McMinnville Municipal Airport
Airport Layout Plan Report

Chapter Four

Airport Facility Requirements

CHAPTER FOUR
AIRPORT FACILITY REQUIREMENTS

INTRODUCTION

This chapter uses the results of the inventory and forecast conducted in **Chapters Two** and **Three**, as well as established planning criteria, to determine the airside and landside facility requirements through the current twenty-year planning period. Airside facilities include runways, taxiways, navigational aids and lighting systems. Landside facilities include hangars, fixed base operator (FBO) facilities, aircraft parking apron, agricultural aircraft facilities, aircraft fueling, automobile parking, utilities and surface access.

The facility requirements evaluation is used to identify the adequacy or inadequacy of existing airport facilities and identify what new facilities may be needed during the planning period based on forecast demand. Options for providing these facilities will be evaluated in **Chapter Five** to determine the most cost effective and efficient means for implementation.

1989 Airport Master Plan Overview

The 1989 Airport Master Plan recommended a variety of facility improvements at MMV for the 20-year planning period. The projects summarized in **Table 4-1** were included in the airport's 20-year capital improvement program. The recommended projects were reviewed to identify those, which have been completed (noted in the table). The previously recommended facility improvements, which have not been implemented, will be revalidated, modified or eliminated based on the updated facility needs assessment and FAA guidelines.

TABLE 4-1: SUMMARY OF 1989 AIRPORT MASTER PLAN RECOMMENDED PROJECTS AND CURRENT STATUS

Completed? Yes/No	Projects
Yes	Extend Runway 4-22 600 feet SW; extend lighting and drainage. (phase I)
Yes	Construct 1000' stopway at SW end of Rwy 4-22 (phase I)
Yes	Extend 4-22 Parallel Taxiway 2,150 feet SW. (phase I)
Yes	Purchase title or easements for lands in clear zone (Rwy 4) (5 acres) (phase I)
Yes	Reconstruct Runway 4-22 (phase I)
Yes	Expand Tiedown Apron (phase I)
Yes	Relocate Segmented Circle, Wind Tee (phase I)
No	Construct Auto Parking – 24 spaces (phase I)
No	Construct New AG Apron/Facilities (phase I)
No	Repair Concrete Apron Joints, Seal Surface (phase I)
Yes	Construct small aircraft hangars (30 units) (phases I-III)
No	Expand Tiedown Apron (Phase II)
No	Airport Park aircraft parking area (phase II)
No	Sealcoat Runway 16-34 (now designated 17-35) and diagonal taxiway (phase II)
No*	Apron Reconstruction (phase II)
Yes	Relocate Parallel Taxiway (phase II)
Yes**	Install medium intensity taxiway lighting and guidance signs (phase II)
No	Relocate county road east of Runway 16-34 (phase II)
No	Sealcoat Runway 4-22, apron and taxiways (phase II)
No	Construct Auto Parking – 30 spaces (phase II)
No	Reconstruct Runway 16-34 (phase III)
No	Reconstruct Diagonal Taxiway (phase III)
No	Sealcoat Runway 16-34 , diagonal taxiway, parallel taxiway (phase III)
No	Construct new access road to terminal area, east of Airport Park, extend utilities into site. (phase III)
No	Construct maintenance hangar (phase III)
No	Construct Auto Parking – 10 spaces (phase III)
No	Construct FBO/Terminal building

* Terminal Apron Expansion scheduled for 2004; ** Lighted guidance signs; no taxiway edge lighting (reflectors)

In addition to the master plan-recommended items completed, several other projects have been completed since 1989:

- Replacement of the airport fuel storage facilities with two aboveground fuel tanks
- Additional Hangar construction (west hangar area & terminal area)
- Terminal area fencing and electronic gates
- Automated surface observation system (ASOS)
- Obstruction Removal (trees)
- Expansion of terminal apron (2004)

Airspace

The 1989 Airspace Plan depicted airspace surfaces for Runway 4/22 and Runway 16/34 (now designated 17/35) based on standards for "other-than-utility" runways (designed for aircraft weighing more than 12,500 pounds). Airspace planning for Runway 4/22 was based on the existing precision instrument approach for Runway 22 and future non-precision approach capabilities for Runway 4. Airspace planning for Runway 17/35 was based on future non-precision instrument approach capabilities. No areas of terrain penetration were identified within the airport's airspace surfaces, although numerous trees were identified as obstructions to the Runway 4 and 22 approach surfaces.

Instrument Approach Capabilities

MMV currently accommodates day and night operations in visual flight rules (VFR) and instrument flight rules (IFR) conditions. Runway 4/22 is the instrument runway at MMV with precision instrument landing system (ILS) and a medium intensity approach light system (MALSR) (Runway 22). The airport also has a straight-in non-precision instrument approach for Runway 22 (non-directional beacon approach) and three "circle-to-land" non-precision instrument approach procedures (NDB, VOR/DME, GPS) that are not runway specific. Runway 4 is equipped with runway end identifier lights (REIL). Runways 4 and 22 are equipped with precision approach path indicators (PAPI). Runway 17/35 is not lighted.

Airport Design Standards

The selection of the appropriate design standards for airfield facilities is based primarily upon the characteristics of the aircraft that are expected to use the airport. The most critical characteristics are the approach speed and wingspan of the design aircraft anticipated for the airport. The

design aircraft is defined as the most demanding aircraft type operating at the airport (or runway) with a minimum of 500 annual itinerant operations (takeoffs and landings). Planning for future aircraft use is important because design standards are used to determine separation distances between facilities that could be very costly to relocate at a later date.

Federal Aviation Administration (FAA) **Advisory Circular (AC) 150/5300-13, Airport Design**, serves as the primary reference in planning airfield facilities. **FAR Part 77, Objects Affecting Navigable Airspace**, defines airport imaginary surfaces which are established to protect the airspace immediately surrounding a runway. The airspace and ground areas surrounding a runway should be free of obstructions (i.e., structures, parked aircraft, trees, etc.) to the greatest extent possible.

FAA **Advisory Circular 150/5300-13** groups aircraft into five categories based upon their approach speed. Categories A and B include small propeller aircraft, many small or medium business jet aircraft, and some larger aircraft with approach speeds of less than 121 knots. Categories C, D, and E consist of the remaining business jets as well as larger jet and propeller aircraft generally associated with commercial and military use; these aircraft have approach speeds of 121 knots or more. The advisory circular also establishes six aircraft design groups, based on the physical size (wingspan) of the aircraft. The categories range from Airplane Design Group (ADG) I, for aircraft with wingspans of less than 49 feet, to ADG VI for the largest commercial and military aircraft. Aircraft with a maximum gross takeoff weight of less than 12,500 pounds are classified as "small aircraft" by the Federal Aviation Administration. A summary of typical aircraft and their respective design categories is presented in **Table 4-2.**

The 1989 Airport Layout Plan listed the "existing" airport reference code (ARC) as B-II based on a "medium twin propeller" as the critical aircraft. Three different "future" critical aircraft were identified based on: wingspan (deHavilland Dash 8), weight (Gulfstream G-II), and approach speed (Learjet 35). By combining these three aircraft types, the recommended future ARC for was D-III. Although the 1989 ALP does not identify a specific design category for Runway 16/34 (now 17/35), several recommended dimensions suggest that ADG II standards were assumed.

As noted in the Forecast Chapter, MMV does not accommodate a significant amount of Design Group III activity. By FAA definition, the "design aircraft" must have a minimum of 500 itinerant annual operations. Both of Evergreen's locally based business jets are approach category D aircraft and the airport accommodates a variety of medium and large transient business jet activity which are included in approach category C and D (predominantly design group II aircraft). The two locally based business jets combined with a portion of the transient business jet operations meet the FAA activity threshold for use as the design aircraft. Based on

existing and forecast activity, the current and future design aircraft is identified as a medium/large business jet, included in ARC C/D-II.

TABLE 4-2: TYPICAL AIRCRAFT & DESIGN CATEGORIES

Aircraft	Airplane Design Group	Aircraft Approach Category	Maximum Gross Takeoff Weight (lbs)
Grumman American Tiger	A	I	2,400
Cessna 182	A	I	3,110
Cirrus Design SR22	A	I	3,400
Cessna 206	A	I	3,600
Beechcraft Bonanza A36	A	I	3,650
Socata/Aerospatiale TBM 700	A	I	6,579
Ayres 400 Turbo Thrush	A	I	9,300
Beechcraft Baron 58	B	I	5,500
Cessna 340	B	I	5,990
Piper Aerostar 602P	B	I	6,000
Cessna Citation CJ1	B	I	10,600
Beech King Air B100	B	I	11,800
Cessna Citation I	B	I	11,850
Piper Malibu (PA-46)	A	II	4,340
Cessna Caravan 1	A	II	8,000
Pilatus PC-12	A	II	9,920
Cessna Citation CJ2	B	II	12,300
Cessna Citation II	B	II	13,300
Beech King Air 350	B	II	15,000
Cessna Citation Bravo	B	II	15,000
Cessna Citation Excel	B	II	20,000
Dassault Falcon 20	B	II	28,660
Bombardier Learjet 31A	C	I	17,000
Bombardier Learjet 55	C	I	21,500
Hawker (HS125-700A)	C	I	25,000
Gulfstream 100	C	II	24,650
Beechcraft Hawker 800XP	C	II	28,000
Cessna Citation Sovereign	C	II	30,250
Gulfstream 200	C	II	34,450
Cessna Citation X	C	II	36,100
Bombardier Challenger 300	C	II	37,500
Learjet 35A/36A	D	I	18,300
Gulfstream IV	D	II	71,780

Source: AC 150/5300-13, change 7; aircraft manufacturer data.

With a design aircraft weight above 12,500 pounds, the use of standards consistent with "large aircraft" and "other-than-utility" runways, as defined in FAR Part 77, is appropriate for Runway 4/22. The wind coverage provided on Runway 4/22 is approximately 90.2 percent (15 miles per hour), which is well below the FAA standard of 95 percent coverage. Based on it use as a crosswind runway, it is appropriate to plan Runway 17/35 based on ADG II standards. However, the significantly more demanding Aircraft Approach Category C or D standards applied to Runway 4/22 are not recommended for Runway 17/35, since virtually all of the activity consists of approach category A and B aircraft. Runway 17/35 accommodates approximately 5,000 annual glider operations, the majority of which are ADG II aircraft (wingspans 49 to 78.9 feet) in addition to a wide range of light aircraft activity during the seasonal crosswind conditions. The FAA generally recommends that runways designed to accommodate ADG II aircraft use "other-than-utility" airspace planning criteria.

Based on the airfield configuration, air traffic, and forecast airport activity, the use of design standards based on **Aircraft Approach Category C or D and Airplane Design Group II is recommended for Runway 4/22** (***Airport Reference Code - ARC C/D-II***) for both current and future planning. As a crosswind runway, Runway 17/35 should be capable of accommodating the majority of airfield operations. However, based on the wind coverage provided on the main runway and existing runway use **Aircraft Approach Category B and Airplane Design Group II design standards are recommended for Runway 17/35**. Airfield design standards for Approach Categories A/B and C/D for ADG II are summarized in **Table 4-3**. A summary of MMV's conformance with FAA-recommended design standards is presented in **Table 4-4**.

TABLE 4-3: AIRPORT DESIGN STANDARDS SUMMARY
(DIMENSIONS IN FEET)

Design Item	Runway 4/22		Runway 17/35	
	FAA Standard ADG II[1] C&D Aircraft	*Existing Dimensions*	FAA Standard ADG II[2] A&B Aircraft	*Existing Dimensions*
Runway Length	5,310/7,000[3]	5,420	3,600[4]	4,676
Runway Width	100	150	75	150
Runway Shoulder Width	10	10	10	10
Runway Safety Area Width	500	500	150	150
Runway Safety Area Length *(Beyond Runway End)*	1,000	1,000 (4) 930 (22)[5]	300	300 (17) 190+/- (35)[6]
Obstacle-Free Zone Width	400	400	400	400
Object Free Area Width	800	800	500	500
Object Free Area Length *(Beyond Runway End)*	1,000	1,000 (4) 930 (22)[5]	300	300 (17) 190+/- (35)[6]
Primary Surface Width	1,000	1,000	500	500
Primary Surface Length *(Beyond Runway End)*	200	200	200	200 (17) 190+/- (35)[6]
Runway Protection Zone Length	2,500 (22) 1,700 (4)	2,500 (22) 1,700 (4)	1,000	1,000
Runway Protection Zone Inner Width	1,000 (22) 500 (4)	1,000 (22) 500 (4)	500	500
Runway Protection Zone Outer Width	1,750 (22) 1,010 (4)	1,750 (22) 1,010 (4)	700	700
Runway Centerline to:				
Parallel Taxiway Centerline	400	400	240	N/A
Aircraft Parking Area	570[7]	500[9]	320[7]	100-125[11]
Building Restriction Line	626[8]	675[10]	376[8]	300[12]
Taxiway Width	35	50	35	N/A
Taxiway Shoulder Width	10	10	10	N/A
Taxiway Safety Area Width	79	79	79	N/A
Taxiway Object Free Area Width	131	131	131	N/A
Taxiway CL to Fixed/Movable Object	65.5	65.5	65.5	N/A

1. Other-than-Utility precision instrument runway (Per FAR Part 77); RPZ dimensions based on approach visibility minimums lower than ¾ mile (Rwy 22) and not lower than 1-mile (Rwy 4) (Per AC 150/5300-13, Change 7).
2. Other-than-Utility runways (Per FAR Part 77); all other dimensions reflect visual runways and runways with not lower than 3/4-statute mile approach visibility minimums (per AC 150/5300-13, Change 7). RPZ dimensions based on visual and not lower than 1-mile approach visibility minimums.
3. Runway length required to accommodate 75 percent large airplane fleet (60,000 pounds or less) at 60 and 90 percent useful load. 83 degrees F, 2-foot change in runway centerline elevation.
4. Runway length required to accommodate 100 percent of General Aviation Fleet 12,500 pounds or less. 83 degrees F, 2-foot change in runway centerline elevation.
5. Cruickshank Road located approximately 930 feet from runway end within RSA/OFA
6. Fence located approximately 190 feet from runway end within RSA/OFA.
7. Distance to accommodate 10-foot aircraft tail height (at the APL) without penetrating the 7:1 Transitional Sfc. & clear of Txy OFA.
8. Distance to accommodate an 18-foot structure (at the BRL) without penetrating the 7:1 Transitional Surface.
9. Front Edge of East Tiedown Apron
10. Southeast Corner of Hangar "Xray"
11. Glider parking adjacent to runway
12. Glider operations building

TABLE 4-4: MMV CONFORMANCE WITH FAA DESIGN STANDARDS

Item	***Runway 4/22*** *Airplane Design Group II C & D Aircraft*	***Runway 17/35*** *Airplane Design Group II A & B Aircraft*
Runway Safety Area	No[1]	No[2]
Runway Object Free Area	No[1]	No[2,3]
Runway Obstacle Free Zone	Yes	No[2,3]
Taxiway Safety Area	Yes	Yes
Taxiway Object Free Area	Yes	Yes
Building Restriction Lines	Yes	No[4]
Aircraft Parking Lines	No[11]	No[3]
Runway Protection Zones	No[5]	No[5]
Runway-Parallel Taxiway Separation	Yes	N/A
Runway Width	Yes[6]	Yes[7]
Runway Length	Yes[8]	Yes[9]
Taxiway Width	Yes[10]	Yes[10]
Runway Visibility Zone	Yes	Yes

Notes:

1. Road; fence beyond Runway 22 end
2. Fence; physical limits of property beyond Runway 35 end
3. Glider parking immediately adjacent to east edge of Runway 17/35 (within OFA, OFZ, Primary Surface)
4. Glider operations building may penetrate transitional surface (Rwy 17/35)
5. Roads located within Runway 22 and 17 RPZ
6. Runway 4/22 width exceeds FAA minimum width standards (100 feet) for ADG II C&D Aircraft
7. Runway 17/35 width exceeds FAA minimum width (75 feet) standards for ADG II A&B Aircraft
8. Per FAA Runway Length Model: Existing runway length exceeds FAA-recommended minimum length required to accommodate 75% of large aircraft weighing less than 60,000# at 60% useful load.
9. Per FAA Runway Length Model: Existing runway length is adequate to accommodate 100% of small aircraft fleet.
10. All main taxiways exceed minimum width (35 feet) standards for ADG II aircraft.
11. Parked aircraft in outer row of aircraft tiedowns penetrate transitional surface.

Airport Design Standards Note:

The following airport design standards are recommended for MMV:

***Runway 4/22: Existing and Future** Airport Design Standards based Airport Reference Code (ARC) C/D-II; precision instrument runways and runways with lower than ¾ statute mile approach visibility minimums. Runway protection zones (RPZ) based on the approach visibility standard "Lower than 3/4-mile" for aircraft approach categories C and D. FAR Part 77 airspace planning criteria based on "other-than- utility runways" with precision approaches (Rwy 22) and non-precision (Rwy 4) (ultimate).*

***Runway 17/35: Existing and Future** Airport Design Standards based Airport Reference Code (ARC) B-II; visual runways and runways with not lower than ¾ statute mile approach visibility minimums. Runway protection zones (RPZ) based on the approach visibility standard "visual and not lower than 1-mile" for aircraft approach categories A and B. FAR Part 77 airspace planning criteria based on "other-than-utility runways" with visual (including circle-to-land instrument approaches) (ultimate).*

All references to the "standards" are based on these assumptions, unless otherwise noted. (Per FAA Advisory Circular 150/5300-13, change 7; FAR Part 77.

Runway Safety Area (RSA)

The FAA defines runway safety area (RSA) as "A defined surface surrounding the runway prepared or suitable for reducing the risk of damage to airplanes in the event of an undershoot, overshoot, or excursion from the runway." Runway safety areas are most commonly used by aircraft that inadvertently leave (or miss) the runway environment during landing or takeoff.

By FAA design standard, the RSA *"shall be:*

(1) cleared and graded and have no potentially hazardous ruts, humps, depressions, or other surface variations;

(2) drained by grading or storm sewers to prevent water accumulation;

(3) capable, under dry conditions, of supporting snow removal equipment, aircraft rescue and firefighting equipment, and the occasional passage of aircraft without causing structural damage to the aircraft; and

(4) free of objects, except for objects that need to be located in the runway safety area because of their function. Objects higher than 3 inches above grade should be constructed on low impact

resistant supports (frangible mounted structures) of the lowest practical height with the frangible point no higher than 3 inches. Other objects such as manholes, should be constructed at grade. In no case should their height exceed 3 inches."

The recommended transverse grade for the lateral RSA ranges between 1½ and 5 percent from runway shoulder edges. The recommended longitudinal grade for the first 200 feet of extended RSA beyond the runway end is 0 to 3 percent. The remainder of the RSA must remain below the runway approach surface slope. The maximum negative grade is 5 percent. Limits on longitudinal grade changes are plus or minus 2 percent per 100 feet within the RSA.

The airport sponsor should regularly clear the RSA of brush or other debris and periodically grade and compact the RSA to maintain FAA standards.

Runway 4/22

The standard C/D-II RSA is 500 feet wide and extends 1,000 feet beyond each runway end. The RSA beyond Runway 4 extends 1,000 feet from the runway end (corresponding with the 1,000-foot paved overrun). The RSA beyond Runway 22 extends approximately 930 feet before encountering Cruickshank Road. The standard 500-foot RSA width is maintained along the entire runway except for the portion affected by Cruickshank Road. The RSA is free of physical obstructions (excluding navigational aids, lighting, airfield signs, etc.) and within grade standard, expect where limited by the road. The section of Cruickshank Road located within the RSA may be closed as part of a future ODOT highway improvement project for Highway 18, or relocated.

Runway edge lights and threshold lights located within the RSA are mounted on frangible supports. Any future lighting (such as REILS or PAPI) located within the RSA will also need to meet the FAA frangibility standard.

Runway 17/35

The standard B-II RSA is 150 feet wide and extends 300 feet beyond each runway end. The RSA beyond Runway 17 extends through and beyond the adjacent Runway 4/22 (approximately 300 feet). The RSA beyond Runway 35 extends approximately 190 feet before encountering the fence marking the southern airport property line. The sides of the B-II RSA for Runway 17/35 are also defined by the outer edges of runway pavement (150 feet wide), except for the portion affected by the fence. The RSA is free of physical obstructions and within grade standard, expect where limited by the fence.

To meet FAA standards, the threshold for Runway 35 could be relocated approximately 110 feet north or additional property could be acquired and the fence relocated. Based on existing conditions, establishing relocated thresholds or declared distances on Runway 35 will reduce the

useable (published) length of Runway 17/35 to approximately 4,566 feet from its current length of 4,676 feet.

The 1989 Airport Layout Plan depicted a RSA for Runway 17/35 300 feet wide and extending 600 feet beyond each runway end. The dimension corresponds with ADG II A&B runways with lower than ¾ mile approach visibility minimums. Under current FAA airspace planning guidelines, approach visibility minimums at or below ¾ mile can only be obtained with a straight-in instrument approach and a runway approach lighting system. Based on this criterion, it is likely that any future instrument approaches developed for Runway 17/35 will have visibility minima above ¾ mile, which does not require the larger RSA.

Runway Object Free Area (OFA)

Runway object free areas (OFA) are two-dimensional surfaces intended to be clear of ground objects that protrude above the runway safety area edge elevation. Obstructions within the OFA may interfere with aircraft flight in the immediate vicinity of the runway. The FAA defines the OFA clearing standard:

"The OFA clearing standard requires clearing the OFA of above ground objects protruding above the runway safety area edge elevation. Except where precluded by other clearing standards, it is acceptable to place objects that need to be located in the OFA for air navigation or aircraft ground maneuvering purposes and to taxi and hold aircraft in the OFA. Objects non-essential for air navigation or aircraft ground maneuvering purposes are not to be placed in the OFA. This includes parked airplanes and agricultural operations."

The airport sponsor should periodically inspect the OFA and remove any objects that protrude into the OFA.

Runway 4/22

The standard C/D-II OFA is 800 feet wide and extends 1,000 feet beyond each runway end. The OFA beyond Runway 4 meets the dimensional standards and is free of objects (excluding navigational aids, etc.). The OFA beyond Runway 22 extends approximately 930 feet before encountering a fence and Cruickshank Road. The standard 800-foot RSA width is maintained along the entire runway except for the portion affected by Cruickshank Road. The Runway 4/22 OFA appears to meet the C/D-II dimensional and obstruction clearance standards, except for the portion affected by Cruickshank Road.

Runway 17/35

The standard B-II OFA is 500 feet wide and extends 300 feet beyond each runway end. The OFA beyond Runway 17 extends through and beyond the adjacent Runway 4/22 (approximately 300 feet). The OFA beyond Runway 35 extends approximately 190 feet before encountering the fence marking the southern airport property line. The OFA is free of permanent physical obstructions, expect where limited by the fence. The options identified to address the RSA deficiency beyond the end of Runway 35 would also address the OFA criteria. It is also noted that the area used for glider parking immediately adjacent to the east side of Runway 17/35 is partially located within the OFA. The glider parking would need to be located at least 250 feet from the runway centerline (100 feet from existing runway edge) to be clear of the OFA.

Obstacle Free Zone (OFZ)

The OFZ are planes of clear airspace extending upward above runway elevation that are intended to protect close-in obstructions that may create hazards for aircraft. The FAA defines the following clearing standard for the OFZ:

"The OFZ clearing standard precludes taxiing and parked airplanes and object penetrations, except for frangible visual NAVAIDs that need to located in the OFZ because of their function."

For Runway 4/22 the required OFZ includes the Runway OFZ, the Inner-approach OFZ (for runways with approach lighting systems), and the Inner-transitional OFZ (for runways with lower than ¾-statute mile approach visibility minimums. For Runway 17/35, only the Runway OFZ is required based on its configuration and approach capabilities.

The FAA defines the Runway OFZ as:

"The runway OFZ is a defined volume of airspace centered above the runway centerline. The runway OFZ is the airspace above a surface whose elevation at any point is the same as the elevation of the nearest point on the runway centerline. The runway OFZ extends 200 feet beyond each end of the runway."

The FAA-recommended Runway OFZ width for Runway 4/22 and 17/35 is 400 feet, based on their ability to serve large airplanes.

The FAA defines the Inner-approach OFZ as:

"The inner-approach OFZ is a defined volume of airspace centered on the approach area. It applies only to runways with an approach lighting system. The inner-approach OFZ begins 200 feet from the runway threshold at the same elevation as the runway threshold and extends 200 feet beyond the last light unit in the approach lighting system. It width is the same as the runway OFZ and rises at a slope of 50 (horizontal) to 1 (vertical) from its beginning."

The Inner-approach OFZ for Runway 22 is overlapped by the runway's 50:1 approach surface, which is wider and extends beyond the Inner-approach OFZ. Vehicles traveling on Cruickshank Road cross under the inner-approach OFZ, although according to data contained on the Airport Obstruction (OC) Chart[28], there is no penetration to the 50:1 surface.

The FAA defines the Inner-transitional OFZ as:

"The inner-transitional OFZ is a defined volume of airspace along the sides of the runway OFZ and the inner-approach OFZ. It applies only to runways with lower than ¾-statute mile approach visibility minimums.

> *(2) For runways serving large airplanes, separate inner-transitional OFZ criteria apply for Category (CAT) I and CAT II/III runways.*
>
> > *(a) For CAT I runways, the inner transitional OFZ begins at the edges of the runway OFZ and inner-approach OFZ, then rises vertically for a height "H", and then slopes 6 (horizontal) to 1 (vertical) out to a height of 150 feet above the established airport elevation."* [29]

Runway 4/22

It appears that there are no penetrations to the Runway 4/22 OFZ, other than the runway lights, PAPI, REIL, directional signage, and distance remaining signs, etc., which have locations fixed by function. All items located within the OFZ must meet the FAA frangibility standard. Aircraft hold lines are located 250 feet from runway centerline on each of the exit taxiways connecting to the runway, which keeps holding aircraft entirely outside the runway OFZ and below the inner-transitional OFZ.

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[28] McMinnville Municipal Airport OC 5626, National Ocean Service (NOS) (February 1993).

[29] (1) In U.S. customary units, $H_{feet} = 61 - 0.094\ (S_{feet}) - 0.003\ (E_{feet})$. S is equal to the most demanding wingspan of the airplanes using the runway and E is equal to the runway threshold elevation above sea level.

Runway 17/35

The Runway 17/35 OFZ is obstructed at the Runway 35 end by the fence located along the southern airport property line, approximately 190 feet from the runway end. The options previously identified to address the RSA and OFA deficiencies beyond Runway 35 would also address the OFZ criteria. Some of the gliders that are parked along the east edge of the runway are also located within the OFZ. The aircraft parking and staging area should be located at least 200 feet from the existing runway centerline in order to remain outside the OFZ (125 feet from existing runway edge). All items located within the OFZ must meet the FAA frangibility standard. The aircraft hold line on the diagonal taxiway should be located 200 feet from runway centerline at its connection to Runway 35.

Taxiway Safety Area

The recommended safety area dimensions for the main access taxiway are based on ADG II design standards (79 feet). Most taxiways at MMV are 50 feet wide, with the exception of hangar access taxiways. The taxiway safety area for the main parallel taxiway (Taxiway A) appears to be free of obstructions and meets the ADG II safety area dimensional standard. The access taxiway connecting the west hangar area to Taxiway A is approximately 34 feet wide; the safety area along the taxiway appears to meet the ADG II dimensional standard, except for the section that crosses the drainage ditch, which is culverted.

Taxiway safety areas should be regularly cleared of brush or other debris and periodically graded and compacted to maintain FAA standards.

Taxiway Object Free Area

The recommended OFA dimension for the main taxiways is 131 feet. The recently relocated parallel taxiway has an unobstructed OFA. All facilities and parked aircraft located along the taxiways should have a minimum setback of 65.5 feet, which corresponds to the outer edge of the ADG II taxiway OFA. Aircraft hold lines should be located on all taxilanes or taxiways that connect to the main taxiways to protect the taxiway OFA (minimum of 65.5 feet from taxiway centerline). However, in the case of Runway 4/22, the outer edge of the primary surface is 500 feet from runway centerline, which prohibits locating any structures or parked aircraft closer than 100 feet from the parallel taxiway.

Building Restriction Line (BRL)

The 1989 Airport Layout Plan (ALP) depicts a 600-foot building restriction line (BRL) on the north side of Runway 4/22 and a 500-foot BRL on the south side of Runway 4/22. A 250-foot BRL is depicted on both sides of Runway 17/35. The BRLs do not extend into the area located near the ends of Runways 22 and 17, which would be within the runway visibility zone (RVZ) and must be maintained with a clear visual line of sight. The 1989 ALP also depicts BRLs located 93 feet on each side of the infield diagonal taxiway. This dimension corresponds to an ADG III taxiway object free area (OFA) width of 186 feet. The infield BRL may be relocated as near as 65.5 feet from taxiway centerline based on the recommended ADG II design standards, although the larger setback can be also maintained.

The 600-foot BRL located on the north side of Runway 4/22 can accommodate structures only about 14 feet above (on the BRL) runway elevation without penetrating the runway transitional surface. The nearest building on the north side of the runway is located approximately 675 feet from the runway centerline. Relocating the BRL to accommodate a more common building height should be considered. A BRL located 640 feet from runway centerline would allow structures up to 20 feet above the corresponding runway elevation without penetrating the transitional surface. A 20-foot roof elevation is consistent with a typical T-hangar or small conventional hangar; larger conventional hangars and other larger structures have typical roof elevations ranging from 20 to 35 feet, which would need to be located further from the runway to avoid a transitional surface penetration. A 35-foot high structure would need to be located approximately 745 feet from runway centerline to meet the obstruction clearance criteria.

The BRL for Runway 17/35 depicted on the 1989 ALP is not adequate to avoid potential transitional surface penetrations based on the "other-than-utility" runway designation. The 1989 ALP recommended the relocation of the county road located along the east side of Runway 17/35, which was presumably intended to allow development of aircraft parking and hangar facilities in the area. The previous recommendation will be reevaluated and if retained, the BRL would need to be relocated to at least 390 feet east of the runway centerline to accommodate a 20-foot structure without penetrating the transitional surface. The existing glider operations building is located approximately 310 feet from runway centerline. In that location, the transitional surface elevation is approximately 8.6 feet above the runway.

The location of BRLs will be reviewed and revised, as necessary based on the recommended configuration of airfield facilities on the updated airport layout plan. Any existing structures that penetrate airspace surfaces should be relocated or have obstruction lights mounted on the roof.

Runway Protection Zones (RPZ)

The FAA provides the following definition for runway protection zones (RPZ):

"The RPZ's function is to enhance the protection of people and property on the ground. This is achieved through airport owner control over RPZs. Such control includes clearing RPZ areas (and maintaining them clear) of incompatible objects and activities. Control is preferably exercised through the acquisition of property interest in the RPZ. The RPZ is trapezoidal in shape and centered about the extended runway centerline. The RPZ begins 200 feet beyond the end of the area useable for takeoff or landing."

RPZs with buildings, roadways, or other items do not fully comply with FAA standards. Roads are currently located within the RPZs for Runways 22 and 35. It is recognized that realigning major surface roads located within the RPZs may not always be highly feasible. However, where possible, the City should discourage development within the RPZs (particularly structures or new roads) that is inconsistent with FAA standards.

Runway 4/22

The recommended RPZ dimensions for Runway 22 are based on Aircraft Approach Categories C & D with approach visibility minimums "Lower than 3/4-mile." This standard is consistent with the existing precision instrument approach for Runway 22. The 1989 ALP depicted the Runway 4 RPZ with dimensions that correspond to approach visibility minimums "Not lower than ¾ mile." Although there are no existing or planned instrument approaches for Runway 4, preserving this potential on the airport's instrument runway is reasonable.

Both RPZs extend beyond airport property, although the 1989 ALP identified several avigation (airspace) easements for those portions of the RPZs that were not in airport ownership. The status of the easements will be verified with City staff and updated as necessary on the ALP drawing.

Runway 17/35

The recommended RPZ dimensions for Runways 17 and 35 are based on Aircraft Approach Categories A & B with approach visibility minimums "visual and not lower than 1-mile."

The RPZ for Runway 17 extends over Highway 18, although the city has acquired property on the opposite (north) side of the highway to protect the RPZ. The Runway 35 RPZ extends beyond airport property over adjacent agricultural lands. A portion of the county road that runs

parallel on the east side of Runway 17/35 curves into the RPZ near the outer end. The 1989 ALP depicted future property acquisition for the Runway 35 RPZ, although the item was not included in the airport's capital improvement program (CIP). This recommendation will be reviewed and revised as necessary.

Aircraft Parking Line (APL)

The 1989 Airport Layout Plan (Terminal Area Plan) depicts an existing aircraft parking setback line 600 feet from runway centerline, although the future aircraft parking setback line was reduced to 500 feet. The outer row of (five) tiedowns on the east apron is located approximately 500 feet from runway centerline (100 feet north of Taxiway A centerline). Although this distance provides adequate clearance for the parallel taxiway object free area, aircraft that are parked in the outer tiedown positions penetrate the runway transitional surface (the 7:1 slope that begins at the edge of the primary surface 500 feet from runway centerline). Based on an average tail height of 10 feet, the aircraft parking line would need to be located a minimum of 563 feet from runway centerline to avoid transitional surface penetrations from parked aircraft. The second row of tiedowns is located approximately 600 feet from runway centerline, which provides sufficient clearance for aircraft tail heights up to 14 feet.

Parking setbacks will need to be established for the planned terminal apron expansion based on the sizes of transient aircraft that are expected to use the apron. For example a Gulfstream IV business jet has a tail height of 24.4 feet. In order to avoid a transitional surface penetration, parking for that size of aircraft would need to be at least 670 feet from runway centerline. The expanded outer portion of the apron will be limited to parking smaller aircraft (with lower tail heights) to avoid transitional surface penetrations.

It is recommended that an APL be established at 565 to 600 feet for aircraft parking areas adjacent to Runway 4/22. Parking setbacks for larger transient aircraft should be variable, with larger aircraft parking reserved in the areas farthest from the runway.

A grass-surfaced area located on the east side of Runway 17/35 is used for glider parking. The standard APL for B-II runways is 250 feet from runway centerline, although at least 320 feet is needed to provide a 10-foot tail-height clearance for the larger than other-than-utility visual runway transitional surface.

Runway - Parallel Taxiway Separation

Runway 4/22 has a full-length parallel taxiway with a 400-foot separation from runway centerline, which meets the C/D-II standard. Runway 17/35 is not currently served by a parallel taxiway. However, any future parallel taxiway improvements for Runway 17/35 should reflect the B-II standard runway separation (240 feet).

Runway Visibility Zone

The FAA requires a clear line of sight between the ends of intersecting runways defined as:

"The runway visibility zone is an area formed by imaginary lines connecting the two runways' visibility points. Terrain needs to be graded and permanent objects need to be designed or sited so that there will be an unobstructed line of sight from any point five feet above one runway centerline to any point five feet above an intersecting centerline, within the runway visibility zone."

The 1989 ALP did not identify a runway visibility zone for MMV. Based on the configuration of the two runways at MMV, the RVZ will extend from the ends of Runway 22 and Runway 17 to the midpoints of both runways. Any future changes in runway length or configuration may affect the RVZ.

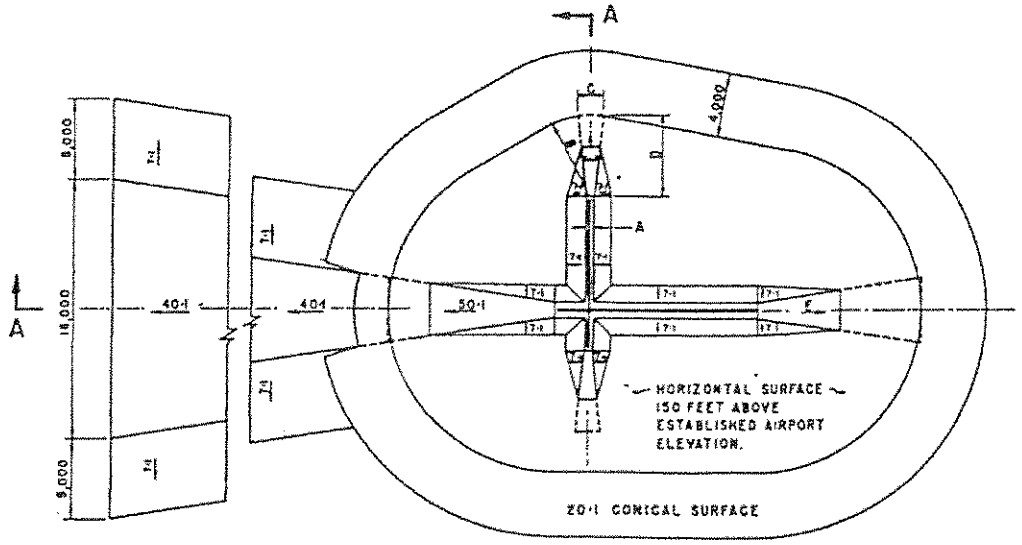
FAR PART 77 SURFACES

Airspace planning for U.S. airports is defined by Federal Air Regulations (FAR) Part 77 – Objects Affecting Navigable Airspace. FAR Part 77 defines imaginary surfaces (airspace) to be protected surrounding airports. **Figure 4-1** on the following page illustrates plan and isometric views of the Part 77 surfaces.

FAA Advisory Circular 150/5300-13, Appendix 7[30] **(Item 3. Airport Airspace Plans)** indicates that the FAR Part 77 Airspace Plan includes: *"(1) Plan view of all 14 CFR Part 77 Subpart C surfaces based on ultimate runway lengths. (2) Small scale profile views of ultimate Part 77 Subpart C approaches."*

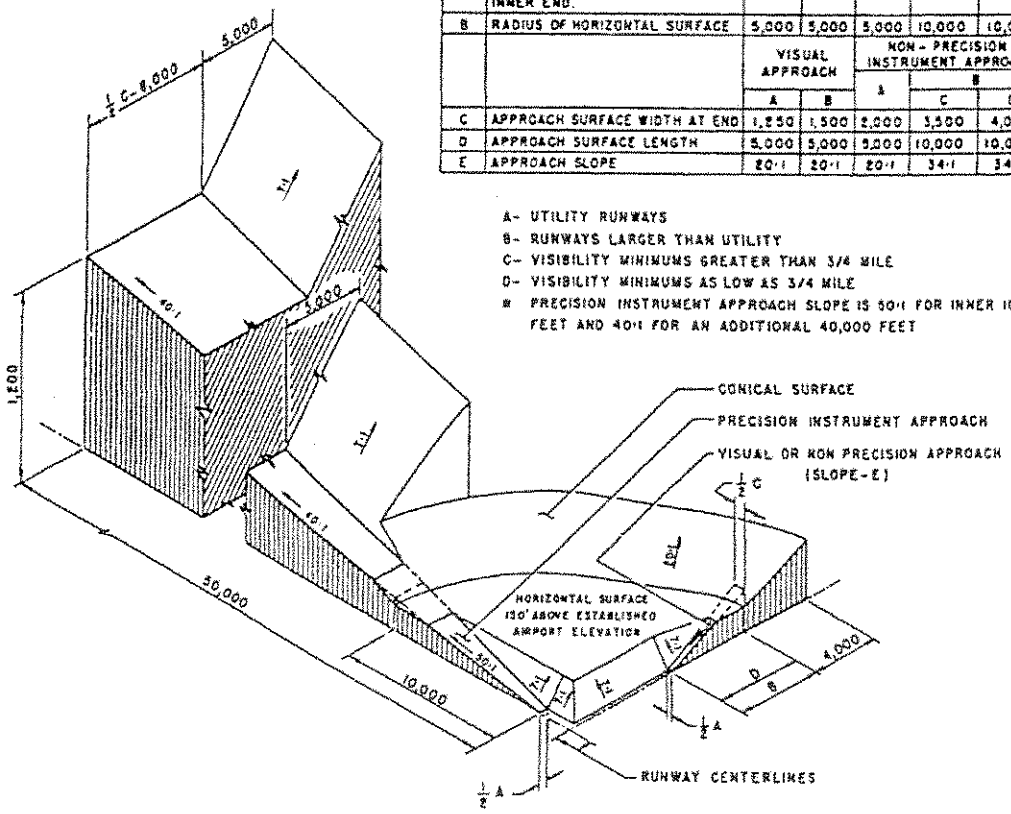
[30] Appendix 7. Airport Layout Plan Components and Preparation

OBJECTS AFFECTING NAVIGABLE AIRSPACE



DIM	ITEM	DIMENSIONAL STANDARDS (FEET)					
		VISUAL RUNWAY		NON-PRECISION INSTRUMENT RUNWAY			PRECISION INSTRUMENT RUNWAY
		A	B	A	B C	B D	
A	WIDTH OF PRIMARY SURFACE AND APPROACH SURFACE WIDTH AT INNER END.	250	500	500	500	1,000	1,000
B	RADIUS OF HORIZONTAL SURFACE	5,000	5,000	5,000	10,000	10,000	10,000
		VISUAL APPROACH		NON-PRECISION INSTRUMENT APPROACH			PRECISION INSTRUMENT APPROACH
		A	B	A	B C	B D	
C	APPROACH SURFACE WIDTH AT END	1,250	1,500	2,000	3,500	4,000	16,000
D	APPROACH SURFACE LENGTH	5,000	5,000	5,000	10,000	10,000	*
E	APPROACH SLOPE	20:1	20:1	20:1	34:1	34:1	*

A- UTILITY RUNWAYS
B- RUNWAYS LARGER THAN UTILITY
C- VISIBILITY MINIMUMS GREATER THAN 3/4 MILE
D- VISIBILITY MINIMUMS AS LOW AS 3/4 MILE
* PRECISION INSTRUMENT APPROACH SLOPE IS 50:1 FOR INNER 10,000 FEET AND 40:1 FOR AN ADDITIONAL 40,000 FEET



ISOMETRIC VIEW OF SECTION A-A

§ 77.25 CIVIL AIRPORT IMAGINARY SURFACES

DESIGNED BY: DM	FAR PART 77 DIAGRAM	CENTURY WEST ENGINEERING CORPORATION 6650 S.W. Redwood Lane, Suite 300 Portland, Oregon 97224 503-419-2130 phone • 503-639-2710 fax www.centurywest.com	FIGURE 4-1
DRAWN BY: JLM			
SCALE: NTS			

The 1989 Airspace Plan depicted "other-than-utility" precision instrument approach surfaces for Runway 22, non-precision surfaces for Runway 4, and visual approach surfaces for Runway 17 and 35. Based on the existing and planned runway configuration and utilization, "other-than-utility" airspace surfaces continue to be appropriate Runways 4/22 and 17/35. The previous airspace planning recommendations for Runway 4/22, including protecting the option of adding a future non-precision instrument approach to Runway 4, remain appropriate based on the runway's existing instrument capabilities and design features.

The 1989 Airspace Plan depicted visual approach surfaces with a slope of 20:1, with "clear" surfaces shown as being 35:1, which is comparable to the 34:1 slope associated with non-precision approach surfaces. There is presently no known demand for adding an instrument approach to Runway 17/35. However, preserving the option through airspace planning may be appropriate to provide flexibility for the airport to accommodate potential upgrades, particularly as satellite navigation (SATNAV) technology evolves. **Table 4-5** summarizes the standard airspace dimensions recommended for MMV.

TABLE 4-5:
FAR PART 77 AIRSPACE SURFACES

Item	**Runway 4/22** *Other than Utility (Precision)*	**Runway 17/35** *Other than Utility (Visual)*	**Runway 17/35** *Other than Utility (Non-Precision)*
Width of Primary Surface	1,000 feet	500 feet	500 feet
Approach Surface Width at End	16,000 feet (22) 3,500 feet (4)	1,500 feet	3,500 feet
Approach Surface Length	50,000 feet	5,000 feet	10,000 feet
Approach Slope	50:1 for 10,000 feet, 40:1 for 40,000 feet	20:1	34:1

Approach Surfaces

Runway approach surfaces extend outward and upward from each end of the primary surface, along the extended runway centerline. As noted earlier, the dimensions and slope of approach surfaces are determined by the type of aircraft intended to use the runway and most demanding approach existing or planned for the runway.

Runway 4/22

The approach surface for Runway 22 is 50,000 feet long with a slope of 50:1 for the first 10,000 feet, then 40:1 for the next 40,000 feet. The approach surface for Runway 22 is 10,000 feet long with a slope of 34:1. The 1989 Airspace Plan identified trees at both ends of the runway penetrating the ultimate approach surfaces. The Airspace Plan also identified Highway 18 (vehicles traveling on the road) as an obstruction to the 50:1 approach surface (36:1 clear). Cruickshank Road is identified on the plan, but no penetration to the approach surface exists (67:1 clear). The 1989 Airspace Plan did not depict the entire 50,000-foot approach surface for Runway 22, although no additional obstructions (for the area unmapped) were noted. A review of topographical mapping will be conducted to verify the obstruction clearance for the approach surface and the entire surface will be depicted on the updated Airspace Plan.

The 1993 Airport Obstruction Chart (OC), prepared by the National Ocean Service (NOS) identified numerous trees within the approach surfaces. The OC was prepared after the runway was extended to its current length. The OC identified eight trees (or groups of trees) as close-in obstructions in the Runway 22 approach surface and a second group of trees located approximately 5,400 feet from the end of Runway 22 (on the north edge of the approach surface) as obstructions; seven trees were identified as obstructions in the Runway 4 approach surface. As noted in the inventory chapter, the airport has completed a tree removal project to address obstructions within the Runway 4/22 approach surfaces. The status of the obstruction survey and the previously charted obstructions will be reviewed as part of the Airspace Plan update. It is interesting to note that the OC does not identify Highway 18 or Cruickshank Road as an obstruction to the Runway 22 approach surface.

Runway 17/35

Based on existing visual approach capabilities for the runway, the length of the approach surface is 5,000 feet with a slope of 20:1. If non-precision instrument capabilities were planned for Runway 17/35, the recommended approach surfaces would be 10,000 feet long with a slope of 34:1.

The 1989 Airspace Plan depicted 10,000-foot approach surfaces with 20:1 slopes for Runway 17/35. The Airspace Plan identified roads at both ends of the runway, although no obstructions were identified (35:1 clear) within the approach surfaces.

The 1993 OC identified unobstructed 20:1 approach surfaces for the runway, although the OC also depicted "supplemental" 34:1 approach surfaces that were obstructed by two trees beyond Runway 17 and one tree beyond Runway 35.

Primary Surface

The primary surface is a rectangular plane of airspace, which rests on the runway (at centerline elevation) and extends 200 feet beyond the runway end. The primary surface should be free of any penetrations, except items with locations fixed by function (i.e., VASI, runway or taxiway edge lights, etc.). The primary surface end connects to the inner portion of the runway approach surface.

Runway 4/22

The primary surface for Runway 4/22 is level and appears to be relatively free of obstructions, with the exception of a small area located near the end of Runway 4, approximately 450 feet north of runway centerline. The 1993 OC identified this area of trees with an elevation 21 feet above the runway end elevation. Recent aerial photography shows the area having been cleared of trees, although a brushy area seems to exist. The OC also identified a bush on the south side of the runway (7 feet above runway elevation) in the drainage ditch that travels NE-SW near the end of Runway 4. The status of the previously charted obstructions and subsequent removal will be reviewed as part of the Airspace Plan update. The primary surface should be cleared to meet Part 77 standards.

Runway 17/35

The primary surface for Runway 17/35 appears to be relatively level and free of obstructions, with the exception of the unpaved tiedown area located on the east side of the runway. Any aircraft that are parked less than 250 feet from the existing runway centerline (175 feet from the runway edge) are located within the primary surface. Parked aircraft are not generally permitted with a runway primary surface. The aircraft parking area will need to be moved outside the primary surface to meet FAA standards.

Transitional Surface

The transitional surface is located at the outer edge of the primary surface, represented by a plane of airspace that rises perpendicularly at a slope of 7 to 1, until reaching an elevation 150 feet above runway elevation. This surface should be free of obstructions (i.e., parked aircraft, structures, trees, etc.).

Runway 4/22

As noted earlier, aircraft parked in the outer row of light aircraft tiedowns on the east apron penetrate the Runway 4/22 transitional surface. No buildings penetrations were identified within the Runway 4/22 transitional surfaces on either the 1989 Airspace Plan or the 1993 OC, although the strip of trees located along the drainage on the north side of the runway (near the Runway 4 end) were identified as obstructions with elevations ranging from 69 to 93 feet above runway elevation.

Runway 22 also has a transitional surface that extends outward 5,000 feet from the sides of the precision approach surface, beyond the boundaries of the conical surface. Although the 1989 Airspace Plan did not depict the full length of the Runway 22 approach and approach transitional surfaces and no terrain obstructions were noted, a review of topographical mapping will be conducted to verify the absence of any obstructions to the surfaces.

Runway 17/35

As noted earlier, some aircraft parked in the glider staging area on the east side of Runway 17/35 appear to penetrate the transitional surface. It also appears that the small glider operations building located in the area may penetrate the transitional surface. The unpaved aircraft parking area should be reconfigured to avoid transitional surface penetrations and the operations building should be relocated or have an obstruction light mounted on the roof if an obstruction is verified through an obstruction survey. No penetrations or other obstructions were identified within the Runway 17/35 transitional surfaces on the 1989 Airspace Plan, although the 1993 OC identified one tree on the west side of the runway approximately 700 feet beyond the Runway 17 end.

Horizontal Surface

The horizontal surface is a flat plane of airspace located 150 feet above runway elevation with its boundaries defined by the radii (10,000 feet for larger-than-utility instrument runways) that extend from each runway end. The outer points of the radii for each runway are connected to form an oval, which is defined as the horizontal surface. The 1989 Airspace Plan indicated that there were no known penetrations to the horizontal surface and no terrain penetrations appear on the 1993 OC.

Conical Surface

The conical surface is an outer band of airspace, which abuts the horizontal surface. The conical surface begins at the elevation of the horizontal surface and extends outward 4,000 feet at a slope of 20:1. The top elevation of the conical surface is 200 feet above the horizontal surface and 350 feet above airport elevation.

The 1989 Airspace Plan indicated that there were no known penetrations to the conical surface and no terrain penetrations appear on the 1993 OC.

AIRSIDE REQUIREMENTS

Airside facilities are those directly related to the arrival and departure and movement of aircraft:

- Runways
- Taxiways
- Airfield Instrumentation and Lighting

Runways

The adequacy of the existing runway system at MMV was analyzed from a number of perspectives including runway orientation, airfield capacity, runway length, and pavement strength.

Runway Orientation

The orientation of runways for takeoff and landing operations is primarily a function of wind velocity and direction, combined with the ability of aircraft to operate under adverse wind conditions. When landing and taking off, aircraft are able to maneuver on a runway as long as the wind component perpendicular to the aircraft's direction of travel (defined as crosswind) is not excessive. For runway planning and design, a crosswind component is considered excessive at 12 miles per hour for smaller aircraft (gross takeoff weight 12,500 pounds or less) and 15 miles per hour for larger aircraft. FAA planning standards indicate that an airport should be planned with the capability to operate under allowable wind conditions at least 95 percent of the time.

Wind data for the airport is available for the period between January 1947 and December 1951.[31] **Table 4-6** summarizes the wind data for each runway at MMV for all weather conditions combined (VFR and IFR). The data indicate that the primary runway (4/22) alone does not meet the FAA-recommended wind coverage of 95 percent for large or small aircraft based on its 15 or 12 mile per hour crosswind coverage. However, with the addition of a secondary runway (17/35), the combined wind coverage for MMV increases to 97.66 percent at 12 miles per hour and 98.45 percent at 15 miles per hour. Based on existing wind coverage, applying Airplane Design Group II standards to both the primary and secondary runway is recommended.

TABLE 4-6:
MMV WIND COVERAGE
(VFR / IFR / ALL WEATHER)

	VFR		IFR		ALL	
Runway	12 MPH	15 MPH	12 MPH	15 MPH	12 MPH	15 MPH
4/22	86.74%	89.43%	91.54%	93.59%	86.75%	90.21%
17/35	92.30%	94.86%	97.48%	98.05%	92.38%	95.17%
Combined	97.85%	98.43%	98.26%	98.84%	97.66%	98.45%

Source: NOAA. Observation Period: 1/47-12/51.

Runway Length

Runway length requirements are based primarily upon airport elevation, mean maximum daily temperature of the hottest month, runway gradient, and the critical aircraft type expected to use the runway. At MMV, the availability of two runways allows specific design standards to be applied to each runway. A summary of FAA-recommended runway lengths for a variety of aircraft types and load configurations are described in **Table 4-7**. The runway length requirements for a variety of business aircraft are summarized in **Table 4-8** for comparison to the output from the FAA model. The 1989 master plan estimated that the specific takeoff distance requirements for a Learjet 35 (6,156 feet) and a Gulfstream II (5,927 feet) at maximum gross weight on an 83-degree day. However, due to the low airfield elevation at MMV, most small and medium business jets will be able to operate at moderate to heavy weights on Runway 4/22 except on very warm days.

[31] Source: NOAA-EDS, Ashville, NC

The 1989 master plan recommended a 600-foot runway extension and construction of a 1,000-foot long paved stopway beyond the Runway 4 end. The stopway was recommended to "maximize the runway length available for aircraft departing on Runway 22." However, based on current FAA criteria, the paved area is not considered a stopway, but rather a paved overrun or safety area. The FAA indicates that paved surface cannot be used in runway length calculations on Runway 22 since there is no extended runway safety area located beyond the pavement. Although the availability of an additional 1,000 feet of pavement provides a cushion for aborted takeoffs or excessive rollouts on Runway 22, the "stopway" does not meet the FAA criteria for use in runway length calculations.

Runway 4/22 accommodates large aircraft (above 12,500 pounds) operations on a regular basis. As a result, the evaluation of runway length requirements would normally be based on the FAA's model for "large airplanes of 60,000 pounds or less." However, since the runway also accommodates regular operations from business jets weighing more than 60,000 pounds, the FAA's recommended length for "airplanes more than 60,000 pounds" should also be considered.

As a secondary runway, Runway 17/35 should be able to accommodate a reasonable portion of the airport's activity under most conditions. At 4,676 feet, Runway 17/35 is approximately 86 percent of the length of the primary runway, which is well within normal primary/secondary runway length ranges. Runway 17/35 accommodates predominantly small aircraft (weighing 12.500 pounds or less). Considering its use, it appears reasonable to determine its length requirements based on accommodating the full range of the small airplane fleet (12,500 pounds and less). According to the FAA model, a length of 3,600 feet is recommended to accommodate 100 percent of small airplanes. Based on the standard runway length requirements, the existing length may be maintained or reduced, depending on other factors.

TABLE 4-7:
FAA-RECOMMENDED RUNWAY LENGTHS
(FROM FAA COMPUTER MODEL)

Runway Length Parameters for MMV

- *Airport Elevation: 163 feet MSL*
- *Mean Max Temperature in Hottest Month: 82.7 F*
- *Maximum Difference in Runway Centerline Elevation: 2 Feet*
- *Existing Runway Lengths: 5,420' (4/22); 4, 676' (17/35)*

Small Airplanes with less than 10 seats	
75 percent of these airplanes	*2,480 feet*
95 percent of these airplanes	*3,030 feet*
100 percent of these airplanes	*3,600 feet*
Small airplanes with 10 or more seats	*4,160 feet*
Large Airplanes of 60,000 pounds or less	
75 percent of these airplanes at 60 percent useful load	*5,310 feet*
75 percent of these airplanes at 90 percent useful load	*7,000 feet*
100 percent of these airplanes at 60 percent useful load	*5,500 feet*
100 percent of these airplanes at 90 percent useful load	*7,730 feet*
Airplanes of more than 60,000 pounds	*5,070 feet*

Based on local conditions and the methodology outlined in **AC 150/5325-4A,** a runway length of 5,070 feet is recommended to accommodate airplanes weighing more than 60,000 pounds. A runway length of 5,310 feet is required to accommodate 75 percent of large airplanes (60,000 pounds or less maximum gross takeoff weight) at 60 percent useful load. These distances are slightly less than the current length of Runway 4/22. A length of 7,000 feet is recommend to accommodate 75 percent of large airplanes (60,000 pounds or less maximum gross takeoff weight) at 90 percent useful load.

The existing site characteristics effectively limits potential runway lengthening options. However, if additional runway length was desired, the paved overrun beyond Runway 4 could be converted into runway (with the existing threshold maintained as a displaced threshold) to provide approximately 6,420 feet for takeoff on Runway 4 only. The absence of safety area beyond the pavement limits available runway length for Runway 22 operations to the existing 5,420 feet.

TABLE 4-8:
BUSINESS AIRCRAFT RUNWAY REQUIREMENTS

Aircraft	Passengers (typical configuration)	Maximum Takeoff Weight	Runway Length Required for Takeoff[1]	Runway Length Required for Landing[2]
Beechcraft King Air 200	6-8	12,500	3,600	2,600
Cessna Citation CJ1	6-7	10,600	4,485	2,875
Cessna Citation CJ2	6-7	12,375	3,950	3,095
Cessna Citation CJ3	6-7	13,870	3,940	3,195
Cessna Citation II	6-9	14,100	4,800	2,510
Cessna Citation Excel	7-8	20,000	4,240	3,320
Citation Sovereign	9-12	30,000	4,020	3,254
Cessna Citation X	8-12	36,100	5,695	3,620
Learjet 45	7-9	20,500	4,350(a)	2,660(a)
Challenger 300	8-15	37,500	4,950(a)	2,600(a)
Gulfstream 100 (Astra)	6-8	24,650	5,395(a)	2,920(a)
Gulfstream 200 (G-II)	8-10	35,450	6,080(a)	3,280(a)
Gulfstream 300 (G-III)	11-14	72,000	5,100(a)	3,190(a)

1. FAR Part 25 Balanced Field Length (Distance to 35 Feet Above the Runway); Sea Level, 89-degrees F; Zero Wind, Dry Level Runway, 15-Degrees Flaps, except otherwise noted.
2. Distance from 50 Feet Above the Runway; Flaps Land, Zero Wind.

a) For general comparison only. **Distances based on sea level and standard day temperature** (59-degrees F) at maximum takeoff/landing weight; higher airfield temperatures will require additional runway length and/or reduction in operating weights.

Source: Aircraft manufacturers operating data, flight planning guides.

Runway Width

Both runways at MMV are currently 150 feet wide, which exceeds the minimum standard for both Category A&B aircraft and C&D aircraft within ADG II. The 1989 Airport Layout Plan listed the future runway length of 4/22 at 150 feet and 100 feet for Runway 17/35.

A number of larger general aviation airports in the Northwest have 150-foot wide runways. Updated planning at most of these airports has resulted in the use of ADG II design standards (75 foot runway width). However, the FAA has generally indicated that narrowing a primary runway to 100 feet often provides an acceptable reduction that also preserves an airport's ability to accommodate occasional use by larger aircraft, although it exceeds the ADG II requirements. However, a cost-benefit evaluation should be prepared prior to any planned runway narrowing to include the costs of relocating runway lights, signage, drainage systems, etc. For Runway 4/22, a future width of 100 feet would be sufficient to accommodate the existing and future C/D-II

design aircraft. Based on the current (excellent) pavement condition of Runway 4/22, no major rehabilitation projects are anticipated until the latter part of the 20-year planning period.

Based on the existing use of Runway 17/35 and its potential use, the existing 150-foot runway width should be reduced to 75 feet at the time of the next major rehabilitation project.

Airfield Pavement

According to the data contained in the 2001 pavement condition report, airfield pavements at MMV ranged from "failed" to "excellent." **Table 4-9** summarizes the five-year maintenance program recommended for MMV[32] and additional pavement maintenance items anticipated during the current twenty-year planning period. The rate of deterioration of airfield pavements increases significantly as they age. A regular maintenance program of vegetation control, crackfilling, and sealcoating is recommended to extend the useful life of all airfield pavements. It should also be noted that some of the pavement plan's recommended 5-year projects might not be required or appropriate if superceded by other projects such as runway narrowing (which would probably also involve an overlay or slurry seal).

[32] Pavement Consultants Inc. (8/21/2001)

TABLE 4-9:
SUMMARY OF RECOMMENDED
AIRFIELD PAVEMENT MAINTENANCE

Pavement	5-Year Recommended Maintenance	Other Recommended Maintenance During 20-Year Planning Period[1]
Runway 4/22	Fog Seal (2004)	Fog Seal/Slurry Seal (2009,2014, 2019)
Runway 17/35	Reconstruct (2003) Fog Seal (north end only) (2004)	Fog Seal/Slurry Seal (2008,2013, 2018)
Taxiway A (4/22 parallel taxiway)	Fog Seal (2004)	Fog Seal/Slurry Seal (2008,2013, 2018) Overlay (west section) (2020)
Taxiway B & C (terminal apron access)	Fog Seal (2005)	Slurry Seal (2010, 2015.2020)
Taxiway D (diagonal taxiway)	Reconstruct (2003) Fog Seal (2007)	Fog Seal/Slurry Seal (2012, 2017, 2022)
West T-Hangar Taxilanes	Fog Seal (2005)	Fog/Slurry Seal (2010, 2015) Overlay (2010-2020)
Terminal Apron Center Section – Inner Area (PCC)	Routine Maintenance	Replace Joints (as needed)
Main Apron (Asphalt Sections)	Fog Seal, Reconstruct specific sections (2005)	Fog/Slurry Seal (2010, 2015)
East Tiedown Apron	Fog Seal, Reconstruct specific sections (2005)	Fog/Slurry Seal (2010, 2015)
West T-Hangar Access Taxiway	Overlay (2006)	Fog Seal/Slurry Seal (2011,2016, 2021)
West T-Hangar Taxilanes	Slurry Seal (2006)	Fog/Slurry Seal (2011, 2016) Overlay (2010-2020)

1. The dates identified for long-term pavement maintenance assume that all 5-year maintenance that has not been accomplished as recommended in Year 1 or 2 (2003 or 2004) will be completed in 2004 or 2005.

Airfield Capacity

As an uncontrolled field, MMV cannot accommodate simultaneous aircraft operations on both runways. For planning purposes, airfield capacity calculations are based on a single runway configuration. The capacity of a single runway with a full-length parallel taxiway (with 4 exits) typically ranges between 100 and 115 operations per hour during visual flight rules (VFR) conditions. The availability of the ILS enables the airport to maintain reasonable hourly capacity during IFR conditions. The 1989 master plan estimated annual airfield capacity at 160,000 operations, which is well above the forecast activity through the current twenty-year planning period and beyond.

Taxiways

Taxiways are constructed primarily to facilitate aircraft movements to and from the runway system. Some taxiways are necessary simply to provide access between apron and runways, while other taxiways become necessary as activity increases and safer and more efficient use of the airfield is needed.

Runway 4/22

The existing parallel taxiway and four connecting exit taxiways provide efficient access to the runway and no major improvements are required. Adding an aircraft holding area at the Runway 4 end of the taxiway could be considered to improve taxiing clearances for departing aircraft. The existing main taxiways are 50 feet wide, which exceeds the ADG II standard of 35 feet. As with the runways, the taxiways may be narrowed in the future based on design standards.

Runway 17/35

The existing taxiway system provides access to the Runway 35 end via Taxiway D or by back-taxiing Runway 17/35. Taxiway D is currently in poor condition and is planned for reconstruction. It may also be prudent to consider establishing a parallel taxiway reserve on the west side of Runway 17/35 to reduce overall taxiing distances to the runway.

Access Taxiways

Improvements to existing access taxiways and hangar taxiways/taxilanes will be required during the planning period, in addition to adding new taxiways to access new hangar or apron developments. The existing taxiway serving the west T-hangar area may need to be widened or a second taxiway added to avoid excessive congestion as the number of aircraft in the area increases. The existing taxiway that extends along the west side of the main apron and continues to Evergreen's facilities also requires resurfacing and widening, or replacement.

Airfield Instrumentation, Lighting and Marking

Runway 4/22

Runway 4/22 has high-intensity runway edge lighting (HIRL), which exceeds the standard for general aviation runways. The HIRL system appears to be in very good operational condition and should not require replacement during the current twenty-year planning period. The other

lighting on the runway (MALSR, REIL, PAPI, and threshold lights) are also in good condition and are not expected to require replacement during the current planning period.

Runway 4/22 has precision runway markings (Rwy 22 end) and non-precision markings (Rwy 4 end). These markings are adequate based on the existing and future approach capabilities of the runway.

Runway 17/35

Runway 17/35 does not have runway edge lighting or visual guidance indicators (VGI). The 1989 master plan did not recommend lighting or VGI systems. However, based on the existing (low) wind coverage on the primary runway, and the use of the runway by ADGII aircraft, adding medium-intensity runway lighting (MIRL) and precision approach path indicators (PAPI) is recommended to improve overall airport capabilities.

Taxiway Lighting

Most taxiways on the airfield have edge reflectors. Based on the relatively low level of nighttime operations at MMV, edge reflectors are adequate for current operations. Medium-intensity taxiway lighting (MITL) may be added to major taxiways in the future.

Airfield Lighting

The existing airport beacon appears to be in good operational condition. Adding lighted wind cones at the Runway 4 end and adjacent to the south end of Runway 17/35 is recommended to improve surface wind recognition for pilots.

On-Field Weather Data

The airport has an automated surface observation system (ASOS), which allows aircraft licensed under FAR Part 135 (air taxi/charter) to operate in IFR conditions at MMV.

LANDSIDE FACILITIES

The purpose of this section is to determine the space requirements during the planning period for landside facilities. The following types of facilities are associated with landside aviation operations areas at MMV:

- *Hangars*

- *Aircraft Parking and Tiedown Apron*
- *Fixed Base Operator (FBO) Facilities*

Hangars

In Fall 2003, MMV had nine conventional hangars and nine T-hangars. The conventional hangars accommodate a combination of aircraft storage and aviation related business uses; the four T-hangars are used primarily for aircraft storage. It is estimated that the existing hangars provide storage space for approximately 93 aircraft.

Table 4-10 highlights the recent increase in hangar utilization at MMV. After an extended period where no new hangars were constructed at MMV, 66 new hangar spaces have been added since 1988. During a nearly three-fold increase in based aircraft since 1988, the number of aircraft stored outside (apron, tiedown areas, etc) at MMV has increased only marginally.

TABLE 4-10:
MMV BASED AIRCRAFT & HANGAR UTILIZATION

	1981	1988	1998	2003
Total Based Aircraft	80	72	110	150
Based Aircraft (on airport) [1]	60	49	90	132
Hangar Spaces (on airport)	27	27	57	93
Percentage of Based Aircraft Stored in Hangars (on-airport)	*45%*	*55%*	*63%*	*71%*
Average Number of Based Aircraft per Hangar Space	2.22	1.82	1.58	1.42

Source: Airport master plans, airport data and historical aerial photography. 1. Total excludes aircraft stored off airport at Evergreen facilities.

It is estimated that approximately 71 percent of the airport's current based aircraft are stored in hangars. For planning purposes, the current level of hangar utilization is expected to increase slightly during the planning period, to 80 percent. It is also assumed that all existing hangar space is committed and future demand will be met through new construction.

A planning standard of 1,500 square feet per based aircraft stored in hangars is used to project gross space requirements. As indicated in the aviation activity forecasts, the number of based aircraft at MMV is projected to increase by 77 aircraft during the twenty-year planning period. Based on a projected 80% hangar utilization level, long-term demand for new hangar space hangars is estimated to be 62 spaces (approximately 93,000 square feet). The projected hangar needs at MMV are presented in **Table 4-11.**

Individual aircraft owners needs vary and demand can be influenced by a wide range of factors beyond the control of an airport. In addition, the forecasts of based aircraft reflect very modest growth rates that could be easily exceeded if economic conditions are favorable. For this reason, it is recommended that additional hangar development reserves be identified to accommodate unanticipated demand. Reserves should be established to accommodate a combination of conventional hangars and T-hangars, roughly equal to 100 percent of the 20-year forecast demand.

Aircraft Parking and Tiedown Apron

Aircraft parking apron should be provided for locally based aircraft that are not stored in hangars and for transient aircraft visiting the airport. Currently, locally based and itinerant aircraft are parked on the main apron on either side of the FBO/Terminal and on the east aircraft tiedown apron. The terminal apron is available for larger aircraft parking but also is used for aircraft fueling and helicopter parking.

The existing east tiedown apron has 17 designated light aircraft tiedown spaces, although as noted earlier, aircraft parked in the outer row of 5 tiedowns penetrate the transitional surface for Runway 4/22, and therefore should be relocated. The western section of the main apron has 8 to 10 light aircraft tiedowns. The terminal apron has approximately 6 light aircraft tiedowns located along the back edge of the apron. Additional parking is available on the terminal apron, although that is normally reserved for larger corporate aircraft. Overall, it appears that there are approximately 33 designated light aircraft tiedowns in the terminal area, although aircraft are also parked in various locations adjacent to the larger hangars.

It appears that approximately fifteen to twenty locally based aircraft currently park on aprons in the terminal area. The airport currently has 21 gliders, which are mostly parked in the unpaved grass area adjacent to Runway 17/35 during soaring season. Based on projected hangar/apron utilization, the long-term forecast of 208 (on-airport) based aircraft will require 39 paved aircraft tiedown positions by 2023 (excluding glider parking). Locally based aircraft tiedowns are planned at 300 square yards per position.

FAA **Advisory Circular 150/5300-13** suggests a methodology by which itinerant parking requirements can be determined from knowledge of busy-day operations. At MMV, the demand for itinerant parking spaces was estimated based on 25 percent of busy day itinerant operations (25% of busy day itinerant operations divided by two, to identify peak parking demand). The FAA planning criterion of 360 square yards per itinerant aircraft was applied to the number itinerant spaces to determine future itinerant ramp requirements. By the end of the twenty-year

planning period, itinerant aircraft parking requirements are estimated to be 29 light aircraft tiedowns.

In addition to light aircraft parking positions, the airport accommodates itinerant business aircraft including turboprops and business jets. Initially, four parking (drive through) spaces for business aircraft should be adequate to accommodate current demand. Additional expansion area for corporate aircraft parking should be reserved adjacent to the terminal area to accommodate future demand, if required. The aircraft parking area requirements are summarized in **Table 4-11.**

As noted with aircraft hangars, reserve areas should be identified to accommodate unanticipated demands for aircraft parking, which may exceed current projections. A development reserve area equal to 100 percent of the 20-year parking demand will provide a conservative planning guideline to accommodate unanticipated demand, changes in existing apron configurations, and demand beyond the current planning period. The location and configuration of the development reserves will be addressed in the alternatives analysis.

Agricultural Aircraft Facilities

There are currently no designated agricultural aircraft facilities at the airport. If needed, adequate undeveloped space exists on the airport to accommodate future AG facility needs.

FBO Facilities

FBO facilities are currently located in the main terminal building. The existing facilities are not considered adequate to accommodate existing use or the anticipated growth in activity, particularly transient corporate and general aviation users. The specific needs for a new general aviation terminal will need to be determined by the FBO and City based on desired levels of service and financial feasibility. In general, an expanded facility would include office space for the FBO/airport manager; flight planning and classroom space, a passenger waiting area, and public restrooms. Facilities that are designed to accommodate frequent business use, often have one or more small conference rooms and other amenities for pilots and passengers.

Existing vehicle parking in the vicinity of the FBO appears to be adequate, although the parking may be affected by changes in the airport access road. The previous ALP recommended adding approximately 30 vehicle parking spaces near the east end of the terminal building. Vehicle parking reserves should be maintained in the terminal area to accommodate potential increases in demand.

TABLE 4-11:
APRON AND HANGAR
FACILITY REQUIREMENTS SUMMARY

Item	Base Year (2003)	2008	2013	2018	2023
Based Aircraft (on-airport) (Forecast)	**131**	**147**	**164**	**207**	**208**
Aircraft Parking Apron *(Existing Facilities)*					
Light Aircraft Tiedowns	33				
Business Aircraft Spaces	3[1]				
Helicopter Parking Spaces					
Total Apron Area	26,250 sy				
Projected Needs *(Demand)* [2]					
Itinerant Aircraft Parking (@ 360 SY each)		20 spaces / 7,200 sy	23 spaces / 8,280 sy	26 spaces / 9,360 sy	29 spaces / 10,440 sy
Locally-Based Tiedowns (@ 300 SY each)		29 spaces / 8,700 sy	33 spaces / 9,900 sy	41 spaces / 12,300 sy	42 spaces / 12,600 sy
Business Aircraft Parking Demand (@ 625 SY each)		4 spaces / 2,500 sy	5 spaces / 3,125 sy	6 spaces / 3,750 sy	6 spaces / 3,750 sy
Total Apron Needs		**53 spaces 18,400 SY**	**61 spaces 21,305 SY**	**73 spaces 25,410 SY**	**77 spaces 26,790 SY**
Aircraft Hangars *(Existing Facilities)*					
Existing Hangar Spaces	93 spaces / 100,000 sf (estimated)				
Projected Needs *(Demand)* [3]					
(New) Hangar Space Demand (@ 1,500 SF per space) *(Cumulative 20-year projected demand: 73 spaces / 111,000 SF)*		**+25 spaces / 37,500 sf** [a]	**+14 spaces / 21,000 sf**	**+18 spaces / 27,000 sf**	**+17 spaces / 25,500 sf**

1. Parking for business aircraft adjacent to FBO/Terminal; additional areas of apron are also available.
2. Aircraft parking demand levels identified for each forecast year represent forecast gross demand.
3. Hangar demand levels identified for each forecast year represent the net increase above current hangar capacity.

a. Includes 10-unit T-hangar planned for 2004 construction.

Surface Access Requirements

The existing surface access to the airport (Cirrus Avenue) connects to Highway 18 (Three Mile Lane). As noted earlier, a major reconfiguration is planned for the Highway 18 corridor. The precise configuration of the airport access has not yet been determined, although it appears that the existing airport connections to Three Mile Lane may be modified. Additional access has been previously recommended to serve the west hangar area from Armory Way. The

configuration of the future airport access road will be a critical factor in determining the expansion of airport facilities. Expansion of landside facilities within the existing development areas will also require extension of internal airport access roads.

Vehicle parking in the terminal areas appears to be adequate based on current needs, although additional parking areas should be provided in conjunction with expansion/replacement of the FBO building and future hangar projects. The requirements for providing designated vehicle parking areas adjacent to hangars vary greatly at small airports. A planning standard of 0.5 to 1.0 vehicle parking spaces per based aircraft will accommodate the most common parking demand levels. For larger hangars, a formula based on the square footage of the building is often used to determine parking requirements. This is a common approach for establishing off-street parking in most communities.

SUPPORT FACILITIES

Aviation Fuel Storage

Aviation gasoline (AVGAS) and jet fuel are available at MMV. As noted in the inventory chapter, the airport currently has airport has two 12,000-gallon above ground tanks for jet fuel and AVGAS, and two fuel trucks. The existing capacity appears to be adequate to accommodate forecast demand. However, space should be reserved to accommodate larger capacity or additional fuel tanks in the event that demand warrants expansion.

Airport Utilities

The existing utilities on the airport appear to be adequate for current and projected needs within existing developed areas of the airport. A project to increase water pressure on the airport was completed in 2004. Potential extensions of water, sanitary sewer and electrical, telephone service to serve future landside developments will also be required.

Overhead electrical and telephone lines should be buried whenever possible; new electrical connections to hangars or other airfield developments should also be placed underground.

Security

The airport has limited wire fencing on its boundary and chain link fencing with electronic gates in the terminal area. There are no major security concerns at the airport, although providing

chain-link fencing and gates along the entire frontage or adjacent to all operations areas is recommended. Flood lighting should be provided in expanded aircraft parking and hangar areas and any other new development areas on the airport to maintain adequate security.

FACILITY REQUIREMENTS SUMMARY

The projected twenty-year facility needs for MMV are summarized in **Table 4-12**. As noted in the table, maintaining and replacing existing pavements represents a significant facility need. The forecasts of aviation activity contained in Chapter Three anticipate relatively modest growth in activity that will result in modest airside/landside facility demands beyond existing capabilities. The existing airfield facilities have the ability to accommodate a significant increase in activity, with targeted facility improvements. For the most part, the need for new or expanded facilities, such as aircraft hangars, will be market driven, although there will be significant front-end investments required in preparation, utility extensions, road extensions, and taxiway construction.

TABLE 4-12:
FACILITY REQUIREMENTS SUMMARY

Item	Short Term	Long Term
Runway 4/22	Pavement Maintenance[1]	Pavement Maintenance[1] Runway Overlay Narrow Runway to 100 Feet
Runway 17/35	Reconstruct/Overlay Narrow Runway to 75 Feet Pavement Maintenance[1]	Pavement Maintenance[1]
Taxiways	Pavement Maintenance[1] Reconstruct/Replace Taxiway D	Pavement Maintenance[1] Overlay/Narrow Taxiways to 35 feet Taxiways to New Hangar Areas Runway 17/35 Parallel Taxiway Reserve
Aircraft Aprons	Expand Terminal Apron Pavement Maintenance[1] Expand/Reconfigure Tiedown Apron	Pavement Maintenance Overlay Main Apron/Tiedown Apron Apron Development Reserves
Agricultural Aircraft Facilities	None	Development Reserve
Hangars	Reserves for T-hangar and Conventional Hangar Development	Same
Navigational Aids and Lighting	MIRL Runway 17/35 PAPI (Rwy 17 & 35)	Additional Flood Lighting As Required
Fuel Storage	None	Fuel Storage Reserve
FBO/GA Terminal	Expanded FBO/Terminal Building	Same
Utilities	Upgrade Water Pressure on Airport Extend Service to New Development Areas	Same
Roadways	Extend Roads to New Development Areas Relocate/Close Cruickshank Road (Rwy 4/22 RSA)	Extend Roads to New Development Areas
Security	Terminal Area Fencing; Perimeter Fencing Flood Lighting	Same

1. Vegetation control, crackfill, sealcoat, slurry seal, localized patching, joint rehabilitation, etc., as required.