

# CHAPTER 1: INTRODUCTION



## *Introduction*<sup>1</sup>

One of the perennial challenges facing modern airports is the encroachment of incompatible land uses. Such encroachments can be in the form of high-intensity uses like arenas or schools that are incompatible with airport operations in terms of safety because they attract large numbers of people. In other instances, structures like tall office buildings may be built too close to runways so that they impede aircraft operations. Of course, adjacent residents' noise concerns abound at the busiest urban airports, and are often a significant constraint on aviation operations. These are not problems unique to Minnesota airports.

This manual focuses on land uses that are incompatible with airport operations because of (1) the potential danger to people and property on the ground from airplane crashes, or (2) the potential danger to aircraft pilots and occupants from obstructions to flight. While noise concerns are rampant at many public airports, a significant body of data, analysis, and advice already exists regarding airport noise controls, which airport sponsors and affected local governments can readily access.<sup>2</sup> Instead, this manual focuses on these two land use safety compatibility concerns that local governments often underestimate in relation to the magnitude of potential risk.

Indeed, newspaper headlines of airplane accidents from around the globe grab the public's attention, and spark calls for better airport control to assure the public's safety. A NASAO-sponsored survey of public airports in 40 responding states, conducted in 2005-06 by the consulting firm Mead & Hunt, revealed that, on average, less than 5% of the national aviation system in those states is protected by airport safety zoning regulations 80-100% of the time. Yet the same survey revealed that issues of compatible land use constituted a "moderate and high concern" for 95% of the public airports surveyed.

### CHAPTER 1 OVERVIEW

- Introduction
- The Importance of Aviation
- Defining the Threat – Incompatible Land Uses
- Who Should Use this Manual
- How the Manual Was Prepared
- How to Use This Manual

<sup>1</sup> If this chapter is read in full, we recognize its contents may overlap with other discussions presented in other chapters. We believe most users will read specific chapters of this manual as needed and, therefore, we feel it is better to include some discussions that may be repetitive. Where possible, however, we have eliminated duplicate text and included cross references.

<sup>2</sup> See Appendix 14 to this manual for resources to address airport noise and mitigation.



Yet, airport officials and all levels of government around the nation have grappled with these public safety issues and concerns for decades. They are particularly challenging because often the jurisdictions or agencies responsible for airport operations do not have direct authority over local land use decisions in the airport vicinity, which are the bailiwick of surrounding cities, towns, and counties. In making airport-related land use decisions, these local governments will understandably often consider economic development goals and legal issues, as well as airport compatibility considerations, in reviewing development proposals.

The Federal Aviation Authority (FAA) is heeding the calls and is currently undertaking several federal initiatives to more comprehensively address airport land use compatibility. One important initiative is an overhaul of the FAA Advisory Circular 150/5190-4A (“A Model Zoning Ordinance to Limit Heights of Objects around Airports”). Working collaboratively with the American Planning Association’s aviation transportation committee, the FAA intends to expand the scope of the circular and republish it as Advisory Circular 150/5190-4B, “Compatible Airspace and Land Use.” Work on the revised circular is continuing through 2006 and likely into 2007.

The Airport Cooperative Research Program, under the auspices of the national Transportation Research Board (TRB)<sup>3</sup> and sponsored by the FAA, announced in February 2006 that it will grant \$500,000 to fund research to assess the impacts of incompatible land uses near airports. The objective of this research will be to define incompatible use and its limits, and develop tools that state and local governments can use to assess the current and future impacts that incompatible land uses will have on future airport expansion and ultimately the life of the airport. It is hoped that the TRB research project will produce a land use compatibility zoning model incorporating land use and third party risk that state and local governments can use as a basis for their ordinances.

For the State of Minnesota, the reason for this manual is very straightforward and simple—public airports are major economic generators for the state and its cities, towns, and counties. They represent huge investments of public funds and generate billions of dollars of economic activity while providing essential transportation links to the rest of the nation and world. They make possible critical public services like medical evacuations and search and rescue missions. As never before, however,

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<sup>3</sup> The TRB is a division of the National Research Council, which serves as an independent adviser to the federal government and others on scientific and technical questions of national importance. The National Research Council is jointly administered by the National Academy of Sciences, the National Academy of Engineering, and the Institute of Medicine. The mission of the Transportation Research Board—one of six major divisions of the National Research Council—is to promote innovation and progress in transportation through research. In an objective and interdisciplinary setting, the Board facilitates the sharing of information on transportation practice and policy by researchers and practitioners; stimulates research and offers research management services that promote technical excellence; provides expert advice on transportation policy and programs; and disseminates research results broadly and encourages their implementation.

Minnesota’s 136 public airports<sup>4</sup> are under threat from incompatible land uses—residential and commercial development, and tall structures—being built too close to runways, cramping airport operations and creating serious safety problems for people on the ground as well as passengers in the air. Already, some public airports in the state are being forced to spend huge sums to buy encroaching land uses or to close and move operations to new sites at the cost of millions of dollars.

All of this development pressure is coming at a time when state aviation forecasts foresee airport demand in Minnesota growing at a steady pace both at commercial and general aviation facilities.

The State of Minnesota has protective legislation to prevent incompatible development around airports. Since 1943, airports in Minnesota have been required by state statute to enact safety zoning.<sup>5</sup> In 1973, zoning was made a condition for receiving federal and state funding. Additionally, the Office of Aeronautics at the Minnesota State Department of Transportation publishes a model zoning ordinance to assist local governments and provides related technical assistance to the 136 publicly owned airports in the state. However, there is growing concern in the aviation industry that the state airport system will be slowly compromised and safety hazards magnified unless action is taken now to prevent additional incompatible development. This manual details the tools and strategies that local governments can use to turn the tide and protect these invaluable community assets.

## *The Importance of Aviation*

Airports are the lynchpins of modern economies. In a world of free trade where business knows few borders, airports are widely recognized as key drivers of state and local economies. Increasingly across the nation, cities and towns without modern airports find it difficult to compete for entrepreneurial firms and for businesses in growing economic sectors. One study in Wisconsin found that in one recent 5-year period, 72 percent of new or expanded manufacturing businesses were located within 10 miles of a public airport.<sup>6</sup>

The nine major commercial airports in Minnesota play a particularly important role in the state economy. In 2004, the Minneapolis-St. Paul International (MSP) Airport alone provided service to 36.7 million passengers and handled 659.5 million pounds of air cargo (air freight, air express and air mail). This airport is currently responsible for bringing over 150,000 jobs to the Twin Cities region through direct, induced, and indirect means.<sup>7</sup> See Table 1-1.

**AIRPORTS IN MINNESOTA PROVIDE:**

- Employment for airport workers and airport related industry
- A base for recreational and corporate aircraft
- Charter transportation services
- A venue for other private businesses to provide services to the general aviation industry
- Corporate travel and business development opportunities
- Tourism industry development
- Fire and police protection
- Agricultural related support
- Pilot training
- Medical and emergency related transportation service

<sup>4</sup> As of January 2006, the State of Minnesota had 136 publicly owned airports, 7 privately owned airports (open to public), and 18 seaplane bases.  
<sup>5</sup> The primary airport compatibility legislation can be found in Minnesota Statutes, Chapter 360.  
<sup>6</sup> Source: Wisconsin Airport Land Use Guidebook 2004 (WisDOT)  
<sup>7</sup> Source: “The Local and Regional Economic Impacts of the Minneapolis/St.Paul



<b>TABLE 1-1: ECONOMIC ACTIVITY OF MINNEAPOLIS-ST. PAUL INTERNATIONAL AIRPORT</b>			
<b>Impacts</b>	<b>Airport Generated</b>	<b>Visitor Industry</b>	<b>Total Impact</b>
<b>JOBS</b>			
Direct	28,545	60,516	89,061
Induced	26,406	22,072	48,478
Indirect	11,264	4,573	15,837
<b>TOTAL</b>	<b>66,125</b>	<b>87,161</b>	<b>153,376</b>
<b>PERSONAL INCOME</b>			
Direct	\$1,456.3	\$988.2	\$2,444.5
Induced	\$2,197.7	\$788.4	\$2,986.1
Indirect	\$438.7	\$95.6	\$534.3
<b>TOTAL</b>	<b>\$4,092.7</b>	<b>\$1,872.2</b>	<b>\$5,964.9</b>
<b>Average Income / Direct Employee</b>	\$51,017.4	\$16,329.6	--
<b>Business Revenue (millions)</b>	\$7,039.5	\$3,649.2	\$10,688.7
<b>Local Purchases (millions)</b>	\$1,105.8	\$154.5	\$1,260.3
<b>State and Local Taxes (millions)</b>	\$429.7	\$196.6	\$626.3
<b>Federal Government Aviation-Specific Taxes (millions)</b>	\$391.4	NA	\$391.4
<i>Source: "The Local and Regional Economic Impacts of the Minneapolis/St. Paul International Airport" John C. Martin Associates LLC (March, 2005)</i>			

There are six reliever airports situated in the vicinity of the Minneapolis-St. Paul International Airport that provide an alternative for private and corporate aircraft. These airports generate an additional \$255 million in economic activity and provide 2,258 jobs to the Twin Cities region.<sup>8</sup> Through the use of such reliever airports, safety and efficiency can also be dramatically increased. See Table 1-2.

International Airport” Prepared for the Metropolitan Airports Commission (March, 2005) by John C. Martin Associates LLC.

<sup>8</sup> Source: “Metropolitan Airports Commission – Economic Impacts Analysis of the Reliever Airport System” prepared by Wilder Research (October, 2005).

**TABLE 1-2: TOTAL ECONOMIC ACTIVITY OF MSP AIRPORT RELIEVER SYSTEM**

Airport	Total Economic Impact
Airlake Airport	\$3,354,219
Anoka County-Blaine Airport	\$35,128,556
Crystal Airport	\$19,272,617
Flying Cloud Airport	\$80,194,872
Lake Elmo Airport	\$4,296,084
St. Paul Downtown Airport	\$112,416,230
<b>Total Reliever Airport System</b>	<b>\$254,662,578</b>

*Source: "Metropolitan Airports Commission-Economic Impact Analysis of the Reliever Airport System" Prepared for Metropolitan Airports Commission by Wilder Research (October, 2005)*

Enplanements at Minnesota’s largest airports have increased significantly during the last five years, and are expected to continue growing steadily over the next twenty years. As shown in Tables 1-3 and 1-4, enplanements at eight of Minnesota’s largest airports, but not including the Minneapolis-St. Paul airport, grew by a total of 66,000 between 1995 and 2000, equivalent to a healthy 1.8% average annual growth rate. Some airports, such as St. Cloud, Bemidji, and Brainerd airports, experienced significant growth well above the average for the eight combined greater Minnesota airports. See Table 1-4. St. Cloud airport witnessed an 11.9% increase from 1995 to 2000, while Bemidji saw a jump of 6.4% in enplanements over the same time period.

At the Minneapolis-St. Paul International Airport, enplanements increased from 12.7 million in 1995 to an estimated 18.5 million in 2005 – for an average annual growth rate of 3.9%.

**TABLE 1-3: HISTORICAL AND FORECAST ENPLANEMENTS**

	1995	2005E*	2010	2015	2020	2025
Bemidji	16,100	29,900	33,900	38,500	43,400	48,000
Brainerd	11,800	20,700	22,000	22,800	22,900	23,000
Duluth	119,200	155,800	182,500	201,300	216,000	226,200
Hibbing	13,100	11,600	11,700	11,700	11,700	11,700
International Falls	19,100	21,800	21,700	21,800	21,800	21,900
Rochester	156,500	143,200	153,600	159,300	165,500	171,400
St. Cloud	8,400	25,900	25,600	27,100	29,100	31,100
Thief River Falls	3,700	5,000	5,000	5,000	5,000	5,000
<b>Total Greater Minnesota</b>	<b>348,000</b>	<b>414,000</b>	<b>456,000</b>	<b>487,500</b>	<b>515,300</b>	<b>538,300</b>
Minneapolis-St. Paul	12,664,300	18,515,600	21,986,000	24,552,000	33,445,200	-
<b>Total Minnesota</b>	<b>13,012,200</b>	<b>18,929,500</b>	<b>22,414,500</b>	<b>24,995,100</b>	<b>33,895,900</b>	<b>-</b>
% Greater Minnesota	2.70%	2.20%	2.00%	2.00%	1.50%	

\*"E" means estimated

*Source: Historical Enplanements: Individual Minnesota Airports - Greater Minnesota Forecasts: KRAMER aerotek, inc. Minneapolis-St. Paul Airport Forecasts: 2010 and 2015, Draft Environmental Assessment - MSP 2015 Terminal Expansion Project, Forecast. 2020 Forecast, FAA Terminal Area*



**TABLE 1-4: COMPOUND ANNUAL GROWTH RATE**

	1995-2005E*	2005-2010	2010-2015	2015-2025	2005-2025
Bemidji	6.4%	2.5%	2.6%	2.2%	2.4%
Brainerd	5.8%	1.2%	0.7%	0.1%	0.5%
Duluth	2.7%	3.2%	2.0%	1.2%	1.9%
Hibbing	-1.2%	0.2%		0.0%	0.0%
International Falls	1.3%	-0.1%	0.1%	0.0%	0.0%
Rochester	-0.9%	1.4%	0.7%	0.7%	0.9%
St. Cloud	11.9%	-0.2%	1.1%	1.4%	0.9%
Thief River Falls	3.1%	0.0%	0.0%	0.0%	0.0%
<b>Total Greater Minnesota</b>	<b>1.8%</b>	<b>2.0%</b>	<b>1.3%</b>	<b>1.0%</b>	<b>1.3%</b>
Minneapolis-St. Paul	3.9%	3.5%	2.2%		
<b>Total Minnesota</b>	<b>3.8%</b>	<b>3.4%</b>	<b>2.2%</b>		

\*"E" means estimated

Source: Historical Enplanements: Individual Minnesota Airports - Greater Minnesota Forecasts: KRAMER aerotek, inc. Minneapolis-St. Paul Airport Forecasts: 2010 and 2015, Draft Environmental Assessment - MSP 2015 Terminal Expansion Project, Forecast. 2020 Forecast, FAA Terminal Area

Commercial activity at all of the airports shown in Tables 1-3 and 1-4 is expected to continue growing steadily over the next twenty years, with a forecast annual average growth rate of 1.3% for the eight Greater Minnesota airports. The Minneapolis-St. Paul International Airport is expected to grow at an annual average rate of 4.0% over the next fifteen years. See Table 1-4, above.

In total, commercial service airports directly create more than 108,600 full-time jobs and generate almost \$10 billion in total economic activity annually within Minnesota.<sup>9</sup>

Other small cities and towns within the state receive a big economic boost from their airports, too. Minnesota currently has 136 public airports that support a wide variety of functions, ranging from corporate/private business transport, pilot training, private transport, package delivery, and sightseeing. The majority of Minnesota's aircraft take-offs and landings (61.3%) occur at general aviation airports, and they generate significant economic activity – more than 5,100 jobs with annual earnings of more than \$131.8 million. Overall, these airports generate more than \$374.6 million in economic activity annually.

<sup>9</sup> Source: "The Economic Impact of Minnesota's Airport System" (Mn/DOT Study: Wilbur Smith Associates) (1997).

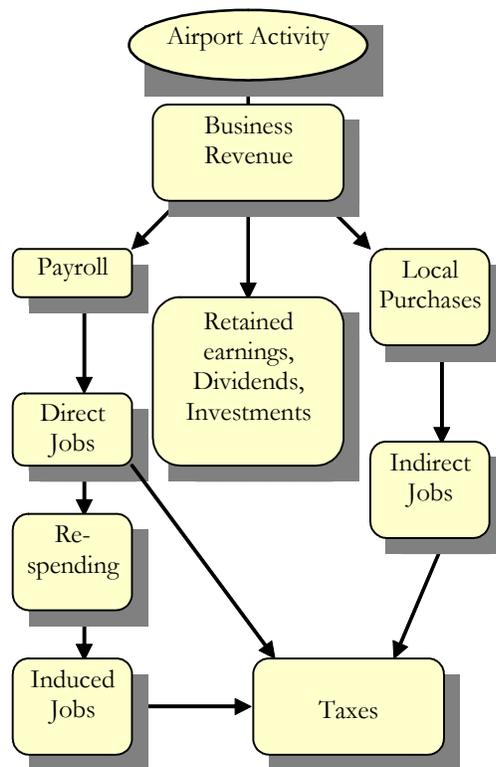
**TABLE 1-5: SUMMARY OF MINNESOTA JOBS RESULTING FROM AIRPORTS**

Impact Source	Airports	Total Jobs
Met Council	6 relievers	2,258
MAC	Minneapolis-St. Paul International	153,376
State Aviation System Plan		113,775
<b>Totals</b>		<b>269,409</b>

Sources: "Metropolitan Airports Commission-Economic Impact Analysis of the Reliever Airport System" Prepared for Metropolitan Airports Commission by Wilder Research (October, 2005)  
"The Economic Impact of Minnesota's Airport System" (Mn/DOT Study: Wilbur Smith Associates) (1997)

Of course, airports bring other important benefits to communities beyond stoking the local economy. They provide vital links for citizens not only for business but also for recreational travel. There are also critical services such as search and rescue missions, medical evacuations, and forest fire control that would be severely hampered without local airports.

**FIGURE 1-1: FLOW OF ECONOMIC IMPACTS GENERATED BY AIRPORT ACTIVITY**





## *Defining the Threat – Incompatible Land Uses<sup>10</sup>*

The story of one airport illustrates many of the challenges and problems Minnesota airports are facing with development that interferes with operations and creates safety hazards. A city approved several major developments around its airport several decades ago, including lighted ball fields, a 130-foot high grain storage elevator, residential uses, and a nursing home. Like many communities, the city saw these developments as important to the city's economic health and tax base, and did not appreciate the impact these decisions would have on future airport operations until it was too late. When a new airport master plan determined the city's airport would have to expand or improve its facilities to accommodate future demand, the city realized it would never get federal or state funding for the expansion because of the already-established incompatible land uses. As a result, the city is closing its current airport and building a brand new airport in the middle of cornfields at a cost of more than \$20 million dollars.

The airport sponsor in our story learned its lessons and has already purchased hundreds of acres of land around the new airport site. Additionally, a new multi-jurisdictional zoning board authorized by state law has been convened, and so far cooperation among the airport, city, county, and townships to limit potentially incompatible land uses is encouraging. The airport sponsor is working hard to retain agricultural uses around the airport and to ban residential uses on adjacent properties.

This case demonstrates how important it is to protect the huge investment in public dollars that airports represent. In a time of tight state and local budgets, no one can afford to make decisions detrimental to the airports and permit incompatible land uses that interfere with airport operations. But these decisions can have an even more serious consequence beyond dollars and cents—building houses, businesses, schools, cell towers, grain elevators, and other structures near runways will inevitably have serious safety consequences. While air travel is the safest form of transportation, and recent studies from 2004 even indicate that the number of accidents is dropping, accidents can and will happen. Putting houses and other structures too close to runways significantly increases the chance of a catastrophic accident with many casualties.

Airport safety can be broken down into three categories:

- Protecting people and property on the ground;
- Minimizing injury to aircraft occupants; and
- Preventing creation of hazards to flight.

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<sup>10</sup> This manual focuses primarily on safety-related issues, not noise impacts of airports. Appendix 14 provides some basic references related to airport noise issues.



National Transportation Safety Board (NTSB) records indicate that over 61% of accidents occur in the vicinity of an airport. Appendix 7 discusses the number of commercial and general aviation aircraft accidents that occurred during each portion of flight. The data clearly show that most of the risk involved with air transportation is associated with takeoffs and landings, with arrival accidents exceeding departure incidents by almost 3 to 1. Interestingly, general aviation flying has more accidents per operation by a factor of approximately five when compared to commercial scheduled flights. See Table 1-6 below.

<b>TABLE 1-6: U.S. CIVIL AVIATION ACCIDENTS IN 2004</b>										
	Accidents		Fatalities				Accidents per 100,000 Flight Hours		Accidents per 100,000 Departures	
	All	Fatal	Total	Aboard	Flight Hours	Departures	All	Fatal	All	Fatal
U.S. air carriers operating under 14 CFR 121										
Scheduled	21	1	13	13	17,000,000	10,547,000	0.124	0.006	0.199	0.009
Nonscheduled	7	1	1	1	575,000	238,000	1.217	0.174	2.941	0.420
U.S. air carriers operating under 14 CFR 135										
Scheduled	5	-	-	-	330,000	593,000	1.515	-	0.843	-
Nonscheduled	68	24	65	64	3,072,000	-	2.21	0.78	-	-
U.S. general aviation	1,614	312	556	556	25,900,000	-	6.22	1.20	-	-
U.S. civil aviation	1,715	338	635	634						
<b>Notes:</b> All data are preliminary; flight hours and departures are compiled and estimated by the Federal Aviation Administration; departure information for non-scheduled part 135 operations and general aviation is not available; accidents and fatalities in the categories do not necessarily sum to the figures in the U.S. civil aviation because of collisions involving aircraft in different categories. <i>Source:</i> National Transportation Safety Board Table 1 2004 Preliminary Statistics <a href="http://www.nts.gov/aviation/Table1.htm">http://www.nts.gov/aviation/Table1.htm</a>										

The primary compatibility concerns range from tall buildings that may be obstructions to flight, to inappropriate higher density uses that put people on the ground in harm's way (such as high-density residential subdivisions and apartments), to uses that might interfere with aircraft operations (e.g., bright lights on towers, radio interference, landfills and standing water that might attract birds).

Population density, particularly in areas closest to a runway's ends and under the runway's approach and departure areas, 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. High-density development in these areas can greatly increase the risk for a catastrophic accident involving people on the ground. Moreover, occupants in developments such as hospitals, schools, and sports stadiums are more vulnerable in an accident because of mobility constraints and probable panic.

In summary, the critical areas at an airport that need to be secured and protected from a land use compatibility standpoint include the runway approach and departure. To enhance airport safety, it is important to



maintain obstruction-free airport airspace and a reasonable amount of vacant land or land with very low intensity uses at both ends of the runway. While some of these potential hazard areas can be purchased by an airport, the large bulk is often beyond normal airport boundaries. Acquisition of huge tracts of land is cost prohibitive. Thus the primary tools available to local governments to prevent incompatible development are zoning and land use controls.

## *Who Should Use This Manual*

While a wide variety of people will find this manual a useful reference, it is aimed primarily at local officials who manage airports, and those who make local land use decisions like city council members, zoning administrators, county commissioners, and planning commissioners, planning staff, and their legal counsel. The manual lays out step-by-step instructions for adopting airport zoning ordinances in Minnesota and suggests ways to protect existing airports.

Local landowners and developers will also find this manual a helpful guide about do's and don'ts for projects within the vicinity of an airport, as will members of the aviation industry who may be interested in the plan for an airport or who will use the facilities identified in the plan. Finally, members of the general public who want to understand the basics of airport compatibility planning will hopefully find it an instructive primer.

## *How The Manual Was Prepared*

This manual is the result of almost two years of intensive research and meetings undertaken at the direction of the Minnesota Department of Transportation Office of Aeronautics. The project was kicked-off in August 2004 when Mn/DOT retained a consultant, Clarion Associates, who performed a review of all 136 public airport zoning ordinances in place throughout the state and conducted follow-up in-depth interviews with 14 airports.<sup>11</sup> The purpose of these interviews was to gain a better understanding of local governments' motivations, politics, and rationale for their airport zoning choices and to hear how well those choices were working on the ground to protect airport operations and prevent airport hazards. In addition, these interviews provided an opportunity to gather specific suggestions "from the field" about what actions or policies the state might take to better guide and support local efforts to achieve airport land use compatibility.

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<sup>11</sup> The airports interviewed included (1) Alexandria, (2) Bemidji, (3) Brainerd Lakes, (4) Faribault, (5) Fergus Falls, (6) Fosston, (7) Hibbing, (8) International Falls, (9) Little Falls, (10) Maple Lake, (11) Perham, (12) Redwood Falls, (13) St. Cloud, and (14) Willmar.

The consultants next undertook a detailed review of state and federal aviation-related statutes, rules, and policy documents. They researched airport land use, zoning, and planning statutes in the following nine states:

1. California
2. Colorado
3. Florida
4. Massachusetts
5. New Jersey
6. New York
7. Oregon
8. Virginia
9. Washington

The goal was to identify any provisions in these other states' laws that are significantly different from Minnesota's airport land use laws and that might prove useful in legislative revision efforts. These nine states were chosen because of their reputations for relatively proactive state approaches to land use zoning regulation and because several of them witnessed substantial airport construction/expansion activity in the last 20 years.

Following discussions with the advisory committee convened by Mn/DOT, the consultants produced a major report entitled "Airport Land Use Compatibility Best Practices & Recommendations." This report:

- Brought together findings and recommendations from research to date.
- Presented best practices for achieving airport land use compatibility in seven (7) areas:
  - Zoning
  - Planning
  - Regulations
  - Property Disclosure Mechanisms
  - Property Acquisition
  - Incentives
  - Public Education and Outreach
- Made recommendations for changes in the state model airport zoning ordinance and state legislation relating to airport land use compatibility.

After review by the advisory committee, staff from the Office of Aeronautics and the consultants prepared this manual, drawing on the airport land use compatibility best practices report and other documents prepared during the project.



## *How To Use This Manual*

This manual is divided into a series of discrete topics that can be read and referenced individually or in tandem.

**Chapter 2: The System Today**, presents a succinct overview of the aviation system in the United States and Minnesota. It identifies key players such as the Federal Aviation Administration and the Minnesota Office of Aeronautics and discusses their roles and duties in airport operations and land use compatibility planning. It includes a brief summary of key federal and state aviation laws such as the state model airport zoning law. It concludes with a more detailed discussion of some of the current challenges and shortcomings with the current system.

**Chapter 3: Compatible Airport Land Uses**, discusses in greater detail the primary land use compatibility concerns facing airports today—everything from too tall buildings to residential subdivisions built too close to the end of airport runways. Drawing from project research, Chapter 3 presents an extensive table of land uses that might be expected to develop around an airport, and assesses the uses' relative safety compatibility. This table should serve as a useful reference to local zoning and planning officials.

**Chapter 4: Preventive and Corrective Strategies for Airport Land Use Compatibility**, presents detailed local strategies for preventing potentially incompatible land uses including planning, regulation, capital investments, acquisition, incentives, and education. It also discusses corrective actions that can be taken by local governments to address incompatible land uses after they are established.

**Chapter 5: Applicable Laws, Statutes, and Legal Issues**, summarizes the most important federal and state aviation laws related to land use compatibility. It also presents the unique aspects of Minnesota land use law that have affected land use planning around airports in the state.

The final chapter, **Chapter 6: Model Airport Safety Zoning Ordinance and Procedural Guide**, first provides an overview of the legal status of the model zoning ordinance and a summary of its contents. The complete Model Airport Safety Zoning Ordinance, with detailed annotations, is found at the end of Chapter 6. The revamped model ordinance reflects modern airport zoning practices as well as minimum requirements under Minnesota law. The intent is to provide more choices and options for local governments to tailor an airport safety zoning ordinance to their own unique circumstances. Mn/DOT encourages all affected public airports and local governments to review their current airport zoning regulations in light of this new model ordinance and to consider updating their regulations as desired. Chapter 6 also outlines the procedures to be used under state law to adopt an airport zoning ordinance, secure state approval, and review development and variance applications after the airport zoning ordinance is in place.

Following these six chapters, a glossary of key terms is set forth and appendices that present major interim project reports and other resource/contact information.



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