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AIRPORT VICINITY ZONING AS A METHOD OF LIMITING OF THE AIRCRAFT IMPACT ON ENVIRONMENT

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Compatibility policies, including both criteria and maps, are the central component of any compatibility plan of the airport. The purpose of this article is to discuss basic concepts and common issues involved in preparing an airport land use compatibility plan and in formulating the policies contained therein.

Політика сумісності, що включає критерії нормування і карти, є центральним елементом кожного плану сумісності аеропорту. Розглянуто базові та загальні особливості, що використовуються під час приготування плану сумісності аеропорту в частині використання земель і формулюванні концепцій, які їх зумовлюють.

Introduction

The airport land use compatibility concerns fall under four broad environmental headings, all identified in Ukrainian and International laws or rules: noise, electro-magnetic radiation, air pollution and safety. The impacts of routine aircraft flight (*over flight)* over a community may be of basic concern too, also as an *airspace protection* around the runways of the airport.

For the purposes of formulating airport land use compatibility policies and criteria, further dividing these basic concerns into functional categories is more practical. These categories are:

Noise: As defined by cumulative noise exposure contours describing noise from aircraft operations near an airport.

Safety: From the perspective of minimizing the risks of aircraft accidents beyond the runway environment.

Electro-magnetic radiation: As defined by contours describing electro-magnetic fields from navigational facilities near an airport.

Air pollution: As defined by contours describing air pollution fields from aircraft operations, other moving and a number of stationary sources in and around airport.

Airspace protection: Accomplished by limits on the height of structures and other objects in the airport vicinity and restrictions on other uses, which potentially pose hazards to flight.

The formulation of airport land use compatibility policies and associated criteria is discussed and an emphasis is made on ways of *categorizing* and *organizing* the policies rather than on the *concepts* behind them. For each compatibility category, four features are outlined below:

Compatibility objective: The objective to be sought by establishment and implementation of the compatibility policies;

Measurement: The scale on which attainment of the objectives can be measured;

Compatibility strategies: The types of strategies which, when formulated as compatibility policies, can be used to accomplish the objectives; and *Basis for setting criteria:* The factors which should be considered in setting the respective compatibility criteria.

Noise

Noise is one of the most basic airport land use compatibility concerns. Moreover, at major airline airports, many busy general aviation airports, and most military airfields, noise is usually the most geographically extensive form of airport impact.

Compatibility objective – The clear objective of noise compatibility criteria is to minimize the number of people exposed to frequent and/or high levels of airport noise capable of disrupting noise-sensitive activities.

Measurement – For the purposes of airport land use compatibility planning, noise generated by the operation of aircraft to, from, and around an airport is primarily measured in terms of the cumulative noise levels of all aircraft operations. In the Ukraine, the equivalent noise level metric established by state regulations, including for airport noise is $L_{Aeq\ day}$ and $L_{A\ eq\ night}$. These metrics provides both a measure of the average sound level in decibels (dB) to which any point near an airport is exposed. To reflect an assumed greater community sensitivity to night time noise, events during these periods must be counted as being louder than actually measured, so their normative values up to 10 dBA less than for daytime.

Cumulative noise levels are usually illustrated on airport area maps as contour lines connecting points of equal noise exposure.

Mapped noise contours primarily show areas of significant noise exposures – ones affected by high concentrations of aircraft takeoffs and landings.

The calculation of cumulative noise levels depends upon the number, type, and time of day of aircraft operations, the location of flight tracks, and other data described elsewhere [1; 2]. For airports with airport traffic control towers, some of these inputs can be derived from recorded data.

Noise monitoring and radar flight tracking data available for airports in most metropolitan areas are other sources of valuable information. At most airports, though, the individual input variables must be estimated.

The important point to be made here is that, despite their computer-generated origin, the location of noise contours is not necessarily precise. Where extensive noise monitoring and flight tracking data are available, current contours can be accurate to within ±1 dB. Elsewhere, the level of accuracy has generally been found to be about ±3 dB. Contours representing projections of future noise levels are inherently even less precise.

The Day-Night Average Sound Level (DNL) metric used elsewhere in the U.S., and recommended by ICAO [3; 4], but adds the evening weighting not included in DNL, like it is done for metric DENL in the EU Directive [5].

The argument chiefly made is that cumulative noise level metrics may not adequately identify some aspects of noise exposure effects, particularly within the context of assessing the environmental impacts of airport improvement projects.

Compatibility strategies – The basic strategy for achieving noise compatibility in airport vicinity is to limit development of land uses, which are particularly sensitive to noise. The most acceptable land uses are ones, which either involve few people (especially people engaged in noise sensitive activities) or generate significant noise levels themselves (such as other transportation facilities or some industrial uses). On occasion, local considerations outweigh noise impacts and result in decisions by local land use jurisdictions to allow residential development in locations where this use would normally be considered incompatible. In such circumstances, approval of the development should be conditioned upon dedication of an aviation easement and requirements for sufficient acoustic insulation of structures to assure that aircraft noise is reduced to an interior noise level of 45 dBA or less.

Basis for setting criteria – Compatibility criteria related to cumulative noise levels are well established in state and international regulations. The basic international criterion sets a DNL of 75 dBA as the maximum noise level normally compatible with urban residential land uses.

For many airports and many communities, 75 dBA DNL is too high for land use planning purposes, even 65 dBA somewhere is too high. A process called “normalization” is one means of adjusting the criteria to reflect ambient sound levels, the community’s previous exposure to noise, and other local characteristics.

This process helps to determine what DNL is of significance to that particular community. Once the baseline maximum acceptable noise level for residential uses is established, criteria for other land uses can be set in a manner consistent with this starting point.

Electro-magnetic fields

Electro-magnetic radiation, comparing with noise, is not so significant for the most basic airport land use compatibility concerns. But their local impact must be included obligatory in land use programs.

Compatibility objective – The clear objective of electro-magnetic compatibility criteria is to exclude the people from the possible exposing to high levels of airport electro-magnetic fields, which are over the norms of the State and International standards.

Measurement – For the purposes of airport land use compatibility planning, electro-magnetic fields (EMF) generated by the operation of navigational and flight control facilities is primarily measured in terms of the unperturbed rms electric and rms magnetic strengths or equivalent plane-wave power density depending of frequency range of the radiation (5 sub ranges inside the total range of the concern 0.1–300 000 MHz) [6].

In the Ukraine, the exposure limits much stricter than recommended by international standards [6; 7].

In accordance with the requirements [7] all the sources of EMF must have the sanitary passport, where there location and radiation strength are defined, and EMF sanitary-protection zones proved.

Compatibility strategies – The basic strategy for achieving noise compatibility in an airport vicinity is to limit development of land uses by defining or sanitary-protection zones or zones of the limited building (land use).

Basis for setting criteria – Compatibility criteria related to cumulative noise levels are well-established in international and state regulations, like shown in table.

General population exposure limits for EMF in terms of the unperturbed rms electric strengths

Metric (in wave length and frequency)	Frequency range, MHz	Exposure limits, V/m	WHO recommendation, V/m
Kilometric, low frequency	0,03–0,3	25	87
Hectometric, medium frequency	0,3–3	15	87/*f*
Decametric, high frequency	3–30	10	87/*f*
Metric, very high frequency	30–300	3	27,5

Note. *f* – radiation frequency, MHz.

Once the baseline maximum acceptable EMF exposure limits for residential uses is established, criteria for other land uses can be set in a manner consistent with this starting point.

Air pollution

Air pollution is one of the most basic airport land use compatibility concerns, anywhere in the world is the biggest for particular airports.

Compatibility objective – The clear objective of air pollution compatibility criteria is to exclude the people from the possible exposing to high concentrations of air pollution, which are over the norms of the State and International standards.

Measurement – For the purposes of airport land use compatibility planning, air pollution, generated by the operation of aircraft, other types of moving sources and by stationary sources inside an airport, is primarily measured in terms of averaged concentrations. In the Ukraine the concentrations, averaged for 30-minutes intervals (maximum immediate) and during the 24 hours of the day (daily).

The calculation of the concentrations depends upon the type of the source of air pollution and their location, air stability class, wind rose and other data described elsewhere [7–10]. Obviously, for stationary sources the calculation methods [7] quite differ from the moving sources [8–10], for aircraft first of all.

Compatibility strategies – The basic strategy for achieving air pollution compatibility in an airport vicinity is to limit development of land uses, more strictly describing – to exclude land use from the polluted area with bounds, defined by limits of the standards for the matters emitted in atmosphere by the sources. For all moving sources and for the fuel storage and fuel consumption stationary sources carbon monoxide CO, carbon dioxide CO_2, nitrogen oxides NO_x (sum of NO and NO_2), hydrocarbons HC (usually called non-methane volatile organic compounds NMVOC), sulfur dioxide SO_2 and particles are of primary concern.

All of them are in the list of matters, which need to be controlled [11].

Basis for setting criteria – Compatibility criteria related to concentrations of the air pollution are well-established in international and state laws [12] and regulations [13].

Once the baseline maximum acceptable air concentration for residential uses is established, sanitary protection zone can be set around an airport in a manner consistent with the requirements [13].

Safety

Compared to noise and air pollution, safety is in many respects a more difficult concern to address in airport land use compatibility policies. A major reason for this difference is that safety policies address uncertain events, which *may occur* with *occasional* aircraft operations, whereas noise policies deal with known, more or less predictable events, which *do occur* with *every* aircraft operation. Because aircraft accidents happen infrequently and the time, place, and consequences of their occurrence cannot be predicted, the concept of ***risk*** is central to the assessment of safety compatibility. From the standpoint of land use planning, two variables determine the degree of risk posed by potential aircraft accidents:

– *Accident frequency:* Where and when aircraft accidents occur in the vicinity of an airport;

– *Accident consequences:* Land uses and land use characteristics which affect the severity of an accident when one occurs.

Compatibility objective – The overall objective of safety compatibility criteria is simply to minimize the risks associated with potential aircraft accidents. There are two components to this objective, however:

– *Safety on the ground:* The most fundamental safety compatibility component is to provide for the safety of people and property on the ground in the event of an aircraft accident near an airport.

– *Safety for aircraft occupants:* The other important component is to enhance the chances of survival of the occupants of an aircraft involved in an accident which takes place beyond the immediate runway environment.

Measurement — In measuring the degree of safety concerns around an airport, the frequency component of risk assessment is most important: what is the potential for an accident to occur?

As mentioned above, there are both *where* and *when* variables to the frequency equation:
– *Spatial element:* The spatial element describes *where* aircraft accidents can be expected to occur. Of all the accidents, which occur in the vicinity of airports, what percentage occur in any given location?
– *Time element:* The time element adds a *when* variable to the assessment of accident frequency. In any given location around a particular airport, what is the chance that an accident will occur in a specified period of time?
Compatibility strategies — Safety compatibility strategies focus on the *consequences* component of risk assessment. Basically, the question is: what land use planning measures can be taken to reduce the severity of an aircraft accident if one occurs in a particular location near an airport? Although there is a significant overlap, specific strategies must consider both components of the safety compatibility objective: protecting people and property on the ground; and enhancing safety for aircraft occupants. In each case, the primary strategy is to limit the intensity of use (the number of people concentrated on the site) in locations most susceptible to an off-airport aircraft accident. This is accomplished by:
– *Density and intensity limitations:* Establishment of criteria limiting the maximum number of dwellings or people in areas close to the airport is the most direct method of reducing the potential severity of an aircraft accident.
– *Open land requirements:* Creation of requirements for open land near an airport addresses the objective of enhancing safety for the occupants of an aircraft forced to make an emergency landing away from a runway.
– *Highly risk-sensitive uses:* Certain critical types of land uses – particularly schools, hospitals, and other uses in which the mobility of occupants is effectively limited – should be avoided near the ends of runways regardless of the number of people involved. Aboveground storage of large quantities of highly flammable or hazardous materials also should be avoided near airports.
Basis for setting criteria – Setting safety compatibility criteria presents the fundamental question of what is safe. Expressed in another way: what is an *acceptable risk*? In one respect, it may seem ideal to reduce risks to a minimum by prohibiting most types of land use development from areas near airports. However, as addressed later in this chapter, there are usually costs associated with such high degrees of restrictiveness. In practice, safety criteria are set on a progressive scale with the greatest restrictions established in locations with the greatest potential for aircraft accidents.
Established guidance: Unlike the case with noise, there are no formal federal or state laws or regulations which set safety criteria for airport area land uses for civilian airports except within *runway protection zones* (and with regard to airspace obstructions as described separately in the next section).
State Aviation Administration safety criteria primarily are focused on the runway and its immediate environment. Runway protection zones – then called *clear zones* – were originally established mostly for the purpose of protecting the occupants of aircraft which overrun or land short of a runway. Now, they are defined by the CAA as intended to enhance the protection of people and property on the ground.

Airspace protection

Relatively few aircraft accidents are caused by land use conditions, which are hazards to flight. The potential exists, however, and protecting against it is essential to airport land use safety compatibility.
Compatibility objective — Because airspace protection is in effect a safety factor, its objective can likewise be thought of in terms of risk. Specifically, the objective is to avoid development of land use conditions, which, by posing hazards to flight, can increase the risk of an accident occurring. The particular hazards of concern are:
– Airspace obstructions;
– Wildlife hazards, particularly bird strikes; and
– Land use characteristics which pose other potential hazards to flight by creating visual or electronic interference with air navigation.
Measurement – The measurement of requirements for airspace protection around an airport is a function of several variables including: the dimensions and layout of the runway system; the type of operating procedures established for the airport; and, indirectly, the performance capabilities of aircraft operated at the airport.
Airspace obstructions: Whether a particular object constitutes an airspace obstruction depends upon the height of the object relative to the runway elevation and its proximity to the airport.
The acceptable height of objects near an airport is most commonly determined by application of standards set forth in FAR Part 77.
These regulations establish a three-dimensional space in the air above an airport. Any object, which penetrates this volume of airspace, is considered to be an obstruction and may affect the aeronautical use of the airspace.

Wildlife and other hazards to flight: The significance of other potential hazards to flight is principally measured in terms of the hazards' specific characteristics and their distance from the airport and/or its normal traffic patterns.

Compatibility strategies – Compatibility strategies for the protection of airport airspace are relatively simple and are directly associated with the individual types of hazards:

– *Airspace obstructions:* Buildings, antennas, other types of structures, and trees should be limited in height so as not to pose a potential hazard to flight.

– *Wildlife and other hazards to flight*: Land uses which may create other types of hazards to flight near an airport should be avoided or modified so as not to include the offending characteristic.

Basis for setting criteria – The criteria for determining airspace obstructions and other hazards to flight have been long-established in US FAR Part 77 and other Federal Aviation Administration regulations and guidelines.

Compatibility criteria tables and maps

Separate criteria tables and maps

Identification of land use compatibility strategies such as those outlined in the preceding section is only one part of the process of developing compatibility policies. The other piece of the puzzle is to relate these strategies to the airport environs both geographically and for various categories of land uses. This is done by means of a compatibility criteria table or tables – although sometimes a list or outline format is used – together with one or more compatibility zone maps.

Tables – Compatibility criteria tables provide the measures by which land use categories of characteristics can be evaluated for compatibility with the airport impacts identified for various portions of the airport environs.

Maps – Compatibility maps show where the various criteria geographically apply within the airport vicinity. Generally, the maps divide the airport environs into a series of zones in which a progressively greater degree of land use restrictions apply the closer the zone is to the airport.

The traditional approach to compatibility criteria tables and maps is to have separate sets for each type of impact. For noise, the table indicates whether each land use classification is or is not acceptable within various ranges of noise exposure as measured on the DNL scale. For safety, the relationship is between each land use category and the degree of accident risk at locations around the airport. An airspace protection map indicates the allowable heights of objects near the airport.

Finally, over flight concerns can be addressed by a map showing where any associated compatibility policies apply.

Advantages: The chief advantage to this approach is that the relationships between the noise and safety concerns and the associated criteria are relatively obvious. For example, at a minimum, residences should not be exposed to noise levels above a DNL of 65 dBA and schools and shopping centres should not be situated in a runway protection zone. A second advantage is that the resulting large number of zones (because noise and safety each have their own set of zones and airspace protection is also separately considered) gives greater flexibility in adjusting the compatibility criteria to suit the circumstances. This flexibility can be particularly important in urban areas where site design and other specific features of the development can become critical to determining the compatibility of a proposed land use.

Disadvantages: The disadvantages involve ease of use and occasional confusion in application. Although technically sound, the use of separate criteria and maps can be more complicated and require greater understanding of airport land use compatibility concepts. For any given land use classification or individual development proposal to be evaluated, it must be checked against multiple sets of criteria tables and maps – noise, safety, and over flight impacts – as well as a map of protected airspace. The confusion sometimes arises because of the lack of coordination between the impact assessments. For a given location, one type of land use may be acceptable with respect to noise, but not for safety; another use may be just the opposite; and, taken together, most forms of urban land use development may sometimes appear to be ruled out. Another disadvantage is the tendency to rigidly apply the delineated zone boundaries, especially for noise, to the evaluation of a particular land use project or action.

Although often advantageous from the standpoint of planning practice, rigid application of the boundaries implies a degree of precision, which does not exist in the measurement of the airport impacts.

Composite criteria table and map

A different approach, one which has become increasingly common, simplifies compatibility assessments by condensing the various factors down to a single set of criteria presented in one table and one map for each airport.

The map defines a small number of discrete zones – preferably no more than five or six, which represent locations with similar *combinations* of noise, safety hazard, and over flight exposure.

Airspace protection criteria can sometimes be included as well.

Advantages: One advantage to the composite approach is that it allows most land uses to be evaluated with quick reference to a single table and map. More significantly, though, is that it allows more flexibility in the *mapping* of compatibility zones (as compared to the separate criteria and map format which offers higher flexibility in defining the compatibility criteria). As discussed later in this chapter, generic boundaries can be drawn for a limited number of airport classes. These boundaries can then be applied to all similar airports and adjusted as necessary to reflect atypical airport operational characteristics, local geographic boundaries, and established land uses.

Disadvantages: The major disadvantage to combining compatibility criteria into a single table and map is that the basis for location of the zone boundaries is not always clear. If more detailed assessment of a complex land use development proposal is necessary, reference to separate noise and safety compatibility tables and maps is often still required.

Detailed land use map

A final format found among some compatibility plans is a detailed land use map comparable to ones found in general plans or specific plans. This format is most likely to be utilized during adoption a compatibility plan which is also prepared for local agency adoption as a specific plan. Depending upon the extent to which the land use categories reflect airport compatibility concerns, a detailed land use map conceivably can bypass the need for compatibility criteria tables.

Advantages: Probably the most significant advantage of the detailed land use map approach to compatibility mapping is that it enables the same map to be adopted as a compatibility plan and by the local agency as a specific plan. Because the maps and plans (or at least the airport-related portions of them) are identical, the two are automatically consistent with each other.

Disadvantages: A major disadvantage of this approach is that it entails more work to prepare than is necessary for the other formats. A detailed land use map prepared for a specific plan must take into account factors, which are not of concern to the authority. Close cooperation between the authority and the city preparing the specific plan is necessary to assure that all essential factors are addressed. Also a potential disadvantage is that a detailed land use map of this type pertains only to a single airport and the compatibility criteria on which it is based may not correspond very closely to criteria used in compatibility plans for other airports within the authority's jurisdiction.

Categorization of land uses

The other variation in the formatting of compatibility criteria pertains to how land uses are categorized in the compatibility table or tables. There are two different approaches to the listing of land uses.

Both are common among ALUC compatibility plans and, as with the overall format of the tables, each has advantages and disadvantages.

Detailed listing format

One approach to land use categorization is to divide the full range of land uses into specific classes.

The number of classifications might be relatively few in number – residential, commercial, industrial, public facility, etc. – as commonly found on general plans or specific plans.

Alternatively, a much more narrowly defined listing might be utilized – one in which the broader land use categories are divided into more precise subcategories.

The detailed listing approach to land use categories works with either separate or composite compatibility tables and maps. It is essential if a detailed land use map approach is used.

Advantages: The advantage of the detailed listing approach is that it removes most of the need for interpretation of standards as required within the performance-oriented categories.

Each listed use can be denoted as either *compatible* or *incompatible* with a given level of airport impacts. This greatly simplifies the task of local planners when they must evaluate an individual development proposal with respect to the local agency's general or specific plan.

Disadvantages: The major disadvantage of this method is that, unless the land use categories are defined very narrowly, the usage intensity (the number of people per acre) and other characteristics which affect compatibility might cover a wide range. Indicating that a particular land use is compatible with the airport could result in development of an activity, which clearly exceeds the intensity considered acceptable.

Oppositely, listing a land use as incompatible might preclude a development, which could be a good airport neighbour.

Another potential difficulty with including a detailed listing of land uses in a compatibility plan is that the selected categories may not conform to those used by the local land use jurisdictions.

This is particularly likely to occur when the compatibility plan covers multiple airports and encompasses several counties and/or cities, each with its own set of land use categories.

Functional or performance-oriented characteristics

This approach entails dividing land uses according to characteristics related to the previously described compatibility planning strategies. It applies primarily to when a composite compatibility table and map are utilized, but could also be employed as a means of evaluating safety compatibility. The number of categories needed is thus kept small. No distinctions are made among different types of land uses with similar functional or performance-oriented characteristics – for example, between an office and a retail store, which attract the same number of people in buildings equivalent in size. When this method of land use categorization is used in a compatibility table, the result for most categories is not an indication of whether the land use is compatible or incompatible. Rather, the table establishes a set of criteria based upon specified performance measures, which, if satisfied, will result in compatible land use. A typical set of performance-oriented land use characteristics and their respective compatibility measures is as follows:

Residential density – For airport compatibility purposes, the chief distinguishing feature among residential land uses is the number of dwelling units per acre. To be compatible with airport activities, the number of dwelling units per acre should not exceed the criterion specified for the compatibility zone where the use would occur.

Non-residential usage intensity – The most significant factor among most other types of land use development is the number of people attracted by the use. Safety is the principal concern in this regard, although noise could also be evaluated in this manner. With the exception of certain sensitive uses, the nature of the activity associated with the actual land use is not highly relevant to airport land use compatibility objectives.

Sensitive uses – This category includes land uses, which, because of their special sensitivity, should be excluded from certain locations near airports even if they meet other quantitative criteria. Children's schools, day care centres, hospitals, nursing homes, and other highly risk-sensitive uses are primary examples. Uses involving storage of large quantities of hazardous materials also fit into this category on the basis of safety.

Open land – Requirements for open land usable for the emergency landing of aircraft near an airport apply regardless of the overall land use classification of the property. The associated criteria indicate what percentage of the land area in each compatibility zone should be devoted to functional open space.

Permitted heights – Another land use characteristic that can be incorporated into a composite compatibility table is the height of structures, which can clearly be attained without penetration of the airport airspace. Including permitted heights as a criterion in a composite compatibility zone works best at airports in relatively level terrain. At airports where elevations of the surrounding terrain vary substantially, special provisions might need to be made to account for the lack of consistent relationship between the height permitted and the location of the individual compatibility zones.

Advantages and disadvantages of this style of land use categorization include:

Advantages: The principal advantage of performance-oriented categorization of land uses is that this method directly addresses factors pertinent to airport land use compatibility. Recognition is given to significant land use characteristics, which might not be distinguished in a traditional listing of land uses.

Disadvantages: The significant disadvantage of performance-based land use categories is that assessing the compatibility of a particular land use designation or individual development proposal requires interpretation of the associated criteria (except for residential uses). If, for example, data regarding the usage intensity is not available, then compatibility evaluation will require reliance on information sources (building and fire code standards, for example), which may not accurately reflect the aviation, related concerns. The results may not always be consistent with previous determinations.

Relationship of zone boundaries to geographic features

The location of airport-related impacts is mostly determined by the location of runways, flight routes, and other aviation-related factors, not geographic features of the airport environs. While defining compatibility zone boundaries based strictly on the impacts provides the closest relationship to those impacts, the resulting maps are not as easy for local planners to use. The alternative is to adjust the zone boundaries to follow geographic features, existing land use development, and other local land use characteristics. By so doing, situations where a compatibility zone boundary splits a parcel can be minimized.

Adjustment of boundary lines is generally more practical in urban areas, because they offer more choices of roads, parcel lines, and other geographic features, than in rural locations where these features are more widely spaced.

Also, the composite criteria and detailed land use map formats better lend themselves to boundary adjustments than do separate compatibility maps.

Relationship of compatibility zones to overall planning area

The overall planning or influence area for an airport is normally the area encompassed by a composite of each of the individual compatibility zones. For most civilian airports, the most geographically extensive compatibility concern is the airspace protection area defined by the outer edge of the FAR Part 77 conical surface. This distance equals 9,000 feet from the runway primary surface for small airports with no instrument approaches and 14,000 feet for most other civilian airports (the primary surface extends 200 feet beyond the runway end).

Base map alternatives

An important step in the mapping of an airport's compatibility zones is selection of an appropriate base map. Common alternatives include:

Geographic Information System (GIS) mapping – These computer-based mapping and data systems are becoming increasingly common in county and city government. When used in planning departments, street systems, parcel lines, and other geographic elements usually form the base map and then a variety of information associated with each parcel is included in the database. GIS maps are typically geo-referenced, thus assuring that at least major features–especially section corners – are geographically accurate. When a GIS has been established, addition of compatibility zones as another data layer or "theme" is highly advantageous. By so doing, the likelihood that compatibility criteria will be overlooked during local review of a development proposal is reduced.

Parcel maps – When GIS mapping is not available, a common alternative is a composite parcel map assembled from assessor's maps or other sources. Producing a reasonably accurate base map from smaller parcel maps can often be a challenge.

Land use or zoning maps – If sufficiently detailed, the same base maps as used for local land use or zoning purposes offer another alternative when a GIS has not been established.

Topographic maps – Topographic maps prepared by the U.S. Geological Service (USGS) are obtainable for all areas of California in both printed and digital form. Because these maps show ground elevations, they are particularly useful for airspace protection plan mapping. However, topographic maps do not show enough detail to facilitate finding particular locations within urban areas and they are generally outdated as well.

A note of caution regardless of the source of the base map: airport runways frequently are not shown, are not accurately located, or are not the correct length. Since most compatibility zones are typically tied to the runway position, not other geographic features, steps should be taken to assure that the runway is correctly depicted. A current airport layout plan indicating the geographic coordinates of the runway ends is an ideal source of runway location data. When GIS is used, this data can be directly entered into the system. Although normally not as precise, aerial photographs can also be used as a means of establishing the placement of a runway on a base map.

Compatibility planning for specific airport types

The State Aeronautics Act requires – or, in the case of military airfields, allows – compatibility plans for various types of airports. While each airport presents a distinct combination of characteristics, both operationally and in terms of surrounding land uses, even broader differences are apparent among the various airport categories. The relative extensiveness of noise versus safety concerns varies between a typical air carrier airport and a typical general aviation facility, for example. The availability of data from which to develop a compatibility plan also tends to differ from one airport type to another. The discussion in this section focuses on the distinctive compatibility planning concerns and approaches common to each category: air carrier airports; general aviation airports; converted military airports; military airports; and heliports.

Air carrier airports

Several factors distinguish compatibility planning for air carrier airports from that for most other facilities. Some of these factors pertain to the substance of the compatibility policies; others involve the resources available for preparation of a compatibility plan.

From a land use compatibility standpoint, noise is usually the dominant concern. The 65-dB DNL contour for a major air carrier airport can extend far beyond the runway ends. Lower-noise-level impacts can encompass several square miles of the airport environs.

As a practical matter, though, the ability of airport land use commissions to address compatibility matters around air carrier airports is often limited. Most air carrier airports in the Ukraine are situated in existing, highly urbanized communities. Except for infill or redevelopment, there are few opportunities for new development and thus few proposed land use actions for the review.

Where new development is allowed, noise insulation programs and the requirement for navigation easements are a major component of land use compatibility policies both for the airport land use commission and the airport itself.

The second distinct factor about compatibility planning for air carrier airports is that data and other resources needed for plan preparation are typically more readily available than for other airports. To start with, these facilities typically have full-time staff specifically assigned to dealing with noise, land use compatibility, and other issues affecting the surrounding communities. Recent calculations of current noise contours and up-to-date projections of future activity levels and noise impacts are commonly available. Moreover, noise monitoring and radar flight track data may be available to increase the precision of both current and projected noise contours. For planning purposes, however, the predictions for the noise environment in the distant future (20+ years) are more important than the measurements of noise in the past.

General aviation airports

The characteristics of general aviation airports and their environs vary widely. They range from very busy "reliever" airports in metropolitan areas to minimally used facilities in rural locations. The extent of compatibility issues and the availability of data from which to create a compatibility plan also run the full gamut. For an average general aviation airport, noise, safety, airspace protection, and over flight compatibility concerns are all important issues to be addressed in compatibility plans. Moreover, because many general aviation airports are located on the fringes of urban areas, both the threat of new incompatible development and the opportunity to preserve a compatible airport land use relationship are great.

Available activity level, noise impact, and other data needed for compatibility planning is not normally as extensive as for air carrier airports. Essential information often must be gathered from a variety of sources ranging from airport master plans to interviews with airport staff and others familiar with operation of the airport. Obtaining data on the locations of principal flight routes can be particularly difficult, yet of key importance at moderately busy facilities. Again, planning for the distant future is highly important.

Converted military airports

Many of the closed bases have included airfields, which have subsequently been or yet could be converted to civilian use. Most of these airports are major facilities with long runways capable of accommodating almost any type of aircraft.

Because of the wide range of future operational scenarios possible for converted military airports and their lack of history as civilian facilities, preparation of compatibility plans for them can be particularly challenging. In this regard, there are two key issues which state/city authority need to address.

Military airports

Most of the remaining military airports are part of large bases covering extensive land areas. Even the bases located near urban areas tend to have substantial amounts of open land near the runways. These buffer areas are valuable in terms of land use compatibility, especially with regard to safety. The noise impacts of military airports, however, can still extend far beyond the base boundaries due in large part to high noise levels generated by many military aircraft.

A particularly unique aspect of compatibility planning for military airports is that aircraft activity forecasts of the sort done for civilian airports are not very meaningful. Military airport activity levels depend almost exclusively on the mission of the base and on national or international events involving military participation. A typical planning approach thus is to postulate a "maximum mission" for the base.

Heliports

Any compatibility plan prepared for a heliport needs to take into account the unique operational characteristics of helicopters. Because of the steep approach and departure profiles which helicopters normally fly, they are effectively operating in an en route manner once beyond a short distance from the heliport (FAR Part 77 airspace surfaces extend just 4,000 feet from the landing pad). Within the immediate vicinity of a heliport, helicopter noise impacts can be relatively intensive on a single-event scale.

However, except for the few heliports, which experience a high volume of operations, cumulative noise impact contours are very small.

Also, the limited accident data available for helicopters suggests that significant safety concerns are generally confined to within a few hundred feet of the landing pad. Perhaps most important with respect to safety is the necessity of keeping established approach/departure corridors clear of obstructions.

Given this combination of factors, some restrictions on land use development is appropriate within the immediate vicinity of public-use and special use heliports. However, except where warranted by high activity levels, more extensive restrictions are normally unnecessary.

Conclusions

Necessity for including the noise, air pollution, electro-magnetic and risk maps in airport proving materials for their certification and license for the operation is a starting point for conceptual consideration of these maps and all supported rules.

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