed do not affect private property. Therefore, the restrictions cannot be challenged as a taking of property.

2. HORIZONTAL ZONE

The horizontal zone is the most restrictive zone affecting private property. The horizontal zone creates an imaginary horizontal airspace surface 150 feet above ground level. No structure or tree located in the horizontal zone may extend above 150 feet. The horizontal zone is created by swinging arcs with radii equal to 10,000 feet or 6,000 feet, depending on the type of runway, from the center of each end of the primary surface and connecting the arcs by lines tangent to those arcs. [Exhibit A, pp. 8-9].

Because the horizontal zone is large, approaching two miles, a substantial amount of private property could be affected by the restrictions imposed within the horizontal zone. The horizontal zone sets a height limit of 150 feet for any structure located within the zone. This restriction has little consequence on private residences, but the impact on commercial property could be significant. Developers seeking to construct



large office buildings, apartments, hotels, or industrial buildings may find their proposed building heights restricted. Developers could claim that the height restrictions constitute a taking of property above 150 feet. There is no doubt that the land retains economic benefits, but those benefits are reduced when a 150-foot office building is constructed versus a 300-foot, 500-foot, or 1000-foot tall structure. However, as will be discussed below, the majority of courts in other states hold that height limitations are not takings of property but are an appropriate exercise of the police power.

3. CONICAL ZONE

The conical zone is also large, extending 4,000 feet out from the periphery of the horizontal zone, potentially affecting significant amounts of private land. The height of the imaginary surface is initially equal to the height of the horizontal zone, but increases one vertical foot for every twenty feet (20:1 slope) the conical zone extends out from the horizontal zone to a final height of 350 feet above which no structure or tree may extend. [Exhibit A, p. 9].

As with the horizontal zone, the conical zone restrictions have little impact on permitted residential development. The major impact is likely to commercial property where developers want to construct large buildings extending above the height limitations imposed in the conical zone. Again, courts tend to hold that height restrictions are not takings of property.

4. APPROACH ZONE AND PRECISION INSTRUMENT APPROACH ZONE

The approach zone protects the safety of aircrafts landing and taking off from the airport. The approach zone places restrictions on land located in the flight path of aircraft. The approach zone is centered on and coincides with the end of the primary zone. The height of the approach zone is initially equal to the height of the primary zone (ground level) and increases one vertical foot every 20 or 40 feet depending on the type of runway. The width of the approach zone is equal to the width of the primary zone and expands to a width of 2,250, 2,500, 3,500, or 4,000 feet, depending on the type of runway, at a distance of 10,000 feet and then continues out an additional 4,000 feet. [Exhibit A, pp. 9-10]. The approach zone overlaps part of other zones and where there is overlap the more restrictive provisions of the approach zone override other zone restrictions.

The precision instrument approach zone is initially the same width and height as the primary zone. The precision instrument approach zone inclines upward and outward at a slope of 50:1 for a distance of 10,000 feet expanding to a width of 4,000 feet, then continues to expand for an additional 40,000 feet at a slope of 40:1 and to a width of 16,000 feet. [Exhibit A, pp. 10-11].

Unlike the horizontal zone, the restrictions imposed in the approach zones not only affect commercial property but may also affect private residential property. For example, at 1,320 feet, or a quarter-mile from the end of the runway, the potential height restriction in the approach zone is about 30 feet above which no tree or structure may be built. Two-story private residences typically are taller than thirty feet, and therefore could not be built in the approach zone. The restrictions imposed in the approach zone have a much greater impact on private property, but should not constitute a taking.

5. TRANSITIONAL ZONE

The transitional zone “extends upward and outward at right angles to the runway centerline and extends at a slope of 7:1 from the sides of the primary zone and from the sides of the approach surfaces until they intersect the horizontal surface or the conical surface.” [Exhibit A, p. 11]. The transitional zone technically lies within the horizontal zone and potentially creates a more restrictive imposition on property than the horizontal zone. The transitional zone creates a transition between the ground level height restriction imposed by the primary zone and the 150-foot height restriction imposed by the horizontal zone. Therefore, property located within the horizontal zone may be affected by the more restrictive transitional zone.

B. SAFETY ZONES PLACE RESTRICTIONS ON USES OF LAND

The model ordinance also establishes three safety zones, A, B, and C which operate in conjunction with the height restriction zones. The height restriction zones described above all established imaginary airspace surfaces above which no structure may protrude. The safety zones described below establish **use** restrictions on the land that lies within the zone boundary.

The majority of Minnesota airport takings jurisprudence, like *McShane*, centers on claims that the land **use** restrictions imposed in the safety zones are compensable takings of property. Plaintiffs assert that the restrictions imposed upon their land prohibit economically viable uses and the government should pay for that loss. The argument is that airport safety zone restrictions serve only a governmental enterprise. The Minnesota Supreme Court in *McShane* agreed and held that airport zoning imposing restrictions on land is a per se taking and must be compensated. The court concluded that airport zoning imposes restrictions on private land for the benefit of the public, and such restrictions serve only a governmental enterprise. Zoning restrictions serving a governmental enterprise constitute per se takings of property.

A description of the safety zones, the restrictions imposed, and their relative likelihood of being alleged a taking, is outlined below.

1. SAFETY ZONE A IMPOSES THE MOST RESTRICTIVE RESTRAINTS UPON LAND, PROVIDING PLAINTIFFS THE STRONGEST CLAIM THAT AIRPORT ZONING CONSTITUTES A TAKING OF PROPERTY

Zone A is the most restrictive of the safety zones. Zone A includes all land that lies in the approach path of a runway. The width of Zone A is equal to the width of the primary surface and extends out from the end of the primary surface a distance equal to two-thirds of the length of the runway. The restrictions imposed on land within Zone A prohibit the construction of any buildings, temporary structures, exposed transmission lines, or other above-ground structural hazards. The uses of Zone A are restricted to uses that will not create, attract, or bring together an assembly of persons. Land located in Zone A may be used for agriculture, horticulture, animal husbandry, raising livestock, wildlife habitat, non-spectator outdoor recreation, cemeteries, and automobile parking. [Exhibit A, p. 12]. This list is not all inclusive.

As seen in the list of permitted uses, land lying within Zone A does not have many economically viable uses other than agriculture. The limited use of land provides plaintiffs the strongest claim that airport zoning constitutes a taking of property. Here, a landowner who wishes to develop land into commercial or residential property may not do so, denying that landowner the economic potential such use provides. Although not all economically viable uses are abolished, the land owner is significantly restricted in the ways the land may be used.



2. ***SAFETY ZONE B PROVIDES FOR THE PUBLIC SAFETY WITH MINIMAL RESTRICTIONS ON PROPERTY***

Zone B is more functional than Zone A, but still contains restrictions. Zone B includes all land extending out from Zone A a distance equal to one-third the length of the runway, so that the combined length of Zones A and B is equal to the total length of the runway. The width of Zone B is equal to that of Zone A. Zone B allows for all uses allowed in Zone A, but also permits residential and commercial uses so long as each site is no less than three acres, each use does not bring together a site population that exceeds 15 times the site acreage, each site has no more than one building plot upon which any number of structures may be erected, and each building plot is a single, uniform, non-contrived area, whose shape is uncomplicated and whose area shall not exceed minimum ratios provided in the model ordinance. Prohibited uses include: churches, hospitals, schools, theatres, stadiums, hotels, motels, trailer courts, campgrounds, and other places of public or semi-public assembly. [Exhibit A, p. 15].

Although less suspect to takings claims than Zone A restrictions, Zone B restrictions could be challenged as a taking of property. Remember, under the *McShane* diminution in value test imposed on zoning regulations serving a governmental enterprise, a plaintiff need only show a substantial and measurable decline in the market value of their property. Plaintiffs may challenge Zone B regulations as a taking of property by arguing, for example, that the land is more valuable as single-family residential housing with sites of one-quarter acre than as residential land with sites of three acres as required under the Zone B restrictions.

3. ***SAFETY ZONE C LIMITS ONLY THE HEIGHT OF NATURAL OBJECTS AND STRUCTURES LOCATED WITHIN THE ZONE, AND IS LEAST LIKELY TO BE CHALLENGED AS A TAKING***

While Zones A and B cover property extending out from the ends of the runways, Zone C includes all land located in a boundary equal to the boundary of the horizontal zone and not included in safety Zone A or Zone B. Property located in Zone C is subject only to height restrictions. The height restrictions are the same as those imposed in the horizontal zone, usually 150 feet. Therefore, no structure or naturally occurring object may exceed a height of 150 feet. Zone C places no restrictions on the use of land. [Exhibit A, p. 15].

Because Safety Zone C only places restrictions on the height of objects and structures located within the zone, it is the least likely of the three safety zones to be challenged as a taking of property. A landowner may only challenge the zoning restrictions by arguing he is prevented from building higher and that this restriction is not an appropriate use of the police power. However, as described below, modern takings jurisprudence nationwide tends to uphold height restrictions as an appropriate use of the police power. Courts are unlikely to find that height restrictions constitute a taking of property.

III. **THE CENTRAL PROBLEM FOR MINNESOTA LOCALITIES WISHING TO ADOPT AIRPORT ZONING LAWS: *MCSHANE V. FARIBAULT* AND THE MINNESOTA SUPREME COURT'S ADOPTION OF THE ENTERPRISE/ARBITRATION TEST**

In 1980, the Minnesota Supreme Court decided *McShane v. City of Faribault*, holding that airport regulations imposing restrictions on private land near an airport are per se takings of property. *McShane v. City of Faribault*, 292 N.W.2d 253 (Minn. 1980). The court determined that the model ordinance, enacted initially in 1945, so restricted private property as to constitute a taking of property. The holding in *McShane* created risks for municipalities by seemingly requiring local governments adopting the model ordinance to compensate land owners for the taking of property subject to the ordinance. The *McShane* holding could



potentially bankrupt some municipalities wishing to keep the airspace safe near airports. However, since the *McShane* holding, Minnesota court decisions have continued to limit the principles outlined in *McShane*, making *McShane* ripe for overruling. To understand the problems faced by municipalities wishing to enforce airport zoning, a description of the *McShane v. Faribault* decision and its implications is helpful.

James McShane and members of his family (collectively “McShane”) owned 42 acres of land adjacent to the Faribault Municipal Airport. The McShane property was affected by zoning regulations adopted by the Faribault-Rice County Joint Airport Zoning Board pursuant to Minn. Stat. §360.063.⁷ Part of the McShane property, 16.49 acres, was located within safety Zone A and 26.04 acres within safety Zone B. Safety Zones A and B, as previously described, are elements of the airport zoning ordinance that impose restrictions on the height of structures and the use of land lying within the physical boundaries of each zone. McShane alleged that the airport zoning restrictions substantially diminished the value of his land, contending that the land, when put to its best possible use—commercial development—was much more valuable than when put to the uses the ordinance allowed the ordinance. The Zoning Board asserted the regulations were a reasonable exercise of the police power; however, the Minnesota Supreme Court disagreed.

The court decided that not all zoning regulations are the same, and adopted the enterprise/arbitration theory posited by Professor Joseph Sax. Professor Sax theorized that zoning regulations fall on a dichotomy and either further a governmental enterprise or arbitrate between competing land uses—the enterprise/arbitration theory. Where land use regulations are designed to benefit a specific public or governmental purpose, the regulations are said to further a governmental enterprise, but where regulations are part of a comprehensive plan, the regulations are merely an arbitration of competing land uses. The distinction between enterprise and arbitration functions is important as each triggers a different test to determine if an unconstitutional taking of property has occurred.

The court stated that where regulations are part of a comprehensive plan, and therefore serve an “arbitration” function, there can be no taking of property unless the owner is deprived of all reasonable use of the property. Under this test it is very rare for a court to hold that zoning regulations constitute a taking of property. This test places a very high burden on plaintiffs as they must show that their land has been deprived of *all* reasonable uses. It is hard to imagine that there could be no possible reasonable use for a piece of property.

In contrast to an arbitration function, where the regulations further a governmental enterprise by placing restrictions on land owned by a few individuals to benefit the greater public, the regulations are a *per se* taking. The property owner is therefore entitled to compensation for any substantial and measurable decline in market value.⁸ This test is relatively easier for plaintiffs to meet. The plaintiff must show that a zoning ordinance furthers a governmental enterprise and that the ordinance caused a measurable decline in the property’s market value compared to similar property not affected by the zoning restrictions.

The *McShane* court held that airport zoning regulations are “clear” examples of regulations designed to benefit a governmental enterprise and applied the less strict diminution in value test. The court found that the McShane property suffered a measurable decline in market value. Therefore, McShane was entitled to compensation for the diminution in value of his property.

The holding in *McShane* established that zoning regulations affecting property around an airport are designed to further a governmental enterprise and, therefore, are a *per se* taking of property. All that a land owner need show is a substantial and measurable decline in market value in order to recover compensation

⁷ Minn. Stat. §360.063 permits an airport zoning board to promulgate regulations dealing with use, population density, and permissible structures on land lying just beyond the end of airport runways.

⁸ The decline in market value test was adopted from *Alevizos v. Metro. Airports Comm’n*, 298 Minn. 471 (Minn. 1974) (“*Alevizos I*”). In *Alevizos I*, the Court found that use of the airspace above plaintiff’s property was not a taking as there was no diminution in value of the property.



from the government. Obviously, Minnesota municipalities who zone lands around airport face potentially severe economic consequences under the *McShane* ruling.

The remainder of this memorandum presents what we believe are colorable arguments for reversing the *McShane* ruling and establishing a rule of law for Minnesota consistent with the majority of other states in the country.

IV. THE RESTRICTIONS IMPOSED BY EACH OF THE THREE SAFETY ZONES SHOULD BE UPHELD AS AN APPROPRIATE USE OF THE POLICE POWER, AND NOT UNCONSTITUTIONAL TAKINGS.

At first glance, these safety zones and their accompanying use and height restrictions appear to be appropriate steps in exercising local governments' police power to protect the public welfare, health, and safety. However, the Minnesota Supreme Court in *McShane* held that these regulations are not a reasonable exercise of the police power, but are in fact per se takings of property. In this respect, Minnesota is in the minority of states, if not the only state, to reach this result. However, Minnesota cases since *McShane* have upheld airport zoning regulations against takings claims—laying the foundation for a possible shift in the state courts' approach to airport zoning challenges. In the following sections, we present arguments why each of the safety zone restrictions could and should withstand takings claims.

A. SAFETY ZONE C RESTRICTIONS DO NOT CONSTITUTE A TAKING

We did not find any Minnesota case law specifically challenging the restrictions imposed by Zone C regulations. We believe that those restrictions, if directly challenged, should be upheld as not constituting a taking of property. First, the fact that there appears to be no Minnesota case challenging these restrictions is encouraging. Second, other states tend to uphold height restrictions as an appropriate use of the police power. Together, current takings jurisprudence from within and outside Minnesota provide an avenue for Minnesota municipalities to safely exercise the police power and avoid paying just compensation for airspace-airport zoning.

Minnesota case law is nearly void of challenges to the height restrictions imposed by airport zoning ordinances.⁹ This fact is encouraging as analogous Minnesota case law has upheld similar height restrictions. Airport-related height restrictions serve a primary public safety purpose: They provide an avigational easement by reducing obstructions in the flight paths of aircraft. Minnesota courts have upheld avigational easements as not constituting a taking even where there is a substantial interference with the use and enjoyment of property. After the *McShane* case was decided, the Minnesota Supreme Court, in *Alevisos v. Metro. Airports Comm's of Minneapolis and St. Paul*, 317 N.W.2d 352 (Minn. 1982) ("*Alevisos II*"), stated:

“Every landowner must continue to endure that level of inconvenience, discomfort, and loss of peace and quiet which can be reasonably anticipated by any average member of a vibrant and progressive society.”

Furthermore, and also persuasive, the Eighth Circuit, interpreting Minnesota law, held that a city zoning ordinance restricting the height of buildings near a city park overlooking the Mississippi River was not a taking of property. *St. Paul v. Chicago, St. Paul, Minneapolis and Omaha R.R. Co.*, 413 F.2d 762,

⁹ Although the court in *McShane* stated that the regulations, including height restrictions, constituted a taking, the court did not directly address whether height restrictions alone would constitute a taking. The holding appears to focus on the use of land restrictions. See, *McShane*, supra.

770 (8th Cir. 1969). The court held that the height restrictions promoted a legitimate police power objective of creating a desirable place to work, shop, live and enjoy.

The model ordinance serves both purposes stated above. The height restrictions attached to land located in Zone C allows aircraft a safe flight path in and out of the airport. Although the flight path of an aircraft is usually through Zones A and B, there is the possibility that the flight path may have to be diverted for safety or other concerns. The diversion would be directly through Zone C, so it is imperative that a safe unrestricted path through Zone C be available in emergency situations. This need for a safe flight path is nothing more than a legitimate exercise of the police power.

Case law from other jurisdictions supports the upholding of airport-related height restrictions as reasonable exercise of the police power. One commentator states:

“The test involves weighing the public interest against the individual property owner’s interest. Some commentators have suggested that the increasingly important interest in air travel as public transportation and as an avenue of commerce (for freight and postal deliveries) constitutes a per se public interest. Along those same lines, a viable argument can be made that the substantial public investment in airports is by itself sufficient justification for police power based regulation. Airports’ important role in defense is a similarly viable justification. However, public safety is an even more direct justification for using police power for airport zoning. Increasing use of existing facilities makes unobstructed approaches to airports essential to public safety.” 62 J. Air L. & Com.. p. 243.

Creating unobstructed approaches to airports in order to defend the public safety is a sufficient justification for exercising the police power. Several state courts have agreed, some upholding height restrictions more onerous than those posed by the Minnesota model ordinance. A recent Nevada Supreme Court case decided that height restrictions near the McCarran Airport do not constitute a per se taking of property. **County of Clark v. Hsu**, No. 38853 (Nev. Sept. 30, 2004). Where better to decide that height restrictions do not constitute a per se taking of property than where multimillion dollar high rise casinos dot the skyline of the Las Vegas strip? The plaintiffs wanted to build a casino on the Las Vegas strip adjacent to the McCarran Airport and within the area governed by height restrictions. The county denied the plaintiffs’ request citing the height restrictions. The plaintiffs then sought inverse condemnation claiming that the height restrictions constituted a per se taking of property, diminishing the value of the property by roughly \$25 million dollars. The Nevada Supreme Court rejected this claim and held that the airport zoning ordinances were not a per se taking of property. The court found that the ordinances are of general applicability to airport area property owners and constitute a legitimate exercise of the police power to prevent public hazards.

Nevada is not alone. Several other state courts have reached the same conclusion. The Alabama Supreme Court upheld a zoning ordinance prohibiting any structure or tree to exceed 35 feet, holding that the ordinance was not an unconstitutional taking of property. **Baggett v. Montgomery**, 160 So.2d 6 (Ala.1963). Similarly, the Illinois Appellate Court upheld airport height restrictions limiting structures to varying maximum heights of 10 feet to 38 feet. **La Salle Nat. Bank v. County of Cook**, 340 N.E.2d 79, 89 (Ill. App. Ct. 1975). The Illinois Court articulated:

“We do not believe that height restriction ordinances such as the one presently at issue do, in fact, appropriate private property for public use. The purpose of such ordinances is to protect the public from air hazards. We believe that in this day when airplane traffic is increasing, the need to protect the public from air hazards is a proper exercise of police power.”



Furthermore, the New Hampshire Supreme Court refused to rule as a matter of law that certain airport zoning regulations that restricted the height of structures, trees, or other objects potentially obstructing the approach zone constituted a compensable taking of property. *Manchester Airport Authority v. Romano*, 412 A.2d 1020 (N.H. 1980). The Ohio Supreme Court found that airport zoning regulations designed to reduce airport hazards may constitutionally be adopted as an exercise of the police power if such regulations are reasonably necessary to insure the safety of aircraft in landing and taking off, the safety of persons occupying or using the area, and the security of property thereon. Accordingly, the court held that there was no taking without compensation of private property on the basis of height restrictions in an airport zoning regulation. *Willoughby Hills v. Corrigan*, 278 N.E.2d 658 (Ohio 1972).

Height restrictions imposed on property adjacent to an airport intended to promote the public safety are an appropriate exercise of the police power. The Minnesota model ordinance imposes similar height restrictions to those upheld by other jurisdictions. If challenged, Minnesota courts should uphold the Zone C height restrictions as a reasonable exercise of the police power in promoting the public health, safety, and welfare.

B. MINNESOTA COURTS HAVE FOUND THAT LAND USE RESTRICTIONS IMPOSED BY ZONE B REGULATIONS DO NOT CONSTITUTE A TAKING OF PROPERTY

The model ordinance establishes Zone B as a restriction on the use of land lying under the approach and take off paths of aircraft entering and leaving an airport. The most significant restriction imposed by Zone B is the limitation of site areas to a minimum of three acres. Zone B restricts each three-acre site to no more than one building plat. This regulation significantly reduces the number of buildings, such as houses, that may be built upon property. Challenges to Zone B restrictions typically assert that the reduced number of buildings that may be built upon property causes a diminution in value of the property and therefore constitutes a taking of property. However, Minnesota courts since *McShane* have disagreed whether Zone B regulations are a taking of property.

There are only two Minnesota court cases addressing whether Zone B restrictions constitute a taking of property. Both cases were decided after *McShane* and applied the enterprise/arbitration test. Both cases found that the Zone B restrictions did not result in takings. First, in *Keenan v. International Falls-Koochiching County Airport Zoning Board*, the Minnesota Court of Appeals rejected Keenan's argument that airport zoning restrictions limiting lot size to 2.5 acres constituted a taking of property. *Keenan v. International Falls-Koochiching County Airport Zoning Board*, 357 N.W.2d 397, 400 (Minn. Ct. App. 1984). The court found that the ordinance did not decrease the value of Keenan's property, therefore, no taking occurred.

Similarly, in *Davis v. Princeton*, the court rejected the plaintiffs' argument that Zone B regulations reducing the maximum number of units that may be built upon property from 199 to 66 constituted a taking of property. *Davis v. Princeton*, 401 N.W.2d 391, 397 (Minn. Ct. App. 1987). The court noted that the number of units that may be built is not the dispositive factor, but that there are numerous factors to consider before finding a diminution in value. The court stated that if the number of units was the dispositive factor then every ordinance would constitute an unconstitutional taking. The court recognized that takings claims place a high burden on the plaintiff to prove that the regulation is the actual cause and did actually cause a diminution in value. The court held that a plaintiff must consider other factors such as: population trends, number of permits recently granted, available commercial markets, number of unimproved lots and houses on the market, number of lots of the proposed size that are vacant, cost of utilities, or platting regulations, among other factors.

Under the holdings of *Keenan* and *Davis*, Zone B restrictions should be upheld as not constituting a taking of property. As *Davis* points out, the plaintiff has a high burden of proof. The plaintiff must show that the ordinance is the sole cause of the diminution in value. The court pointed out several factors that may



contribute to any diminution in value. Within this framework, there has been no successful challenge of Zone B regulations.

C. ZONE A REGULATIONS POSE THE MOST SIGNIFICANT TAKINGS THREAT

Zone A regulations, particularly those relating to permissible uses, are the most restrictive of the zoning regulations imposed by the model ordinance. Therefore, they pose the most significant threat for municipalities maintaining airports. Given the significant diminution in value likely to be associated with Zone A regulations, they present the greatest likelihood that a court will find a takings as applied to a specific property. The upholding of Zone A regulations as a constitutional exercise of the police power will be difficult under *McShane* and the enterprise/arbitration theory.

V. MCSHANE SHOULD NO LONGER BE CONSIDERED GOOD LAW BECAUSE ITS RELIANCE ON THE ENTERPRISE/ARBITRATION THEORY IS SUSPECT

Since *McShane*, Minnesota courts have struggled with the application of its holding. The courts’ attempts at applying the enterprise/arbitration theory reveal the unwieldiness inherent in it. The theory’s first flaw is presuming that all zoning regulations can be categorized clearly as either advancing a governmental enterprise or arbitrating between competing land uses. As will be seen, immediately after the decision in *McShane*, the Minnesota courts struggled to identify which test to apply when zoning regulations do not appear to neatly fall within one of the two categories. Moreover, Minnesota courts have had difficulty identifying when a zoning regulation is a governmental enterprise and when regulations are an arbitration between land uses. The ambiguous nature of this distinction makes it nearly impossible for governmental entities to know when they will be exposed to takings liability.

Courts applying the enterprise/arbitration theory are also troubled when determining what constitutes a diminution in value, as well as what is the actual cause of the diminution in value. The courts have recognized that zoning regulations do not exist in a vacuum, and that there may be several factors that contribute to the loss of value. The government should not pay for diminution in value that it has not caused.

Finally, Minnesota courts are not the only ones who have questioned the validity of the enterprise/arbitration theory, Professor Sax, the law professor behind the original theory, recognized its inherent flaws and refuted his own theory only seven years after its conception. Following Professor Sax’s lead, at least one other state has refused to adopt the enterprise/arbitration theory.

Taken all together, these events support an arguments that the *McShane* case was wrongly decided and that the Minnesota courts should reject the enterprise/arbitration test.

A. MCSHANE WAS WRONG WHEN IT WAS DECIDED IN 1980

Even accepting the arbitration/enterprise test posited by the *McShane* court, the test was misapplied to public airports and airport zoning restrictions for three critical reasons: (1) Public airports are not governmental enterprises; (2) Airport zoning does not primarily further a governmental enterprise; and (3) Airport zoning arbitrates between competing land uses.



1. ***PUBLIC AIRPORTS ARE NOT GOVERNMENT ENTERPRISES***

Airports do not constitute an “enterprise” within the plain and ordinary meaning of that word. The term “enterprise” infers a primary profit-making motive. Public airports’ primary purpose is to provide essential public services, particularly by facilitating the safe, convenient, and efficient movement of both people and goods. Airports’ primary motive is not to make a profit; indeed, public airports are not operated as profit-making businesses, as the term “enterprise” would imply. Furthermore, airports have indisputably become essential to the growth and development of individual metropolitan areas and to growth of the nation’s collective prosperity. Just because users pay to use an airport’s services does not automatically inflate the airport into a “government enterprise.”

2. ***AIRPORT ZONING DOES NOT PRIMARILY FURTHER A GOVERNMENTAL ENTERPRISE***

Airport zoning regulations are not intended to primarily further the operation of an airport as a governmental enterprise; they are valid exercises of a local government’s police powers. Police powers must be exercised to provide for the public safety and welfare. “This power of the legislature to impose uncompensated duties and even burdens, upon individuals and corporations for the general safety, is fundamental. It is the ‘police power.’ Its proper exercise is the highest duty of government.” *Alexander Co. v. Owatonna*, 222 Minn. 312, 322 (Minn., 1946). Recognizing this fundamental purpose of the police power, Minnesota courts have noted that if a municipal ordinance is a proper effort to protect the health or safety of the public, there will be no taking. *Zeman v. Minneapolis*, 552 N.W.2d 548, 553 (Minn. 1996).

First and foremost, airport zoning is intended to promote the public’s health, safety, and general welfare. Airport zoning regulations protect the public on the ground not only from the noise generated by airport usage, but also from the dangers of airplane crashes that can occur during takeoff and landing. Airport zoning also protects persons piloting or flying in an aircraft from possible navigational obstructions (e.g., too tall structures or excessive glare) that can endanger their safety. *McShane* failed to recognize that airport zoning regulations are promulgated primarily to protect the public, a legitimate purpose for the use of police powers. By holding that airport zoning regulations are a per se taking of property, the Minnesota Supreme Court improperly punished local governments for exercising the “highest duty of government.”

3. ***AIRPORT ZONING ARBITRATES BETWEEN COMPETING LAND USES***

The use of one property inherently restricts the use of surrounding property. For example, a homeowner mowing the lawn inherently places restrictions upon an adjacent homeowner’s right of quiet enjoyment. Competing land uses must exist in harmony. Zoning in general often serves an arbitrating function by favoring land uses that can exist in harmony with each other. Airport zoning is intended primarily to ensure compatible land uses next to airports—in this sense, it arbitrates between competing uses of such properties by favoring those land uses than can exist most safely and most in harmony with a nearby airport.

Airport zoning accomplishes this arbitration function by restricting private property surrounding an airport to protect the safety of those using the airport as well as the public on the ground. The private property owner, in turn, imposes “hidden” restrictions upon the airport. The use of land near airports invariably effects and can ultimately restrict the number or type of aircraft allowed at the airport, the level of noise, and in some cases even the hours of airport operation. Airport zoning merely arbitrates between competing land uses by minimizing the potential impacts each use ultimately places upon the other.

Thus, we argue that even if the enterprise/arbitration theory remains in place, *McShane* wrongly characterized public airports as government enterprises and wrongly characterized airport zoning as promoting such enterprise rather than as merely arbitrating between competing land uses.



B. THE HOLDING IN MCSHANE SHOULD BE NARROWLY CONSTRUED BECAUSE IT DOES NOT ADDRESS THE CONSTITUTIONALITY OF HEIGHT RESTRICTIONS

The *McShane* holding is limited to its facts, the constitutionality of land use restrictions imposed on land lying within the Safety Zones A and B. *McShane* did not address height restrictions imposed by the airport zoning regulations and offers no guidance in the determination of whether height restrictions may constitute a taking of property. There is a broad distinction between restrictions upon the use of land and height restrictions. As the *Alevisos* line of cases point out, avigational easements do not constitute takings of property. Residential neighborhoods, including those located nowhere near an airport, all have height restrictions imposed. Being near an airport does not change the underlying constitutionality of height restrictions. *McShane* has no bearing on the constitutionality of height restrictions around airports.

C. THE ENTERPRISE/ARBITRATION TEST IS IMPRACTICAL TO APPLY

The struggle with the enterprise/arbitration theory began immediately after *McShane*. As seen in *Pratt v. Dept. of Natural Resources*, 309 N.W.2d 767, 770 (Minn. 1981), Minnesota courts faced the immediate problem of identifying which part of the test to apply. The holding in *McShane*, although recognizing that zoning regulations do not fall neatly at one end of the spectrum or the other, gave no guidance as to which test the courts should apply when zoning regulations appear to encompass both enterprise and arbitration characteristics.

In *Pratt*, Pratt, the plaintiff, owned all the land surrounding three lakes where he grew and harvested wild rice. 309 N.W.2d at 770. Pratt used mechanical devises, and had done so for years, to harvest the rice. The Department of Natural Resources promulgated regulations banning the use of mechanical devises for harvesting wild rice in public waters. The Department also reclassified the three lakes on the Pratt property as public waters.¹⁰ Pratt alleged the new regulations were a taking of property because mechanical devises were much more profitable than the uses allowed under the regulations. The court found that the regulations served an arbitration function by arbitrating among competing wild rice harvesters. The court found that the regulations also served an enterprise function by preserving the harvest for the Native Americans as an alternative to subsidies. The court noted that the regulations in *McShane* served only an enterprise function, but the regulations in the present cases served multiple uses. The court stated that regulations serving multiple uses were more the rule, whereas, regulations serving a single purpose, as in *McShane*, were more the exception and *McShane* gave no hint how the enterprise/arbitration test was to be applied to these mixed circumstances. The court, struggling to apply the principles in *McShane*, held that “to be **at all useful**, the principles enunciated in *McShane* for determining whether a taking has occurred must be applied with some flexibility.” The court found that determination of takings is a matter of degree and cannot be disposed of by general propositions.

The reasoning in *Pratt* shows just how impractical application of the enterprise/arbitration theory is to zoning regulations that typically serve multiple purposes. Most airport zoning regulations serve multiple purposes, like the regulations in *Pratt*. Under *McShane*, airports are deemed to serve a governmental enterprise and airport zoning furthers that enterprise. However, airport zoning also arguably arbitrates between competing land uses, such as between airport-compatible uses like industrial uses and incompatible uses like residential uses. Under such an argument, it would be arbitrary to apply one prong of the enterprise/arbitration theory versus the other, leaving the court to improvise and struggle, as the *Pratt* court so obviously did.

¹⁰ Minnesota law states that landowners own the lake bed but not the waters and classifies all waters having a beneficial public purpose as public waters. *Pratt*, 309 N.W.2d at 770.



Challenges to zoning regulations, as the *Pratt* court surmised, cannot be resolved by either general or ambiguous propositions. The enterprise/arbitration theory, due to its inherent ambiguity, gives local government, litigants, and courts little guidance. Local lawmakers have to take a calculated risk in deciding to apply airport zoning, and, in some instances choose not to restrict or strictly prohibit incompatible land uses for fear of property owner challenges. Parties to a zoning lawsuit invariably have to argue both sides of the enterprise/arbitration test because of its ambiguity; they cannot afford to guess wrong and cannot know which test to apply until the court decides for them. This makes litigation more uncertain, settlement less likely, and the entire process more time-consuming and costly.

D. THE ENTERPRISE/ARBITRATION THEORY ALSO GIVES LITTLE GUIDANCE WHEN ZONING REGULATIONS APPEAR TO SERVE A SINGLE PURPOSE

Since *Pratt*, Minnesota courts have limited the *McShane's* reach. This process has occurred through the labor of determining which zoning regulations advance a governmental enterprise and which arbitrate land uses. This process has provided no clarity.

In *Thompson v. City of Red Wing*, the plaintiff wanted to mine gravel from part of his land. *Thompson v. City of Red Wing*, 455 N.W.2d 512 (Minn. Ct. App. 1990). The land that the plaintiff wanted to mine contained Indian burial grounds protected by state statute. The trial court found that the statute protecting the burial grounds was an enterprise function and therefore amounted to a taking of property. The Appeals Court reversed, holding that regulations for the purpose of historic preservation do not constitute enterprise functions. Although historic preservation appears to meet the definition of a government enterprise by placing restrictions on land owned by a few for the benefit of the public, the Appeals Court found otherwise. The court found that the enterprise analysis applies only where the governmental enterprise has acquired an effective easement. The court held that the state statute protecting burial mounds bears no relationship to any governmental enterprise.

In *Arcadia Development Corp. v. Bloomington*, the plaintiff alleged that a city ordinance requiring trailer park owners to pay for relocation costs of its residences when the owner sells the park benefited a governmental enterprise and, therefore, constituted a per se taking of property. *Arcadia Development Corp. v. Bloomington*, 552 N.W.2d 281, 285 (Minn. Ct.A pp. 1996). The court found the purpose of the ordinance was not to benefit a governmental enterprise so *McShane* did not apply. The court held that the question is not whether an ordinance evinces a governmental enterprise, but whether the ordinance was specifically designed to benefit a governmental enterprise. This definition provides no clarity as it is hard to imagine many ordinances that are not designed to further a governmental purpose.

In an unpublished opinion with strong parallels to airport zoning, the Minnesota Appeals Court held that regulations benefiting a state recreational area were not for the purpose of a governmental enterprise. *Olsen v. Ironton*, 2001 WL 379010, 4 (Minn. Ct. App. 2001). In *Olsen*, a local zoning ordinance prohibited Plaintiff from developing his property into residential housing. Plaintiff's property was adjacent to a state recreational area that was created to "provide appropriate recreational and educational opportunities in a natural environment." The ordinance's prohibition on adjacent residential uses was intended to further this purpose. Here, it is even less clear how a state recreational area open to the public for public use differs substantially from a public airport, and how ordinances restricting the use of land in order to benefit the recreation area differ from restrictions on land promoting the public safety and compatible uses around airports.

Although the facts of the above cases appear to meet the definition of a governmental enterprise, the courts held differently and greatly limited what constitutes a governmental enterprise. The logic of these decisions indicates that *McShane* incorrectly characterized airport zoning regulations as furthering a governmental enterprise. It is hard to distinguish the above cases from *McShane*.



Furthermore, the above decisions give no guidance for determining when a zoning regulation is for the benefit of a governmental enterprise. This void creates special problems for lawmakers, who will have no guidance for creating laws that will be deemed not to promote a governmental enterprise.

E. THE ENTERPRISE/ARBITRATION TEST DOES NOT ACCOUNT FOR THE ACTUAL CAUSE OF ANY DIMINUTION IN VALUE

In a similar case, a plaintiff's property fell within the boundaries of Zone B, which limits the minimum lot size to three acres. *Davis v. Princeton*, 401 N.W.2d 391, 393 (Minn. Ct. App. 1987). Plaintiff wanted to sell the land to a developer who could develop the land utilizing smaller lot sizes, and therefore, having the ability to build more units. The court held that determining the impact of the regulations on the value of the property required more than a determination of the maximum number of units that could be built: "If that were the only factor at issue, every airport zoning ordinance that imposes more restrictive rules than the underlying zoning would be held to be a constitutional taking." The court held that the plaintiff must actually link the ordinance to the diminution in value. The plaintiff must show that there is an actual market for more units than the ordinance allows, and that the ordinance, not market demand, creates an inability to sell the property.

The holding establishes that mere diminution in market value is not enough. The plaintiff must also show a direct link between the ordinance and the diminution of market value. The *Davis* holding sets a higher bar for plaintiffs to achieve; no taking will be found unless the plaintiff meets this threshold. The *Keenan* and *Davis* courts have limited *McShane*, and have established a difficult hurdle for plaintiffs wishing to prove governmental regulations amount to a taking of property.

At the same time, these cases underscore the weakness of the *McShane* holding. The *McShane* court failed to consider other factors that cause land values to decline. *McShane* held that if there is a regulation supporting a governmental enterprise and the plaintiff can prove a diminution in the value of the property, a taking has occurred that must be paid for by the government. This is simplistic and not reflective of market realities: land use values fluctuate for a number of reasons besides a change in regulations. To hold that one factor is the sole cause, without having to prove a nexus between that factor and the actual diminution, is nonsensical and unfair.

F. PROFESSOR SAX HAS REFUTED HIS ENTERPRISE/ARBITRATION THEORY

Professor Sax first posited the enterprise/arbitration theory in 1964.¹¹ In 1980, the Minnesota Supreme Court in *McShane* adopted the theory. Notably, *McShane* did not acknowledge a 1971 article by Professor Sax in which he repudiated his earlier views on the basis that typical land use regulation was too complex for such a test. 20 Wm. Mitchell L. Rev. 433.

In that article Professor Sax states:

"The following pages should make clear the respects in which my present thoughts depart from those expressed in my earlier article. In general, I am still persuaded that neither the traditional diminution-of-value theory nor the noxious use theory is acceptable. Also unchanged is my view that neither history nor reason requires us to protect a property owner against total economic loss when the regulatory authority of government is exercised for a legitimate purpose. I am compelled, however, to disown the view that whenever government can be said to be acquiring resources for its own account, compensation must be paid. I now view the problem as considerably more

¹¹ Sax, *Takings and the Police Power*, 74 Yale L.Rev. 36 (1964).



complex. The pages that follow are an extended commentary on why and how my views have changed on this point.” 81 Yale L.J. 149, 150 n. 5.

Professor Sax goes on to state that the enterprise/arbitration theory introduces a “doctrinal rigidity inconsistent with the kind of planning essential to optimal resource allocation.” The enterprise/arbitration theory does not take into account the interdependence of land uses, and assumes that governmental restrictions on land acquires for the public something which the public had no previous right. In essence, all land use regulations are arbitrations of competing interests, as Professor Sax noted:

“Surely it is naive, however, to suppose that one who profits from a piece of property necessarily uses only those resources within his boundaries, and equally naive to think the consequences of one property user’s activities are confined to his property. Property does not exist in isolation. . . . Frequently, use of any given parcel of property is at the same time effectively a use of, or a demand upon, property beyond the border of the user.” 81 Yale L.J. 149, 152.

Given the crumbling of the foundation of its *McShane* holding, the Minnesota Supreme Court, like Professor Sax, should repudiate the enterprise/arbitration test for takings claims.

G. OTHER STATES HAVE REJECTED THE ENTERPRISE/ARBITRATION TEST

Following Professor Sax’s lead, the Maryland Court of Appeals recognized the ineffectiveness of the enterprise/arbitration theory and refused to adopt it. Based upon Professor Sax’s refutation of his own theory, the Maryland Court of Appeals reversed the Court of Special Appeals’ adoption of the enterprise/arbitration theory. The court recognized that no court has developed an “as applied” takings test that categorically determines whether a taking has occurred, and the court refused to adopt Sax’s original theory that any and all loss caused in furtherance of a governmental enterprise is compensable, per se, as a taking. *Maryland Port Administration, Et Al. v. QC Corporation*, 529 A.2d 829; 833 (Md. Ct. App. 1987). Instead the court followed the majority rule “that when the owner of property continues in use and possession as before, it is not taken in the constitutional sense, *however much it may be depreciated in value.*” *Id.* at 389 (citing J. Sackman, *Nichols on Eminent Domain* § 6.38[1], at 6-114-15 (3d ed. 1980)) (emphasis added).

There can be no stronger evidence that the enterprise/arbitration theory is unworkable than its own creator disavowing it and a state court refusing to adopt it. Both Professor Sax and the Maryland Court recognize that governmental regulation is too complex to be resolved by what the Minnesota Supreme Court, recognized as a general proposition, lifted from a repudiated law review article. The enterprise/arbitration theory fails to address takings issues in any workable manner. There is no indication the Minnesota Supreme Court knew of Professor Sax’s recantation when it decided *McShane*; however, the court adopted a theory that its own creator rejected.

The holding in *McShane* has left Minnesota trial courts with no recourse but to apply an unworkable test. As Professor Sax and the Maryland Court recognized, the enterprise/arbitration test cannot be applied to complex airport zoning regulations promulgated by local governments. Minnesota should follow other jurisdictions when determining whether land use regulations constitute takings.



VI. TAKINGS JURISPRUDENCE OUTSIDE OF MINNESOTA CONCLUDES AIRPORT REGULATIONS IMPOSING RESTRICTIONS ON SURROUNDING LAND DO NOT CONSTITUTE A TAKING OF PROPERTY

The national trend towards height restrictions and airport zoning has changed over time. An older line of cases considered and rejected governments’ various arguments justifying airport zoning restrictions, and found that both height and use restrictions near airports were unconstitutional takings. These cases are uniformly outdated, having been decided decades ago. The older cases do not in any way reflect the modern trend among state courts, nor do they incorporate current takings jurisprudence announced by the United States Supreme Court.

The more modern line of cases, decided within approximately the last 20 years, uniformly conclude that building height restrictions within airport safety zones are not unconstitutional takings, but are valid exercises of police power.

A. OUTDATED STATE CASE LAW

1. HEIGHT AND USE RESTRICTIONS

The vast majority of authority that is 30 years old or older approaches taking jurisprudence differently than modern case law. These older cases generally found that governmental height and use restrictions were compensable takings. These courts found that application of even necessary safety measures placed an improper restriction on private property owners. This older body of law was more concerned with allowing property owners unrestricted use of their land, than with protecting citizens from the possibility of airport hazards.¹²

2. LOCAL GOVERNMENT INVOLVEMENT

A takings has been found in older cases where properties are rezoned by the local government in anticipation of the airport physically acquiring the property. The court found in *Kissinger v. Los Angeles*, 327 P.2d 10 (Cal. App.1958), that a takings occurred where other properties in the area had not been rezoned and the ordinance’s obvious purpose was to allow the airport to acquire the subject property for a lower price. In *Merkur Steel Supply Inc. v. City of Detroit*, 680 N.W.2d 485, (Mich. App. 2004), the city intended to acquire all of the tenant’s property, but did not want to pay just compensation. In order to demonstrate a takings, the court allowed the tenant of the leased property to segment the property. The court in *Sjolander v. Houston*, 551 S.W.2d 166 (Tex. Civ. App. 1977), found that a partial takings was present where the airport restricted the use of airspace over a leasehold interest. In deciding a partial taking was present, the

¹² In *United States v. 48.10 Acres of Land*, 144 F. Supp. 258 (1956) (just compensation was required where the government took an aviation easement over private property); *Kentucky Airport Zoning Comm. v. Kentucky Power Co.*, 651 S. W. 2d 121 (1983) (the court in favor of property owners where airport imposed height restrictions); *See also Tara Engineering Corp. v. City of Newark*, 40 A.2d 559 (1945) (a height restriction ordinance was a taking regardless of its classification by the city as a regulation); *Ackerman v. Port of Seattle*, 55 Wash. 2d 400 (1960) (height restrictions on private property surrounding the airport was a taking); *Peacock v. County of Sacramento*, 271 Cal. App. 2d 845 (1969) (restriction of structures surrounding the planned airport was a taking); *Rice v. Newark*, 40 A.2d 561 (1945); *Sneed v. County of Riverside*, 218 Cal. App. 2d 205 (1963) (taking was present when a city ordinance limited height of property surrounding the airport); *see also, Dutton v. Mendocino*, (1948 Cal Super Ct.) 1949 US Av 1; *Indiana Toll Road Comm. v. Jankovich*, 244 Ind. 574 (1963) (building height restrictions on property adjacent to the airport to permit takeoffs and landings was a taking); *Jackson Municipal Airport Auth. v. Evans*, 191 So.2d 126 (Miss. 1966) (a takings was present when the land owned by the defendant was subject to Instrument Approach Zone and Transition Zone height restrictions); *Hageman v. Board of Trustees of Wayne Township*, 251 N.E. 2d 507 (1969) (proper exercise of police power was not present where a local government enacted airport zoning regulations limiting the height of structures on land adjacent to the airport); *Roark v. City of Caldwell*, 394 P.2d 641 (1964) (when an airport zoning ordinance limited the use of land adjacent to the airport a takings was present); *see also, Mutual Chemical Co. v. Baltimore*, (1939, Md CC) US Av 11.



court found that petitioner failed to show a reduction in market value and therefore damages were not awarded.

B. MODERN TRENDS IN STATE AIRPORT-AIRSPACE TAKINGS LAW

The prevailing approach to airspace takings claims have addressed various restrictions on private property and found no takings. Specifically, recent state court decisions have found that a takings is not present with respect to either height or use restrictions. One leading treatise has commented, “[w]hile there is some older authority for the proposition that zoning regulations cannot be used to control construction of aviation hazards near an airport, the trend of most recent cases is to uphold airport hazard zoning ordinances placing height and use restrictions on property near airports as valid and constitutional.” 8A AM.JUR.2D AVIATION, § 88, 88-89.

In order to determine whether the ordinance is a proper exercise of government power, modern courts will consider the public interest, government interest, and authority of police power regulations. These courts will determine whether the government action is an appropriate safety measure. In addition, courts will consider evidence of a diminution in market value to determine whether the takings claim is proper.

1. PUBLIC INTEREST

As cities grow and expand, there is a need for planned development, which was not advanced when the early zoning cases were decided. Modern courts are more willing to support the government’s proposition that the public interest is advanced by protecting areas surrounding or in close proximity to airports. Today, it is difficult for petitioners to overcome the presumption that the ordinance serves a beneficial public interest. In *Cheyenne Airport Bd. v. Rogers*, 707 P.2d 717 (Wy. 1985), the state authorized local governments to impose structural height restrictions for the purpose of averting aviation hazards. One zoning scheme adopted pursuant to this authorization was the Cheyenne Municipal Airport Zoning Ordinance, which had the “general purpose” of keeping “the approach zones to the Cheyenne airport runways free from such obstructions as would interfere with the landing and taking off of airplanes.” While the plaintiffs claimed that the ordinance affected an uncompensated taking of an easement in the airspace above their property, the Wyoming Supreme Court disagreed. The plaintiffs failed to satisfy their burden of proving that flights from the Cheyenne airport substantially interfered with their property’s use and enjoyment. According to the court the plaintiff’s merely showed that, “planes were flying in the airspace that the state and federal governments have reserved for lawful air travel.” The airport ordinance did not affect a property interest because the disputed airspace was never an actual property interest vested in the landowners. See also *Manchester Airport Authority v. Ramano*, 412 A.2d 1020 (Nh. 1980), where the court refused to find that as a matter of law specific airport regulations constituted a compensable takings.

2. GOVERNMENT INTEREST

Modern courts are also unlikely to find a takings where a sufficient governmental interest is addressed. In contrast to the government enterprise theory advanced by the *McShane* court, a government interest is similar to a public interest because it is meant to protect citizens from the apparent hazards that result from living in close proximity to an airport. The restrictions imposed as a result of the government interest are seen as a benefit to society as a whole.

The court in *Harris v. City of Wichita*, 862 F. Supp. 287 (D. Kan. 1994), found that restrictions imposed on private land situated around a nearby air force base did not constitute a physical invasion of the land. The Airport Overlay District served to reduce accident risks in runway approach zones and departure paths. According to the court, the plaintiffs were able to continue their existing land uses without any limitation, and were allowed to apply for a land use variance. The court found that the regulations were permissible because they served to protect citizens in the event of a crash. The Airport Overlay District did not amount to a



physical invasion or a per se taking as a matter of law. In *Pace v. Bd. of Adjustment*, 492 So.2d 412 (Fla. App. 1986), the Florida appeals court found no taking because there was no evidence that frequent low overflights interfered with the property’s approved use as a landfill; a decline in market value alone is insufficient to establish a taking. See also *Franchise Developers v. City of Cincinnati*, 505 N.E.2d 966 (Ohio 1987) (Overlay zoning scheme that created environmental quality districts was proper exercise of city’s zoning authority to preserve and protect character of certain neighborhoods).

Other courts have followed the holding in *Baggart v. Montgomery*, 160 So.2d 6 (Ala. 1963), which upheld an airport zoning regulation against arguments that the ordinance failed to protect a property owner from confiscation of his property and that it was arbitrary and unreasonable. The Alabama court reasoned that because the ordinance allowed property owners to obtain variances and appeal holdings of the administrative board, the ordinance amply protected property owners. For example, in *Pinheiro v. County of Marin*, 131 Cal Rptr. 633 (Cal App. 1976), a takings was not present where the city rezoned property to open space allegedly for the benefit of the local airport. The court found that the plaintiff’s failed to demonstrate facts sufficient to show restrictive zoning for a public purpose. See also *Holaway v. Pipestone*, 269 N.W.2d 28 (Minn. 1978) (zoning change from single-family residential to industrial did not constitute a taking); *Chacon v. San Antonio*, 562 S.W.2d 279 (Tex. Civ. App. 1978) (neither the official announcement of plans for an airport nor passage of airport zoning ordinance was a taking); *Clarke v. Port of Portland*, 543 P.2d 1099 (Ore. App. 1975) (No takings where developers claimed loss of “highest and best use”—if “highest and best use” were the standard, all zoning and land use planning laws would be jeopardized).

Modern case law also reveals courts’ growing deference toward the exercises of the police power where local regulations advance a legitimate public interest. Airport regulations designed to reduce airport hazards may be adopted as a proper exercise of police power if such regulations are reasonably necessary to insure the safety of aircraft in landing and taking off, the safety of persons occupying the area, and the security of property.¹³ For example, in *Maryland Aviation Administration v. Newsome*, 652 A.2d 116 (Md. App. 1995), the court upheld a state statute for overlay zoning where the intent of the statute was to protect the health and general welfare of the occupants located near the airports. Similarly, in *Commonwealth v. Rogers*, 634 A.2d 245 (Pa. 1993), a state statute was upheld which required approval by the Pennsylvania Department of Transportation in order to erect a sign in the airport runway approach area.

3. HEIGHT AND USE RESTRICTIONS

Modern courts are more likely to find that height and use restrictions are necessary in order to protect the public interest from airport hazards. *Patza v. New Jersey Dep’t of Transp.*, 271 N.J. Super. 294 (N.J. 1994), addressed the constitutionality of an air safety zoning act that required the adoption of building height restrictions within airport safety zones. The court found that the state may, “impose very substantial zoning and other restrictions on the use of property in order to advance legitimate public interests without being obligated to provide compensation.” Rejecting the notion that the act “lacks a rational relationship to a justifiable legislative purpose,” the court explained:

“It was enacted to prevent ‘the creation or establishment of airport hazards’ that ‘endanger[] the lives and property of the users of the airport and of occupants of land in the vicinity thereof, and also, if the hazard is of the obstruction type, . . . tend to destroy or impair the utility of the airport and the public benefit therein.’”

¹³ See *Willoughby Hills v. Corrigan*, 278 N.E. 2d 658 (Ohio 1972), which found that a takings was not present where the property owners land was located in a transition zone. See also *City of Iowa City v. Hagen*, 545 N.W. 2d 530 (Iowa 1996); See also, *County of Clark v. Hsu*, Docket No. 38853 (Nev. 2004), where the Supreme Court of Nevada reversed an inverse condemnation claim. The court found that an ordinance restricting the height of buildings surrounding the airport was a proper exercise of a police power regulation designed to prevent public hazards.



The court determined that “[c]ontrolling the use of property in the immediate vicinity of airports in order to prevent the creation of new obstructions certainly is not arbitrary or unreasonable on its face” and does not make “its enactment tantamount to a taking.” *Id.* at 304-305, 638 A.2d at 871-872.

In *Schmidt v. City of Kenosha*, 214 Wis. 2d 527 (Wis. App. 1987), the court found that an airport zoning ordinance that prohibits construction along aerial approaches of an airport “is not arbitrary or capricious, but is reasonably related to a legitimate public purpose.”

In *Northwest Props. v. Outagamie County*, 223 Wis. 2d 483, 487-90 (Wis. App. 1998), the court determined that a municipality had authority to enact a zoning ordinance that protects the aerial approaches of an airport by “regulating, restricting and determining the use, location, height, number of stories and size of buildings and structures and objects of natural growth in the [airport’s] vicinity.”

Similarly, in *Aeronautics Comm’n v. State ex rel. Emmis Broad. Corp.*, 440 N.E.2d 700, 706 (Ind. App. 1982), the court found that a state “high structures safety act” which regulates structural height near airports for the purpose of, “protect[ing] the safety and welfare of persons and property in the air and on the ground by ensuring the navigable airspace overlying the state is maintained in an unobstructed condition, is valid.” According to the court, “Congress has evidenced a purpose to leave legal enforcement of regulations pertaining to high structures and air safety to state and local governments.”

In *Kimberlin v. City of Topeka*, 238 Kan. 299, 305-06 (Kan.1985), the court held that a zoning ordinance that establishes height and use restrictions to promote airport safety is a proper exercise of police power and does not result in an unconstitutional taking without just compensation.

Finally, in *La Salle Nat’l Bank v. County of Cook*, 340 N.E.2d 79 (Ill. App. 1975), the court determined that the enactment of an airport zoning ordinance imposing height restrictions on buildings near certain airports, including a naval station, did not deprive landowners of their property interest. In *La Salle Bank*, the court found that state law was determinative in holding that local governments’ “power to regulate the height of a structure where it is reasonably necessary for the protection of the public health, safety or welfare is in exercise of police power, and that all private power is held subject to a reasonable exercise of that power.” *See id.* at 277, 340 N.E.2d at 89. The court explained:

“We do not believe that height restriction ordinances such as the one presently at issue do, in fact, appropriate private property for public use. The purpose of such ordinances is to protect the public from air hazards. We believe that in this day when airplane traffic is increasing, the need to protect the public from air hazards is a proper exercise of police power. . .In our opinion the present ordinance was created for a valid purpose within the police power of the County and it was not the purpose and has not been the effect of the Ordinance to take private land and appropriate to public use.” *Id.*

On these grounds, the court affirmed the trial court’s judgment in the government’s favor.¹⁴

4. **REDUCTION IN MARKET VALUE**

In determining whether the airport height or use restriction is valid, the court will consider the plaintiff’s evidence of whether a reduction in the market value of the property interest is present. Virtually all modern

¹⁴ See also *Eck v. Bismarck*, 302 N.W.2d 739 (ND. 1981), where an agricultural use limitation was not a takings of property; *Richmond, Fredericksburg & Potomac R.R. Co. v. Metropolitan Washington Airport Auth.*, 251 Va. 201 (Va.1996), where 23,000 overflights per year were not sufficient to establish a takings because there was no evidence of “the types of aircraft using the runway, the height at which they passed over the property, or the frequency of landings.” See also *Persyn v. United States*, 935 F.2d 69 (5th Cir. 1991), where increased noise did not prohibit the plaintiffs from use of their property;

cases have found that the restriction has not reduced the market value substantially enough to cause a taking of all reasonable use.

The court found valid an airport zoning ordinance in *Sarasota-Manatee Airport Authority v. Harrell's Candy Kitchen*, 111 So.2d 439 (Fla.1959), where the zoning ordinance limited the height of the building to 28 feet. According to the court, the defendants failed to substantiate their claim that reducing their building structure from the building's present height of 41 feet would depreciate the value of the defendant's property, adversely affect the appearance of the structure, or reduce the effectiveness of the tower as an advertising medium. In *Fitzgarrald v. City of Iowa*, 492 N.W.2d at 65-66 (Iowa 1992), the court found that the landowners "continue to have an economically viable use of their property even though its market value has to some extent been diminished as a result of the airport zoning ordinances" and held that [t]his loss of value is insufficient to support a finding that a regulatory taking has occurred."

In *Austin v. Travis County Landfill Co.*, 73 S.W.3d 234 (Tex. 2002), the Texas Supreme Court found that the plaintiff failed to establish a claim of compensable taking. The plaintiff did not provide evidence sufficient to support the claim that flights from the city airport over the landfill directly impacted the property's surface and caused the value to decline. Even though the landfill owner was exposed to an influx of risks and costs, the evidence was not sufficient to show that civilian overflights resulted in or even contributed to the land's decline in market value.

Following the trend in modern legislation, the recent case of *Vacation Village, Inc. v. Clark County, Nevada*, Adversary No. 98-2313-RCJ, decided in December of 2004. In the 1960s and 1970s, the plaintiffs entered into various agreements with the county in order to construct and maintain a 501-room hotel and an 85,000 square foot casino. The county conditioned approval of the hotel on various regulations imposed by the airport because of the airport's close proximity to the Vacation Village property. In 1990, the county adopted an ordinance that further restricted a 1.25 acre portion of the Vacation Villages property. The restrictions limited the 1.25 acre parcel to uses as a parking lot, water area or landscaping. Vacation Village claimed that the county's regulations resulted in the unconstitutional taking of its 1.25 acre parcel by severely limiting its uses.

The court first analyzed whether a categorical takings was present, which occurs when *all* economic use has been denied by regulation. Under this rule, a takings only occurs when there is "no productive or economically beneficial use of the land." See *Tahoe-Sierra Preservation Council v. Tahoe Regional Planning Agency*, 535 U.S. 302, 330 (2002). The categorical takings test requires the court to compare "the value that has been taken from the property with the value that remains in the property." *Tahoe-Sierra*, at 302. The Supreme Court has stated that regulatory taking jurisprudence "does not divide a single parcel into discrete segments and attempt to determine whether rights in a particular segment have been entirely abrogated." *Id.* In deciding whether a particular governmental action has affected a taking, the Court focuses both on the character of the action and on the nature and extent of the interference with rights in the parcel as a whole. *Tahoe-Sierra* at 327. Following this line of holdings, the *Vacation Village* court first determined the regulations' effect on the entire 24-acre parcel, or the "parcel as a whole". *Even if* the court determined that all 1.25 acres were totally deprived of all economic benefit, the remaining 95% of the property was not. Thus, while the regulation did impose a severe burden on the 1.25 acres, the *entire* parcel was not deprived of all economic benefit.

The *Vacation Village* court also considered the test first set forth in *Penn Central Trans. Co. v. City of New York*, 438 U.S.104 (1978), which considers a) the character of the government action; b) the regulation's economic effect on the landowner; and c) the extent to which the regulation interferes with the reasonable investment-backed expectations. These inquiries all look at the effects of the regulation on the entire parcel. *Tahoe*, 535 U.S. at 327.



In its determination, the court noted that the zoning change did not eliminate *all* potential uses of the land. The small portion of property could still be used as landscaping or a parking lot. Furthermore, 95% of the property was not adversely affected by the regulation; as the U.S. Supreme Court has stated: “where an owner possesses a full ‘bundle’ of property rights, the destruction of one ‘strand’ of the bundle is not a taking.” *Tahoe*, 535 U.S. at 327.

In recognizing the ordinance limited the use of the 1.25 acres to a parking lot, water area or landscaping, the *Vacation Village* court stated that frustration of some investment-backed expectations is allowed when the regulation furthers an important public interest. *Vacation Village*, at 21. The court further noted that the property in question had always been subject to some type of regulation limiting the use of the land because of the property’s close proximity to the airport. In conclusion, the court found no takings had occurred as applied to the plaintiff’s 1.25 acres of land.

Under the modern line of airport zoning decisions summarized above, a case presenting facts similar to those at issue in *McShane* should be analyzed under the line of reasoning described in the *Vacation Village* case. In particular, Minnesota courts should examine the impacts of airport zoning regulations on the property as a whole, and not improperly segment the affected portion for scrutiny alone.

VII. THE MINNESOTA MODEL ORDINANCE IS ACCEPTABLE AND CONSTITUTIONAL WHEN TESTED AGAINST CURRENT UNITED STATES SUPREME COURT TAKINGS JURISPRUDENCE

There is another reason why the Minnesota Model Ordinance should be considered a valid and constitutional law – it certainly meets the tests that have been adopted by the United States Supreme Court for deciding if a land use regulation is proper exercise of the police power or an unconstitutional taking.

The United States Supreme Court has announced two tests for determining if a law violates the Takings Clause. One test focuses on whether airplanes flying over land can cause an unconstitutional taking of the property interest below the airplanes. The other test considers whether land use laws in general, including laws like the Minnesota Model Ordinance, constitute takings. The Minnesota Model Ordinance meets both tests, which further supports the proposition that *McShane* is ripe for overruling.

The first Supreme Court takings test derives from two airplane overflight cases – *Causby* and *Griggs*, discussed below. These cases establish that it may be an unconstitutional taking if aircraft overfly land to the point of completely destroying the surface-based private property interest there. The Minnesota Model Ordinance obviously does not violate this principle – in fact, adoption of the Ordinance prevents a *Causby* and *Griggs* takings challenge by restricting the very planes that might otherwise have harmed the surface interest to the point of being a taking.

The second test is a multi-part analysis which considers whether a land use law (like the Minnesota Model Ordinance) produces a taking in light of the *effect* of the law on the private property owner restricted by the law. The test, which derives from the *Penn Central*, *Palazzolo*, and *Tahoe-Sierra* cases (also discussed below), asks whether the law permits any use somewhere within the property owner’s *entire parcel* after the law has been applied to that parcel. The rule is that if there remains any economically viable use of some of the *entire parcel*, there is like not a taking, especially if the law is intended to further a legitimate police power purpose. Of course, the Minnesota Model Ordinance not only serves a valid public purpose, when applied to private land near airports, it will rarely if ever removes all economically viable use of the entire parcel. Therefore, the Ordinance also meets the second U.S. Supreme Court takings test, thereby belying the continued viability of the discredited *McShane* test.



A. AIRPLANE OVERFLIGHT CASES

There are two Supreme Court cases that ascertain the presence of a takings claim when there are airplane overflights; these cases are distinguished from modern zoning cases where the issue is whether the land use law itself (not the airplanes) has marked a taking. The cases of *Causby* and *Griggs* both involve low and frequent overflight of aircraft to the point of destroying the plaintiff’s property interest.

In *United States v. Causby*, 328 U.S. 256 (1946), the Court examined the legal effects of military overflights on existing land uses. In finding a taking was present airplanes from the local airport flew over the property owners’ land at low altitudes, ruining the owners’ chicken farm business. The court stated that the “airplane is part of the modern environment of life, and the inconveniences which it causes are normally *not* compensable under the Fifth Amendment.” A takings claim arises under *Causby* only when overflights have impaired an existing use of the land. *Griggs v. County of Allegheny*, 369 U.S. 84, 87-90 (1962).

In *Griggs v. County of Allegheny*, 369 U.S. 84 (1962), airplanes from the Pittsburgh airport passed over the property owners’ land at altitudes of 30 to 300 feet. The noise caused by the low altitude flight patterns made the land unusable. According to the court, “the navigable airspace which Congress has placed in the public domain is ‘airspace above the minimum safe altitudes of flight prescribed by the Civil Aeronautics Authority.’” Furthermore, “the air is a public highway” and that to recognize “private claims to the airspace would clog these highways, seriously interfere with their control and development in the public interest, and transfer into private ownership that to which only the public has a just claim.” Therefore, the navigable servitude in airspace imposes no less than an inherent limitation on the title to underlying property. Again the Supreme Court found that the county had taken an avigation easement over the property and that just compensation to the property owners was owed.

In applying both *Causby* and *Griggs*, irrespective of whether aircraft fly over private land at altitudes below 500 feet, they result in a taking only when aircraft overflights are so low and so frequent that they have destroyed an existing use of the underlying land. *Causby*, 328 U.S. at 266. The federal law applicable in *Causby* allowed private citizens to own land in the airplane safety zones. However, federal law in effect at the time of *Griggs* and since has expressly precluded ownership. See *Griggs*, 369 U.S. at 88 (pointing out that “[f]ollowing the decision in the *Causby* Case, Congress redefined ‘navigable airspace’ to mean ‘airspace above the minimum altitudes of flight prescribed by regulations issued under this chapter, and shall include airspace needed to insure safety in take-off and landing of aircraft’”); 49 U.S.C. § 40102(a)(30).

The taking in *Causby* was the result of frequent overflights below the navigable airspace, as then defined, which destroyed the plaintiff’s existing use of land as a chicken farm. *Griggs*, in contrast, simply found that a taking may occur when the aircraft impairs existing underlying land uses as they fly through the navigable airspace during takeoff and landing, circumstances not present in the *McShane* case. See *Griggs*, 369 U.S. at 88-90. A taking of a property interest associated with the affected land use may occur on those occasions, but the airspace remains within the public domain and subject to public regulation, in both cases.

Causby and *Griggs* are not takings cases per se, but are overflight cases that require far more than mere passage of aircraft through airspace to constitute a takings. A takings occurs as stated in *Causby*, and reaffirmed in *Griggs*, only when the overflight of aircraft are so frequent and so low that they have substantially impaired the existing land use. See *Causby* 328 U.S. 266; *Griggs*, 369 U.S. 87-90. The taking that results is not of the airspace, but of the vested property right represented by the existing land use. When each element of this test is not met, the United States Supreme Court has concluded that the “[f]lights over private land are *not* a taking.” See *Causby*, 328 U.S. at 266.

These cases may be distinguished from most height restriction cases because their holding relates to cases where arrivals and departures of aircraft below 500 feet are present, an invasion of property occurs, and the



Causby three part test applies. These cases do not find that a total takings occurred, but that a substantial invasion of airspace was present.

Both the *Causby* and *Griggs* United States Supreme Court cases can be distinguished from the facts in other cases involving airport zoning regulations. *Causby* and *Griggs* involved the impairment of existing, on-the-ground land uses due to noise generated by low over-flying airplanes. In the *McShane* case, the offending government action is not overflights by airplanes, but the ordinance imposing use restrictions on private property in the vicinity of an airport. *Causby* and *Griggs* do not tell us about the constitutionality of land use regulations designed to prevent airplanes from colliding with buildings located near airports. These cases only instruct that flights over private land may be a taking if they are so low and frequent as to constitute a direct and immediate interference with the use of the land.

B. MODERN U.S. SUPREME COURT TAKINGS TEST

In *Tahoe-Sierra Preservation Council v. Tahoe Regional Planning Agency*, 535 U.S. 302 (2002), the U.S. Supreme Court applied the parcel as a whole concept to determine that a takings was not present. The defendant imposed a development moratorium for 32 months while determining a development plan for the Lake Tahoe area. The Supreme Court reaffirmed its finding that courts must consider the entire parcel of property not just the affected portion. The Supreme Court instructed litigants that per se takings occur only in extraordinary cases, typically only when there has been a permanent or regulatory denial of all economically viable use of the relevant property. Under this reasoning, an occasional over-flight is not a permanent occupation of the airspace. When no permanent physical occupation is present, the next question is whether there has been a permanent regulatory deprivation of all economically viable use of the relevant property interest. If the relevant parcel is the parcel as a whole, then only the airspace segment is without use and the land below the height limit still has economic use and value. Therefore, there has been no permanent regulatory deprivation of all value of the applicable parcel.

Tahoe-Sierra also finds that when there is neither a permanent physical occupation nor permanent regulatory deprivation of all economically viable use, the “default rule” applies. This rule is the “more fact specific inquiry” that rejects a per se approach and instead embraces the multifactor test.

The Supreme Court’s finding in *Tahoe-Sierra* is important to the takings analysis presented in *McShane*. In applying the parcel as a whole application to the *McShane* case, the court will consider the effect of the land use ordinance on the claimant’s *entire parcel*, not just the affected portion. Using this test in the *McShane* case, the parcel would include the property located within the transition zone as well as the land located outside the zone. If the court does follow the parcel as a whole rule, it will be difficult for courts to find that land use restrictions like those enforced in Minnesota have taken a separate and discrete property interest.

In *Palazzolo v. Rhode Island*, 121 S. Ct. 2448 (2001), petitioner purchased three undeveloped tracts adjoining the eastern stretch of Atlantic Avenue, which faces north and borders upon the Winnapaug Pond. The property is salt marsh and subject to tidal flooding. Before any significant structures could be built, considerable filling was required, as much as six feet in some areas.

The petitioner submitted an application in 1962 to the Rhode Island Division of Harbors and Rivers (DHR). The request was denied for lack of essential information. A second application was submitted the following year and a third was sent while the second application was pending. The second application proposed more limited filling of the land for use as a private beach club. The latter two applications were initially agreed upon, but were later withdrawn citing adverse environmental impact. *Id.* at 2455. No further attempts were made for over a decade. During this time period Rhode Island enacted legislation creating a council charged with the duty of protecting the State’s coastal properties.



In 1983 petitioner renewed the efforts to develop the property and submitted an application to fill the entire marshland area. The Council rejected the proposal citing that it was vague and inadequate and that the proposed activities would have an adverse impact upon the waters and wetlands of the Winnapaug Pond. *Id.* at 2456. The petitioner then hired counsel and again attempted to gain approval to fill the marshland, but according to the Council a landowner was required to obtain a “special exception” from the Council. In order to obtain such an exception the proposed use must “serve a compelling public purpose as a whole as opposed to individual or private interests.”

As a result of the Council’s failure to approve the petitioner’s development plan, petitioner filed an inverse condemnation action alleging that the State’s wetland regulations, as applied by the Council to his parcel, had taken the property without compensation. The petitioner alleged that the State had taken his property in violation of Fifth and Fourteenth Amendments, thereby depriving him of “economically, beneficial use” of his property resulting in a total taking. *Id.*

In agreement with the Rhode Island Supreme Court, the United States Supreme Court found that all economically beneficial use was not deprived because the uplands portion of the property could still be improved. The State trial court and Council had determined that the uplands portion of petitioner’s property was worth \$200,000 in development value under the State’s wetland regulations. The petitioner nevertheless asserted that he suffered a total taking of property.

The court found that a taking of petitioner’s property did not occur. Regardless of a *significant* reduction in value of his property, *some* economic use of a portion of his property was possible, which precluded the finding of a taking.

In applying the *Palazzolo* case to a *McShane* analysis, if some economically viable use of the property is available for even a *portion* of the property, a takings is not effected.

VIII. CONCLUSION

Minnesota should abandon the *McShane* enterprise/arbitration test for determining the constitutionality of zoning ordinances in general, and airport zoning ordinances in particular. The test is ambiguous, outmoded, and impractical. Even its originator, Professor Sax, has openly repudiated its usefulness. Other states, including Maryland, which have considered the enterprise/arbitration test, rejected it because it prescribes an overly simplistic approach to an area of property law that is inherently fuzzy and gray. Minnesota should follow Professor Sax’s and others’ lead and similarly jettison the test. Under the “majority” rule for determining whether an unconstitutional takings has occurred, as described in the *Penn Central*, *Tahoe*, *Palazzolo*, and *Vacation Village* cases, Minnesota’s model airport zoning regulations would likely NOT cause an actual takings in the vast majority of circumstances.

Even if *McShane* persists as good law in Minnesota, a strong argument can be made that airport zoning is not intended to further the purpose of a “government enterprise” within the plain meaning of that term. Airport zoning has multiple purposes. Its primary purpose is to advance the public’s health, safety, and welfare by protecting persons in aircraft and on the ground from dangers associated with aircraft operations, including the possibility of catastrophic accidents. Airports themselves are not operated as a profit-making “enterprise”; rather, airports perform an essential public service in facilitating interstate commerce and efficient and convenient mass public transit. Thus, even under the awkward arbitration/enterprise test, airport zoning serves an arbitration function rather than an enterprise function—the zoning succeeds in arbitrating between competing land uses near airports by favoring those uses that are more compatible with the risks associated with aircraft operations. The State Legislature could buttress this interpretation with amendments to Chapter 360 that more clearly declares the operation of the state’s public airports to be an essential public service and not the operation of a government enterprise. Courts will typically take notice and could give some weight to such a declaration in interpreting the state law.



The state may also consider actively supporting efforts to overturn *McShane*. In particular, the state might consider seeking a test case to challenge the continued viability of *McShane*. Finally, the state should consider passing new legislation that adopts the majority takings rule and expressly rejects *McShane* as the standard for review applicable to constitutional takings claims against local zoning ordinances. While ultimately the applicable adjudicatory test is within the courts' province, such a legislative declaration may carry persuasive weight in a court's reconsideration of *McShane*.



Appendix 1- Outdated Case Law

Lied v. County of Clark, 94 Nev. 275, 279, 579 P.2d 171, 173-174 (1978), in order to prove a trespass, like a taking “a property right must be shown to have been invaded.”

United Power Ass’n v. Heley, 277 N.W.2d 262, 267 (N.D. 1979), where the court found that flights do not infringe any property rights as long as they proceed in the manner prescribed by law.

Yee v. Escondido, 503 U.S. 519 (1992), where the court found that a governmentally imposed restriction on the use of property, constitutes a noncompensable regulation of land use instead of a per se physical taking because it does not compel a property owner to submit to a physical occupation.

Satellite Broad. & Communications Ass’n v. F.C.C., 275 F.3d 337 (4th Cir. 2001), where a takings does not occur under a Loretto analysis unless the government has required acquiescence in the permanent physical occupation of property.

United States v. 48.10 Acres of Land, 144 F. Supp. 258 (S.D.N.Y. 1956), finding a direct condemnation of an aviation easement where the glide angle plane passed over the subject land.

Kentucky Airport Zoning Comm’n v. Kentucky Power Co., 651 S.W.2d 121 (Ky. 1983), finding a taking where a power company had been ordered to mark and relocated electric power lines, which preexisted the nearby airports for purposes of aviation safety.

Ackerman v. Port of Seattle, 55 Wash. 2d 400 (1960), finding a taking based on continuing and frequent low overflights.

Peacock v. County of Sacramento, 271 Cal. App. 2d 845 (1969), finding a taking where the subject land “had no practical value or beneficial use” after its development had been frozen by government regulation.

Sneed v. County of Riverside, 218 Cal. App. 2d 205 (1963), holding without resolving the issue of liability that the complaint stated a claim for the taking of an aviation easement within the glide angle of approach zones and where frequent low overflights had been alleged.

Indiana Toll Rd. Comm’n v. Jankovich, 244 Ind. 574 (1963), where a taking was present when a toll road had been built in a manner as to cross the inner area approach zone of a runway.

Jackson Mun. Airport Auth. v. Evans, 191 So.2d 126 (Miss. 1966), the court found a taking where the city airport authority demanded the topping or removal of trees that grew within an airport approach zone because they posed a serious obstruction to landing and departing aircraft.

Hageman v. Bd. of Trustees of Wayne Township, 251 N.E.2d 507 (1969), finding a taking where zoning established a corridor for use in the takeoff and landing of military aircraft.

Roark v. City of Caldwell, 87 Idaho 557 (1964), where a taking was present where zoning designed to protect the runway approach limited portions of the subject land to agricultural uses.

Kissinger v. City of Los Angeles, 161 Cal. App. 2d 454 (1958), the court invalidated spot zoning where evidence suggested that the legislative intent was to depress the property’s value in order to facilitate its acquisition by the government at a lower price.



Appendix 2 - Modern Case Law

Patzau v. New Jersey Dep't of Transp., 271 N.J. Super. 294 (App. Div. 1994), which addressed the constitutionality of an air safety and zoning act that, among other things, required the adoption of building height restrictions within airport safety zones. The court found that “the state may impose very substantial zoning and other restrictions on the use of property in order to advance legitimate public interests without being obligated to provide compensation.”

Aeronautics Comm'n v. State ex. rel. Emmis Broad. Corp., 440 N.E.2d 700, (Ind. App. 1982), the court found that a state “high structures act,” which regulates structural height near airports for the purpose of protect[ing] the safety and welfare of persons and property in the air and on the ground by ensuring the navigable airspace overlying the state is maintained in an unobstructed condition,” is valid “because Congress has evidenced a purpose to leave legal enforcement of regulations pertaining to high structures and air safety to state and local governments.”

La Salle Nat'l Bank v. County of Cook, 34 Ill. App. 3d 264 (1975), in which the court determined that the enactment of an airport zoning ordinance that imposed height restrictions on buildings near certain airports, including a naval air station, for the purpose of preventing aviation hazards did not unconstitutionally deprive a landowner of its property without just compensation.

Cheyenne Airport Board v. Rogers, 707 P.2d 717 (Wy. 1985), appeal dismissed, 476 U.S. 1110, 106 S. Ct. 1961, 90 L.Ed.2d 647 (1986), where the Wyoming Supreme Court applied federal and state law definitions of airspace property right to reject a takings claim.

Kimberlin v. City of Topeka, 710 P.2d 682 (1985), the court held that a zoning ordinance that establishes height and use restrictions to promote airport safety is a proper exercise of police power and does not result in an unconstitutional taking without just compensation.

Fitzgerald v. City of Iowa City, 492 N.W.2d 659 (Iowa 1992), where the court found no compensable physical invasion was present where the evidence presented by plaintiffs was devoid of any evidence showing either the frequency or approximate altitudes of planes flying over the plaintiffs' lands.

Vacation Village, Inc. v. Clark County Nevada, Adversary No.98-2313-RCJ (December 30, 2004), where no takings was present as to 1.25 acres of plaintiffs land where the “parcel as a whole” was not diminished in value.

Schmidt v. City of Kenosha, 214 Wis. 2d 527 (Wis. App. 1997), the court concluded that an airport zoning ordinance that prohibits construction along aerial approaches to an airport “is not arbitrary capricious, but is reasonably related to a legitimate public purpose.”

Northwest Props. v. Outagamie County, 223 Wis. 2d 483 (Wis. App. 1998), the court determined that a municipality had authority to enact a zoning ordinance that protects the aerial approaches to an airport by regulating, restricting and determining the use, location, height, number of stories and size of buildings and structures and objects of natural growth in the [airport's] vicinity.”

Keystone Bituminous Coal Ass'n v. DeBenedictis, 480 U.S. 470 (1987), where the United States Supreme Court rejected the notion that a public nuisance must be an inherently noxious or unreasonable land use and found that what would otherwise have been a lawful coal mine posed a threat to the common welfare akin to a public nuisance because of the subsidence risks it created.

Welch v. Swasey, 214 U.S. 91 (1909), where the court has long recognized that police power enactments limiting vertical, lateral, and subjacent property development do not effect compensable takings.

Penn Central Trans. Co. v. City of New York, 438 U.S. 104 (1978), where the situation in which a landowner is restrained in his or her use of one spatial area of the property-his airspace, side yards, or subsoil- as merely one species of regulation and no actual property in these cases have been appropriated by the government.

In re Letourneau, 168 Vt. 539 (1998), where the court found it okay that building setback requirements from a highway protect sight lines for automobiles and ensure emergency access to the buildings for fire protection purposes without blocking the highway.

Richmond, Fredericksburg & Potomac R.R.Co. v. Metropolitan Washington Airports Auth., 251 Va. 201 (1996), where 23,000 annual overflights were insufficient to establish a taking because there was no evidence of the types of airplanes using the runway, the height at which they passed over the property, or the frequency of landings.

Gorieb v. Fox, 274 U.S. 603 (1927), where the government imposition of setback requirements for aesthetic and other purposes is an appropriate, noncompensable exercise of the police power.

Yara Eng'g Corp. v. City of Newark, 40 A.2d 559 (N.J. 1945), finding a taking where zoning which the state legislature had not authorized, restricted development of salt marsh and meadow land and left it with only nominal value.

Ackerman v. Port of Seattle, 55 Wash. 2d 400 (1960), finding a taking based on continuing and frequent low overflights.

Village of Willoughby Hills v. Corrigan, 278 N.E.2d 658 (Ohio 1972), where the court found that unlike a surface invasion of land, an invasion of airspace above the land does not constitute a per se taking.

Harrell's Candy Kitchen v. Sarasota-Manatee Air. A., 111 So.2d 439 (Fla. 1959), where the court upheld the validity of airport height restrictions without payment of just compensation. The court determined that the police power authority was necessary where the restrictions promoted the welfare of the state.

Austin v. Travis County Landfill Co., 73 S.W.3d 234 (Tex. 2002), the Texas Supreme Court found evidence insufficient to support a compensable taking where flights over landfill did not reduce market value. were insufficient where the Texas Supreme Court found that plaintiff failed to establish a claim of compensable taking by aircraft. The plaintiff did not provide evidence sufficient to support the claim that flight from the city airport over the landfill directly impacted the property's surface and caused the value to decline. Even though the landfill owner was exposed to an influx of risks and costs, the evidence was not sufficient to show that civilian overflight effects caused or contributed to the land's decline in market value.



Appendix 3 – Cases That Limit Causby and Griggs

County of Clark v. Hsu, Docket No. 38853 (Nev. 2004), The Supreme Court of Nevada reversed an inverse condemnation claim against Clark County. The claim was based on a county ordinance which limited the height of buildings surrounding the airport.

United States v. Brondum, 272 F.2d 642 (5th Cir. 1959), the court found that an aviation easement provides not just for flights in the air as a public highway, but it also provides for flights that may be so low and so frequent as to amount to a taking of property.

Nollan v. California Coastal Comm'n, 483 U.S. 825 (1987), the Supreme Court held that the Commission had to pay landowners just compensation for the grant of a public access easement across beachfront property. According to the Court the police power regulation was not valid because it did not further public purposes related permit requirement.

Penn Central Transportation Co. v. New York City, 438 U.S. 104 (1978), where the landowners argued that regulations prohibiting construction of a high-rise office building deprived them of “air rights”. The court concluded that the plaintiffs could not establish a taking simply by showing they were denied the ability to use a property interest they previously believed was available for development.

Harris v. City of Wichita, 862 F. Supp. 287 (D. Kan. 1994), where the court found that restrictions imposed on private land situated around a nearby air force base did not constitute a physical invasion of the land. The purpose of the airport overlay district was to restrict the use of the land in the event of a crash, so as to affect as few people as possible.

Village of Willoughby Hills v. Corrigan, 278 N.E.2d 658 (Ohio 1972), where the court found that unlike a surface invasion of land, an invasion of airspace above the land does not constitute a per se taking.

Hadacheck v. Los Angeles, 239 U.S. 394 (1915), where an ordinance was valid even though it prohibited the highest and best use of the property.

Pennsylvania Coal v. Mahon, 260 U.S. 415 (1922), where the court determined that state regulation of property may also require just compensation, recognizing regulations that go too far will be recognized as a taking.

William C. Haas v. City & Cty. of San Francisco, 605 F.2d 1117 (9th Cir. 1979), where zoning regulations were not a taking although they reduced the value of the property from \$2,000,000 to \$100,000.

United States v. Cress, 243 U.S. 316 (1917), where just compensation was necessary for a per se physical invasion or occupation when the government dams a river and floods upland parcels.

United States v. Pewee Coal Co., 341 U.S. 114 (1951), just compensation was also found where the government seized and operated a coal mine.

Kaiser Aetna v. United States, 444 U.S. 164 (1979), compensation was necessary the government attempts to require public access to private property.

Loretto v. Teleprompter Manhattan CATV Corp., 458 U.S. 419 (1982), a taking was present where the government authorizes a cable company to install cable boxes on apartment building.

Yee v. Escondido, 503 U.S. 519 (1992), no taking was present where a mobile home rent control ordinance was effected to restrict evictions.

Pruneyard Shopping Center v. Robins, 447 U.S. 74 (1980), an ordinance requiring a shopping center to permit distribution of literature on its property during business hours was not a taking.

YMCA v. United States, 395 U.S. 85 (1969), when a building is damaged during riots while under the protection of federal officers, a taking is not present.

United States v. Causby, 328 U.S. 256 (1946), where a chicken farming business was destroyed from airplanes making frequent and low overflights of property, a taking is present.

Griggs v. Allegheny County, 369 U.S. 84 (1962), here the court determined whether a county-operated airport took an easement over a house through noise and air pollution from frequent and low overflights. Based on evidence that the homeowners abandoned their home because they became nervous and distraught from extreme noise and pollution, the Court held that a compensable taking was present.

Dolan v. City of Tigard, 512 U.S. 374 (1994), where the court found that the government must demonstrate that the condition sought for granting a development permit meets the essential nexus test and is roughly proportional to the problem created by the development.

Highline Sch. Dist. No. 401, King Cty. v. Port of Seattle, 548 P.2d 1085 (Wash. 1976), where frequent and low overflights over property amounted to a taking.

Lucas v. South Carolina Coastal Council, 505 U.S. 1003 (1992), where the court found that even if a regulation removes all economic value from property, a compensable taking may not occur if the “logically antecedent inquiry into the nature of the owner’s estate shows that the proscribed use of interests were not part of his title to begin with.”

Tahoe-Sierra Preservation Council, Inc. v. Tahoe Regional Planning Agency, 535 U.S. 302 (2002), where the Court determined that the parcel as a whole test must be used in determining whether a taking is present.

Euclid v. Ambler Co., 272 U.S. 365 (1926), where regulations were valid although they effected a seventy-five percent diminution in value of property.

Kinzli v. City of Santa Cruz, 818 F.2d 1449 (9th Cir. 1987), even if a landowner has submitted development plans and been rejected, an applied regulatory taking case might still not be ripe; a landowner must submit a meaningful application for development.

Gilbert v. City of Cambridge, 932 F.2d 51 (1st Cir. 1991), where a landowner must establish that the potential denial of a development permit is more than a mere possibility, rather the prospective of refusal must be certain.

Palazzolo v. Rhode Island, 121 S. Ct. 2448 (2001), The United States Supreme Court found that all economically beneficial use was not deprived because a portion of the plaintiff’s property could still be developed.



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APPENDIX 9: ADDITIONAL FEDERAL STATUTES AND REGULATIONS

Federal Airport Noise Statutes and Regulations

These laws provide general federal and state guidelines for two primary areas: the measurement of noise and the methods of mitigation. They focus on how noise is measured, how it can affect surrounding land uses, and how impacts can be reduced by various mitigation measures. This is not an exhaustive list, but it provides a summary of the key laws related to noise issues.

Aviation Safety and Noise Abatement Act of 1979 (ASNA), as amended by the Airport and Airway Safety and Capacity Expansion Act of 1987 and Vision 100—Century of Aviation Reauthorization Act of 2003

TITLE 49, UNITED STATES CODE (USC), CHAPTER 475

This Act requires development of a single system for measuring noise and determining noise exposure caused by airport operations. It requires identification of land uses normally compatible with exposures of individuals to noise and provides for preparation of noise exposure maps. The Act authorizes the Secretary of Transportation to make grants for airport noise compatibility planning to minimize noise impacts on communities around airports.

Vision 100 included some significant changes in the previous ASNA standard for noise compatibility programming.¹⁵ The Act prohibits the FAA from approving a Part 150 Noise Compatibility Program that includes any measure requiring federal grant funding to address noise in areas exposed to less than DNL 65 dB. The FAA has issued an opinion indicating that the provision will not affect existing Noise Compatibility Programs and will not prohibit airport owners from using Passenger Facility Charges and other airport revenues to fund mitigation and abatement measures in areas exposed to noise less than DNL 65 dB. This provision was inserted into the legislation at the request of Minnesota Senator Trent Lott to prevent implementation of a noise program at Minneapolis-St. Paul International Airport. The Act's broad language, however, signifies the first time that Congress or the FAA has attempted to use the DNL 65 dB threshold as a legal standard; historically, DNL 65 dB reflected only an FAA guideline on what the agency considers to constitute significant noise exposure.

In Subchapter II of Chapter 475 is found the “national aviation noise policy,” adopted in response to increasing public outcry against aircraft noise. The policy required the establishment of a procedure to eliminate Stage I (the noisiest) and Stage II aircraft from operating in the United States, and required that as of December 31, 1999, all turbojet aircraft must meet the quietest Stage 3 noise levels.

Notice and Approval of Airport Noise and Access Restrictions

TITLE 14, CODE OF FEDERAL REGULATIONS (CFR), PART 161

These regulations establish notification requirements and procedures for the implementation of Stage 2 and Stage 3 aircraft noise restrictions.

¹⁵ *Source*: “Airport Law Alert,” Kaplan, Kirsch & Rockwall, LLP, (Denver, CO: December 19, 2003).



Airport Noise Compatibility Planning

TITLE 14, CODE OF FEDERAL REGULATIONS (CFR), PART 150

These regulations describe the procedures, standards, and methodology for the development, submission, and review of airport noise exposure maps and airport noise compatibility programs. It contains criteria for the identification of uses of land that are compatible and incompatible with various noise exposure levels around airports. This part has recently been amended to incorporate changes to the sections on noise exposure maps. The amended rule became effective on October 25, 2004. Comments were invited, however, and may result in amendments to the final rule. 69 Federal Register 57622 (Sept. 24, 2004).

Noise Control and Compatibility Planning for Airports

FAA ADVISORY CIRCULAR (AC) 150/5020-1 (1983)

This document provides guidance for the implementation of 14 CFR Part 150, which allows for the development of a plan to establish compatibility in land uses surrounding airports through the reduction of incompatible land uses and the prevention of additional incompatible land uses.

Guidance on the Balanced Approach to Noise Management

FAA ADVISORY CIRCULAR (AC) 150/5020-2 (2004)

In this document, the FAA accepts the International Civil Aviation Organization (ICAO) document, “Guidance on the Balanced Approach to Noise Management,” which provides information to help ICAO members establish noise management plans at international airports. The FAA offers this as additional information to consider when implementing the regulations in Parts 150 and 161 at international airports in the United States.

Airport Landscaping for Noise Control

FAA ADVISORY CIRCULAR (AC) 150/5320-14 (1978)

This document provides guidance for landscaping for noise control. It recommends various species of vegetation to be used for noise control.

Federal Environmental Statutes and Regulations

This section summarizes the primary federal environmental laws and regulations that typically are implicated in airport development. Development at public airports almost always involves the use of federal funds, which triggers environmental review under a number of federal statutes. This review is intended to analyze and disclose the impacts of federal actions –including funding this nation’s public airports – on the surrounding human environment. Any identified adverse impacts must be substantially mitigated. As seen in the description, one of the criteria for determining impact is whether existing and planned land uses in the vicinity of an airport are or will be compatible with the proposed airport development. The more compatible surrounding airport land uses are, the easier it is to make a finding of “no significant impact,” and the smoother the path toward future airport growth.

The following list serves as a general guide, only, and is not intended to be all-inclusive. These are complex laws that require considerable expertise to ensure compliance with all their mandates and to coordinate their requirements with other related or applicable laws at the federal and state level.

National Environmental Policy Act of 1969 (“NEPA”) And Implementing Regulations

NEPA sets forth minimum standards and procedures for application of a declared national policy to consider the impacts of proposed federal government action on the environment.

NEPA and its implementing regulations, promulgated by the Council on Environmental Quality (CEQ) in accordance with Executive Order (E.O.) 11514, Protection and Enhancement of Environmental Quality, March 5, 1970, as amended by E.O. 11991 (sections 2(g) and 3(h)), May 24, 1977, establish a broad national policy to protect and enhance the quality of the human environment, and develop programs and measures to meet national environmental goals.

Section 101 of NEPA sets forth Federal policies and goals to encourage productive harmony between people and their environment, and directs that “governments, and other public and private organizations, use all practical means and measures to create and maintain conditions under which man and nature can exist in harmony.”

The NEPA process addresses impacts of Federal actions on the human environment, including noise, socioeconomic, land uses, air quality, and water quality. Section 102(2) provides specific direction to Federal agencies, sometimes called “action-forcing” provisions (40 CFR 1500.1(a), 1500.3, and 1507) on how to implement the goals of NEPA. The major provisions include the requirement to use a systematic, interdisciplinary approach (section 102(2)(A)) and develop implementing methods and procedures (section 102(2)(B)). Section 102(2)(C) requires detailed analysis for proposed major Federal actions significantly affecting the quality of the human environment, providing authority to prepare environmental impact statements (EIS).

In land use planning for airports, when an airport sponsor proposes a project or action that requires federal approval or action (including funding and permitting), all such projects or actions are reviewed according to the procedures and disclosure requirements in NEPA to determine their impacts on the environment.

Vision 100—Century of Aviation Reauthorization Act of 2003, Title III (“Aviation Streamlining Approval Process Act of 2003.”)

Title III of Vision 100, signed into law on December 12, 2003, is also cited as the “Aviation Streamlining Approval Process Act of 2003.” In Title III, Congress found that the Federal Aviation Administration (FAA), airport authorities, communities, and other Federal, State, and local government agencies must work together to develop a plan, set and honor milestones and deadlines, and work to protect the environment while sustaining the economic vitality that will result from the continued growth of aviation.

The Act is intended to reduce the current time involved in conducting environmental review and issuing approvals and permits, which currently takes several years and often vary between agencies. Accordingly, the Act imposes specific requirements for expedited environmental review of capacity enhancement projects at congested airports and designated safety and security projects. For these projects, the Act requires federal agencies with jurisdiction over a project to conduct their review and issue approvals and permits concurrently and expeditiously (within a time period established by the Department of Transportation). The Act also delegates lead agency authority to the FAA for preparation of EISs, and other federal agencies are required to defer to the FAA on the scope of environmental review, the statement of purpose and need, and project alternatives.

The FAA responded to Title III of Vision 100 in its recently amended Order 1050.1E (see below), that states the FAA will give review priority to the projects specified in the Act, require the establishment and management of review timelines, improve and expedite interagency coordination, reduce undue delays,



emphasize accountability, and otherwise assist in facilitating environmental reviews. The Order accomplishes this by new and amended categorical exclusions and new policies to reduce paperwork and delays. For projects subject to environmental streamlining, the Order states that the FAA will comply with all environmental protection requirements outlined in the Order, will maintain the integrity of the environmental process, and will respect the environmental responsibilities of other agencies.

Environmental Impacts: Policies and Procedures, FAA Order 1050.1E (Revised June 8, 2004)

This order presents the FAA agency-wide policies and procedures for compliance with the National Environmental Policy Act (NEPA) and implementing regulations issued by the Council on Environmental Quality (40 CFR parts 1500-1508). The order is not a substitute for the regulations promulgated by CEQ, rather, it supplements the CEQ regulations by applying them to FAA programs. The provisions of this order and the CEQ regulations apply to actions directly undertaken by the FAA and where the FAA has sufficient control and responsibility to condition the license or project approval of a non-federal entity. The requirements in this order apply to, but are not limited to, the following: all grants, loans, contracts, leases, construction, research activities, rulemaking and regulatory actions, certifications, licensing, permits, plans submitted to the FAA by state and local agencies which require FAA approval, and legislation proposed by the FAA.

Chapter 2 of this order presents an overview of the NEPA process. Depending upon the context and potential impacts, NEPA procedures can differ. Chapter 3 of this order addresses those types of FAA actions that do not normally require preparation of an EA or EIS, called categorical exclusions absent extraordinary circumstances. Chapters 4 and 5 of this order outline the processes for preparing EA's and EIS's. These procedures apply to classes of FAA actions that have or may have a significant impact on the human environment.

The 2004 revisions to this order provide direction on using the NEPA review process to ensure compliance with other environmental laws, regulations and executive orders that may be applicable to proposed FAA actions. The 2004 revision added to the list of categorical exclusions and incorporates sections of interest from "Vision 100 -- Century of Aviation Reauthorization Act." Previous to the 2004 revision, the order was last revised in 1983.

Airport Environmental Handbook, FAA Order 5050.4A

The Airport Environmental Handbook, published by the FAA, provides internal guidance for environmental review of proposed airport development proposals requiring federal approval. The FAA uses the Handbook to conduct environmental analysis of proposals to ensure compliance with applicable federal environmental requirements. Airport sponsors and/or their environmental consultants also use the Handbook to prepare necessary environmental documentation and to qualify for federal Airport Improvement Program funding. Compliance with this order signifies compliance with the FAA's "Policies and Procedures for Considering Environmental Impacts" (FAA Order 1050.1E).

The Handbook outlines over 20 categories of impacts that should be evaluated, as relevant, as part of the environmental review process for airport development, including:

- Compatible Land Uses – defined as “the compatibility of existing and planned land uses in the vicinity of the airport and are usually associated with the extent of the noise impacts related to that airport.”
- Social Impacts – associated with the relocation of residences or businesses, altering surface transportation patterns, dividing or disrupting established communities, or disrupting orderly, planned development.

- Impacts on Jurisdictional Wetlands.
- Air Quality and Water Quality Impacts.
- Impacts on Endangered/Threatened Species.
- Impacts on Registered Historical Properties and impacts on other significant architectural, archaeological, and cultural resources.

Under these guidelines, findings that a significant number or array of possibly incompatible land uses exist or are planned in the vicinity of an airport might lead to a finding under NEPA and its implementing regulations that a proposed airport development project will result in significant environmental impacts. Such a finding can trigger extensive, additional environmental review and the possibility for costly mitigation measures to ensure the ultimate completion of the proposed airport development.



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APPENDIX 10: SAMPLE EASEMENT AND OTHER AGREEMENTS

Indemnification and Cooperation Agreement – MAC and 7 Minneapolis/St. Paul Metro Local Governing Bodies

INDEMNIFICATION AND COOPERATION AGREEMENT

REGARDING THE WOLD-CHAMBERLAIN FIELD

JOINT AIRPORT ZONING BOARD AND THE

MINNEAPOLIS-ST. PAUL INTERNATIONAL

AIRPORT ZONING ORDINANCE

This Agreement is made this ____ day of _____, 2002, by and between the Metropolitan Airports Commission (“MAC”), the Cities of Bloomington, Eagan, Mendota, Mendota Heights, Minneapolis, Richfield, and Saint Paul and the County of Hennepin (collectively “the Entities”) and Mary Hill Smith, an individual (“M. Smith”).

RECITALS

A. The parties to this Agreement are all of the members of the Wold-Chamberlain Field Joint Airport Zoning Board (“the JAZB”) formed pursuant to the authority of Minn. Stat § 360.063. M. Smith was appointed by the other members as Chair of the Board pursuant to the authority of Minn. Stat. § 360.063, subd. 3(b).

B. In 1984 the JAZB adopted the *Minneapolis – St. Paul International Airport (Wold-Chamberlain Field) Zoning Ordinance* (“the Ordinance”) to govern land use and the permitted height of structures, vegetation and other potential obstacles in areas proximate to the Minneapolis-St. Paul International Airport (“the Airport”) and under the approach and departure paths for flights to and from the Airport.

C. Under the provision of the Ordinance, an employee of each of the Entities is designated as the Zoning Administrator who is responsible for administering and enforcing the Ordinance for lands located within each respective Entity.



D. In connection with construction of a new runway at the Airport and with other changes made at the Airport since 1984, the JAZB is considering certain Amendments to the Ordinance (“the Amendments”) that, if formally proposed by the JAZB, must be approved by the Commissioner of the Minnesota Department of Transportation (“the Commissioner”) and adopted by the JAZB before they become effective.

E. If the Amendments are adopted by the JAZB in a form acceptable to MAC, MAC desires that each of the Entities amend its respective comprehensive plan and zoning code to require compliance with the Ordinance as amended by the Amendments (“Amended Ordinance”) and to include the Amended Ordinance as an appendix to its zoning code. MAC also desires that an employee of each Entity act as the Zoning Administrator to administer and enforce the Amended Ordinance within its respective boundaries.

F. The Entities are willing to amend their respective comprehensive plans and zoning codes and to administer and enforce the Amended Ordinance within their respective boundaries. The Entities desire, however, to be protected against possible legal liability that may arise from their doing so.

G. M. Smith desires to be protected against possible legal liability that may arise from serving as Chair of the Board, from actions taken by the Board and by actions taken by the Entities to amend their respective comprehensive plans and zones codes and to administer the Amended Ordinance.

AGREEMENT

In consideration of the mutual promises and consideration set forth herein and other good and valuable consideration, the receipt and sufficiency of which is hereby acknowledged, the parties, intending to be legally bound, agree as follows:

1. **Adoption Of Amendments And Effectiveness:** After the second public hearing on the Amendments, the JAZB shall send its proposed final version of the Amendments to MAC. The MAC Board of Commissioners shall either approve the proposed final draft or respond by stating the changes to the Amendments needed for this Agreement to be acceptable to the MAC. If the JAZB changes the Amendments as set forth by the MAC Board of Commissioners and adopts the Amendments as changed,

and if such Amendments are acceptable to the Commissioner of the Minnesota Department of Transportation, the Agreement shall become effective immediately, provided it has been executed by MAC and the Entities.

2. **Indemnification Of Entities:** In consideration of Entity’s (i) amendment of its comprehensive plan to show the area affected by the Amended Ordinance and to guide land uses in those areas in conformance with the Amended Ordinance, (ii) amendment of its zoning code to incorporate therein a provision requiring compliance with the Amended Ordinance and to add to thereto as an appendix the Amended Ordinance and (iii) designation of one of its employees to act as the Zoning Administrator to administer and enforce the Amended Ordinance within the Entity’s boundaries, MAC agrees that, subject to the other provisions of this Agreement, it will indemnify and hold harmless:

- a. the Entity
- b. any person who serves or has served as the Entity’s representative at meetings of the JAZB;
and
- c. any officer, employee or agent of the Entity, other than an attorney employed or retained by the Entity, who may hereafter be responsible for or participate in administering or enforcing the Amended Ordinance within the Entity’s boundaries,

(collectively, “Indemnified Parties” and individually “an Indemnified Party”) from and against any and all losses, liabilities, obligations, costs, expenses, judgments, settlements or other damages (including reasonable attorneys’ fees and expenses and reasonable costs of investigating or defending any claim, action, suit, or proceeding or of avoiding the same or the imposition of any judgment or settlement), suffered by the Indemnified Party resulting from or arising out of any act of that Indemnified Party in connection with the consideration and adoption of the Ordinance and Amendments by the JAZB, the amendment of its comprehensive plan to show the areas affected by the Amended Ordinance and to guide land uses in those areas in conformance with the Amended Ordinance, the amendment of its zoning code to require compliance with the Amended Ordinance, the incorporation of the Amended Ordinance as an appendix to its zoning code and administration or enforcement of the Amended Ordinance by the Entity.



3. **Indemnification of M. Smith:** In consideration of M. Smith's service as the Chair of the JAZB, MAC agrees that, subject to the other provisions of this Agreement, it will indemnify and hold harmless M. Smith from and against any and all losses, liabilities, obligations, costs, expenses, judgments, settlements or other damages (including reasonable attorneys' fees and expenses and reasonable costs of investigating or defending any claim, action, suit, or protection or of avoiding the same or the imposition of any judgment or settlement) suffered by M. Smith resulting from or arising out of any act of M. Smith as Chair of the JAZB, in connection with the consideration and adoption of the Ordinance and Amendments by the JAZB or out of the acts of the Entities to amend their comprehensive plans to show the areas affected by the Amended Ordinance and to guide land uses in those areas in conformance with the Amended Ordinance, to amend their zoning codes to require compliance with the Amended Ordinance, to incorporate the Amended Ordinance as an appendix to their zoning codes or to administer or enforce the Amended Ordinance. Therefore, for the purposes of this Agreement, M. Smith shall also be an Indemnified Party.

4. **Limitations and Exclusions:** MAC will not indemnify an Indemnified Party with respect to liabilities or costs resulting from or arising out of:

a. a failure by the Indemnified Party or official, employee or agent of the Indemnified Party to follow the procedures established by the Amended Ordinance, by the comprehensive plan or zoning code of the respective Entity or by applicable state law in performing any act as to which indemnification would otherwise be available under this Agreement;

b. the gross negligence or willful misconduct of an Indemnified Party or an official, employee or agent of that Party in performing any of the acts as to which indemnification would otherwise be available under this Agreement;

c. actions involving self-dealing or conflict of interest by the Indemnified Party or an official, employee or agent of the Party; or

d. actions of any individual (whether or not that individual is an Indemnified Party) not performed in an official capacity as a representative of the Entity of which the individual is an official, employee or agent and in direct performance of the individual's duties.

5. **Notice Of Claim:** If an Indemnified Party receives notice of a claim or of the commencement of an action or proceeding with respect to which the Party believes MAC is required by this Agreement to provide indemnification (“Claim”), the Party must give written notice thereof to MAC within 21 calendar days if the Claim is not asserted in a formal complaint (“Notice of Claim”). The failure to give Notice of Claim within the time specified in this section shall relieve MAC of its obligations under this Agreement if in MAC’s reasonable judgment the failure is materially prejudicial to MAC’s ability to negotiate, settle or defend the Claim.

6. **Assumption Or Rejection of Defense:** Within 10 days after receiving a Notice of Claim in accordance with section 5 of this Agreement, MAC must notify the Indemnified Party providing the Notice of Claim either:

a. that MAC will assume complete control of the negotiation, settlement and defense of the Claim and will be responsible for the entire amount of any costs incurred in negotiating, settling and defending the Claim, including any amount required to be paid in settlement of the Claim or in satisfaction of a final judgment, after the conclusion of any appeals, in a lawsuit based on the Claim. MAC must also notify the Indemnified Party of the name and address of the counsel whom it has assigned or retained to perform MAC’s duties under this section. Thereafter, except with the consent of the Indemnified Party, MAC may not enter into any settlement of the Claim that does not include, as an unconditional term of such settlement, receipt from the claimant of an unconditional release to the Indemnified Party from all liability with respect to such Claim; or

b. that the Claim is not a claim for which indemnification is required under this Agreement and that MAC therefore declines to provide indemnification. In such a case, the Indemnified Party may itself control negotiation, settlement and defense of the Claim at its own expense and may select counsel of its own choice for that purpose, and MAC must cooperate with the Indemnified Party in the respects described in sections 7.a, 7.b, 7.c of this Agreement as if MAC were an Indemnified Party.



7. **Cooperation Of The Indemnified Party:** As a condition of MAC's obligation to indemnify and hold harmless, an Indemnified Party and any Entity with which an individual Indemnified Party is associated:

a. must make available to MAC and its counsel all of its books, records and documents that MAC or its counsel determines to be necessary for the defense of any Claim for which indemnification is sought;

b. must cooperate fully with MAC to secure any information or testimony that MAC or its counsel determines to be relevant or material to the Claim;

c. must execute all necessary pleadings or other documents in any litigation arising out of, or with respect to, any Claim when requested to do so by MAC or its counsel; provided however, that an Indemnified Party may have counsel of its own choice review any such pleading or documents, provided that MAC will not be liable for any expenses relating to an Indemnified Party's consulting such separate counsel; and

d. must not settle or compromise any Claim for which MAC has undertaken the Indemnified Party's defense without the prior written consent of MAC.

8. **Termination Of Indemnification Obligation:** MAC's obligation to provide indemnification pursuant to section 2 of this Agreement will terminate:

a. as to an Entity and any Indemnified Party associated with that entity, if the Entity, having amended its respective comprehensive plan and zoning code as required by section 2 of this Agreement as a condition of its becoming eligible for indemnification, thereafter further amends its comprehensive plan or zoning code so as to change materially the provisions previously adopted pursuant to section 2 of this Agreement;

b. as to any Indemnified Party, if the Indemnified Party or an Entity with which an individual Indemnified Party is associated fails to perform any of its obligations under section 7 of this Agreement and does not correct such failure within 30 days after being given notice by MAC that MAC will cease to provide indemnification if the failure is not corrected;

c. as to any Indemnified Party, if the Indemnified Party or an Entity with which an individual Indemnified Party is associated fails to perform its obligations under section 5 of this Agreement and if such failure is not materially prejudicial to MAC's ability to negotiate, settle or defend the Claim; or

d. as to any Indemnified Party, if, after MAC has assumed responsibility for a Claim under section 6 of this Agreement, MAC or a court or other adjudicating entity subsequently determines that the Claim is of a type described in section 4 of this Agreement, as to which no indemnification is required, in which case MAC must promptly notify the Indemnified Party that it will no longer provide indemnification. MAC agrees to notify an Indemnified Party promptly if MAC determines that one of the Limitations of Exclusions in section 4 may apply. In the case of a termination pursuant to section 8.d of this Agreement, MAC shall be entitled to reimbursement of its costs incurred pursuant to section 6.a of this Agreement, and upon receipt of an itemized bill for those costs from MAC, the Indemnified Party shall promptly reimburse MAC for the billed costs.

9. **Separate Representation Of Indemnified Party:** If an Indemnified Party reasonably determines that there may be a conflict between the positions of MAC and the Indemnified Party in connection with the defense of a Claim, or that there may be legal defenses available to the Indemnified Party different from or in addition to those being asserted on its behalf by MAC, counsel for the Indemnified Party may conduct, at the Indemnified Party's own expense and at no expense to MAC, a defense to the extent that the Indemnified Party's counsel believes necessary to protect that Indemnified Party's interests. In any event, the Indemnified Party shall be responsible for all fees and expenses of its separate counsel arising from or related to the defense of a Claim for which MAC has assumed responsibility under section 6 of this Agreement.

10. **Resolution Of Disputes Between Parties:** If a dispute arises between MAC and an Indemnified Party concerning either party's compliance with or obligations under this Agreement and the parties are unable to resolve the dispute by negotiation or other procedure (including mediation or



arbitration) on which the parties may agree at the time, any lawsuit arising from the dispute must be filed in the Minnesota District Court for the Fourth Judicial District (Hennepin County).

11. **Notice:** Any notice, direction, or instrument to be delivered hereunder shall be in writing and shall be delivered to the following:

To MAC: Metropolitan Airports Commission
Attn: Thomas W. Anderson, Esq.
General Counsel
6040 28th Avenue South
Minneapolis, MN 55450-2779

To City of Bloomington: City of Bloomington
Attn: Mark Bernhardson
City Manager
2215 West Old Shakopee Road
Bloomington, MN 55431-3096

To City of Eagan: City of Eagan
Attn: Thomas L. Hedges
City Administrator
3830 Pilot Knob Road
Eagan, MN 55122

To City of Mendota: City of Mendota
P.O. Box 50688
Mendota, MN 55150

To City of Mendota Heights: City of Mendota Heights
Attn: Mayor Charles E. Mertenson
1101 Victoria Curve
Mendota Heights, MN 55118

To City of Minneapolis: City of Minneapolis
Attn: Charles D. Ballentine
Director of Planning
350 South Fifth Street
Minneapolis, MN 55415-1385

To City of Richfield: City of Richfield
Attn: Samantha Orduno
City Manager
6700 Portland Avenue South
Richfield, MN 55432

To City of Saint Paul: City of Saint Paul
Attn: Mayor Randy Kelly
390 City Hall
St. Paul, MN 55102

To County of Hennepin: Office of the Hennepin County Attorney
Attn: Mark Chapin
Managing Attorney
A200 Government Center
Minneapolis, MN 55487

To M. Smith: Mary Hill Smith
515 North Ferndale Road
Wayzata, MN 55391

Such notice shall be either (i) personally delivered (including delivery by Federal Express or other overnight courier service) to the addresses set forth above, in which case it shall be deemed delivered on the date of delivery to said offices, or (ii) sent by certified U.S. Mail, return receipt requested, in which case it shall be deemed delivered on the date shown on the receipt unless delivery is refused or delayed by the addressee, in which event it shall be deemed delivered on the 3rd business day following deposit in the U.S. mail.

Parties may change to whom notice shall be given by giving notice in accordance with this section, provided that no party may require notice to be sent to more than two addresses.

Any individual who claims entitlement to indemnification under this Agreement must include with the Notice of Claim required by section 6 of this Agreement the address to which any notice, direction or instrument under this paragraph should be delivered to that individual.

12. **Caption:** The section headings in this Agreement are for convenience of reference only any shall not define, limit, or prescribe the scope or intent of any provision of this Agreement.

13. **Construction:** The rule of strict construction shall not apply to this Agreement. The Agreement shall not be interpreted in favor of or against either MAC or any Indemnified Party merely because of their respective efforts in preparing it.

14. **Governing Law:** This Agreement shall be governed by the laws of the State of Minnesota.

15. **Complete Agreement Amendment:** This Agreement sets forth the complete agreement of the parties with respect to its subject matter. It may be amended, modified or waived as between MAC and any Indemnified Party only by a writing signed by both of them.

16. **Signatures:** This Agreement may be executed in any number of counterparts each of which when so executed shall be deemed to be an original, and such counterparts together shall



constitute and be one and the same instrument. Each signatory below represents and warrants that he or she is expressly authorized to enter into this Agreement on behalf of the Party for which that person is signing.

**INDEMNIFICATION AND COOPERATION AGREEMENT
REGARDING THE WOLD-CHAMBERLAIN FIELD
JOINT AIRPORT ZONING BOARD AND THE
MINNEAPOLIS-ST. PAUL INTERNATIONAL
AIRPORT ZONING ORDINANCE**

SIGNATURE PAGE

IN WITNESS WHEREOF, the undersigned have caused this Indemnification and Cooperation Agreement to be executed for the City of Bloomington

Dated: 4/17/03

By: *Paul Pastorek*

Reviewed and approved by the
City Attorney.

John Smith
City Attorney

Title: Mayor

Witness: *Kathleen Eiler*

Title: Legal Secretary

By: *M. J. Johnson*

Title: City Manager

Witness: *Kathleen Eiler*

Title: Legal Secretary

Sample Avigation & Noise Easement: City of South St. Paul, Minnesota

Warranty Deed Document No. 1596848/October 15, 1999

1. Reserving unto the Grantor, for the use and benefit of the public, a perpetual avigation and noise easement and right of way for the unobstructed and unrestricted flight of aircraft above the transition surface airspace described as follows:

All area of Lots 1 to 10, inclusive, Block 1, Village Heights 2nd Addition, according to the recorded plat thereof, above an imaginary surface which at the Southwest corner of Block 1, Village Heights 2nd Addition has an elevation of 879.48 and at the Northwest corner of Lot 34, Block 1, Village Heights has an elevation of 954.72; the line connecting these points on the imaginary surface being above the east right-of-way line of Florence Street, as dedicated in Inver Grove Factory Addition, according to the recorded plat thereof (also known as Cooper Avenue), and the elevation of any point on that line being proportional to the distance between the points and the elevations of the imaginary surface at these points; the surface then slopes upward from this line in an easterly direction on a bearing of North 43 Degrees, 16 Minutes, 34 Seconds East at a ratio of one foot vertical for each seven feet horizontally to an elevation of 970.00, after which the elevation remains constant (all elevations are feet above mean sea level);

Together with the right to go upon, over and across the real estate hereby conveyed by means of any and all noise of any kinds, or at any level, which may now or may hereafter, directly or indirectly, arise from the flights of aircraft above the transition surface airspace free of any claims by Grantee, or Grantees successors, heirs, personal representatives, or assigns, that noise from the flight of aircraft is an unreasonable interference with the use and enjoyment of, or reduces the value of the real estate hereby conveyed.

2. Reserving unto the Grantor an easement in and upon the following described real property for the maintenance, repair and replacement of a fence located on, or to be located on, land located westerly thereof and abutting thereon:

That part of Block 1, Village Heights 2nd Addition according to the recorded plat thereof, that lies westerly of a line parallel to and ten (10) feet easterly of the westerly line of said Block 1.

3. Covenants, conditions, restrictions, declarations, and easements of record, if any.

4. Liens, encumbrances, adverse claims, and other matters which Grantee has created, suffered, or permitted to occur after January 22, 1998.



Sample Avigation Easement: California

Avigation Easement—Avigation easements transfer certain property rights from the owner of the underlying property to the owner of an airport. A decision-making body may require avigation easement dedication as a condition for approval of development on property subject to high noise levels or a need to restrict heights of structures and trees to less than might ordinarily occur on the property. Also, airports may require avigation easements in conjunction with programs for noise insulation of existing structures in the airport vicinity. A sample of a standard avigation easement is shown below:

TYPICAL AVIGATION EASEMENT (CALIFORNIA)

This indenture made this ____ day of _____, 20____, between _____ herein after referred to as Grantor, and the [Insert County or City name], a political subdivision in the State of California, hereinafter referred to as Grantee.

The Grantor, for good and valuable consideration, the receipt and sufficiency of which are hereby acknowledged, does hereby grant to the Grantee, its successors and assigns, a perpetual and assignable easement over the following described parcel of land in which the Grantor holds a fee simple estate. The property which is subject to this easement is depicted as _____ on “Exhibit A” attached and is more particularly described as follows:

[Insert legal description of real property]

The easement applies to the Airspace above an imaginary plane over the real property. The plane is described as follows:

The imaginary plane above the hereinbefore described real property, as such plane is defined by Part 77 of the Federal Aviation Regulations, and consists of a plane [describe approach, transition, or horizontal surface]; the elevation of said plane being based upon the _____ Airport official runway end elevation of _____ feet Above Mean Sea Level (AMSL), as determined by [Insert name and Date of Survey or Airport Layout Plan that determines the elevation] the approximate dimensions of which said plane are described and shown on Exhibit A attached hereto and incorporated herein by reference.

The aforesaid easement and right-of-way includes, but is not limited to:

- (1) For the use and benefit of the public, the easement and continuing right to fly, or cause or permit the flight by any and all persons, or any aircraft, of any and all kinds now or hereafter known, in, through, across, or about any portion of the Airspace hereinabove described; and
- (2) The easement and right to cause or create, or permit or allow to be caused or created within all space above the existing surface of the hereinabove described real property and any and all Airspace laterally adjacent to said real property, such noise, vibration, currents and other effects of air, illumination, and fuel consumption as may be inherent in, or may arise or occur from or during the operation of aircraft of any and all kinds, now or hereafter known or used, for navigation of or flight in air; and
- (3) A continuing right to clear and keep clear from the Airspace any portions of buildings, structures, or improvements of any kinds, and of trees or other objects, including the right to remove or demolish those portions of such buildings, structures, improvements, trees, or other things which extend into or above said Airspace, and the right to cut to the ground level and remove, any trees which extend into or above the Airspace; and

(4) The right to mark and light, or cause or require to be marked or lighted, as obstructions to air navigation, any and all buildings, structures, or other improvements, and trees or other objects, which extend into or above the Airspace; and

(5) The right of ingress to, passage within, and egress from the hereinabove described real property, for the purposes described in subparagraphs (3) and (4) above at reasonable times and after reasonable notice.

For and on behalf of itself, its successors and assigns, the Grantor hereby covenants with the [Insert County or City name], for the direct benefit of the real property constituting the _____ Airport hereinafter described, that neither the Grantor, nor its successors in interest or assigns will construct, install, erect, place or grow in or upon the hereinabove described real property, nor will they permit to allow, any building structure, improvement, tree or other object which extends into or above the Airspace, or which constitutes an obstruction to air navigation, or which obstructs or interferes with the use of the easement and rights-of-way herein granted.

The easements and rights-of-way herein granted shall be deemed both appurtenant to and for the direct benefit of that real property which constitutes the _____ Airport, in the [Insert County or City name], State of California; and shall further be deemed in gross, being conveyed to the Grantee for the benefit of the Grantee and any and all members of the general public who may use said easement or right-of-way, in landing at, taking off from or operating such aircraft in or about the _____ Airport, or in otherwise flying through said Airspace.

Grantor, together with its successors in interest and assigns, hereby waives its right to legal action against Grantee, its successors, or assigns for monetary damages or other redress due to impacts, as described in Paragraph (2) of the granted rights of easement, associated with aircraft operations in the air or on the ground at the airport, including future increases in the volume or changes in location of said operations. Furthermore, Grantor, its successors, and assigns shall have no duty to avoid or mitigate such damages through physical modification of airport facilities or establishment or modification of aircraft operational procedures or restrictions. However, this waiver shall not apply if the airport role or character of its usage (as identified in an adopted airport master plan, for example) changes in a fundamental manner which could not reasonably have been anticipated at the time of the granting of this easement and which results in a substantial increase in the impacts associated with aircraft operations. Also, this grant of easement shall not operate to deprive the Grantor, its successors or assigns, of any rights which may from time to time have against any air carrier or private operator for negligent or unlawful operation of aircraft.

These covenants and agreements run with the land and are binding upon the heirs, administrators, executors, successors and assigns of the Grantor, and, for the purpose of this instrument, the real property firstly hereinabove described is the servient tenement and said _____ Airport is the dominant tenement.

DATED: _____

STATE OF

ss

COUNTY OF

On _____, before me, the undersigned, a Notary Public in and for said County and State, personally appeared _____, and _____ known to me to be the persons whose names are subscribed to the within instrument and acknowledged that they executed the same.

WITNESS my hand and official seal.

Notary Public



Sample Deed Notice – California

Recorded Deed Notice—Deed notices are a form of buyer awareness measure whose objective is to ensure that prospective buyers of airport area property, particularly residential property, are informed about the airport’s impact on the property. Unlike easements, deed notices do not convey property rights from the property owner to the airport and do not restrict the height of objects. They only document the existence of certain conditions which affect the property—such as the proximity of the airport and common occurrence of aircraft overflights at or below the airport traffic pattern altitude. A decision-making body may make recording of deed notices a requirement for project approval within portions of the airport influence area where aviation easements are not essential.

TYPICAL DEED NOTICE (CALIFORNIA)

A statement similar to the following should be included on the deed for any real property subject to the deed notice requirements set forth in the [Insert ALUC name] *Airport Land Use Compatibility Plan*. Such notice should be recorded by the county of [Insert County name]. Also, this deed notice should be included on any parcel map, tentative map, or final map for subdivision approval.

The *Airport Land Use Compatibility Plan* and [Insert County/City name] Ordinance (Ordinance No. _____) identify a [Insert Airport name] Airport Influence Area. Properties within this area are routinely subject to overflights by aircraft using this public-use airport and, as a result, residents may experience inconvenience, annoyance, or discomfort arising from the noise of such operations. State law (Public Utilities Code Section 21670 et seq.) establishes the importance of public-use airports to protection of the public interest of the people of the state of California. Residents of property near such airports should therefore be prepared to accept the inconvenience, annoyance, or discomfort from normal aircraft operations. Residents also should be aware that the current volume of aircraft activity may increase in the future in response to [Insert County name] County population and economic growth. Any subsequent deed conveying this parcel or subdivisions thereof shall contain a statement in substantially this form.

Sample Noise Easement – Oregon

THIS AGREEMENT, made this _____ day of _____, 20____, between the _____ (Airport Authority), a municipal corporation of the State of Oregon, hereinafter referred to as “Grantee”; The Grantor does hereby grant, in consideration for the right to develop the subject property for residential use, pursuant to City Planning and Zoning Code, Chapter _____ (No.), to the Grantee, its successors and assigns, to have and to hold an easement for aircraft noise impact until _____ shall be abandoned or shall cease to be used for airport purposes, over the following described parcel of land situated in the County of _____, State of Oregon, as follows:

(Legal description and street address of Grantor’s parcel of land)

Said Easement shall encompass the right, in the airspace above the surface of the Grantor’s property having the same boundaries as the above described property and extending from the surface upwards to the limits of the atmosphere of the earth, to cause in said airspace a maximum of such noise as reflected by the Noise Impact Zone Map adopted by City Ordinance _____ (No.). This easement is only applicable to airport noise caused from runway alignments existing in _____ (Year). More specifically, the noise created by aircraft now known or hereafter used for navigation of or flight in air, shall not exceed the permitted annual average DNL level obtained by using established measurement standards and procedures. The permitted



annual average DNL level shall not be greater than the annual average DNL level established in _____ (Year), or the most recent annual average DNL established, pursuant to Section _____ (No.), prior to the date of said Easement, whichever is the lesser. If the permitted annual average DNL level can be shown to have been exceeded, as provided for by Section _____ (No.), said Easement shall be void.

The granting of said Easement shall establish the Grantor’s right to develop the above-described parcel of land for residential use. The Grantor’s execution and offering of said Easement is sufficient to fulfill the requirements for the issuing of a building permit if all other zoning requirements have been met.

It is understood and agreed that these covenants and agreements shall run with the land, that notice shall be made to and shall be binding upon heirs, administrators, executors, successors, and assigns of the Grantor.

IN WITNESS WHEREOF, the Grantor has hereunto set his hand and seal this

_____ day of _____, 20_____.

Grantor

Sample Avigation and Hazard Easement – Oregon

WHEREAS, (full name of property owner(s)) hereinafter called the Grantors, are the owners in fee of that certain parcel of land situated in the City of _____, County of _____, State of _____, more particularly described as follows:

(Full description of property to be covered by easement)

hereinafter called “Grantors’ property,” and outlined on the attached map (Exhibit 1); NOW, THEREFORE, in consideration of the sum of _____ dollars (\$_____) and other good and valuable consideration, the receipt and sufficiency of which is hereby acknowledged, the Grantors, for themselves, their heirs, administrators, executors, successors, and assigns, do hereby grant, bargain, sell, and convey unto (owner and operator of airport, i.e., City of _____) hereinafter called the Grantee, its successors and assigns, for the use and benefit of the public, as easement and right of way, appurtenant to (full name of airport) or the unobstructed passage of all aircraft, (“aircraft” being defined for the purpose of this instrument of any contrivance now known or hereafter invented, used, or designed for navigation of or flight in the air) by whomsoever owned and operated.

In the airspace above Grantors’ property above an imaginary plane rising and extending in a general (i.e., Easterly) direction over Grantors’ property, said imaginary plane running from approximately (i.e., 25) feet Mean Sea level above Point A on Exhibit 1 at the rate of one foot vertically for each (i.e., 50) feet horizontally to approximately (i.e., 55) feet Mean Sea level above Point B on Exhibit 1, to an infinite height above said imaginary plane,1

(OR USE THE FOLLOWING)



in the airspace above Grantors' property above a Mean Sea level of (i.e., 150) feet, to an infinite height above said Mean Sea level of (i.e., 150) feet,¹ [Alternative language depending upon desired coverage of easement]

(OR USE THE FOLLOWING)

in all airspace above the surface of Grantors' property, to an infinite height above said Grantors' property.⁽¹⁾

Together with the right to cause in all airspace above the surface of Grantors' property such noise, vibrations, fumes, dust, fuel particles, and all other effects that may be caused or may have been caused by the operation of aircraft landing at, or taking off from, or operating at or on said _____ (full name of airport).

The easement and right of way hereby granted includes the continuing right in the Grantee to prevent the erection or growth upon Grantors' property of any building, structure, tree, or other object, extending into the airspace above the aforesaid imaginary plane,

(OR USE THE FOLLOWING)

extending into the airspace above the said Mean Sea level of (i.e., 150) feet,¹

(OR USE THE FOLLOWING)

extending into the airspace above the surface of Grantors' property;¹

and to remove from said airspace, or at the sole option of the Grantee, as an alternative, to mark and light as obstructions to air navigation, any such building, structure, tree or other objects now upon, or which in the future may be upon Grantors' property, together with the right of ingress to, egress from, and passage over Grantors' property for the above purposes.

TO HAVE AND TO HOLD said easement and right of way, and all rights appertaining thereto unto the Grantee, its successors, and assigns, until said (full name of airport) shall be abandoned and shall cease to be used for public airport purposes.

AND for the consideration hereinabove set forth, the Grantors, for themselves, their heirs, administrators, executors, successors, and assigns, do hereby agree that for and during the life of said easement and right of way, they will not hereafter erect, permit the erection or growth of, or permit or suffer to remain upon Grantors' property any building, structure, tree, or other object extending into the aforesaid prohibited airspace, and that they shall not hereafter use or permit or suffer the use of Grantors' property in such a manner as to create electrical interference with radio communication between any installation upon said airport and aircraft, or as to make it difficult for flyers to distinguish between airport lights and others, or as to impair visibility in the vicinity of the airport or as otherwise to endanger the landing, taking off, or maneuvering of aircraft, it being understood and agreed that the aforesaid covenants and agreements shall run with the land.

In consideration of the premises and to assure Grantee of the continued benefits accorded it under this Easement, (name of mortgagee), owner and holder of a mortgage dated _____ and recorded _____ covering the premises above described, does hereby covenant and agree that said mortgage shall be subject to and subordinate to this Easement and the recording of this Easement shall have preference and precedence and shall be superior and prior in lien to said mortgage irrespective of the date of the making or recording of said mortgage instrument.² [2 Local recordation and subordination practices must also be met. If subordination is necessary, in which case the mortgagee must join in the agreement, the above language is suggested.]

IN WITNESS WHEREOF, the Grantors have hereunto set their hands and seals this _____ day of _____, 20_____.

Signed, sealed, and delivered in the presence of:

_____ (SEAL)

_____ (SEAL)

(Notarial Acknowledgment)

Sample Hold Harmless Agreement – Oregon

KNOW ALL MEN BY THESE PRESENTS, that the undersigned, hereinafter referred to as Grantees (whether singular or plural), hereby covenant and agree that they shall not, by reason of their ownership or occupation of the following described real property, protest or bring suit or action against the _____ Airport or the City (County) of _____ for aviation related noise, property damage or personal injuries resulting from activities at or connected with the _____ Airport when such activities conform to the then existing rules and regulations of said airport and the applicable federal air regulations and no negligence on the part of said airport is involved. The real property of Grantees subject to this covenant and agreement is situated in the County of _____, State of Oregon, and described as follows:

(Insert Legal Description and Appropriate Map)

This covenant and agreement is made and executed by the Grantees in consideration of the City (County) of _____ granting a conditional use permit for Grantees use and development of the above described real property, which real property is located in the airport approach zone of the _____ Airport. The execution of this covenant and agreement by Grantees is required by the City (County) of _____ as a prerequisite to the granting of the above said conditional use permit to Grantees. This agreement is executed for the protection and benefit of the _____ Airport and the City (County) of _____ interest in said airport and to prevent development in adjacent lands to said airport which will interfere with the continued operation existent and development of said airport. This covenant and agreement is intended to be binding upon the Grantees, their heirs, assigns, and successors and inure to the benefit of the City (County) of _____ and the Airport, their successors and assigns.

DATED this _____ day of _____, 20_____.

(STATE OF OREGON) GRANTEES:

ss. _____



City/County of _____

Sample Fair Disclosure Statement – Oregon

A disclosure statement, adhering to the form of the statement below, shall be provided to and signed by each potential purchaser of property within the Airport Influence Area as shown on the approved Airport Land Use Drawing. The signed statement will then be affixed by the Seller to the agreement of the sale.

The tract of land situated at

in _____ (County and State), consisting of approximately _____ acres which is being conveyed from _____ to _____ lies within

_____ miles of _____ (airport name) may be subjected to varying noise levels, as the same is shown and depicted on the official Zoning Maps.

CERTIFICATION

The undersigned purchaser(s) of said tract of land certify(ies) that (he) (they) (has) (have) read the above disclosure statement and acknowledge(s) the preexistence of the airport named above and the noise exposure due to the operation of said airport.

(SIGNED)

Suggested Disclosure To Real Estate Buyers – Oregon

Customarily, someone will request a letter from the municipality about outstanding charges and assessments against a property. Something similar to this language, adapted for your airport, can be incorporated into a letter sent to buyers and title companies in preparation for closing.

“Please be advised that the subject property is located within the height restriction zone of the (blank) airport, or is located within a similar distance from the airport. It is conceivable that standard flight patterns would result in aircraft passing over (or nearly so) the property at altitudes of less than (blank) feet. Current airport use patterns suggest that the average number of takeoffs/touchdowns exceeds (blank) annually. A property buyer should be aware that use patterns vary greatly, with the possibility of increased traffic on (blank). The airport presently serves primarily recreational aircraft, and there are no current initiatives to extend any runway beyond the current (blank) length. Airport plans allow for runway extension in the future, which might impact the number and size of both pleasure and non-pleasure aircraft. Generally, it is not practical to redirect or severely limit airport usage and/or planned-for expansion, and residential development proximate to the airport ought to assume, at some indefinite date, an impact from air traffic.”

APPENDIX 11: FAA 7460-1 FORM (SAMPLE)

Form Approved OMB No. 2120-0001

FAA Form 7460-1 (2-99) Supercedes Previous Edition

NSN: 0052-00-012-0008



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APPENDIX 12: PLANTS ATTRACTIVE TO WILDLIFE

Listings within groups are in order of extent of use, which in some cases may be affected by availability.

| Plants Extensively Used as Food by Wildlife ¹⁶ | | | |
|---|-------------------------------|------------------|--------------------------------------|
| Woody Plants | | | |
| Alder | <i>Alnus spp.</i> | Maple | <i>Acer spp.</i> |
| Aspen | <i>Populus spp.</i> | Mesquite | <i>Prosopis spp.</i> |
| Beech | <i>Fagus grandifolia</i> | Mulberry | <i>Morus spp.</i> |
| Birch | <i>Betula spp.</i> | Oak | <i>Quercus spp.</i> |
| Blackberry | <i>Rubus spp.</i> | Persimmon | <i>Diospyros spp.</i> |
| Blackgum | <i>Nyssa sylvatica</i> | Pine | <i>Pinus spp.</i> |
| Blueberry | <i>Vaccinium spp.</i> | Poison Ivy | <i>Toxicodendron radicans</i> |
| Cedar | <i>Juniperus spp.</i> | Pricklypear | <i>Opuntia spp.</i> |
| Dogwood | <i>Cornus spp.</i> | Sagebrush | <i>Artemisia spp.</i> |
| Douglas-fir | <i>Pseudotsuga taxifolia</i> | Saltbush | <i>Atriplex spp.</i> |
| Elderberry | <i>Sambucus spp.</i> | Serviceberry | <i>Amelanchier spp.</i> |
| Fir | <i>Abies spp.</i> | Snowberry | <i>Symphoricarpos</i> |
| Gooseberry | <i>Grossularia</i> | Spruce | <i>Picea spp.</i> |
| Grape | <i>Vitis spp.</i> | Sumac | <i>Rhus spp.</i> |
| Greenbrier | <i>Smilax spp.</i> | Virginia creeper | <i>Parthenocissus spp.</i> |
| Hackberry | <i>Celtis spp.</i> | Wild cherry | <i>Prunus spp.</i> |
| Holly | <i>Ilex spp.</i> | Willow | <i>Salix spp.</i> |
| Manzanita | <i>Arctostaphylos spp.</i> | | |
| Upland Weeds and Shrubs | | | |
| Bluegrass | <i>Poa spp.</i> | Gramma grass | <i>Bouteloua spp.</i> |
| Bristlegrass | <i>Setaria spp.</i> | Knotweed | <i>Polygonum spp.</i> |
| Brome grass | <i>Bromus spp.</i> | Oats | <i>Avena spp.</i> |
| Chickweed | <i>Stellaria media</i> | Panic Grass | <i>Panicum spp.</i> |
| Clover | <i>Trifolium spp.</i> | Pigweed | <i>Amaranthus spp.</i> |
| Crabgrass | <i>Digitaria spp.</i> | Ragweed | <i>Ambrosia spp.</i> |
| Deervetch | <i>Lotus spp.</i> | Russian thistle | <i>Salsola kali</i> |
| Doveweed | <i>Croton spp.</i> | Sedge | <i>Carex spp.</i> |
| Dropseed grass | <i>Sporobolus spp.</i> | Sunflower | <i>Helianthus spp.</i> |
| Fescue | <i>Festuca spp.</i> | Tarweed | <i>Madia spp. and Hemizonia spp.</i> |
| Filaree | <i>Erodium spp.</i> | Turkey Mullein | <i>Eremocarpus setigerus</i> |
| Goosefoot | <i>Chenopodium spp.</i> | | |
| Marsh and Aquatic Plants | | | |
| Algae | <i>Chlorophyta</i> | Pondweed | <i>Potamogeton spp.</i> |
| Arrowhead | <i>Sagittaria spp.</i> | Saltgrass | <i>Distichlis spp.</i> |
| Bulrush | <i>Scirpus spp.</i> | Smartweed | <i>Polygonum spp.</i> |
| Burreed | <i>Sparganium spp.</i> | Spikerush | <i>Eleocharis spp.</i> |
| Cordgrass | <i>Spartina spp.</i> | Water lily | <i>Nymphaea spp.</i> |
| Duckweed | <i>Lemna spp.</i> | Weidgeongrass | <i>Ruppia maritime</i> |
| Horned-pondweed | <i>Zannichellia palustris</i> | Wildcelery | <i>Vallisneria spiralis</i> |
| Muskgrass | <i>Chara spp.</i> | Wildmillet | <i>Echinochloa spp.</i> |
| Naiad | <i>Najas spp.</i> | Wildrice | <i>Zizania aquatica</i> |
| Cultivated Plants | | | |
| Alfalfa | <i>Medicago sativa</i> | Grape | <i>Vitis</i> |
| Apple | <i>Malus pumila</i> | Oats | <i>Avena sativa</i> |
| Barley | <i>Hordeum vulgare</i> | rice | <i>Oryza sativa</i> |

¹⁶ Sources: Martin, A.C., H.S., Zim, and A.L. Nelson. 1961. American wildlife and plants. Dover Publications, N.Y. 500 pp. Lefebvre, p.W., and D.F. Mott. 1987. Reducing bird/aircraft hazards through control of bird nesting, roosting, perching, and feeding. Section of Bird Control, Denver Wildl. Res. Ctr., ADC/APHIS/USDA, Denver, CO., Bird Damage Res. Rept. 390 . 91 pp.



| | | | |
|---|-------------------------------|-------------------------------|-------------------------------------|
| Cherry | <i>Prunus spp.</i> | Sorghum | <i>Sorghum vulgare</i> |
| Corn | <i>Zea mays</i> | Wheat | <i>Triticum spp.</i> |
| Ornamental Trees and Shrubs Attractive to Birds¹⁷ | | | |
| Serviceberry | <i>Amelanchier canadensis</i> | Russian olive | <i>Eleagnus angustifolia</i> |
| Alleghany serviceberry | <i>A. laevis</i> | American beech | <i>Fagus grandifolia</i> |
| Yellowbirch | <i>Betula lutea</i> | Purple beech | <i>F. sylvatica</i> |
| Gray birch | <i>B. populifolia</i> | Weeping birch | <i>F. sylvatica</i> |
| River birch | <i>B. nigra</i> | Betchel crabapple | <i>Malus ioensis</i> |
| Paper birch | <i>B. papyrifera</i> | Pissard plum | <i>Prunus cerasifers</i> |
| Western white birch | <i>B. commutate</i> | Amur choke cherry | <i>P. maackii</i> |
| Flowering dogwood | <i>Cornus florida</i> | May Day tree | <i>P. padus commutate</i> |
| Japanese dogwood | <i>C. kousa</i> | Autumn Flowering Higan cherry | <i>P. subhirtella</i> |
| Cornelian cherry | <i>C. mas</i> | Shubert choke cherry | <i>P. virginiana</i> |
| Pacific dogwood | <i>C. nuttali</i> | White cedar | <i>Thuja occidentalis</i> |
| Cockspur thorn | <i>Crataegus crus-galli</i> | Hedge cotoneaster | <i>C. lucida</i> |
| Toba hawthorn | <i>C. x mordensis "Toba"</i> | Witchhazel | <i>Hamamelis virginiana</i> |
| English hawthorn | <i>C. oxyacantha</i> | Oregon grape | <i>Mahonia aquifolium</i> |
| Paul's scarlet hawthorn | <i>C. sp.</i> | Virginia creeper | <i>Parthenocissus quinguenfolia</i> |
| Cutleaf peashrub | <i>Caragan arborescens</i> | Western sand cherry | <i>P. tomentosa</i> |
| Weeping caragana | <i>C. arborescens</i> | Flowering almond | <i>P. triloba</i> |
| Tidy caragana | <i>C. microphylla</i> | Alpine currant | <i>Ribes alpinum</i> |
| Silverleaf dogwood | <i>Cornus alba</i> | Austrian brier rose | <i>Rosa foetida</i> |
| Siberian dogwood | <i>C. alba</i> | Shining rose | <i>R. nitida</i> |
| Yellowdoe dogwood | <i>C. alba</i> | Redleaf rose | <i>R. rubrifolia</i> |
| Red osier dogwood | <i>C. stolonifera</i> | Burnett rose | <i>R. spinosissima</i> |
| Yellow twig dogwood | <i>C. stolonifera</i> | Korean spice viburnum | <i>Viburnum carlesii</i> |
| Peking cotoneaster | <i>Cotoneaster acutifolia</i> | Wayfaring tree | <i>V. lantana</i> |
| Early cotoneaster | <i>C. adpressa praecox</i> | European highbush cranberry | <i>V. opulus</i> |
| Rockspray cotoneaster | <i>C. horizontalis</i> | | |

¹⁷ Sources: Thomas, W.A. (Coordinator). 1977. Airport grounds development and maintenance manual. Airports and Construction Services Directorate (Canada).

Lefebvre, p.W., and D.F. Mott. 1987. Reducing bird/aircraft hazards through control of bird nesting, roosting, perching, and feeding. Section of Bird Control, Denver Wildl. Res. Ctr., ADC/APHIS/USDA, Denver, CO., Bird Damage Res. Rept. 390 . 91 pp.

APPENDIX 13: WILDLIFE MANAGEMENT

*Background*¹⁸

The management of wildlife on and near airports is not usually an easily solved problem. This management can be as diverse as habitat manipulation to use of predators to repelling wildlife to lethal control of wildlife. Types of wildlife associated with safety issues at airports include birds, mammals and reptiles. This section contains sources/references the reader may find useful in establishment of a personal management plan for their local airport.

Birds

Birds make-up 97% of the reported strikes, mammals about 3%, and reptiles less than 1% of reported strikes. (FAA) The large number of bird strikes has resulted in a major effort by United States and Canadian airports officials to find ways to handle this problem, including the establishment of a Bird Strike Committee. The following resources provide information on controlling birds at the airport:

- USA Bird Strike Committee: Committee devoted to reducing bird strike risk in aviation
- Male Border Collie Lands Ever Hound's Dream Job: "Using Border Collies to Control Birds At Airports," (Chicago Tribune article)
- Airport Wildlife Management: Developing a wildlife control plan
- Alaska Regional Initiatives: Bird/Wildlife Hazard Reduction: Discusses Challenges and Plan For Bird/Wildlife Management.

Habitat

Animals are attracted to areas that reflect their natural habitat and provide basic living needs such as food and water. By understanding and controlling possible animal habitats at the airport, wildlife strike risk can be reduced. For additional information on habitat modification or other procedures for controlling hazardous wildlife at airports, see FAA's Wildlife Hazardous Management at Airports and the Transport Canada Control Procedures Manual Habitat Modification.



AIRPORT PLANNING

Airport planning plays an important role in bird strike hazard reduction. Proper planning of an airport can help to recognize land uses on or near the airport site that can potentially attract wildlife. By controlling these

¹⁸ The following information has been excerpted from the FAA's Airport Technology R & D Branch website link: <http://wildlife.pr.erau.edu/WildlifeManagement.htm>



land uses, bird strike hazard can be reduced. From archival data, it has been found that some of the most hazardous wildlife to airport operations include:

- Gulls
- Waterfowl
- Raptors
- Deer

Land uses that attract these species of wildlife include:

- Putrescible-waste disposal operations
- Wastewater treatment facilities
- Wetlands
- Dredge spoil containment areas

Recognizing existing wildlife attractants, as well as mitigating the creation of new wildlife attractants on or near the airport will help to reduce the risk of wildlife strikes. For more information, see the FAA Circular 150/5200-33, [Hazardous Wildlife Attractants On or Near Airports](#) and Transport Canada's [Land Uses in the Vicinity of the Airport](#) - Planning Guidelines.

HABITAT DETERRENCE

Improper landscaping can attract animals to the airport and create wildlife hazards, while proper landscaping can deter animals away. Some plants provide food or shelter for potentially hazardous wildlife and should be avoided, while other plants may repel wildlife. Habitat deterrence is an effort to create an environment around the airport that is unattractive to potentially hazardous animals.

For more information on deterrent landscaping, please refer to the following resources, which may be found at the FAA's website:

- Landscaping to Avoid Wildlife Conflicts
- Trees That Deer Don't Like
- Shrubs That Deer Don't Like
- Bedding Plants That Deer Don't Like
- Climbers, Vines & Ground Covers That Deer Don't Like

GENERAL DETERRENCE

- Wildlife Management Library (Kansas State University)
- Prevention and Control of Wildlife Damage (University of Nebraska - Lincoln)
- USDA/APHIS/Wildlife Service Publications (US Dept of Agriculture)

OTHER HABITAT INFORMATION

Understanding an animal's habitat is key to creating a habitat deterrence. The following resources provide information as to the habitats of many different species.

- Animal fact sheets (University of Florida Extension, Institute of Food & Agricultural Sciences)
- Wildlife Species Life Form (US Dept of Agriculture, Forest Service)
- Wildlife Species Life Form--Mammal List (US Dept of Agriculture, Forest Service)
- Wildlife Species Life Form--Bird List (US Dept of Agriculture, Forest Service)
- Wildlife Species Life Form--Reptile List (US Dept of Agriculture, Forest Service)
- Wildlife Species Life Form--Amphibian List (US Dept of Agriculture, Forest Service)
- Informational Series Fact Sheets (Connecticut Dept of Environmental Protection)
- Migrating Birds Know no Boundaries (Israeli project for tracking migratory birds)
- Canada Goose Management at the Minneapolis-St. Paul International Airport (University of Minnesota, College of Natural Resources)

Other Wildlife

Mammals are the most common animals other than birds which are associated with aircraft strikes. Mammal strikes are only a small per cent of the total recorded strikes, but strikes with large ungulates including deer are extremely dangerous. The number of white-tailed deer in the US has increased from 100,000 in 1900 to 26 million in 2000. In a ten-year period of 1990-1999 430 civil aircraft were involved with collisions with deer.

Deer Presence on the Airfield¹⁹

Deer and on the airfield pose an immediate risk to aviation safety. Although considerable resources have been placed on controlling the presence of deer on airports over the last few years, specifically through the installation of wildlife fencing, wildlife hazard assessments, and subsequent development of wildlife hazard management plans, much work is still needed. USDA Wildlife Services reported that approximately 40 deer related incidents were added to the national Wildlife Strike Database in fiscal year 2005.

14 CFR Part 139.337 (a) states that a certificate holder, in accordance with it's Airport Certification Manual (ACM), and the requirements of the section, must take immediate action to alleviate wildlife hazards whenever they are detected.



¹⁹ The following has been excerpted from the FAA / Great Lakes Region Airport Certification Information Bulletin 1/1/06, Number 06-01



Harassment techniques are not a solution to the problem of deer on the airfield, especially those airports with deer fencing already in place. The removal of deer through lethal measures is needed in many instances to alleviate the hazard and provide the safest environment possible for aircraft operations. The airport must obtain current permits and establish local procedures whenever lethal measures are used for deer population management. The FAA Great Lakes Region encourages you to coordinate with USDA, Wildlife Services. Please contact the State Director, Wildlife Services, for the latest wildlife research and information.

APPENDIX 14: AIRPORT NOISE MITIGATION AND STRATEGIES

Introduction

The following text has been excerpted from the Oregon Department of Aviation’s “Airport Land Use Compatibility Guidebook” (January 2003) (pages 6-9 – 6-10). In addition to this Appendix, readers should seek guidance on noise issues at the FAA’s website:

http://www.faa.gov/about/office_org/headquarters_offices/aep/aircraft_noise/

Noise Mitigation

Aircraft noise is one of the largest areas of concern with regards to land use issues. Developing mitigation options for noise impacts is one of the most costly corrective measures. Noise is often defined as unwanted sound, which provides a very large spectrum of options when trying to address a “noise” related problem. For example, someone who lives fifteen hundred feet from the end of a runway has a different definition of noise compared to someone who is three thousand feet away from the airport, yet they both may have noise complaints. Soundproofing, noise barriers, and land acquisition are common types of noise mitigation measures available.

| CORRECTIVE TECHNIQUES FOR ESTABLISHING COMPATIBLE LAND USES | | | | |
|---|---|--|--|---|
| Preventive Measures | | | | |
| Technique | Description | Advantage | Disadvantage | When to Use |
| Change Operational Procedures | Changing normal patterns to reduce noise can include preferential runway end use, non-standards turns on departures, non-standard approach and departure altitudes. | Can help reduce noise impacts in areas of incompatible development. | Does not change incompatible land use; may be only temporary fix if continued development of incompatible use occurs or airport grows. | Consider as part of Master Plan, Part 150 or Environmental Assessment for airport; must be fully coordinated with airport owner, users, and FAA. |
| Noise Mitigation | Sound barriers or soundproofing can be used to mitigate existing noise impacts. | Can help to reduce noise impacts on noise-sensitive land uses that have developed within the airport environs. | Very costly to implement; is not a long-term solution but a temporary fix. | Can be investigated as part of an airport planning or noise study; applicable for larger airports and smaller airports that want to do volunteer soundproofing and ground sound barriers. |



NOISE BARRIERS

Noise barriers provide mitigation options with a very specific focus. Since noise barriers have limited applications, they are typically used on airport property to shield noise-sensitive areas from the most intense levels of noise from the airport. For example, when aircraft depart an airport they must do a run-up where the engine(s) of the aircraft are brought to full power and then tested. The action is typically noisy and normally done at the end of the runway just prior to take-off. If an airport has a noise-sensitive area near the run-up area, then a noise barrier may be required to shield the sensitive area from the run-up noise. This also applies to airports that have aircraft engine repair or maintenance. Since these businesses often test the engines after their repair or maintenance, a specific location for engine run-ups may be necessary. A noise barrier can surround this run-up area in an effort to contain the aircraft noise.

Noise barriers can take many different forms. Coniferous trees and shrubs can often be used as noise barriers, however, these forms of vegetation often have limited noise reduction attributes but act as a visual barrier and are thus perceived as a noise barrier. Topographic features can also be used as barriers. Earthen berms are the most common topographic feature since they are easy to create and fairly inexpensive to construct. Man-made noise barriers are the most costly of the options, which often include fencing or masonry walls. Fencing is the most common type of noise barrier since it serves two purposes; the screening of the visual impacts as well as the noise. Masonry walls also provide barriers but are used in areas where there is a specific point of noise generation such as the engine run-up areas previously discussed.

SOUNDPROOFING

Soundproofing, while considered a mitigation measure, is a temporary fix to a noise issue. Since soundproofing only addresses the indoor environment, the outside impacts of noise levels go unchecked. For example, if a home is determined to be within an area with a high level of noise, the house can have improvements made to reduce the levels of noise within the structure. Windows and doors of a more dense construction can be installed, as well as air conditioning units or a central air system, which reduces the need to open windows that allow noise to enter the structure. Additional insulation can also be installed to deaden the outside noise. All of these measures, while helpful to the indoor setting, do nothing to lower the outdoor noise levels. While this is acceptable, it should be a consideration when developing a compatible land use plan. For example, an airport receives repeated calls from a neighbor of the airport with noise complaints. He complains about noise levels while he is trying to entertain guests at his home on the weekends in the summer. This neighbor is most likely having a barbecue or picnic in his backyard. In this instance, soundproofing his residence will not mitigate his noise issues since the major complaints are associated with outdoor activities. It is important to recognize this issue and be cognizant of it as an airport attempts to mitigate noise issues in the local community.

SUMMARY OF NOISE MITIGATION

As outlined above, noise barriers and soundproofing are methods of addressing noise related land use issues, however, both of them may have limited applications depending upon the nature of noise complaints at each airport. Prior to utilizing either of these methods, the long term goals of the land use plan should be identified to ensure that these methods will provide the desired results and advance the existence of compatible land uses around the airport. More often, land acquisition is a more viable option since it addresses the heart of the problem - incompatible land uses in close proximity of the airport.



Sample Avigation & Noise Easement: City of South St. Paul, Minnesota

Warranty Deed Document No. 1596848/October 15, 1999

1. Reserving unto the Grantor, for the use and benefit of the public, a perpetual avigation and noise easement and right of way for the unobstructed and unrestricted flight of aircraft above the transition surface airspace described as follows:

All area of Lots 1 to 10, inclusive, Block 1, Village Heights 2nd Addition, according to the recorded plat thereof, above an imaginary surface which at the Southwest corner of Block 1, Village Heights 2nd Addition has an elevation of 879.48 and at the Northwest corner of Lot 34, Block 1, Village Heights has an elevation of 954.72; the line connecting these points on the imaginary surface being above the east right-of-way line of Florence Street, as dedicated in Inver Grove Factory Addition, according to the recorded plat thereof (also known as Cooper Avenue), and the elevation of any point on that line being proportional to the distance between the points and the elevations of the imaginary surface at these points; the surface then slopes upward from this line in an easterly direction on a bearing of North 43 Degrees, 16 Minutes, 34 Seconds East at a ratio of one foot vertical for each seven feet horizontally to an elevation of 970.00, after which the elevation remains constant (all elevations are feet above mean sea level);

Together with the right to go upon, over and across the real estate hereby conveyed by means of any and all noise of any kinds, or at any level, which may now or may hereafter, directly or indirectly, arise from the flights of aircraft above the transition surface airspace free of any claims by Grantee, or Grantees successors, heirs, personal representatives, or assigns, that noise from the flight of aircraft is an unreasonable interference with the use and enjoyment of, or reduces the value of the real estate hereby conveyed.

2. Reserving unto the Grantor an easement in and upon the following described real property for the maintenance, repair and replacement of a fence located on, or to be located on, land located westerly thereof and abutting thereon:

That part of Block 1, Village Heights 2nd Addition according to the recorded plat thereof, that lies westerly of a line parallel to and ten (10) feet easterly of the westerly line of said Block 1.

3. Covenants, conditions, restrictions, declarations, and easements of record, if any.

4. Liens, encumbrances, adverse claims, and other matters which Grantee has created, suffered, or permitted to occur after January 22, 1998.