Appendix E
SUPORT DOCUMENTATION FOR LAND USE REGULATIONS WITHIN AND BELOW 65 DNL

Lincoln Airport

Appendix E
SUPPORTING DOCUMENTATION FOR LAND USE REGULATIONS WITHIN AND BELOW 65 DNL

The purpose of this appendix is to summarize tools used by various jurisdictions to regulate land use within the noise contours of airports across the United States. Attached is **Exhibit E1** which depicts the location of a sampling of jurisdictions that regulate within, and below, the 65 DNL noise contour. **Table A** outlines the name of the jurisdiction, the tool used to implement noise-related regulations, and the types of regulations in place. Also attached are sample regulations from the cities of Naples and Orlando in Florida, and Adams County near Denver, Colorado.

Why Regulate Outside of the 65 DNL Noise Contour?

In areas where few noise complaints are received or the airport is located in a sparsely populated area, individuals may not understand why the areas around the airport need to be protected from non-compatible development. The problem of non-compatible development is often not identified until it is too late, and the Airport is surrounded by land uses that are not appropriate. This was the case in cities such as Denver, Colorado where Stapleton Airport was surrounded by development. The Airport had a small, cramped terminal and the ramp and runways were not able to be expanded as the airport was completely surrounded by urban development. Denver International Airport was constructed and Stapleton Airport was closed. This $5.3 billion project was funded by the City and FAA and is a prime example of what can happen when

proper planning does not occur. Interestingly enough, even though residents of adjacent neighborhoods of Stapleton languished for years under the punishment of jets flying at treetop level, the new Denver International Airport receives thousands more noise complaints each month than what was received at Stapleton. This is partially attributed to the lower ambient noise level of the new Airport environs, as the Airport was constructed in a rural area on the eastern edge of the city.

Lincoln Airport is by no means comparable to the former Stapleton Airport in Denver as Lincoln Airport does not experience the magnitude of commercial air and air cargo service that is experienced in Denver. However, Lincoln Airport does experience a large amount of military training activity due to its runway facilities and open airspace. This military activity cannot be predicted as the airport is required, through grant assurances, to accommodate any users which want to utilize the airport's facilities. Currently, the Airport is fortunate in that the military training users which utilize the airport on a regular basis are accommodating in that they attempt to avoid overflying the noise-sensitive development to the west of the Airport. Additionally, many of the KC-135s based at the Lincoln Air National Guard facilities have been hush-kitted. At any time, this situation may change depending on the mission of those military aircraft which utilize the airport. In addition, Lincoln Airport has the facilities to attract additional cargo service and is located in the center of the United States.

There are a number of other reasons why the City of Lincoln and Lancaster County should consider strengthening the land use regulations for the areas within the Airport Environs Noise District. These reasons are summarized within the following bullet points.

- The previous ANCLUC study prepared for the Airport suggested that serious consideration should be given to siting noise-sensitive uses outside the 55 to 65 DNL contour.

- Noise complaints received by Lincoln Airport are received from individuals that reside outside of the 65 DNL noise contour.

- Utilizing boundaries that are similar to the current boundaries would allow the city to ensure that, over time, development near the airport will contain at least a minimum level of noise mitigation. The development process is more predictable when property owners and developers know what to expect in terms of regulation and do not have to contend with changing regulatory boundaries.

- Under the current recommendation, land owners will not experience a change in development regulations; therefore, what landowners in the vicinity of the Airport can build today, they will be able to build in the future.

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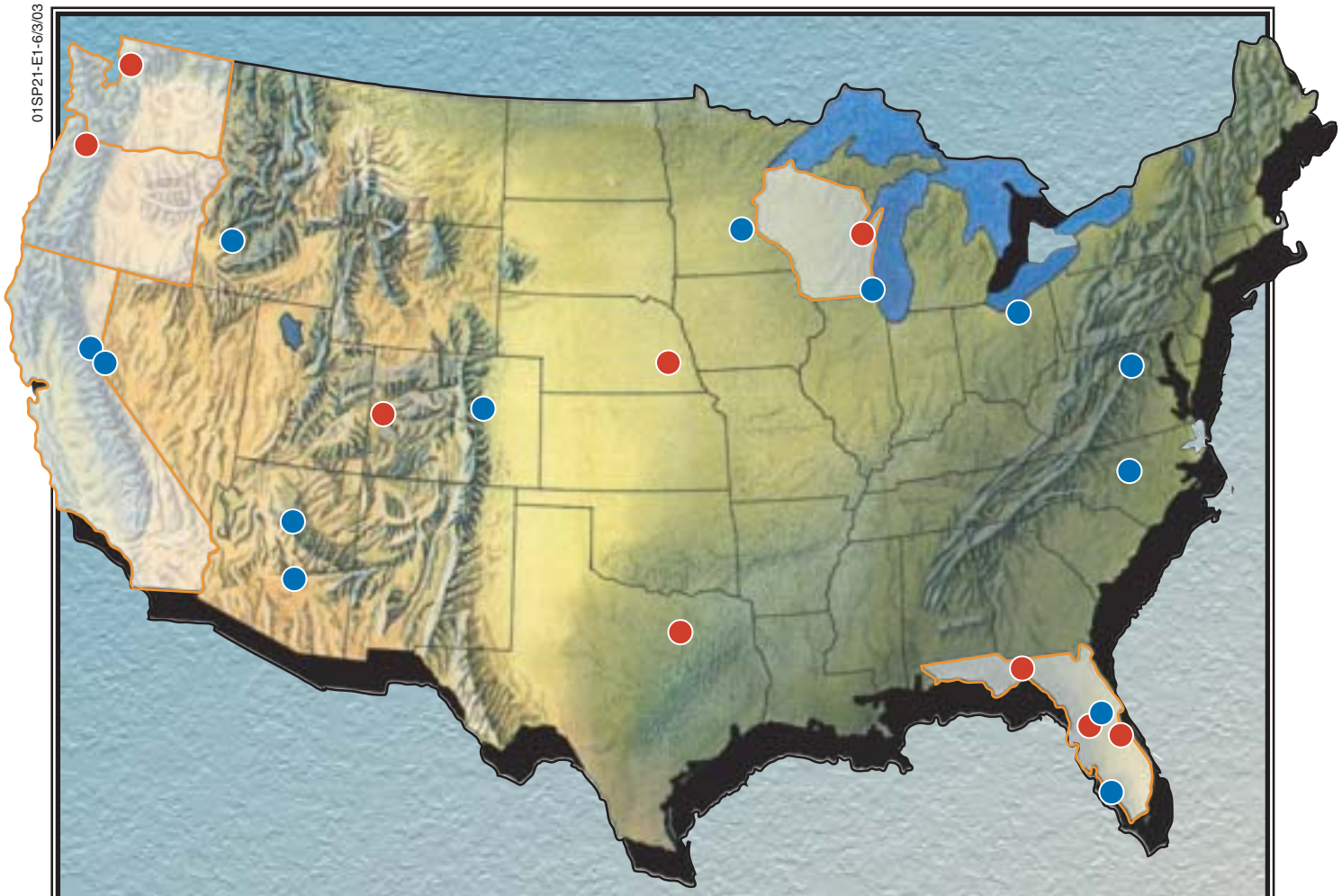

JURISDICTIONS THAT REGULATE DEVELOPMENT WITHIN THE 65 DNL CONTOUR

- Indian River County, FL
- Polk County, FL
- Tallahassee, FL
- Skagit County, WA
- Grand Junction, CO
- Portland, OR
- Brown County, WI
- Lincoln, NE
- Addison, TX

JURISDICTIONS THAT REGULATE WITHIN LESSER NOISE CONTOURS

- Truckee, CA (55)
- Orlando, FL (55)
- Adams County, CO (60)
- Raleigh-Durham, NC (60)
- Kenosha, WI
- Loudoun County, VA (60)
- Naples, FL (60)
- Flagstaff, AZ (60)
- Reno, NV (80 Lmax)
- Mesa, AZ (60)
- Cleveland, OH (60)
- Minneapolis, MN (60)
- Boise, ID (60)

STATES WITH ADOPTED LAND USE COMPATIBILITY GUIDES (highlighted on map)

- Wisconsin
- Oregon
- Washington
- Florida
- California

Lincoln Airport

Exhibit E1
CITIES AND COUNTIES WITH
LAND USE COMPATIBILITY REGULATIONS

- Lincoln Airport is a valuable community resource and should be protected from urban encroachment. Direct and indirect benefits received by the City of Lincoln include the employment of approximately 7,100 individuals and the receipt of gross revenues totalling $693 million annually. The Airport also improves the essential services of the community including enhanced medical care, support for law enforcement, and courier delivery of freight and mail. Urban encroachment may limit the ability of the Airport to meet future demand; thereby limiting its benefit to the City.

- While noise contours are useful for providing an understanding of where airport noise is concentrated, they are meant to depict an average day and do not necessarily reflect actual noise events or the community's perception of airport noise. Airport operations are constantly being adjusted to accommodate for weather patterns, traffic volume, military training exercises, and emergencies. Since these situations may not be typical for the airport, they are not reflected within the noise contours.

- The cost of mitigating or purchasing land use incompatibilities is usually far greater than avoiding them in the first place.

- Federal monies are not available for mitigation of noise-sensitive development constructed within the 65 DNL noise contour after October 1, 1998.

- Federal Interagency Council on Noise (FICON) recognized the potential for noise impacts down to 60 DNL for the following reasons:

  - Schultz curve recognizes that some individuals would be "highly annoyed" at these levels
  - Large changes in noise levels (on the order of 3 dB or more below 65 dB) can be perceived by people as a degradation of their noise environment.
  - Improved techniques for assessing noise impacts below 65 DNL are now in existence.

- Professionals are beginning to understand the limitations of the DNL metric for use in local regulations. Its limitations result from a decreasing accuracy at lower noise levels and its inability to incorporate varying perceptions of noise in a community. As a result, noise regulation and mitigation for airports are being applied to areas with less prolonged noise exposure such as the 55 and 60 DNL noise contours.

- FAA has established the Center of Excellence for Aircraft Noise Mitigation. This research center is a partnership between academia, industry, and government. Part of the center's focus will be on what level of noise is

significant as well as other noise metrics that can be used to assess the impact of aircraft noise on individuals.

- EPA Guidelines published in 1974 stated that interference with outdoor activities may become a problem when noise levels exceed 55 DNL.

- In 1995, the House of Representatives introduced a bill to require the Department of Transportation to develop a plan to reduce the number of people residing within the 60 DNL contours of airports by 75 percent. (This bill did not pass; however, these developments indicate concerns with noise levels under 65 DNL.)

- Residents residing between the 55 and 65 DNL noise contours at Raleigh-Durham International Airport were awarded compensation for noise damages in 1992. Since that time the State of North Carolina passed legislation which requires fair disclosure of airport operations for properties within the 55 DNL noise contour of airports within the state.

- Within the State of California's Airport Land Use Planning Handbook, it states that the 65 DNL noise contour is not an appropriate criterion for evaluating the appropriateness of new noise sensitive development. At a minimum, communities should assess the suitability and feasibility of setting a lower standard for new residential and other noise-sensitive development. (*California Airport Land Use Planning Handbook*, prepared for the State of California Department of Transportation, Division of Aeronautics, 2002.)

- The State of Oregon recognizes that, in some instances, land use controls and restrictions that apply to the 65 DNL may be appropriate for application to areas impacted by lower noise levels. For example, a rural area exposed to 55 to 65 DNL noise levels may be more affected by these levels than an urban area. This is because the is typically a higher level of background noise associated with an urban area. (*Airport Land Use Compatibility Guidebook*, published by the Oregon Department of Aviation, 2003.)

- Guidance prepared by the State of Florida's Aviation Office, states that each local government should prohibit new residential development and other noise sensitive uses for those areas down to at least the 65 DNL noise exposure contour level for any airport. Where practical, new residential development should be limited in areas down to the 55 DNL noise exposure contour. The rationale for this is due to the potential to create a body of residents who are annoyed by noise. These individuals will inevitably create pressure to decrease, limit, or prevent aircraft operations which will effect the economic viability of the airport in the future. (*Airport Compatible Land Use Guidance for Florida Communities*, published by the Florida Department of Transportation, Aviation Office, 1994.)

TABLE A
Sampling of Jurisdictions that Implement Noise-related Land Use Regulations

Name of Jurisdiction	Regulating Tool	Noise Boundaries Established	Description of Regulation
Adams County, Colorado	Comprehensive Plan	60 DNL contour	• Residential development is prohibited within the 60 DNL contour.
	Zoning Ordinance	60 DNL contour	• New residential, institutional care, and university facilities are prohibited within the 60 DNL contour. Additional uses are prohibited at the discretion of the planning director. • Commercial and industrial development must incorporate sound attenuation measures.
Addison, Texas	Comprehensive Plan (*Town of Addision Comprehensive Plan* 1991)	65 DNL contour	• Plan contains a recommendation that residential uses not be permitted where noise exposures exceed 65 DNL.
Boise, Idaho	Comprehensive Plan (*Boise City Comprehensive Plan - 1997*)	Airport Influence Area, squared off 60 to 65 DNL and 65 to 70 DNL noise contours	• Within the 60 to 65 DNL contour, residential development and schools must be sound insulated. • Residential development is not allowed within the 65 to 70 DNL contour. Sound insulation is required for other development within this contour. • Efforts are to be made to control development within the Airport Influence area to promote non-residential land uses. • Protection of the airport from the encroachment of non-compatible development is considered the highest priority.
	Zoning Ordinance	Airport Noise Transition Zone	• Maximum lot coverages are defined within this zone for all land uses
Brown County, Wisconsin	Zoning Ordinance	Airport Influence Area, 65 DNL contour	• Residential development is not allowed within the 65 DNL contour. Other development within this contour must incorporate sound attenuation measures. • Residential development within the remaining portions of the airport influence area must incorporate sound attenuation standards.

TABLE A (Continued)
Sampling of Jurisdictions that Implement Noise-related Land Use Regulations

Name of Jurisdiction	Regulating Tool	Noise Boundaries Established	Description of Regulation
Cleveland, Ohio	Not Applicable	60DNL noise contour	• The City of Cleveland is mitigating noise impacts down to the 60 DNL noise contour by providing sound insulation to existing noise sensitive development. The area within the City of Cleveland's portion of the 60 DNL noise contour is fully developed; therefore, the City did not feel that a change to the zoning ordinance (i.e. overlay zoning) was warranted.
Durham, North Carolina	Zoning Ordinance	60 and 65 DNL contours	• Noise-sensitive development, including residences, is prohibited within the 65 DNL contour. • Residential development within the 60 DNL contour require sound attenuation and fair disclosure.
Flagstaff, Arizona	General Plan (*2001 - Flagstaff Area Regional Land Use and Transportation Plan*)	60 DNL contour	• Residential development is discouraged within the 60 DNL contour.
	Land Use Development Code	60 to 65, 65 to 70, and 70 to 75 DNL contours, avigation area zone (aka Airport Influence Area)	• Overlay zoning • Residential development is allowed within the 60 to 65 and 65 to 70 DNL noise contours with the use of sound insulation; however, residential uses are strongly discouraged within the 65 to 70 DNL noise contours. Other noise-sensitive development is also allowed with sound attenuation measures. • Residential development is not allowed within the 70 to 75 DNL noise contour. Other noise-sensitive uses are allowed with sound attenuation. • The issuance of avigation easements is a condition of development, or re-development, within the avigation area zone.
Grand Junction, Colorado	Zoning Ordinance	Area of Influence, 65 to 70 DNL contour	• Residential and other noise-sensitive development are allowed with the issuance of a conditional use permit as well as the incorporation of sound insulation. • Avigation easements are required prior to any development within the Area of Influence

TABLE A (Continued)
Sampling of Jurisdictions that Implement Noise-related Land Use Regulations

Name of Jurisdiction	Regulating Tool	Noise Boundaries Established	Description of Regulation
Indian River County, Florida	Zoning Ordinance	65 to 70 DNL contour	• Noise-sensitive development (including residential) is permitted within the 65 to 70 DNL contour with the incorporation of sound insulation. • An avigation easement is required for development.
Kenosha, Wisconsin	Zoning Ordinance	Airport Influence Area, 65 DNL contour	• Residential development is not allowed within the 65 DNL contour. Other development within this contour must incorporate sound attenuation measures. • Residential development within the remaining portions of the airport influence area must incorporate sound attenuation standards.
	Airport Site Review Permit		• A permit is required for any development within the Airport Overlay zones.
Lincoln, Nebraska	Zoning Ordinance (Chapter 27.58)	Airport Environs Noise District (squared-off area that extends one mile beyond the65 DNL contour) ; 65, 70, and 75 DNL noise contours	▸ Development within the Airport Environs Noise District requires the issuance of a Noise and Avigation Easement ▸ Within the 65 DNL contour, residential development requires the incorporation of sound insulation and is considered a conditional use. Mobile homes, schools, libraries, churches, health care facilities, and other noise-sensitive development are allowed within the contour. ▸ Within the 70 DNL contour, no residential uses are permitted. Hotels, motels, playgrounds, and noise-sensitive manufacturing and communication facilities are allowed. ▸ Within the 75 DNL contour, minimal noise-sensitive development is allowed (i.e. theaters, cemeteries).
	Subdivision Regulations	Boundaries established within the zoning ordinance	▸ Prior to plat approval, all of the requirements of the Airport Environs Noise District must be met.

TABLE A (Continued)
Sampling of Jurisdictions that Implement Noise-related Land Use Regulations

Name of Jurisdiction	Regulating Tool	Noise Boundaries Established	Description of Regulation
Loudoun County, Virginia	Zoning Ordinance	60 and 65 DNL contours, and area extending 1 mile from 60 DNL contour boundary	▸ For areas located within one mile of the 60 DNL contour boundary, full disclosure statements are required. ▸ Residential uses are allowed within the 60 to 65 DNL noise contour will the following: full disclosure statement, acoustical treatment, and avigation easements. ▸ Within the 65 DNL contour, residential uses are not allowed.
Mesa, Arizona	General Plan (*Mesa 2025 General Plan - 2002*)	60 and 65 DNL noise contour	▸ Plan prohibits residential development within the 65 DNL contour and limits residential development within the 60 DNL contour. ▸ Noise contours are contained on all exhibits within the plan.
	Zoning Ordinance	60 to 65, 65 to 70, and 70 to 75 DNL contours, overflight areas	▸ Within the 75 DNL contour, no noise-sensitive land uses are permitted. ▸ Within the 70 to 75 DNL and the 65 to 70 DNL contour, residential uses are permitted with sound insulation, an avigation easement, and design review. Other noise-sensitive uses are allowed with the incorporation of sound insulation measures. ▸ Within the 60 to 65 DNL contour, residential uses are permitted with sound insulation and the issuance of an avigation easement. ▸ Within the designated overflight areas, residences are allowed with the incorporation of sound insulation. ▸ As part of the building permit issuance, certified proof of sound insulation must be provided.
Minneapolis, Minnesota	Not Applicable	60DNL noise contour	▸ The City of Minneapolis is mitigating noise impacts down to the 60 DNL noise contour by providing sound insulation to existing noise sensitive development. The area within the City of Minneapolis' portion of the 60 DNL noise contour is fully developed; therefore, the City did not feel that a change to the zoning ordinance (i.e. overlay zoning) was warranted.

TABLE A (Continued)
Sampling of Jurisdictions that Implement Noise-related Land Use Regulations

Name of Jurisdiction	Regulating Tool	Noise Boundaries Established	Description of Regulation
Naples, Florida	Comprehensive Plan *(VISION 2005* - 1998)	60 DNL contour	▸ Development within the 60 DNL contour requires approval by the City Council
	Zoning Ordinance	Airport Overlay District; School Impact Area; squared-off 60, 65, 70, and 75 DNL contours	▸ The School Impact Area is defined as an area five miles long in direct line with the runway centerline with a width of 2,500 feet. The development of schools within this area is prohibited. ▸ Residential uses, nursing homes, and schools are prohibited within the 60 DNL noise contour. Churches, libraries, and hospital's are considered a conditional use within the 60 DNL contour. ▸ Public notice of the existence of maps depicting noise impacted areas shall be published at least three times in a newspaper of general circulation in the county. ▸ Avigation easements are required for all new development, or redevelopment, within the 60 DNL noise contour. ▸ Any person, in a first sale from the developer, selling any interest in real property located within the noise impact zone shall disclose in writing in the sales contract or addendum the noise impact zone the property lies in as well as a statement that the property lies within an area which airport noise may be present and objectionable.

TABLE A (Continued)
Sampling of Jurisdictions that Implement Noise-related Land Use Regulations

Name of Jurisdiction	Regulating Tool	Noise Boundaries Established	Description of Regulation
Orlando, Florida	Comprehensive Plan (*City of Orlando's Growth Management Plan - 1991*)	Airport Noise Overlay District	▸ Requires compatible development within the overlay district. ▸ Provides for the issuance of avigation easements as well as fair disclosure.
	Zoning Ordinance	Composite contours based on the 75, 70, 65, 60, and 55 DNL contours as well as the 75 and 80 dBA aircraft noise metric contours,	▸ Residential development is not allowed within the 70 DNL noise contour and is strongly discouraged within the 65 DNL contour. Avigation easements, a waiver of claim, fair disclosure, and sound insulation are required within the 65 DNL contour. ▸ Residential development within the composite 60 DNL contour requires a waiver of claim, fair disclosure, and sound insulation. ▸ Residential development within the composite 55 DNL contour requires fair disclosure. ▸ Other noise sensitive development is not allowed within the 65 DNL contour. Avigation easeements, sound insulation, and fair disclosure are required prior to development within the lesser contours.
	Subdivision regulations		▸ Require avigation easements prior to issuance of building permit.
Polk County, Florida	Zoning Ordinance	65, 70, and 75 DNL contours	▸ Education facilities are not allowed within an area that extends five miles out for the end of a runway, along the extended runway centerline, and which has a width measuring one-half the length of the runway. ▸ Residential development is strongly discouraged within the 65 and 70 DNL noise contour. If development of residences is allowed, sound attenuation is required. ▸ Hospitals and schools are strongly discouraged within the 65 DNL contour and not allowed within the 70 DNL contour. ▸ Disclosure statements and avigation easements are required prior to development within the 65 DNL contour.

TABLE A (Continued)
Sampling of Jurisdictions that Implement Noise-related Land Use Regulations

Name of Jurisdiction	Regulating Tool	Noise Boundaries Established	Description of Regulation
Portland, Oregon	Zoning Ordinance	65 and 68 DNL contours	▸ New residential uses are prohibited within the 68 DNL contour. ▸ All development within the 65 DNL contour is required to obtain a noise disclosure statement and incorporate sound attenuation. ▸ Noise easement is required for development within the 65 DNL noise contour.
Reno, Nevada	Master Plan (*City of Reno Master Plan, 1999*) Zoning Ordinance	65 DNL contour FAR Part 77 horizontal surface, 80 Lmax, and 65 DNL contour	▸ A policy was adopted that "guides" noise-sensitive development away from areas within the 65 DNL contour. ▸ Properties within the FAR Part 77 horizontal surface are required to grant an aviation easement to the airport authority whenever a building permit is requested. ▸ Properties within the 80 Lmax and 65 DNL contours are required to provide sound insulation to achieve an indoor noise level of 45 DNL (must be certified). Additionally, properties within the 65 DNL contour must have a formal noise disclosure document, relative to aircraft overflights and noise, which is separate from the title agreement. Dwellings within the 65 DNL contour must also have air conditioning systems installed.
Skagit County, Washington	Zoning Ordinance	Airport Environs	▸ Residential and other noise-sensitive development must be sound insulated to achieve an indoor noise level of 45 DNL. ▸ Avigation easements are required prior to development within the Airport Environs district.
Tallahassee, Florida	Zoning Ordinance	65 DNL contour	▸ Noise-sensitive development is not allowed within the 65 DNL contour.

TABLE A (Continued)
Sampling of Jurisdictions that Implement Noise-related Land Use Regulations

Name of Jurisdiction	Regulating Tool	Noise Boundaries Established	Description of Regulation
Truckee, California	General Plan - 1996 (currently being updated)	60 to 65, 65 to 70, and 70 to 75 CNEL contours	▸ Residential uses are conditionally acceptable within the 60 to 65 CNEL contour; normally unacceptable within the 65 to 70 CNEL contour; and clearly unacceptable above 75 CNEL. ▸ Hospitals, schools, and other noise-sensitive uses are conditionally acceptable within the 65 to70 CNEL contour; normally unacceptable within the 70 to 80 CNEL contour; and clearly unacceptable above 80 CNEL.
	Zoning Ordinance	55, 60, and 65 CNEL contours	▸ Residences, schools, places of worship, etc. are not allowed within the 65 CNEL contour. Additionally, commercial development within the 65 CNEL contour are typically required to be sound insulated. ▸ Within the 55 CNEL contour, an acoustical analysis must be preformed for all noise sensitive development and sound insulation is required in order to achieve an indoor sound level of 45 CNEL.
	Subdivision regulations	55, 60, and 65 CNEL contours	▸ Reinforces the contents of the zoning ordinance. ▸ Requires an avigation for development within the 55 CNEL noise contour as well as the largest safety area zone.

The City of Lincoln has expressed interest in comparing vehicular and aircraft noise methodologies. The development of a comparison between these two transportation noise sources is very problematic. The following discussion is for informational purposes only and provides two basic reasons why these two transportation noise methodologies are not comparable.

First, the noise metrics used to determine the level of impact are very different. The Federal Highway Administration and the Nebraska Department of Roads utilize the **Leq(h)** and **L_{10}(h)** noise metrics for assessing noise impacts related to highways. Leq is defined as a measure of the increase in the cumulative noise level of the community for a specified time (an hour in this case). L_{10}(h) is the statistical measure that represents the percentile of time a specified sound level is exceeded over a one-hour period (10 percent in this case). Leq(h) and L_{10}(h) are commonly used to measure steady-state sound or noise that is usually dominant. The ability to measure the magnitude of change of a steady-state sound is well-suited for assessing highway noise impacts (highways with noise problems generally have a fairly regular flow of traffic and road alignment is the same).

The hourly nature of both Leq(h) and L_{10}(h) metrics is also beneficial because highways are designed based upon peaking characteristics like the "design hour." The Federal Highway Administration has also developed their land use compatibility criterion adjacent to highways using these metrics. A number of highway noise studies have been prepared for the Lincoln area in the past years using the both Leq(h) and L_{10}(h) metrics to determine noise impacts.

The Federal Aviation Administration (FAA) has chosen the DNL metric for assessing impacts related to aircraft noise. DNL, or Day-Night Sound Level, is a cumulative noise metric that accounts for people's responses to daytime and nighttime noise events. Most people sleep at night and are much more sensitive to noise intrusion (nighttime noise events are penalized ten-fold in the DNL noise calculation).

DNL metric is based upon a 24-hour period. This is well-suited for assessing aircraft noise because, unlike the steady-state of highway noise, aircraft noise is much more sporadic. Constantly changing variables throughout the day such as weather (wind direction, cloud cover, etc.) and flight schedules can also effect the direction aircraft fly, number of aircraft operating, and duration of aircraft noise at a given location throughout the day. Therefore, it is important to assess aircraft noise over a longer period of time.

A second point that should be made is that studies by Finegold (1994) and Miedema and Vos (1998) show that aircraft noise is more annoying than other forms of transportation noise. Therefore, applying the same compatibility criterion to all forms of transportation would be overly restrictive on land adjacent to highways and railroads.

References

Finegold, Lawrence S., C. Stanley Harris, and Henning E. von Gierke, (1994). "Community annoyance and sleep disturbance: Updated criteria for assessing the impacts of general transportation noise on people", Noise Control Eng. J., 42(1), 25-30 (1994- January-February).

Miedema, Henk M.E. and Henk Vos, (1998). "Exposure-response relationships for transportation noise," J. Acoust. Soc. Am., 104(6), 3432-3445, (December, 1998).

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