
CHAPTER 3

# Facility Requirements

In this chapter, the existing facilities at the Central Wisconsin Airport (CWA or the Airport) are evaluated to determine their ability to meet the forecasted activity and demand. Disparities are evaluated in this chapter, and alternatives are recommended in the following chapter. Each facility is addressed in detail in the following sections:

- Annual Service Volume
- Airside Facilities
- Pavement Conditions
- General Aviation Apron
- Navigation Aids
- Aircraft Hangars
- Fuel Facilities
- Passenger Terminal
- Maintenance and Snow Removal Equipment (SRE) Facilities
- Aircraft Rescue and Firefighting (ARFF) Facilities
- General Aviation Terminal
- Auto Parking and Circulation
- Summary

## 3.1 Annual Service Volume

An airport's ability to satisfy demand is a predominant factor for long term planning. Annual Service Volume (ASV) is often used as the metric for long term planning decisions such as land acquisition and operational capacity expansion, such as additional runways. Therefore, the ASV is an appropriate place to begin when determining CWA's overall needs. This section determines the airfield's annual operational capacity, compares that capacity to forecasted growth, and concludes with a discussion of timing for any improvements needed to accommodate the forecasted growth.

According to Federal Aviation Administration (FAA) Advisory Circular (AC) 150/5060-5 (AC 150/5060-5), *Airport Capacity and Delay,* airfield capacity is the maximum number of aircraft operations that a given airfield configuration can accommodate during a specified time interval of continuous demand. This theoretical level of capacity is influenced by weather conditions, number and configuration of exit taxiways, types of aircraft that use a facility, time of day, and air traffic control handling procedures. The following measurements of airfield capacity are calculated and evaluated as part of this study:

- **Peak hour capacity** – The maximum number of aircraft operations that can occur in one hour under specific operating conditions, assuming a continuous demand for service.
- **Annual Service Volume (ASV)** – An estimate of an airport's annual capacity that accounts for differences in runway use, aircraft mix, weather conditions, etc. that would be encountered over a year's time. ASV assumes an acceptable level of aircraft delay as described in AC 150/5060-5, which is held constant throughout this analysis.

AC 150/5060-5 was last updated in 1983 and is in the process of being re-written. It is possible that recent Airport Cooperative Research Program (ACRP) guidelines will form the basis for a new demand capacity AC. Until publication of the new AC, AC 150/5060-5 is the only approved guidance for analyzing capacity at CWA.

### 3.1.1 Factors Affecting Runway Capacity

Several factors have an impact on hourly runway capacity. These factors are described in the following sections:

- Ceiling and Visibility
- Runway Use Configuration
- Aircraft Mix Index
- Percent Arrivals
- Percent Touch-and-Go Operations
- Exit Taxiway Locations

***Ceiling and Visibility***

Weather conditions can impact an airport's capacity by requiring additional spacing between aircraft. The two primary categories for weather conditions related to operating aircraft are Visual Flight Rules (VFR) and Instrument Flight Rules (IFR). VFR weather conditions exist when the cloud ceiling is greater than or equal to 1,000 feet above ground level (AGL), and/or visibility is greater than or equal to 3 miles. IFR conditions are those below VFR minimums. Aircraft operations during IFR weather largely depend on the minimum instrument approaches available, which at CWA are 200-foot cloud ceiling and 1/2-mile visibility.

CWA tracks weather conditions using an Automated Weather Observation System (AWOS). It is important to differentiate IFR and VFR conditions because greater separation distances are required under IFR conditions. The AWOS-3 unit located on the Airport observed the following frequency of VFR and IFR conditions for 2011 – 2016.

- 86.1% of the total hourly observations reported VFR weather conditions.
- 13.9% of the total hourly observations reported IFR weather conditions.

#### *Runway Use Configuration*

Runway use configuration is the number, location, and orientation of active runways; the type and direction of operations; and the flight rules in effect at a particular time. AC 150/5060-5 includes a series of schematic diagrams of various airport runway use configurations. The AC instructs capacity analysts to select the runway use configuration diagram that best represents the use of the airport during the hour of interest. CWA has two intersecting runways, and the distance from the Runway 17 end to the runway intersection is approximately 400 feet. Based on this layout, the appropriate runway use configuration diagram from the AC is Diagram Number 76.

#### *Aircraft Mix Index*

The aircraft mix is the relative percentage of operations conducted by four categories of aircraft. The mix index has a significant impact on airfield capacity. As the diversity of approach speeds and aircraft weights increase, airfield capacity decreases due to differences in aircraft approach speeds, as well as safety issues related to wake vortices. A wake vortex is a phenomenon that creates air turbulence behind an airplane as a result of its movement through the air. Heavier aircraft cause more severe wake vortices than smaller aircraft.  Although more prevalent during departures than arrivals, wake vortices can be a significant safety hazard during any operation.

To alleviate the hazards of wake vortices, aircraft are spaced according to the difference in their airspeeds and weight. Light aircraft are typically required to wait up to two minutes before operating on a runway after a heavy aircraft. This delay results in a loss in airfield capacity. The greater the size and weight differential of the aircraft fleet, the greater the separation required between successive aircraft operations.

Aircraft are categorized by their physical aspects and their relationship to terms used in wake turbulence standards. It is important to note that the categories used in evaluating the aircraft mix index for capacity purposes in FAA AC 150/5060-5 vary from the categories identified in FAA AC 150/5300-13A (AC 150/5300-13A), *Airport Design*. The aircraft categories listed in **Table 3-1** are based on the takeoff weight and wake turbulence factor of an aircraft.

**Table 3-1: Aircraft Mix Index Categories**

| Class | Maximum Takeoff Weight (pounds) | Aircraft Type | Wake Turbulence Factor |
|---|---|---|---|
| A | 12,500 or less | Small Single-Engine | Small |
| B | 12,500 or less | Small Multi-Engine | Small |
| C | 12,500 - 300,000 | Large | Large |
| D | 300,000 or more | Heavy | Heavy |

*Source: FAA Advisory Circular 150/5060-5, Airport Capacity and Delay*

The aircraft fleet mix for CWA was determined based upon FAA operations data for the year 2015; however, the remainder of this section focuses on the forecasted operations presented in Chapter 2, *Aviation Activity Forecast*. The Traffic Flow Management System Counts (TFMSC) database collects information for flights that fly under IFR and are captured by the FAA's en route computers. Although CWA has an Air Traffic Control Tower (ATCT) on the field, the available traffic counts record only the type of operation and not the weight of the aircraft. Therefore, TFMSC data is preferred. This information is considered alongside the DOT T100 data, which shows air carrier activity.

The aircraft mix index is defined by AC 150/5060-5 as the percentage of Class C aircraft plus three times the percentage of Class D aircraft. As there are not any Class D aircraft expected at CWA during the planning period, this will not affect the aircraft mix index. Using this definition, the 2015 aircraft mix index for CWA is 60% in VFR conditions and 80% in IFR conditions. The aircraft mix index is expected to remain consistent in both VFR and IFR conditions throughout the next 20 years.

### *Percent Arrivals*

Percent arrivals is the ratio of arrivals to total operations. Because aircraft on final approach are typically given absolute priority over departures, higher percentages of arrivals during peak periods reduce the ASV. Percent arrivals is computed as follows:

$$Percent\ Arrivals = \frac{A + .5(T)}{A + D + T}\ X\ 100$$

*A = number of arriving aircraft in the hour*
*D = number of departing aircraft in the hour*
*T = number of touch-and-go operations in the hour*

According to the peak aircraft operations analysis presented in Chapter 2, *Aviation Activity Forecast*, there were 36 operations during the peak month average day at CWA in 2015. Of these 36 operations, it is estimated that 16 were arriving aircraft, 16 departing aircraft, and 4 were touch and go operations. Using these estimates and the equation above, the percent of arrivals during the peak hour is 50%.

### *Percent Touch-and-Go Operations*

Touch-and-go operations are defined as an operation by an aircraft that lands and departs on a runway without stopping or exiting the runway. Such operations are typically associated with training exercises. Although there is a relatively small general aviation (GA) presence on the Airport, the presence of a flight school means that flight training is conducted on the Airport. Therefore, touch-and-go operations are estimated at 10%.

### *Exit Taxiway Locations*

Exit taxiway locations can be a capacity-limiting factor if they do not provide adequate access to the parallel taxiway for arriving aircraft. The taxiway intersection distances from each runway end listed in **Table 3-2** were used in the peak hour airfield capacity analysis. It should be noted that intersection distances listed are rounded down to the nearest 50 feet. This is done in accordance with air traffic procedures to provide a margin of safety when pilots inquire about intersection distances from air traffic control.

**Table 3-2: Runway Exit Intersection Distances from Runway End**

| Runway | Taxiway Intersection Distance from Runway End (feet) | | | | | |
|---|---|---|---|---|---|---|
| **Runway 08/26** | **17** | **A** | **B** | **D** | **E** | **C** |
| 08 | 0 | 1,000 | 1,650 | 3,200 | 5,200 | 7,650 |
| 26 | 7,650 | 6,650 | 6,000 | 4,450 | 2,450 | 0 |
| **Runway 17/35** | **C** | **08** | **R** | **J** | **B** | N/A |
| 17 | 0 | 400 | 2,350 | 4,350 | 6,500 | |
| 35 | 6,500 | 6,100 | 4,150 | 2,150 | 0 | |

### 3.1.2 Peak Hour Airfield Capacity

Utilizing guidelines contained in AC 150/5060-5, hourly airfield capacity was computed under both VFR and IFR conditions. Peak hour runway capacity is computed as follows:

$$Hourly\ Capacity = C^{*}\ x\ T\ x\ E$$

$C^{*}$ = Hourly capacity base
$T$ = Touch-and-go factor
$E$ = Exit factor

The hourly capacity base (C*) is determined based on performance curves specific to the runway use configuration at the Airport. As shown in **Figure 3-1** and **Figure 3-2** below, C* is determined by identifying the aircraft mix index and percent arrivals at the Airport, which at CWA are 60% / 80% (VFR/ IFR) and 50%, respectively. Using these inputs C* is 83 operations per hour in VFR conditions and 57 operations per hour in IFR conditions.

The touch-and-go factor (T) is determined based on the aircraft mix index and percent touch-and-go, which are 60% / 80% (VFR/ IFR) and 10%, respectively. A table specific to the runway use configuration identifies T based on pairing these two factors. For the runway use configuration at CWA, T equals 1.02 in VFR and 1.00 in IFR conditions.

The exit factor (E) is determined based on the aircraft mix index, percent arrivals, and the average number of exits that are within appropriate exit range and separated by at least 750 feet. Based on the taxiway intersection distances shown in **Table 3-2**, the average number of exits (N) for Runways 08/26 and 17/35 is two. Using these inputs, E is 0.92 for VFR and 1.00 for IFR conditions.

Using the hourly capacity bases (C*), touch-and-go factors (T), and exit factors (E) described above, the hourly capacities of the airfield at CWA when winds allow use of both runway are as follows:

$VFR\ Hourly\ Capacity = C^* \ x\ T\ x\ E = 83\ x\ 1.02\ x\ 0.92 = 77.9$

$IFR\ Hourly\ Capacity = C^* \ x\ T\ x\ E = 57\ x\ 1.00\ x\ 1.00 = 57.0$

**Figure 3-1: VFR Hourly Capacity Base**

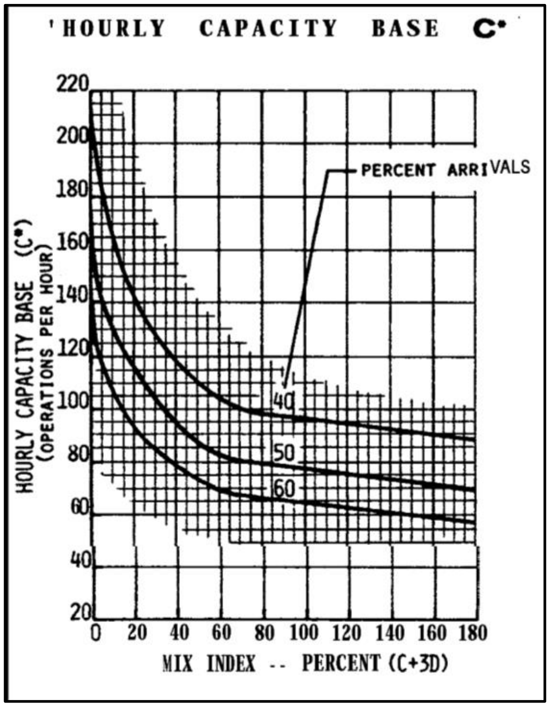
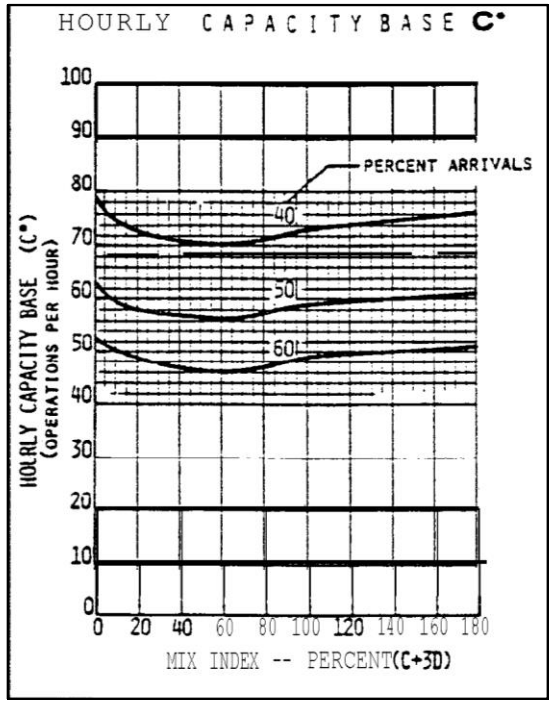



**Figure 3-2: IFR Hourly Capacity Base**




*Source: AC 150/5060-5, Airport Capacity and Delay*

### 3.1.3 Annual Service Volume Calculation

The formula for calculating ASV contain three variables: weighted hourly capacity ($C_w$); the ratio of annual demand to average daily demand in the peak month (D); and the ratio of average daily demand to average peak hour demand during the peak month (H).

Based on the formulas contained in AC 150/5060-5, the weighted hourly capacity ($C_w$) of the airfield at CWA is 73.6 operations.

The Daily Demand Ratio (D) is the ratio of annual demand to average daily demand in the peak month. Using 2015 operational levels, this ratio was calculated as follows:

$D = Annual\ Demand\ /\ Peak\ Month\ Average\ Daily\ Demand$

$D = 12{,}664\ /\ 36$

$D = 351.8$

The Hourly Demand Ratio (H) is the ratio of average daily demand to average peak hour demand during the peak month. This ratio was calculated using 2015 operational levels, as follows:

$H = Peak\ Month\ Average\ Daily\ Demand\ /\ Peak\ Hour\ Demand$

$H = 36\ /\ 11$

$H = 3.3$

Finally, the Annual Service Volume (ASV) is calculated as shown:

$ASV = C_w\ x\ D\ x\ H$

$ASV = 73.6\ x\ 351.8\ x\ 3.3$

$$ASV = 85{,}445$$

The AC does not provide any direct guidance on how the ASV may change over time. Therefore, a typical airfield capacity analysis fixes the ASV at a given number (in this case, 85,445 operations) throughout the planning period, rather than allowing for changes in operational demand. Aircraft operations growth forecasts are then compared to the static ASV to determine when and if the Airport will need additional airfield capacity, as shown in **Table 3-3**.

**Table 3-3: Forecasted Operations as a Percentage of ASV**

| Year | Forecasted Annual Operations | % of ASV |
|---|---|---|
| 2015 | 12,664 | 14.8% |
| 2020 | 11,726 | 13.7% |
| 2025 | 11,781 | 13.8% |
| 2030 | 12,264 | 14.4% |
| 2035 | 12,911 | 15.1% |

### 3.1.4 Relationship of ASV to Airfield Improvements

Current FAA guidelines in the National Plan of Integrated Airport Systems (NPIAS) call for beginning to plan capacity improvements when actual operations reach 60% to 75% of the ASV. This conservative percentage was chosen to give airports adequate time to plan for improvements, complete environmental review, and purchase land prior to construction, which should occur before 80% of ASV is reached.

***Capacity Improvements within the Planning Period***

As shown in **Table 3-3**, the preferred forecasts presented in Chapter 2 result in 17.7% of ASV being reached by the end of the planning period.

***Capacity Improvements beyond the Planning Period***

The recommended actions and level of certainty tend to decrease as the planning period is extended. In general, facility requirements forecasted to occur within one to five years should result in immediate action. Those forecasted for five to ten years into the future should be seriously planned with initial designs. Finally, those forecasted for 10 to 20 years into the future should be placed in a general planning framework. Beyond 20 years it is difficult to make valid conclusions regarding capacity-related needs.

### 3.1.5 Conclusion

Based on the forecasted growth at the Airport, facilities as a whole are meeting current needs for the annual number of operations. Planning for airfield capacity expansion is not considered necessary at this time as Airport annual activity is not forecasted to reach 60% of the ASV by the end of the planning period.

## 3.2 Airside Facilities

This section discusses the layout of the existing runway and taxiway configuration, their ability to meet future demand, and any current issues.

### 3.2.1 Runways

This first section discusses the runways at CWA including wind coverage, critical aircraft, and configuration analysis.

***Wind Coverage***

Crosswinds directly impact aircraft performance and are a factor in determining what aircraft can operate on a given runway. Safety is also an important consideration as strong crosswinds make it difficult for aircraft to land or takeoff. GA aircraft are particular susceptible to crosswinds given their relatively slower approach speed and lower weight. To account for the variation in susceptibility to crosswinds, the FAA has assigned allowable crosswinds for each Runway Design Code (RDC). **Table 3-4** shows the allowable crosswind component for each RDC.

**Table 3-4: Crosswind Limitations per RDC**

| RDC | Allowable Crosswind Component |
|---|---|
| A-I and B-I | 10.5 knots |
| A-II and B-II | 13 knots |
| A-III, B-III,<br>C-I through D-III<br>D-I through D-III | 16 knots |
| A-IV and B-IV<br>C-IV through C-VI<br>D-IV through D-VI<br>E-I through E-VI | 20 knots |

*Source: AC 150/5300-13A*

The FAA recommends that 95% wind coverage be provided to aircraft expected to use the Airport. If a single runway cannot meet this standard, then a crosswind runway should be provided. As shown in **Table 3-5**, neither runway meets this standard individually, and a crosswind runway is necessary. The primary runway at CWA, Runway 08/26, provides better coverage. Runway 17/35 cannot provide coverage to any of the aircraft limited to 10.5 knots or to aircraft with a 13 knot limitation during IFR conditions. However, when the runways are considered together, crosswind coverage is adequately provided.

**Table 3-5: Runway Wind Coverage Crosswind Component**

| Weather Conditions | 10.5 kts | 13 kts | 16 kts | 20 kts |
|---|---|---|---|---|
| ***Runway 08/26*** | | | | |
| All Weather | ***93.95%*** | 96.82% | 99.30% | 99.86% |
| VFR | ***93.84%*** | 96.77% | 99.30% | 99.87% |
| IFR | ***94.57%*** | 97.10% | 99.31% | 99.85% |
| ***Runway 17/35*** | | | | |
| All Weather | ***91.85%*** | 95.30% | 98.55% | 99.67% |
| VFR | ***92.11%*** | 95.48% | 98.61% | 99.69% |
| IFR | ***90.03%*** | ***93.97%*** | 98.09% | 99.50% |
| ***Both Runways*** | | | | |
| All Weather | 99.35% | 99.87% | 99.98% | 100.00% |
| VFR | 99.36% | 99.88% | 99.98% | 100.00% |
| IFR | 99.37% | 99.87% | 99.99% | 100.00% |

*Source: National Climatic Data Center, FAA Standard Wind Analysis Tool*
*Station: CWA AWOS, Period of Record: 2006 – 2015*

### *Critical Aircraft*

Many facilities at an airport are designed based on the most demanding aircraft expected to use the airport. Determining this aircraft, often referred to as the critical aircraft, is therefore a crucial point of any planning process. Currently, the most common aircraft operating at CWA are 50-seat aircraft, mainly, the CRJ200 and EMB145. In addition to the aircraft that regularly serve CWA, charter flights have a regular presence on the Airport. For more than 10 years Sun County Airlines has conducted flights to the Las Vegas area and Washington, DC, several times a year using the Boeing 737-800 (B737). In 2015 the B737 conducted 114 operations at CWA.

It is also crucial to evaluate what aircraft will likely serve an airport in the future. Air carriers are beginning to transition away from 50-seat aircraft in favor of larger aircraft, such as the 78-seat EMB170 or 86-seat CRJ900. Larger aircraft are more fuel efficient per passenger due to the greater load they carry and longer distances they are able to travel. Air carriers are expected to transition away from 50-seat aircraft by the early to middle 2020s. Therefore, it would be unwise to plan extensively for the EMB145 or CRJ200. Potential future aircraft, including possible replacements for the 50-seat aircraft, are shown in **Table 3-6** below. Based on the trends discussed in Chapter 2, *Aviation Activity Forecast*, the CRJ900 is selected as the critical aircraft for runway length throughout the 20-year planning period. However, while the CRJ900 is the most demanding aircraft for runway length, other aircraft that frequently use the Airport surpass it in taxiway needs. The critical aircraft for Airport taxiways will be selected in the relevant section.

**Table 3-6: Potential Fleet Mix**

| Aircraft Type | Maximum Seating | Runway Design Code | Approach Speed (knots) | Wingspan (feet) | Tail Height (feet) |
|---|---|---|---|---|---|
| CRJ200 | 50 | C-II | 135 | 69 | 20 |
| CRJ700 | 70 | C-II | 137 | 76 | 24 |
| **CRJ900** | **86** | **C-III** | **141** | **81** | **24** |
| EMB145 | 50 | C-II | 135 | 65 | 22 |
| EMB170 | 78 | C-III | 124 | 85 | 32 |
| EMB175 | 86 | C-III | 124 | 85 | 31 |
| B737-800 | 184 | D-III | 141 | 113 | 41 |

*Source: Airport Planning Manuals*

***Runway Length***

Runway length is not determined by a defined standard but is instead tailored to the specific needs of an airport and the aircraft serving it. Runway length necessary for a given aircraft is a function of aircraft performance and trip haul length. This section will first provide a discussion and analysis of the existing haul lengths at CWA, followed by aircraft performance demands, and it will conclude by considering the ability of each runway to support future demand.

FAA AC 150/5325-4B, *Runway Length Requirements for Airport Design*, Section 403.c(2) divides operations into short-haul and long-haul depending on the relationship of an aircraft's operating weight to its payload and range. If the haul length exceeds the distance at which fuel requirements place any limitation on payload – also known as the payload break point – the flight is considered a long-haul flight, and for planning purposes, the operating weight of the aircraft should be set to the Maximum Takeoff Weight (MTOW). If haul length does not exceed the payload break point, the operation is considered a short haul operation, and the actual operating weight of the aircraft should be used.

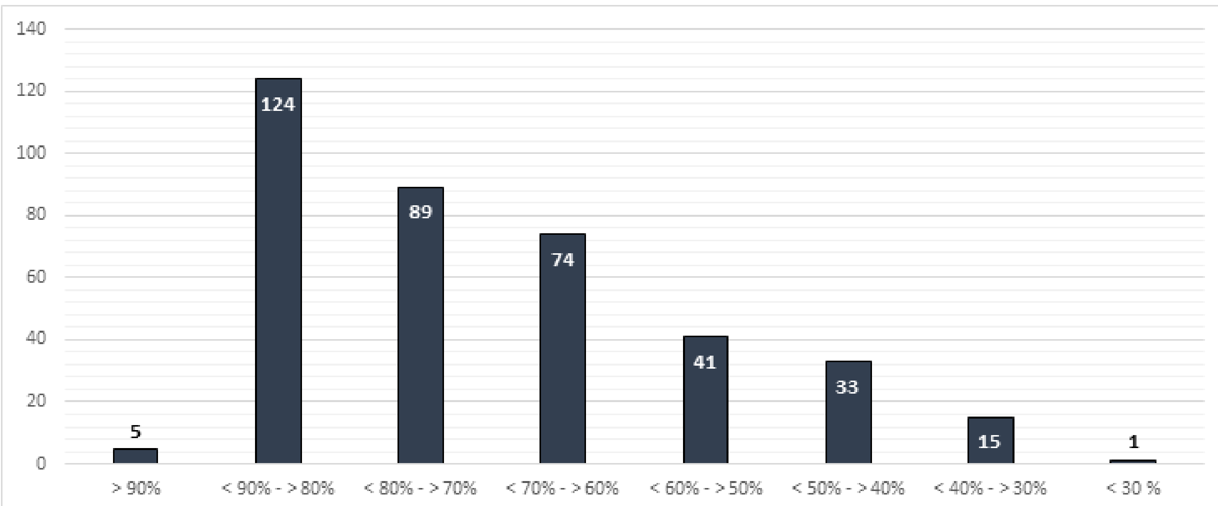
The two most demanding aircraft that currently exceed the regular use threshold, defined by FAA as 500 operations per year, are the CRJ200 and the ERJ145. The most distant location currently served by the CRJ200 is Detroit, Michigan, (363 statute miles), and the most distant location currently served by the ERJ145 is Chicago, Illinois, (213 statute miles). The payload break point during long range cruise while meeting FAA requirements is approximately 1,010 statute miles for the CRJ200ER and 1,320 statute miles for the ERJ145LR. As neither of these distances exceed the payload break point, the actual operating weight of the aircraft should be used when determining existing runway length needs.

Airline dispatchers were contacted in an attempt to determine the typical aircraft operating weights for Sun Country Airlines, Endeavor Air operating on behalf of Delta Air Lines, Envoy Air operating on behalf of American Airlines, and ExpressJet Airlines and SkyWest Airlines, which both operate on behalf of United Air Lines. Of these, Sun Country and SkyWest provided the requested information. Although the data from Sun Country is important to consider, the B737 aircraft does not meet the 500 annual operations threshold.

SkyWest operates the CRJ200 to Chicago O'Hare (ORD). Although SkyWest uses different variants of the CRJ200 and occasionally used the CRJ700ER and ERJ175 during the retrieved time period, the CRJ200ER is the most common aircraft and comprised 95.5% of SkyWest CRJ200 operations during this time. Therefore, the CRJ200ER takeoff weights were analyzed to determine operating trends.

**Figure 3-3** summarizes useful loads for the 382 takeoff operations by SkyWest to ORD using the CRJ200ER during the time period for which the airline supplied its operations data. As shown in the figure, useful loads vary widely depending on the specific operation, but operating weights exceeding 80% useful load were observed for approximately one third of operations. The ERJ145 is also used on routes to ORD by Envoy Air. Given that the ERJ145 has operating weights, seat capacity, and useful load capacity that are similar to the CRJ200, it is reasonable to expect that it is operated at similar useful loads. Next, the required runway lengths for various useful loads will be determined using aircraft performance data.

**Figure 3-3: Operations by Useful Load**




*Source: SkyWest, Mead & Hunt*

The second factor when determining required runway length is aircraft performance. Aircraft performance is dependent on local environmental factors such as air density, which decreases as elevation and temperature increase. Air density influences aircraft performance in two ways. The first is that the thrust generated by an aircraft, through either propeller or jet propulsion, will be less effective as the thinner air will not produce as much forward momentum in the aircraft. Second, the air moving over the wing will not generate as much lift, and greater speeds will be required to generate the same amount of lift from the wing. These two principles compound to exponentially increase an aircraft's takeoff distances as the temperature and elevation increase.

According to draft AC 150/5324-4C, *Runway Length Recommendations for Airport Design*, the temperature used to determine aircraft performance should be the average maximum temperature during the hottest month at the airport. Based on temperature data from the Wausau Downtown Airport (AUW), which is located 10 miles to the north, the applicable temperature is 78.6°F. The elevation at CWA is 1,277 feet Mean Sea Level (MSL), which occurs at the threshold of Runway 17.

Ideally, aircraft would be able to operate at maximum useful load from the Airport in all scenarios. This would enable air carriers to maximize the utility of their aircraft by carrying the maximum number of passengers and/or maximum amount of cargo. However, as runway length decreases, or as temperature and elevation increase, greater demand is placed on the aircraft, and its takeoff weight is often reduced to compensate and ensure safe operating performance. **Figure 3-4** shows the required runway lengths for existing and potential future aircraft based on the percentage of maximum useful load they are carrying. Lengths shown were determined by the respective aircraft's performance charts available from the manufacturer. Maximum useful load is defined as the MTOW of the aircraft minus their operating empty weight. Both existing runway lengths are shown by the red dashed lines, representing current limitations.

As can be seen, Runway 08/26, at 7,648 feet in length, offers enough length for the majority of aircraft to takeoff at 100% useful load. However, of the aircraft currently operating at CWA, the B737 and EMB145 are currently limited to less than 100% useful load. This means that these aircraft must either reduce their fuel on board (and subsequent potential range and markets) or the number of passengers and/or amount of cargo that they carry.

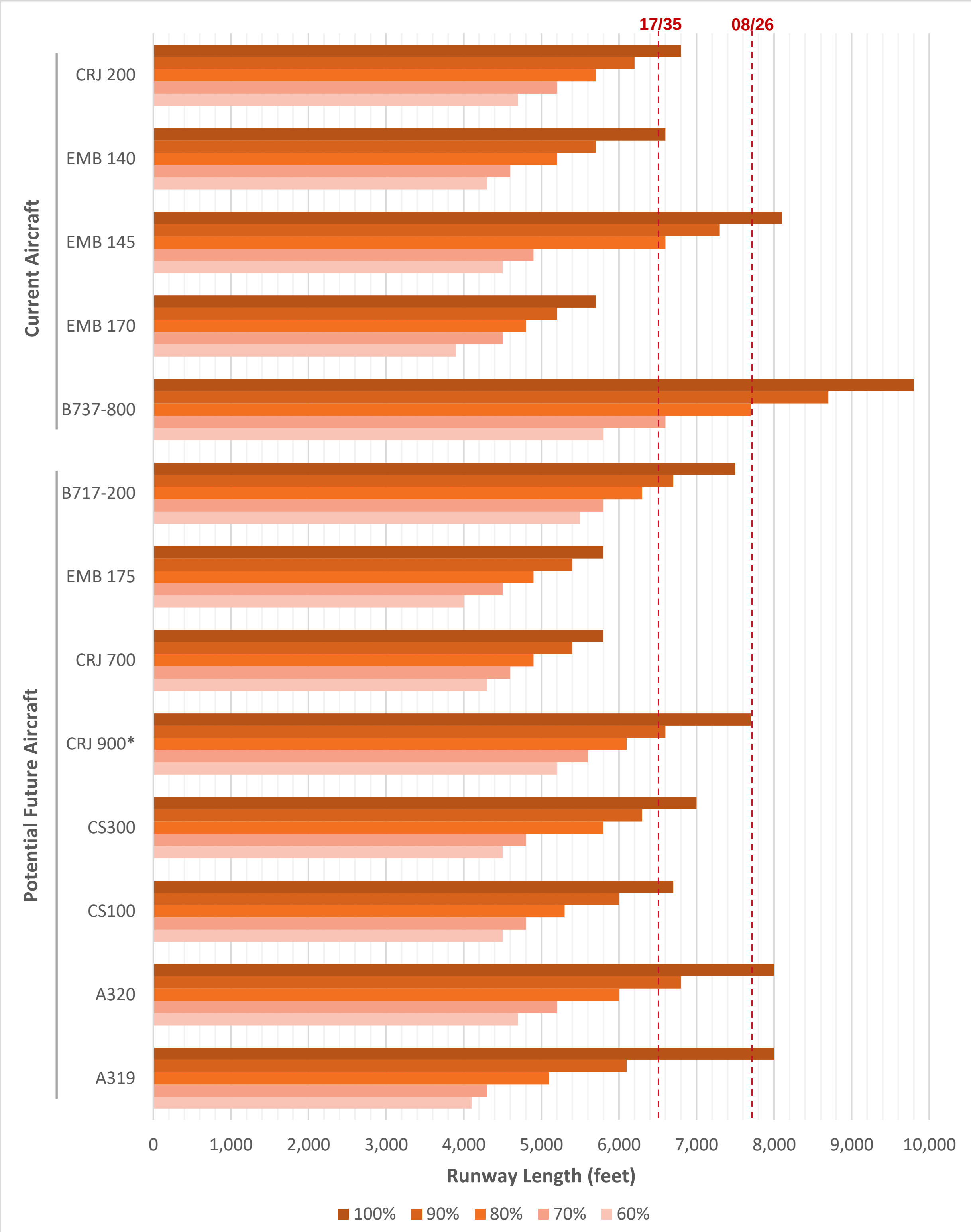
The runway lengths at CWA can meet most current demands at the Airport. However, any reduction in length would limit the current operations of the EMB145 and B737 and future operations of the CRJ900. Although the EMB145 is currently limited, it is expected to be phased out in the coming decade. Therefore, the runway length should be planned for the transition to larger aircraft, such as the CRJ900. Due to the existing and anticipated aircraft fleet mix performance and trip demands, any meaningful reduction in runway length available for takeoff would negatively impact the Airport's utility and reliability.

***Runway Configuration Analysis***

In 2006, a CRJ-100 inadvertently attempted a takeoff from an incorrect runway at the Blue Grass Airport in Lexington, Kentucky. As the runway was of insufficient length, it resulted in a runway overrun and the aircraft collided with a tree. This accident triggered the 2007 Wrong Runway Departures study by the FAA's Commercial Aviation Safety Team (CAST). The CAST examined reports from a variety of databases, such as the FAA Pilot Deviation System and NASA Aviation Safety Reporting System, dated 1981 through 2006, which identified 696 total reports of interest. Of the Part 121 air carrier reports, 80 were examined for contributing factors and potential mitigation strategies.

The CAST identified one incident at CWA that merited inclusion in the 2007 study. This incident occurred in 1996. An ATR 42 (a regional air carrier aircraft) was taxiing toward the intersection of Runway 17 and 08 when they were cleared for takeoff while the flight crew was completing pre-takeoff checks. After departing Runway 17, the controller informed the flight crew via radio they had departed on the incorrect runway. However, after the incident, the captain and first officer of the aircraft stated that they heard no mention of Runway 08, but ATCT personnel stated they had specified Runway 08 for departure. The airport environment was listed as a contributing factor, although the primary cause of the incident was listed as ambiguous on the Aviation Safety Reporting System report.

**Figure 3-4: Air Carrier Takeoff Runway Length Requirements**




*Source: Aircraft Planning Manuals, Mead & Hunt.*

Based on review of the 1996 incident described above, four common factors contributing to wrong runway departures were found to apply at CWA. These four factors, and their applicability at CWA, are listed below. The fifth, not included below and not found to be applicable at CWA, is a complex airport design.

- **Taxiway Distance –** The taxiway distance between the airport terminal and the runways at CWA is short. Although this makes for efficient taxiing, it may not allow flight crews sufficient time to compete preflight checklists. Many of the events studied showed that flight crew members were rushed to complete their checklists in order to be ready for departure. At CWA, the taxi distance from the passenger terminal apron is approximately 1,200 feet to the Runway 17 threshold, which must be crossed to reach the Runway 8 threshold approximately 400 feet to its immediate south.
- **One Taxiway to Multiple Runways –** A flight crew may take the “correct” taxiway, but if multiple runways are attached to that taxiway it creates an additional opportunity for flight crews to turn onto the wrong runway. Currently, Taxiway C provides sole access to both the Runway 17 and Runway 08 thresholds.
- **Close Proximity to Multiple Runway Departure Ends –** Areas where there are multiple runway thresholds in close proximity to one another may lead a flight crew to turn onto the wrong runway. The Runway 17 and 08 thresholds are only separated by 400 feet.
- **Runway Used As Taxiway –** When operations require flight crews to use a runway to taxi to the assigned departure runway, pilots may depart on the runway they are taxiing on, instead of turning onto the correct runway when a takeoff clearance is issued. At CWA, aircraft must taxi across the Runway 17 threshold and approximately 400 feet down the runway to access the Runway 08 threshold.

The following chapter will examine potential runway intersection reconfiguration options to address these issues while maintaining an efficient airfield at CWA.

### 3.2.2 Taxiways and Taxilanes

This section will discuss the taxiway and taxilane requirements at CWA, including the following:

- Taxiway and Taxilane Configuration Analysis
- Taxiway and Taxilane Design Standards

***Taxiway and Taxilane Configuration Analysis***

The taxiway system at CWA consists of Taxiway C, a full parallel taxiway to Runway 08/26; Taxiway B, a full, partially parallel taxiway to Runway 17/35; and Taxilane E, a partial parallel taxilane to Taxiway C that offers an alternate route on the east side of the terminal area and access to several facilities in this area. Connector taxiways, such as Taxiway A and a portion of Taxiway B, allow traffic to connect from the terminal area to the airfield. However, both of these connector taxiways provide direct access from the apron to the runway. AC 150/5300-13A states that it is undesirable for a taxiway to link directly from an apron to a runway.

The direct route from the apron to the runway makes it possible for a pilot to taxi onto the runway inadvertently when expecting to encounter a parallel taxiway. Therefore, the following chapter will consider alternatives to the existing layout that eliminate this direct connection at CWA while maintaining access to the airfield.

In addition, access to the T-hangars near the terminal area is limited. Two taxilanes on either side of the of the ATCT provide access to both T-hangars, with a total of 28 units, and additional box hangars. The taxilane to the west of the ATCT is suited only for small GA aircraft, while the taxilane to the east of the ATCT can support larger piston and small turbine aircraft. Surrounding structures also limit the size of aircraft able to enter this area. In addition to space limitations, this entrance creates a bottleneck of two access points to an area where infrastructure could potentially support more than 30 aircraft.

In conclusion, there are three primary taxiway configuration concerns. These will be addressed in Chapter 4, *Alternatives*:

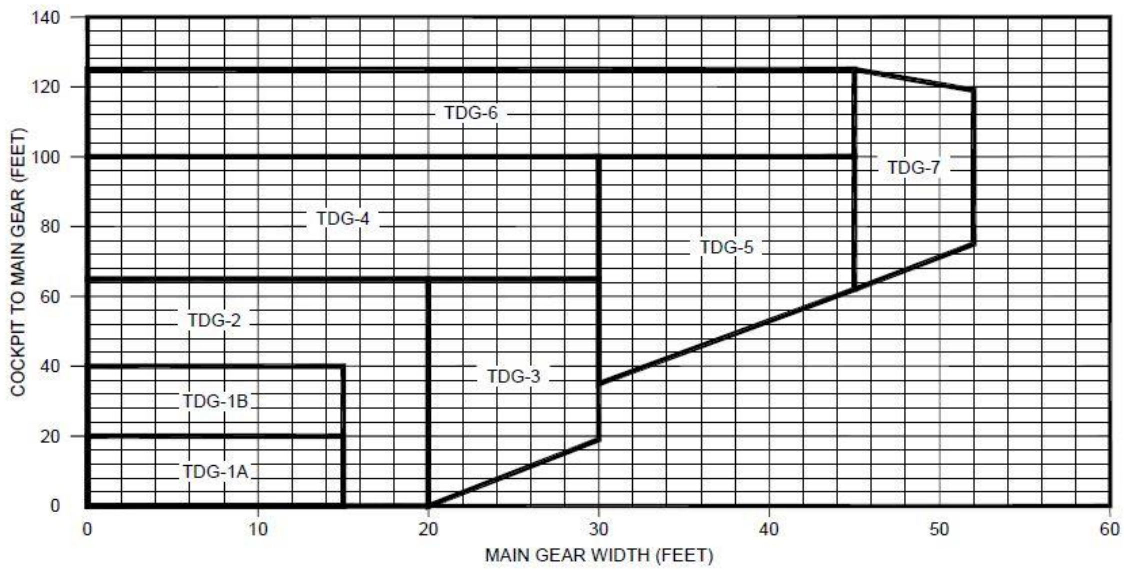
- Bottleneck entrance to existing hangar area
- Direct connections to the runway from the apron
- Maintaining runway access after potential runway reconfiguration

***Taxiway and Taxilane Design Standards***

Taxiway design is based on the taxiway design group (TDG) and aircraft design group (ADG) classification of the critical aircraft intended to operate on the taxiway in question. The TDG classification determines the physical dimensions of the taxiway pavement, while the ADG classification determines required taxiway separations and the width of the taxiway safety area and taxiway object free area. Taxiways should be designed for the aircraft expected to use the runway they serve. Historically taxiway pavement dimensions were based on the ADG of the critical aircraft. The updated guidance instead uses the TDG, which is based upon the overall main gear width and the cockpit to main gear distance of the landing gear. The TDG categories are illustrated in **Figure 3-5**. The TDGs for the expected fleet mix at CWA are presented in **Table 3-7**, and the standards for these categories are shown in **Table 3-8**. Of the aircraft expected to replace the CRJ200, the most demanding aircraft that will also likely surpass the 500 annual operations threshold is the EMB175, a TDG 3 aircraft.

Most taxiways at CWA, such as Taxiways B and C, are approximately 60 feet wide and exceed TDG 4 standards but do not meet TDG 5 standards. Smaller taxilanes such as Taxilane E are approximately 40 feet wide, which exceeds TDG 2 standards. The taxilanes do not meet higher TDG standards because they are not intended to be used by commercial passenger aircraft. However, existing taxiways serving both runways can support the EMB175 and B737 (TDG 3). These aircraft types should continue to be the critical aircraft for taxiway design at CWA. Due to the design stands for TDG 3 aircraft, it is expected that the 60 foot wide taxiways, Taxiways B and C, will only be eligible for federal funding for reconstruction up to 50 feet wide in accordance with TDG 3 standards.

**Figure 3-5: Taxiway Design Groups**




*Source: FAA AC 150/5300-13A, Airport Design*

**Table 3-7: Future Fleet Mix Taxiway Design Groups**

| Aircraft Type | Taxiway Design Group | Main Gear Width | Cockpit to Main Gear |
|---|---|---|---|
| CRJ200 | TDG-1B | 13 feet | 34 feet |
| CRJ700 | TDG-2 | 16 feet | 38 feet |
| CRJ900 | TDG-2 | 16 feet | 39 feet |
| EMB145 | TDG-2 | 14 feet | 47 feet |
| EMB170 | TDG-3 | 21 feet | 38 feet |
| EMB175 | TDG-3 | 21 feet | 41 feet |
| B737-800 | TDG-3 | 23 feet | 56 feet |

**Table 3-8: Taxiway Design Group for Future Critical Aircraft**

| Criteria | Category | | | | |
|---|---|---|---|---|---|
| ***Taxiway Design Group Criteria*** | ***TDG 1B*** | ***TDG 2*** | ***TDG 3*** | ***TDG 4*** | ***TDG 5*** |
| Taxiway Width | 25 feet | 35 feet | 50 feet | 50 feet | 75 feet |
| Taxiway Edge Safety Margin | 5 feet | 7.5 feet | 10 feet | 10 feet | 15 feet |
| Taxiway Shoulder Width | 10 feet | 15 feet | 20 feet | 20 feet | 30 feet |
| ***Airplane Design Group Criteria*** | ***ADG I*** | ***ADG II*** | ***ADG III*** | ***ADG IV*** | ***ADG V*** |
| Taxiway Safety Area Width | 49 feet | 79 feet | 118 feet | 171 feet | 214 feet |
| Taxiway Object Free Area Width | 89 feet | 131 feet | 186 feet | 259 feet | 320 feet |
| Taxilane Object Free Area Width | 79 feet | 115 feet | 162 feet | 225 feet | 276 feet |

*Sources: Planning Manuals, FAA AC 150/5300-13A*

Most of the Airport has direct access to an apron, and taxiways around the terminal area are limited. As previously discussed, most taxilanes are located near the GA and corporate area approximately 1,000 feet to the east of the passenger terminal, where several bottlenecks exist. Although the width of these taxilanes varies slightly, most of the taxilanes are around 40 feet wide. The taxilanes associated with the T-hangars are compliant with ADG I standards for the smaller piston driven aircraft that typically use T-hangars. The taxilane on the east side of this area is compliant with ADG II standards and suits existing and expected future corporate tenants.

## 3.3 Pavement Conditions

Although the role of pavement at airports is more subtle than other facilities, pavement plays the crucial role of supporting aircraft in nearly every operation on an airport. Because of this central role, pavement condition is crucial. Pavement in poor condition is not only more difficult to traverse and maintain, but also as pieces break off and are confronted with jet or propeller wash, they may pose a threat to nearby aircraft, facilities, and personnel. The Pavement Condition Index (PCI) is a numerical value indicating the integrity of specific pavement sections and serves as a guideline for planning pavement rehabilitation and maintenance projects. When the PCI is above 60, crack sealing and patching are often sufficient for maintaining the pavement. Pavements with PCIs between 40 and 60 usually are good candidates for major repairs such as overlays. Once the PCI drops below 40 reconstruction is typically the only viable option to restore the pavement.

The most recent Pavement Condition Report for CWA, commissioned by the Wisconsin Bureau of Aeronautics in 2015, assigns the overall area-weighted PCI of 83 for CWA. When summarizing PCI values, an area-weighted calculation eliminates the skewing of the PCI due to the disparity of the section sizes. Although Chapter 1, *Inventory*, provided a discussion of pavement conditions in general, the pavement areas that are below 80, as of the 2015 evaluation, are identified in **Table 3-9**. Generally, pavement sections will deteriorate between 1 and 3 PCI points per year due to use and weather.

The pavement in the poorest condition is a relatively small taxilane near the corporate hangars, segments of which have a PCI of 10, 18, and 38, as of 2015. However, the primary concern in planning for future pavement reconstruction for the Airport is the condition of Runway 17/35. Much of the runway has a PCI in the sixties as of 2015 and has deteriorated further since that time. Runway 35 currently has the only fully operational Instrument Landing System (ILS) approach, as the Medium Intensity Approach Lighting System With Runway Alignment Indicator Lights (MALSR) for Runway 08 is currently inoperative and offers the lowest visibility minimums at the Airport at 1/2 statute mile. This runway is due to be reconstructed soon, but the Runway 08 MALSR should be returned to full operation before reconstruction, so as not to have a negative impact on the Airport's accessibility during instrument conditions.

**Table 3-9: Pavement Conditions**

| Description | Section Area (square feet) | Construction Date* | 2015 PCI | Condition |
|---|---|---|---|---|
| ***Airside*** | | | | |
| North Section of Runway 35 | 41,616 | 2006 | 79 | Good |
| North Section of Runway 35 | 40,000 | 1998 | 79 | Good |
| North Section of Taxiway B | 123,942 | 1977 | 79 | Good |
| North Section of Taxiway B | 243,329 | 1972 | 68 | Good |
| North Section of Taxiway B | 8,795 | 2006 | 65 | Good |
| North Section of Taxiway B | 457,946 | 1972 | 60 | Good |
| Taxilane E | 95,079 | 1991 | 48 | Fair |
| Taxiway D Connector | 13,290 | 1991 | 46 | Fair |
| Western Section of Taxilane E | 9,200 | 1986 | 38 | Poor |
| ***Landside*** | | | | |
| West Terminal Apron | 40,116 | 1991 | 75 | Good |
| West Terminal Apron | 42,455 | 1997 | 72 | Good |
| East Terminal Apron | 11,962 | 1969 | 65 | Good |
| GA Apron | 306,504 | 2001 | 53 | Good |
| Corporate Hangar Spur | 17,904 | 1993 | 18 | Very Poor |
| Corporate Hangar Spur | 4,726 | 1995 | 10 | Very Poor |

*Source: 2015 Pavement Condition Report*

## 3.4 General Aviation Apron

The GA apron at CWA is approximately 300,000 square feet and located near the GA area. However, most of this space is not dedicated to aircraft parking. This apron offers 25 aircraft tie downs and additional space to maneuver through the area. As aircraft based at CWA prefer hangars, aircraft tie downs are typically used as temporary parking for itinerant aircraft. AC 150/5300-13A states that the required amount of GA apron is based on local conditions specific to each airport. Future peak demand for the GA apron will be based on the peak demand of itinerant GA and air taxi traffic. As specific itinerant aircraft types are difficult to predict and will vary by type and dimensions, a figure of 2,000 square feet per itinerant aircraft is used to provide a safety buffer and account for the variance of each aircraft.

There are 3,017 annual itinerant GA operations projected for the duration of the planning period. As peak month operations generally occur in October and amount to 8.9% of annual operations, peak month itinerant operations are projected to be 269 operations. When divided by 31, for the number of days in October, an estimated nine itinerant operations are anticipated during the average day of the peak month. This means that at least 18,000 square feet needs to be reserved for itinerant aircraft parking. Although approximately 35,000 square feet is currently marked for aircraft parking, it does not conflict with other apron uses, and ample room remains for other aircraft and vehicles and parking to traverse the apron. Potential changes to aircraft parking will be discussed in the following chapter to maintain efficient and complementary use of the apron.

## 3.5 Navigation Aids (NAVAIDs)

This section discusses NAVAIDs at CWA and their ability to meet the current and anticipated demand.

### 3.5.1 Visual Glide Slope indicators

Runways 26 and 17 each have a precision approach path indicator (PAPI) indicator unit that aids pilots in identifying the runway environment and establishing a smooth approach path. Each of the existing PAPIs appear to meet current Airport needs. However, Runways 08 and 35 do not have visual glide slope indicators to provide pilot cues when conducting approaches. Therefore, it is recommended that PAPIs be added to Runway 08 and 35 as well, although PAPIs require a score of at least 1 based on the FAA's Benefit Cost Analysis tool.

### 3.5.2 Instrument Approaches

As discussed in Chapter 1, *Inventory*, Runways 08 and 35 each have an ILS and Area Navigation (RNAV) Global Positioning System (GPS) approach with 1/2-mile visibility minimums, although the approach lighting system (ALS) for Runway 08 is currently inoperative. Runways 17 and 26 each have an RNAV GPS approach. As the Runway 08 ALS has a MALSR is out of service, all aircraft are limited to 3/4-mile visibility when using the ILS approach and 1-mile visibility when using the RNAV or localizer (LOC) approaches for Runway 08. This reduces the utility of Runway 08 and should be corrected. The timing of repairing the MALSR should be considered in conjunction with the decoupling of the two runways. To provide continuous service to aircraft at CWA, the Runway 08 MALSR should be operational before any construction on the Runway 35 end, and construction affecting the approaches should be coordinated so that interruptions to IFR service are minimal.

### 3.5.3 Wind Indicators

AC 150/5340-30H, *Design and Installation Details for Airport Visual Aids*, recommends that supplemental wind cones should be visible to pilots and within 1,000 of each runway end. As stated in Chapter 1, Inventory, the three wind indicators on the Airport are within 1,000 feet of each runway end. Therefore, no changes are recommended for the wind indicators at CWA.

### 3.5.4 Automated Weather Observing System (AWOS)

CWA has an AWOS-3 that provides automated weather reporting. The AWOS-3 variant provides more information than other AWOS types, such as visibility and cloud/ceiling data, but does not report precipitation type and intensity. However, the AWOS-3 appears to be meeting Airport needs, and an upgrade of the AWOS-3 to an Automated Surface Observing System (ASOS), which provides precipitation information, is not necessary at this time. The AWOS-3 is owned by the Airport and located to the south of Runway 08/26 near Taxiway B. The AWOS-3 is sited in compliance with FAA Order 6560.20B, *Siting Criteria for Automated Weather Observing Systems*.

## 3.6 Aircraft Hangars

It is assumed that all locally based aircraft will be stored in hangars to reduce exposure to the elements and provide an area for preventive maintenance and service. The demand for each type of hangar can be determined based on the specific aircraft anticipated at CWA. T-hangars are ideal for single-engine piston and other light piston aircraft, while turbine aircraft and some multiengine aircraft usually require box hangars due to their size. **Table 3-10** summarizes the approximate square footage needed to park each aircraft. This includes a margin around the aircraft to account for different sized aircraft and owner preference. **Table 3-11** shows the forecasted based aircraft fleet mix for CWA.

**Table 3-10: Approximate Hangar Unit Sizes for Aircraft Fleet Mix**

| Aircraft Type | Examples | Approximate Square Feet |
|---|---|---|
| Single Engine Piston/Turboprop | Cessna 172, Cirrus SR-22 | 1,400 square feet |
| Multi Engine Piston/Turboprop | Piper Seneca, Beechcraft King Air | 2,500 square feet |
| Small & Mid-Sized Jets | Cessna Citation, Learjet | 4,000 square feet |
| Large Business Jets | Gulfstream G550, Global Express | 10,000 square feet |
| Helicopter | Sikorsky S-76, Bell 206 | 2,400 square feet |

**Table 3-11: Forecasted Fleet Mix**

| Year | Single | Multi | Jet | Total |
|---|---|---|---|---|
| 2015 | 15 | 4 | 3 | 22 |
| 2020 | 16 | 4 | 4 | 24 |
| 2025 | 16 | 4 | 4 | 24 |
| 2030 | 17 | 4 | 4 | 25 |
| 2035 | 17 | 4 | 5 | 26 |

*Note: These numbers only include aircraft stored at CWA for six months or more per calendar year.*

CWA has a total of 28 T-hangar units in two T-hangar buildings with five box hangars located along the GA apron and to the east of the T-hangars. Space required for the anticipated aircraft is combined with the number and type of aircraft anticipated over the planning period to determine hangar demand. In addition to the aircraft permanently based at the Airport, there are approximately 10 more users that currently hangar their aircraft at CWA for a portion of the year. While these aircraft do not count as based aircraft at CWA according to FAA definitions, they impact hangar requirements at the Airport and should be considered when planning for future hangar needs. The total hangar demand for CWA is determined in **Table 3-12**.

**Table 3-12: Projected Box Hangar Area Demand by Aircraft Fleet Mix Classification**

| Aircraft Type | 2015 | 2020 | 2025 | 2030 | 2035 |
|---|---|---|---|---|---|
| ***Single Engine*** | | | | | |
| Projected Aircraft | 24 | 25 | 25 | 26 | 26 |
| Total Hangar Demand (sq. ft.) | 33,600 | 35,000 | 35,000 | 36,400 | 36,400 |
| ***Multi Engine*** | | | | | |
| Projected Aircraft | 5 | 5 | 5 | 5 | 5 |
| Total Hangar Demand (sq. ft.) | 12,500 | 12,500 | 12,500 | 12,500 | 12,500 |
| ***Jet Aircraft**** | | | | | |
| Projected Aircraft | 3 | 4 | 4 | 4 | 5 |
| Total Hangar Demand (sq. ft.) | 28,000 | 32,000 | 32,000 | 32,000 | 36,000 |
| | | | | | |
| Total T-Hangar Space Available | 33,600 | 33,600 | 33,600 | 33,600 | 33,600 |
| T-Hangar Demand | 40,000 | 41,400 | 41,400 | 42,800 | 42,800 |
| ***T-Hangar Difference*** | **-6,400** | **-7,800** | **-7,800** | **-9,200** | **-9,200** |
| | | | | | |
| Box Hangar Space Available | 46,000 | 46,000 | 46,000 | 46,000 | 46,000 |
| Box Hangar Demand | 53,000 | 57,000 | 57,000 | 57,000 | 61,000 |
| ***Box Hangar Difference*** | **-7,000** | **-11,000** | **-11,000** | **-11,000** | **-15,000** |
| | | | | | |
| **Total Difference** | **-13,400** | **-18,800** | **-18,800** | **-20,200** | **-24,200** |

*Note: *This includes the existing 20,000-square-foot hangar.*

As shown in **Table 3-12**, the number of T-hangars is already insufficient. Although there are some vacancies in the smaller sized T-hangars, there is a waiting list for the larger T-hangar units. This indicates that the current hangars are not what potential tenants desire, and additional large T-hangar units should be provided in an alternate location. Relocation of the existing T-hangars should also be considered to keep all T-hangars in the same general location. Due to the expected increase in jet aircraft, additional box hangars will be needed over the planning period. The location of additional box hangars and relocated T-hangars will be considered in detail in Chapter 4, *Alternatives*.

## 3.7 Fuel Facilities

In 2017, the existing Jet A and 100 Low Lead (LL) fuel tanks were refurbished in their existing location. The Airport intends to relocate the unleaded and diesel fuel to the SRE facility, for non-aviation fuel to be more accessible. The Airport also intends to reduce 100LL capacity and add one more 20,000-gallon Jet A tank to the existing fuel farm. These changes in aviation fuel capacity and non-aviation fuel location would better suit the needs of the Airport and allow separation of aviation fuel trucks and other vehicles.

## 3.8 Passenger Terminal

Terminal facility requirements are based on the number of passengers and aircraft using the facility. The CWA terminal facility provides scheduled air passenger service and offers regular charters to the traveling public. The partners of three major airlines (American, Delta, and United) offer daily direct service to three hub airports (Chicago, Detroit, and Minneapolis), and various charter services operate regularly from the terminal.

### 3.8.1 Peak Passenger Activity

Terminal facility demand is determined based on the forecasted peak period activity presented in Chapter 2, *Aviation Activity Forecast*. The design hour (peak passenger activity) is developed from a series of historic enplanement records and used to calculate terminal space requirements as facilities must be sized appropriately for periods of high passenger volume. During the design hour the terminal facility generally experiences usage of 5 to 10 % less than the absolute peak level of activity.

Peak activity forecasts include both enplanements and deplanements to account for the total number of passengers in the terminal during the design hour and to determine requirements for portions of the terminal facility that specifically serve either enplaning or deplaning passengers. For airports with no connecting flights, such as CWA, it is assumed that enplanements and deplanements are equal.

Enplanements at CWA were negatively affected by the recession from 2008 until 2012; but, the number of enplanements has generally grown since 2012. This organic recovery from the recession has occurred in conjunction with increases in average available seats per flight and passenger load factor. Currently, approximately 30% of airline departures occur during the peak hour.

### 3.8.2 Fleet Mix

Gates provide access to aircraft from the passenger terminal. Aircraft size within the fleet mix determines the distance needed between boarding gates. Similarly, the seating capacity of the aircraft will influence the amount of hold room space needed per gate.

Over the last several decades the industry trend has been that aircraft size and capacity have been growing while the frequency of flights has been reduced. From 2009 to 2012 at CWA, the 34-seat SAAB340 turboprops were replaced by 50-seat CRJ200 and EMB145 regional jets. The more recent trend is the 50-seat jets are being retired from the fleet, and airlines are transitioning to larger aircraft from 70-seat to 90-seat regional jets. These aircraft have wingspans of up to 81 feet and require greater clearances than their predecessors.

While CWA is expected to be one of the last airports served by 50-seat aircraft, it will need to accommodate larger aircraft in the near-term future. Additionally, at least one gate will need to continue to accommodate the even larger narrow-body jets such as the 175-seat B737.

### 3.8.3 Terminal Requirements Analysis

One of the Airport's goals is to provide the necessary terminal facilities to accommodate future commercial flights and charter flights in a flexible, efficient manner that does not limit potential future development. An assessment of the terminal facility's functionality with reference to anticipated demand shows that the non-secure area and security checkpoint are generally in good condition and have sufficient capacity to meet current and anticipated demand.

On the secure side of the checkpoint, the 1997 pier concourse area generally functions in an acceptable manner with today's aircraft fleet but is outdated. The ground boarding gate is no longer used, and the concessions area is undersized. All four of the passenger boarding bridges (PBBs) that were installed as part of the 1997 pier addition are beyond their useful life and have recurring maintenance issues. They need replacement but are not in optimal locations for accommodating the change to larger aircraft or to allow future concourse growth. Additionally, new PBBs will need to comply with the Americans with Disabilities Act, which will impact the slope and length of the PBBs and corresponding aircraft parking positions.

For the current aircraft fleet and air service, discussions with the airport confirm that the number of gates with PBBs is sufficient for current and near-term future needs. However, two additional gates with PBBs should be considered for the 20-year planning period for a total of six gates with PBBs. Because most of the concourse is built at a higher elevation than the terminal, and several PBB doors are even higher than the concourse floor, a large portion of the concourse is dedicated to pedestrian ramping, which is necessary to move people from one elevation to another. The ramping makes the seating layout less efficient and the reorganization or expansion of the concourse more complicated than if it were at a single elevation. Additional concourse area will need to be provided in association with the two additional gates, providing space for functions such as seating, circulation, and concessions. The space assessment in **Table 3-13, Table 3-14,** and **Table 3-15** show the estimates for the necessary space of each functional area in the passenger terminal throughout the 20-year planning period.

**Table 3-13: Terminal Facility Space Assessment**

| Facility | Existing Square Footage | Recommended Square Footage | | | | |
|---|---|---|---|---|---|---|
| | | 2015 | 2020 | 2025 | 2030 | 2035 |
| ***Terminal – Security Checkpoint*** | | | | | | |
| Number of Lanes | 2 | 2 | 2 | 2 | 2 | 2 |
| Passenger Screening | 2,590 | 2,600 | 2,600 | 2,600 | 2,600 | 2,600 |
| Checkpoint Queueing | 1,550 | 800 | 800 | 800 | 800 | 800 |
| Checkpoint Exit | 1,130 | 1,100 | 1,100 | 1,100 | 1,100 | 1,100 |
| *Checkpoint Total* | *5,270* | *4,500* | *4,500* | *4,500* | *4,500* | *4,500* |
| ***Terminal – Landside*** | | | | | | |
| Circulation and Queuing | 26,435 | 15,006 | 16,399 | 20,251 | 21,646 | 25,539 |
| Waiting and Bag Claim | 6,525 | 6,463 | 7,291 | 7,964 | 8,591 | 9,254 |
| Public Restrooms | 4,390 | 2,389 | 2,576 | 2,729 | 2,871 | 3,021 |
| Concessions and Vending | 4,550 | 1,639 | 1,850 | 2,020 | 2,179 | 2,347 |
| Support Space | 940 | 1,142 | 1,282 | 1,402 | 1,518 | 1,643 |
| *Subtotal Public* | *42,840* | *26,639* | *29,398* | *34,365* | *36,805* | *41,804* |
| ***Terminal – Nonpublic Areas*** | | | | | | |
| (NP) Baggage Screening | 980 | 2,400 | 2,400 | 2,400 | 2,400 | 2,400 |
| (NP) Inbound/Outbound Baggage | 9,835 | 5,397 | 6,107 | 6,639 | 7,150 | 7,678 |
| (NP) Airline Areas | 4,875 | 2,727 | 3,077 | 3,361 | 3,626 | 3,906 |
| (NP) Car Rental Areas | 3,340 | 2,160 | 2,312 | 2,476 | 2,653 | 2,844 |
| (NP) Leased Space | 4,100 | 2,874 | 3,031 | 3,165 | 3,294 | 3,431 |
| (NP) Airport Offices and Support Areas | 9,145 | 8,871 | 9,116 | 9,314 | 9,500 | 9,696 |
| *Subtotal Nonpublic* | *32,275* | *24,429* | *26,043* | *27,355* | *28,622* | *29,954* |
| *Utilities, Chases, Circulation* | *14,505* | *10,925* | *12,144* | *13,133* | *14,061* | *15,041* |
| **Terminal Total** | **94,890** | **66,492** | **72,084** | **79,354** | **83,987** | **91,299** |

*Sources: FAA Advisory Circulars; Airports Cooperative Research Program; Mead & Hunt*
*Notes: (NP): Non-public. All existing and recommended spaces estimated by Mead & Hunt based on industry standard guidance and consultant experience. Actual required areas dependent on space adjacency and arrangement. Not all spaces are eligible for FAA funding. Further study is recommended as part of project design.*

**Table 3-14: Concourse Facility Space Assessment**

| Facility | Existing Square Footage | Recommended Square Footage | | | | |
|---|---|---|---|---|---|---|
| | | 2015 | 2020 | 2025 | 2030 | 2035 |
| ***Concourse – Public Areas*** | | | | | | |
| Passenger Boarding Bridges | 4 | 4 | 4 | 5 | 5 | 6 |
| Circulation | 5,115 | 5,141 | 5,594 | 7,106 | 7,560 | 9,072 |
| Gates and Seating | 8,120 | 7,368 | 7,928 | 9,132 | 9,556 | 10,754 |
| Restrooms | 960 | 1,289 | 1,323 | 1,395 | 1,531 | 1,657 |
| Concessions and Vending | 395 | 1,171 | 1,321 | 1,443 | 1,557 | 1,677 |
| *Subtotal Public* | *14,590* | *14,969* | *16,166* | *19,077* | *20,204* | *23,160* |
| ***Concourse – Nonpublic Areas*** | | | | | | |
| (NP) Airport Support and Tenants | 375 | 852 | 954 | 1,057 | 1,136 | 1,238 |
| (NP) Utilities, Chases, Circulation | 4,095 | 4,491 | 4,850 | 5,723 | 6,061 | 6,948 |
| *Subtotal Nonpublic* | *4,470* | *5,343* | *5,804* | *6,780* | *7,197* | *8,186* |
| **Concourse Total** | **19,060** | **20,312** | **21,970** | **25,856** | **27,401** | **31,346** |

*Sources: FAA Advisory Circulars; Airports Cooperative Research Program; Mead & Hunt*
*Notes: (NP): Non-public. All existing and recommended spaces estimated by Mead & Hunt based on industry standard guidance and consultant experience. Actual required areas dependent on space adjacency and arrangement. Not all spaces are eligible for FAA funding. Further study is recommended as part of project design.*

**Table 3-15: Total Facility Space Assessment**

| Facility | Existing Square Footage | Recommended Square Footage | | | | |
|---|---|---|---|---|---|---|
| | | 2015 | 2020 | 2025 | 2030 | 2035 |
| Terminal Total | 94,890 | 66,492 | 72,084 | 79,354 | 83,987 | 91,299 |
| Concourse Total | 19,060 | 20,312 | 21,970 | 25,856 | 27,401 | 31,346 |
| **Facility Total** | **113,950** | **86,804** | **94,054** | **105,210** | **111,388** | **122,645** |

*Sources: FAA Advisory Circulars; Airports Cooperative Research Program; Mead & Hunt*
*Notes: (NP): Non-public. All existing and recommended spaces estimated by Mead & Hunt based on industry standard guidance and consultant experience. Actual required areas dependent on space adjacency and arrangement. Not all spaces are eligible for FAA funding. Further study is recommended as part of project design.*

## 3.9 Maintenance and Snow Removal Equipment (SRE) Facilities

SRE is currently stored in a shared facility with Aircraft Rescue and Firefighting (ARFF) equipment. The current facility is located east of the terminal where the commercial apron and GA apron meet. Although this provides a central location for maintenance and emergency operations, the building size is not sufficient to house both operations. SRE that does not fit into the facility is stored in several cold storage units on the east side of the Airport, approximately 3/4 miles east of the SRE/ARFF facility. This not only makes for a less efficient configuration, as personnel must travel nearly 1 1/2 miles to retrieve equipment and return to the terminal area, but the general condition of the cold storage units is poor. Cold temperatures and exposure to the elements shortens the useful life of equipment and increases maintenance requirements and wear. Currently, when maintenance is performed on vehicles, other vehicles must be parked on the apron to provide enough space within the building. This is undesirable as it not only requires additional staff time but occupies apron parking space intended for aircraft. The SRE fleet is aging, and, as older equipment tends to be less reliable, additional equipment provides redundancy. However, this system requires additional maintenance and monetary support to keep aging equipment in working order. Finally, as there is not sufficient room within the main SRE facility, maintenance must often take place outside on the aircraft apron in front of the SRE facility. Outdoor maintenance is undesirable, as it is not only less efficient for personnel and impedes on surrounding activity, but also presents the potential for oils and solvents released during the process to drain uninhibitedly, which may affect the surrounding environment.

Response time to clear snow from the Airport environment is based on the number of operations at the Airport. Total Airport operations in 2015 were 12,644 and are projected to grow to 15,016 in 2035. Based on guidance in AC 150/5200-30D, *Airport Field Condition Assessments and Winter Operations Safety*, because the Airport has more than 10,000 operations but less than 40,000 operations, it should have enough equipment to clear priority areas within one hour.

The Airport owns and maintains a variety of maintenance equipment and SRE, including two snow blowers, four plows, three sweepers, four spreaders, and two front end loaders. A list of these vehicles and equipment by vehicles make/model is presented in **Table 3-16**.

Based on the FAA Snow Removal Equipment Calculation spreadsheet, the Airport Improvement Program-eligible SRE fleet is determined based on calculations for primary runway, taxiways, and critical apron area, coupled with airport size and winter climate history. Only eligible equipment can be used to properly size an SRE facility, and vehicles and equipment identified as ineligible cannot be used to determine the facility's square footage. Eligible equipment for CWA according to the SRE calculations spreadsheet is shown in **Table 3-17**.

**Table 3-16: CWA SRE/Maintenance Vehicles and Equipment**

| Equipment Type | Year | Make | Model | Dimensions (feet) | Eligible Area (square feet) |
|---|---|---|---|---|---|
| Snow Blower | 1996 | Oshkosh | H-Series | 37x10x14 | 940 |
| Snow Blower | 2002 | Kodiak | LMSC | 34x10x14 | N/A |
| Sand Truck | 2003 | Oshkosh | P2538 | 31x11x12 | 861 |
| Naac Truck | 1996 | Oshkosh | P2538 | 33x11x12 | 903 |
| Sand Truck | 2005 | Oshkosh | P2538 | 31x11x12 | 861 |
| E-36 Truck | 1984 | Oshkosh | P2525 | 33x12x12 | 946 |
| Plow Truck | 2017 | MB | MB2 | 67x24x13 | 2,618 |
| Runway Broom* | 2017 | MB | 4600-CRDL | 67x24x13 | N/A |
| Plow Truck | 2017 | MB | MB2 | 67x24x13 | 2,618 |
| Runway Broom* | 2017 | MB | 4600-CRDL | 67x24x13 | N/A |
| Plow Truck | New | - | MB2 | 67x24x13 | 2,618 |
| Runway Broom* | New | - | 4600-CRDL | 67x24x13 | N/A |
| Blower Loader | 1998 | CAT | 970F | 34x10x14 | 880 |
| Ramp Plow Loader | 2008 | Volvo | L110F | 22x9x13 | 608 |
| Ramp Plow Loader | 2004 | CAT | 924G | 20x8x11 | 540 |
| Sand Loader | 1989 | Case | 821 | 22x9x13 | 608 |
| Sidewalk Sweeper | 2015 | Bobcat | Toolcat | 19x5x8 | N/A |
| Sidewalk Blower | 1998 | Kubota | Turfcat | 12x6x7 | N/A |
| Salt Truck | 1981 | GMC | - | 28x9x11 | N/A |
| ***Total Eligible Area Based on Equipment*** | | | | | ***15,001*** |

*Notes: *Denotes attachment*
*Source: Airport Records*

**Table 3-17: Identification of Justifiable SRE**

| Eligible Items | Max Quantity |
|---|---|
| Snow Blower | 2 |
| Plow | 4 |
| Sweeper | 3 |
| Hopper Spreader | 4 |
| Front End Loader | 2 |

*Source: Mead & Hunt*

Although the Airport is currently at its maximum amount of eligible equipment, some of the equipment is old and needs to be replaced. As stated previously, duplicate equipment provides redundancy when repairs are needed. By replacing older pieces of equipment with new models, operation and maintenance costs would be reduced. When relocating or reconstructing the SRE building, personnel efficiency and safety must be considered. Ideally, equipment storage would have an entrance on each side so that vehicles can enter or exit and backing in or out is not required. As the personnel that provide snow removal at CWA are also responsible for ARFF response, it is desirable for the SRE and ARFF facilities to be easily accessible or have personnel in the ARFF area while air carrier operations are conducted. FAR 139.319, *Aircraft Rescue and Firefighting: Operational Requirements*, requires that from the time of the alarm at least one ARFF vehicle must be able to reach the midpoint of the farthest runway serving air carrier aircraft from its assigned post within three minutes. These factors will be accounted for when considering alternatives.

FAA AC 150/5200-18A, *Building for Storage and Maintenance of Airport Snow and Ice Control Equipment and Materials*, provides guidance on storing maintenance and SRE. SRE/Maintenance building needs are related to paved areas, activity levels, and climate. Increases in runway, taxiway, and apron pavement, as well as increases in activity levels, result in additional need for SRE building space. Maintenance, SRE, and sand should be housed in a heated building to prolong the useful life of the equipment and to assist with a more rapid, effective response to operational needs. Additionally, facilities should have available area within the building for onsite equipment maintenance and repair during the winter season. Based on the eligible equipment at CWA, space in the current SRE facility is inadequate. Vehicle storage, maintenance bays, sand and chemical storage, and other areas will be assessed individually in each section below and the total space requirements for the proposed SRE building will be summarized.

### 3.9.1 Vehicle Storage and Circulation

Nearly 10,000 square feet is available for vehicle storage in the current SRE facility. However, this is an approximate area, with entrances only on one side. Vehicles are often parked in a manner that requires those in the front to be moved to allow others to exit or enter. This layout makes circulation difficult and is inefficient for personnel. It is estimated that the Airport could acquire funding for a total of 15,001 square feet of space for vehicle storage and circulation under current AIP eligibility requirements, as shown in **Table 3-15**. A center aisle angled parking building layout or multiple drive through aisles are preferred as it would improve circulation and efficiency.

### 3.9.2 Maintenance Bay

FAA Order 5100.38D, *Airport Improvement Program (AIP) Handbook*, allows for funding of a maintenance bay up to 1,500 square feet. The current space has limited access, which makes it difficult to service equipment. The industry standard for SRE equipment is growing, and new industry standard bays allow for overhead oil, grease, and air, and an overhead hoist for heavy equipment. A larger space should be provided and would be fully eligible for AIP funding at CWA.

### 3.9.3 Parts and Equipment Storage

There is minimal space in the main SRE facility to store additional equipment and vehicle attachments. Equipment that is used more seldom is often stored in the cold storage facilities located to the east of the main facilities. As previously stated, these buildings are in poor condition and expose stored equipment to the elements. In addition, the distance between these cold storage units and the main facility creates inefficiency as personnel must travel between them. Designated storage areas in one location would help to centralize maintenance activities. It is estimated that approximately 1,500 square feet should be provided for parts and equipment storage at CWA. However, parts and equipment storage spaces are not typically eligible for FAA funding under current AIP guidelines.

### 3.9.4 Sand and Chemical Storage

Current AIP eligibility requirements allow for funding of indoor sand and chemical storage areas. Heated sand storage prevents moisture from freezing in the sand, which requires significantly more effort to load, and may hamper response times during snow events. It is estimated that approximately 5,000 square feet of sand storage and 2,500 square feet of chemical storage would be eligible for AIP funding at CWA.

### 3.9.5 Office and Personnel Support Space

Although office and personnel support spaces are not eligible for FAA funding under current AIP guidelines, they are important considerations when determining facility needs. As the current facility is shared between the ARFF and SRE function, the personnel space in the facility is largely dedicated to ARFF for emergency response. An area available for training and other support roles should be included in a new SRE facility. It is estimated that approximately 1,000 square feet should be provided for office and personnel support.

### 3.9.6 Space Assessment Summary

SRE/maintenance space requirements for each functional area are summarized in **Table 3-18**. Development alternatives for SRE/maintenance space will seek to satisfy these requirements. It is expected that it will not be practical or feasible to fulfill these requirements in the existing location as the ARFF and SRE buildings are collocated, and several of the satellite equipment storage locations are in poor condition. The following chapter will evaluate alternative sites on Airport property for a larger and more efficient SRE/maintenance facility.

**Table 3-18: SRE Space Requirements**

| Functional Area | Required SF | AIP Eligible |
|---|---|---|
| Vehicle Storage and Circulation | 15,001 | Yes |
| Maintenance/Wash Bays | 1,500 | Yes |
| Parts and Equipment Storage | 1,500 | No |
| Sand and Chemical Storage | 7,500 | Yes |
| Office and Support Space | 1,000 | No |
| **Total** | 26,501 | - |

*Notes: Required space needs are estimated. Additional analysis will be required to determine federal funding eligibility and building/layout dimensions.*
*Source: Mead & Hunt, Airport Staff*

## 3.10 Aircraft Rescue and Fire Fighting (ARFF) Facilities

The ARFF and SRE facilities are currently conjoined. The next chapter will discuss the construction of a new SRE building that will allow the current building to be converted to ARFF use. As stated in Chapter 1, *Inventory,* two Striker vehicles currently meet Airport ARFF needs. A single Striker vehicle meets Index A requirements, and when considered together, the two meet Index B requirements. The ARFF index is determined by the most demanding air carrier aircraft that conducts five or more average daily departures. Index B is for aircraft at least 90 feet but less than 126 feet in length while Index A is for aircraft less than 90 feet in length. The only aircraft to exceed five daily departures at CWA is the CRJ 200, which is less than 90 feet and therefore CWA is an Index A Airport. However, the ERJ-145 (98 feet) currently conducts an average of 3 departures a day and the future critical aircraft, the CRJ 900 (119 feet) and ERJ-175 (104 feet), are also Index B. Therefore, it is expected that the Airport will increase from Index A to Index B within the planning period.

In addition to serving as the ARFF facility, once the SRE function is relocated, the existing building could serve as an emergency operations center (EOC) for the city during a local crisis. The Federal Emergency Management Agency (FEMA) provides a checklist of items to consider when determining a location for an EOC. The checklist assists in determining if the facility can provide the capability needed while demonstrating survivability, security, interoperability, and other important elements to a successful and resilient EOC. Although more thorough coordination with the City and FEMA would be needed to confirm, the current ARFF facility offers several initial advantages for an EOC, as it is an accessible building with existing security features.

## 3.11 General Aviation (GA) Terminal

The GA terminal at CWA is located approximately 500 feet to the east of the passenger terminal. Although the GA terminal has access to an 11,500-square-foot hangar, the building itself is aging and constrained. CWA is well suited to support corporate operations due to its runways and geographic location, and the GA terminal is often the “face” of the airport when corporate traffic is arriving or departing. The current building is outdated and has limited pilot rest areas, passenger circulation, and front service area.

Several aspects of the GA terminal should be considered to better meet Airport needs. The front area is congested with limited space for employees to interact with passengers and pilots without interfering with people in the waiting area. While the current crew rest area is partially separated from the rest of the GA terminal, which promotes a peaceful environment, access and capacity is limited. The layout of the building could be changed so that each function of the building is more complementary.

## 3.12 Auto Parking and Circulation

A total of 1,671 parking spaces at CWA are separated into four lots, including a main public lot, a designated rental car area, and two satellite lots west and east of the main lot. To determine the number of parking spaces needed, a ratio of parking spaces to enplanements was used. This ratio is based on the number of average daily enplanements that occur during the peak month compared to the number of parking spaces. Several Midwest airports were selected that have similar peak month enplanements as CWA. This method can be seen in **Table 3-19**.

**Table 3-19: Vehicle Parking Demand**

| Airport | Parking Spaces | Peak Month Enplanements | Peak Month Average Day Enplanements | Parking Spaces Per Daily Enplanements |
|---|---|---|---|---|
| La Crosse Regional (LSE) | 1,001 | 8,216 | 265 | 3.8 |
| Grand Forks International (GFK) | 1,274 | 15,429 | 498 | 2.6 |
| Rochester International (RST) | 970 | 10,425 | 336 | 2.9 |
| Duluth International Airport (DLH) | 1,116 | 13,432 | 433 | 2.6 |
| Central Wisconsin (CWA) | 1,671 | 12,100 | 390 | 4.3 |

*Note: 2013 – 2015 data was checked when available in order to ensure outliers were not used.*

When CWA is not considered, the average ratio of sampled airports is 2.9, less than the 4.3 at CWA. As CWA recently had additional parking lots installed, it is reasonable to expect that CWA would have enough parking for the planning period. The existing ratio of 4.3 is based on the existing peak month enplanements and is expected to drop to 3.0 by the end of the planning period as peak month enplanements are projected to rise to 17,326. If the 2.9 ratio is held for the duration of the planning period, then parking space demand can be seen below in **Table 3-20**. Therefore, no additional parking expansions are expected to be required by the end of the planning period.

**Table 3-20: Public Vehicle Parking Space Requirements**

| Year | Peak Month | Peak Month Average Day | Total Required Parking Spaces |
|---|---|---|---|
| 2015 | 12,100 | 390 | 1,132 |
| 2020 | 13,652 | 440 | 1,277 |
| 2025 | 14,911 | 481 | 1,395 |
| 2030 | 16,085 | 519 | 1,505 |
| 2035 | 17,326 | 559 | 1,621 |

## 3.13 Summary

The section summarizes the facility requirements described throughout this chapter. These items will be explored further in the following chapter.

- The Runway 17 and Runway 08 thresholds should be decoupled based on findings of the FAA 2007 Wrong Runway Departures study.
- The Runway 08 MALSR is inoperative and should be replaced to improve Runway 08 approaches.
- Taxiways need to be reconfigured after the runways are decoupled to accommodate the new runway layout and address existing configuration issues.
- Runway 17/35 should be reconstructed in the near-term to address deteriorating pavement conditions.
- The passenger terminal meets most current needs, but replacement of the PBBs should be considered in the near-term, and concourse expansion should be considered to meet long-term demand.
- The T-hangars are near capacity, and vacant units are smaller than desired by potential tenants. Relocation and expansion of the T-hangars should be considered. Additional box hangars will need to be constructed to meet projected turbine aircraft demand.
- The SRE facility and associated storage facilities are aging and do not meet existing equipment needs.
- The ARFF facility is currently constrained because it is combined with the SRE facility. If a separate SRE storage building is constructed, then portions the existing ARFF/SRE building can be repurposed to better meet needs.
- Vehicle parking at CWA is sufficient to meet needs throughout the 20-year planning period.
- A 20,000-gallon Jet A tank should be added and 100LL fuel capacity reduced in the existing fuel farm location.
- Precision approach path indicators (PAPIs) should be added for Runway 08 and 35.