



BASELINE CAPACITY AND DELAY ANALYSIS

Prepared for:

Regional Airport Planning Committee



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The Baseline Capacity Analysis Answers Two Critical Study Questions

- 1. What are the capacity limits of the primary Bay Area airports?**
- 2. When are these limits likely to be reached?**

- ◆ **Capacity and Delay modeling was performed for OAK, SFO and SJC at several activity levels:**
 - 2007 (Actual), 2020 and 2035 (Base Case Forecast)
- ◆ **All operations at each airport, including Commercial and GA flights, were considered since they may share the use of runways and are managed together by the FAA.**
- ◆ **The analysis focuses on runway capacity and delays. Only airspace issues within the immediate vicinity of the airport are addressed.**
- ◆ **The modeling reflects existing conditions and does not consider potential airfield improvements or ATC enhancements.**

All Assumptions and Parameters Were Developed With Input and Consultation from the FAA and Airport Personnel

FAA Personnel

- ◆ **OAK ATCT**
 - Ora King and Deborah Omowale
- ◆ **SFO ATCT**
 - Mark Sherry
- ◆ **SJC ATCT**
 - Mark DePlasco and John DeCuir
- ◆ **FAA NORCAL TRACON**
 - Mike Desrosiers and Jason Busch

Airport Personnel

- ◆ **OAK**
 - Wayne Bryant and Hugh Johnson
- ◆ **SFO**
 - Danielle Rinsler, John Bergener and Bert Ganoung
- ◆ **SJC**
 - Craig Simon

Final Results for Each Airport were Reviewed with Airport Personnel

The Modeling Approach Used for the Bay Area Has Been Used by FTA to Assess Capacity and Delays at Major Airports Worldwide



Capacities for Each Runway Configuration Were Calculated Using the FLAPS Simulation Model

- ◆ **A configuration is defined as a set of active runways, runway assignments by aircraft class and appropriate weather conditions.**
- ◆ **The key input variables for the capacity calculation are:**
 - Fleet Mix: distribution of aircraft operations by type
 - Aircraft Characteristics: weight class, approach speed, braking performance, etc.
 - Airport Geometry: runway lengths, locations and intersections, and taxiway locations and exit speeds
 - Separation Standards: required clearance between arrivals and/or departures on one or more runways
 - ATC Procedures and runway assignment policies
- ◆ **The resulting configuration capacities, runway utilization and weather conditions serve as inputs to the delay modeling.**

The DELAYSIM Model was Used to Simulate Future Airport Operations and Estimate Delays

- ◆ **DELAYSIM simulates the selection of runways and the resulting aircraft delays at an airport using weather conditions and actual or forecast patterns of aircraft flight demand.**
- ◆ **Key inputs are:**
 - Historical Weather: 10 years of National Weather Service data (1998-2007)
 - Aircraft Demand: Base year and forecast aircraft operations by hour
 - Runway Configuration Capacities: Determined by FLAPS Model
- ◆ **On an hourly basis, DELAYSIM selects the "best" available runway configuration given weather, flight demand and runway availability.**
- ◆ **Hour by hour delays are calculated based on the ratio of flight demand to runway capacity.**

Delay Thresholds Used to Estimate Airfield Capacity

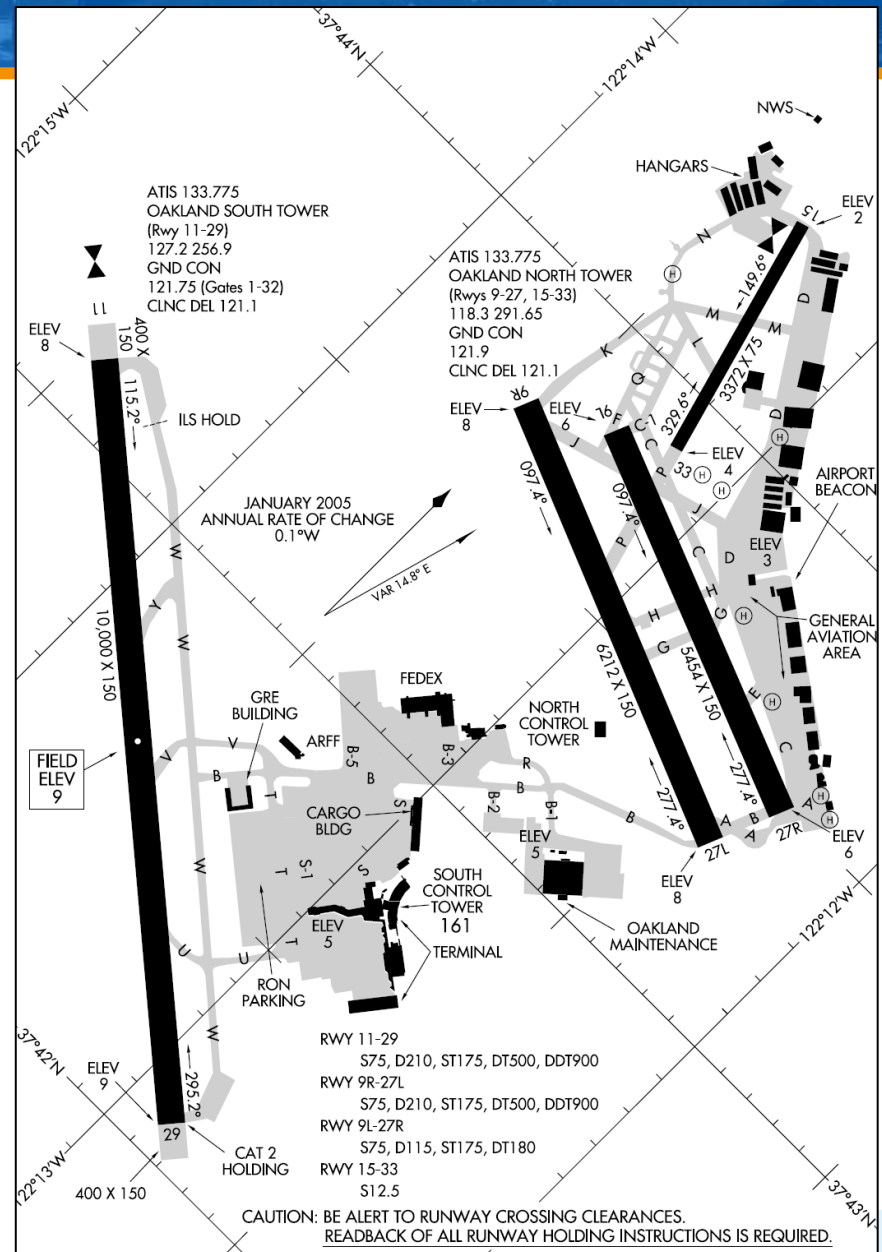
- ◆ **Airfield capacity and delays vary by hour, weather conditions and flight demand.**
- ◆ **Average aircraft delay is a common metric for defining annual airfield capacity.**
 - An average delay of 15 minutes per aircraft is commonly accepted as a serious delay condition.
- ◆ **For this study, the airports are projected to reach capacity when average annual delays range from 12 to 15 minutes per flight.**

Oakland (OAK): Airfield Layout and Key Operating Factors

- ◆ **OAK is two airports in one.**
 - The North Field is primarily used by General Aviation and Air Taxi operators
 - The South Field is used by nearly all commercial carriers

- ◆ **OAK has a noise policy that discourages North Field jet departures to the west and jet arrivals from the west.**

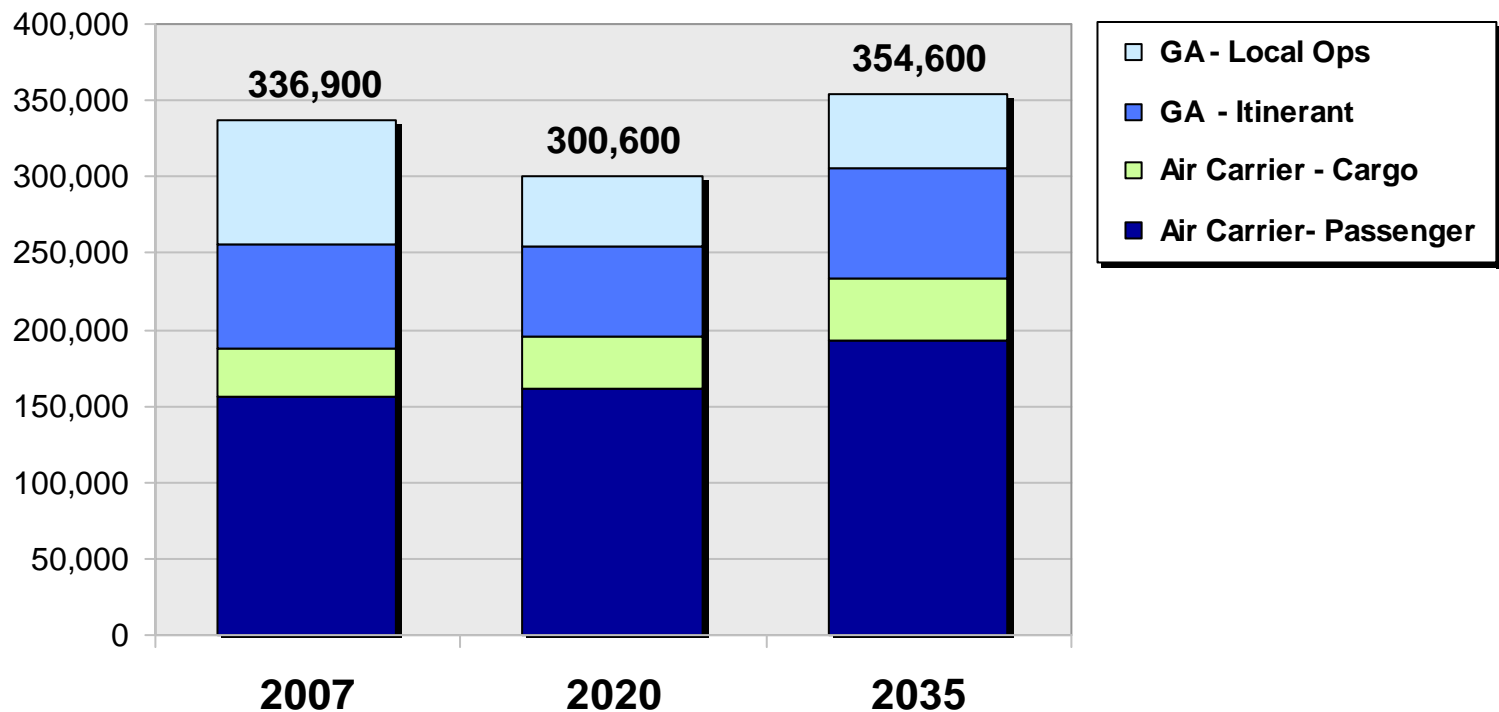
- ◆ **The GA activity using the North Field has been a large part of OAK's activity.**
 - The forecast predicts a significant reduction in this activity from 2007 to 2020.



OAK's Runway Demand is Forecast to Decline from 2007 to 2020, then Resume Growth, Increasing to 355,000 Operations in 2035

Annual Aircraft Operations

Baseline 2007 and Base Case Forecast 2020 and 2035

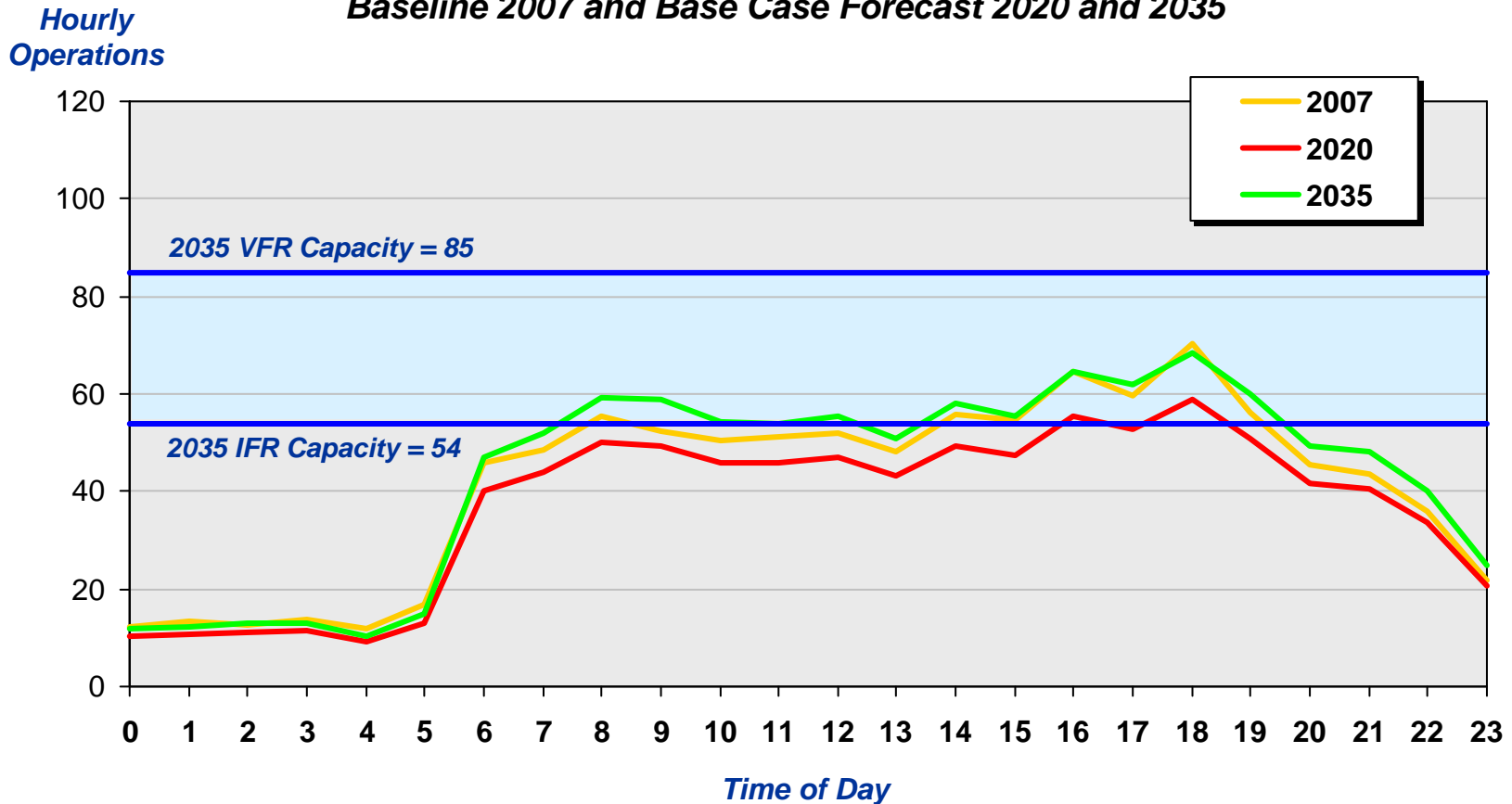


Note: Includes runway demand for both the North and South Fields. Excludes military operations.

Source: Regional Airport System Plan Update – Baseline Aviation Activity Forecasts for the Primary Bay Area Airports, August 27, 2009

OAK is Forecast to Operate Within its Maximum VFR Capacity Over the Forecast Period

Average Weekday Aircraft Operations by Hour
 Baseline 2007 and Base Case Forecast 2020 and 2035

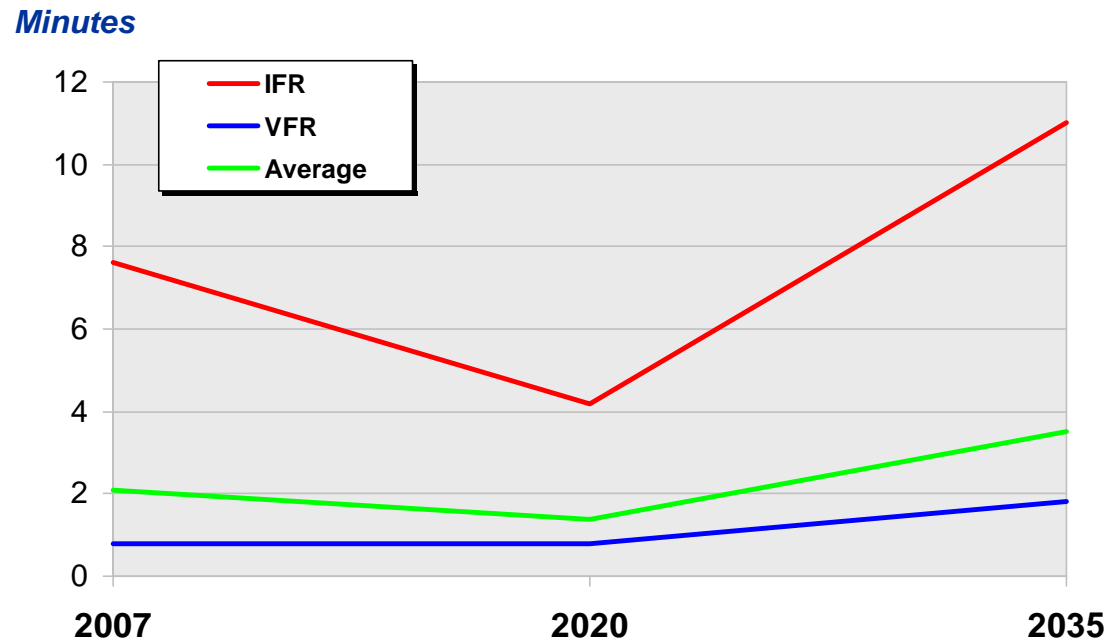


Notes: 2007 capacities = 105 VFR and 55 IFR; 2020 capacities = 88 VFR and 54 IFR

OAK's Average Delay is Estimated at Less Than 4 Minutes in 2035, While IFR Delays Average Approximately 11 Minutes

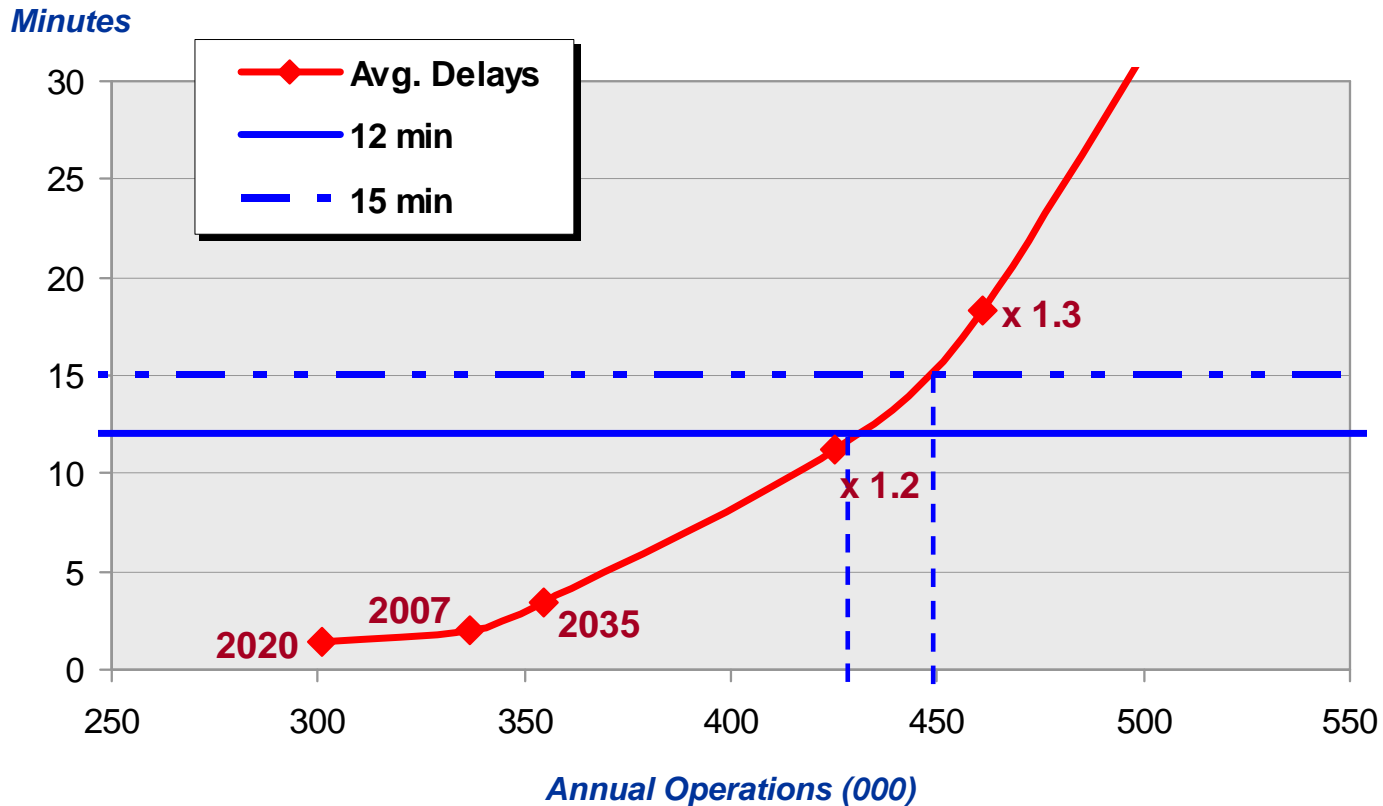
- ◆ OAK operates under VFR 77% of the time
- ◆ IFR conditions occur approximately 23% of the time

Average Minutes of Delays by Weather Condition
Baseline 2007 and Forecast 2020 and 2035



Under Current ATC Procedures, OAK is Predicted to Reach Airfield Capacity at 425,000 to 450,000 Annual Operations, or 20%-25% Above the 2035 Forecast

OAK Average Delays



Notes: Capacities are for North and South Fields combined.

"x1.2" = 1.2 times 2035 operations; "x1.3" = 1.3 times 2035 operations

OAK's *Ultimate Airfield Capacity Study* Identifies 450,000 Annual Operations as the Airport's Maximum Practical Capacity

Similarities

- ◆ **Maximum annual capacity (i.e., 450,000 operations)**
- ◆ **General aircraft fleet mix**
- ◆ **VFR/IFR Split**
- ◆ **Similar average delay results for unimproved airfield conditions**

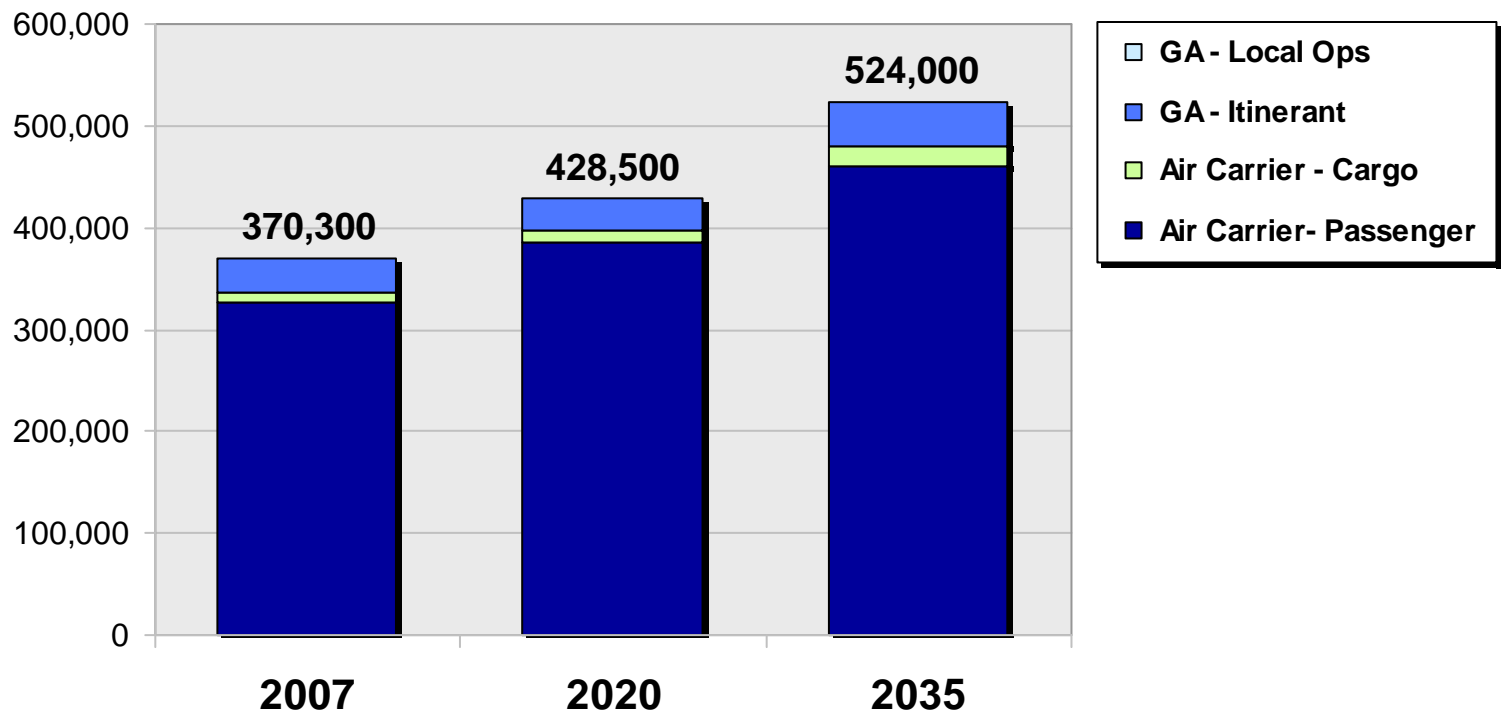
Major Differences

- ◆ **Modeling approach (SIMMOD Pro vs. FLAPS/DELAYSIM)**
- ◆ **Airspace interactions between airports are included in OAK's analysis**
- ◆ **Airfield and airspace improvements are included in OAK's analysis**
- ◆ **OAK's analysis does not include North Field GA demand during IFR conditions**
- ◆ **OAK's delay threshold is based on airline schedule integrity during the peak vs. average annual delay for our study**

Runway Demand at SFO is Projected to Increase by 42% Over the Forecast Period

Annual Aircraft Operations

Baseline 2007 and Base Case Forecast 2020 and 2035

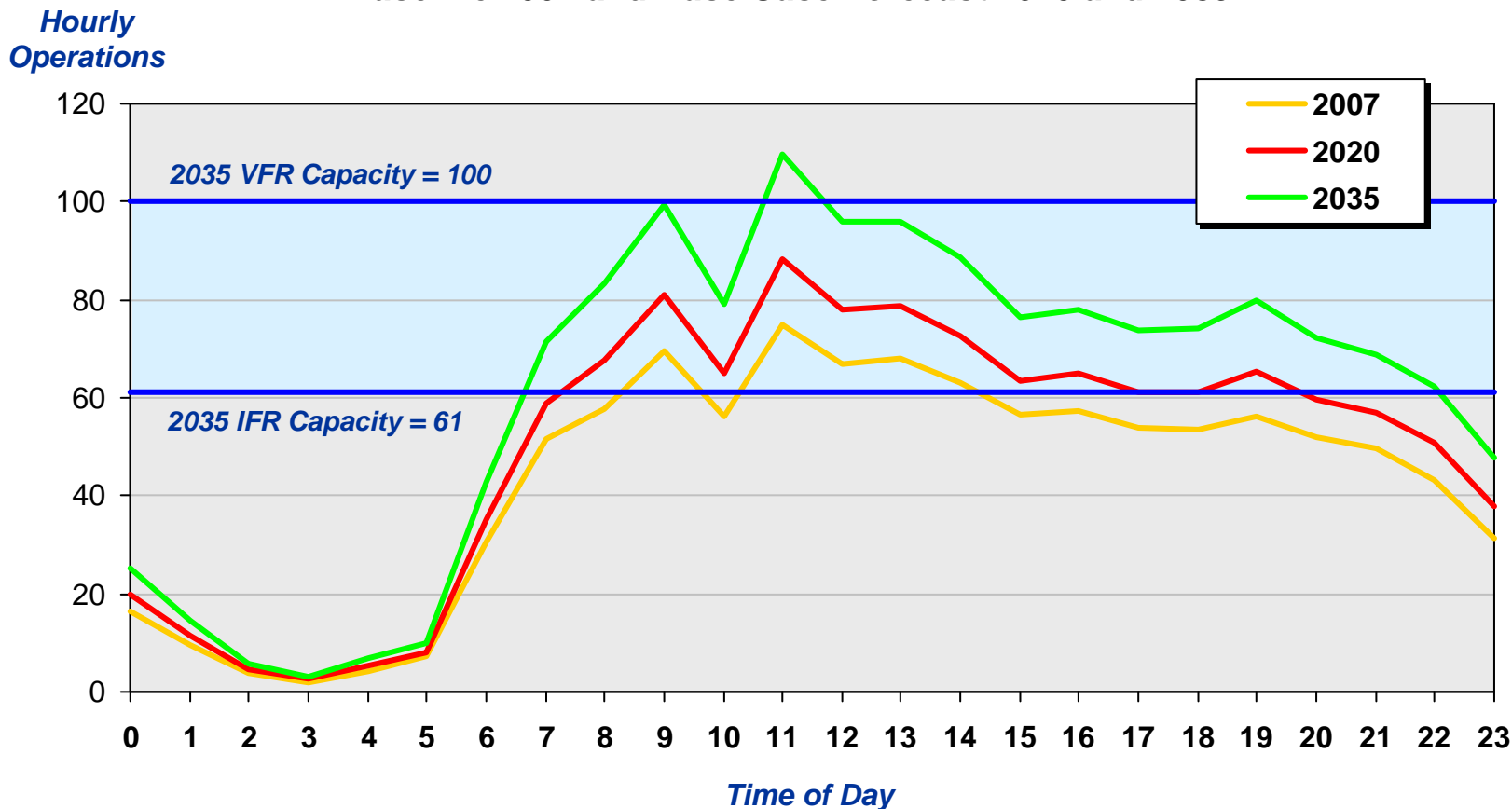


Note: Excludes military operations.

Source: Regional Airport System Plan Update – Baseline Aviation Activity Forecasts for the Primary Bay Area Airports, August 27, 2009

Under the 2035 Forecast, Late Morning Demand Will Exceed SFO's Maximum VFR Capacity

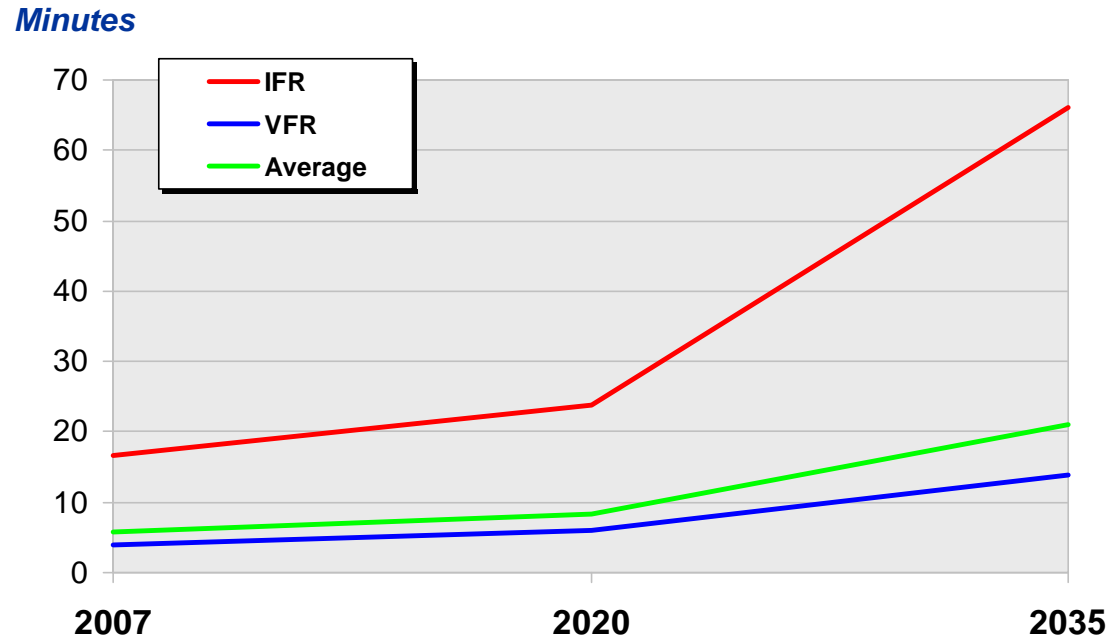
Average Weekday Aircraft Operations by Hour
Baseline 2007 and Base Case Forecast 2020 and 2035



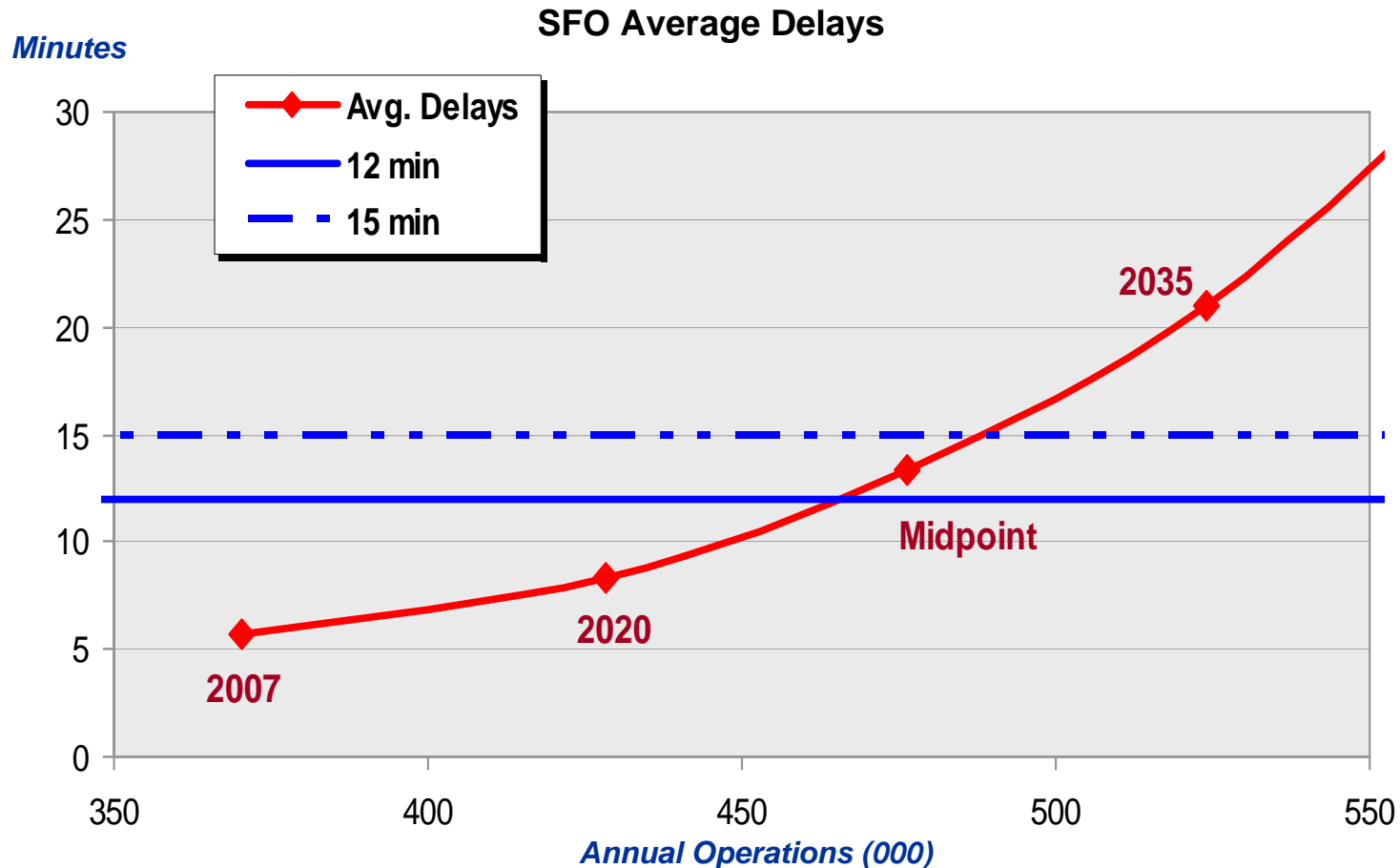
SFO's Average Delay Exceeds 20 Minutes in 2035

- ◆ SFO operates under VFR more than 80% of the time
- ◆ IFR West flow conditions occur about 16% of the time
- ◆ Average good weather (VFR) delay is 14 minutes in 2035

Average Minutes of Delays by Weather Condition
Baseline 2007 and Forecast 2020 and 2035



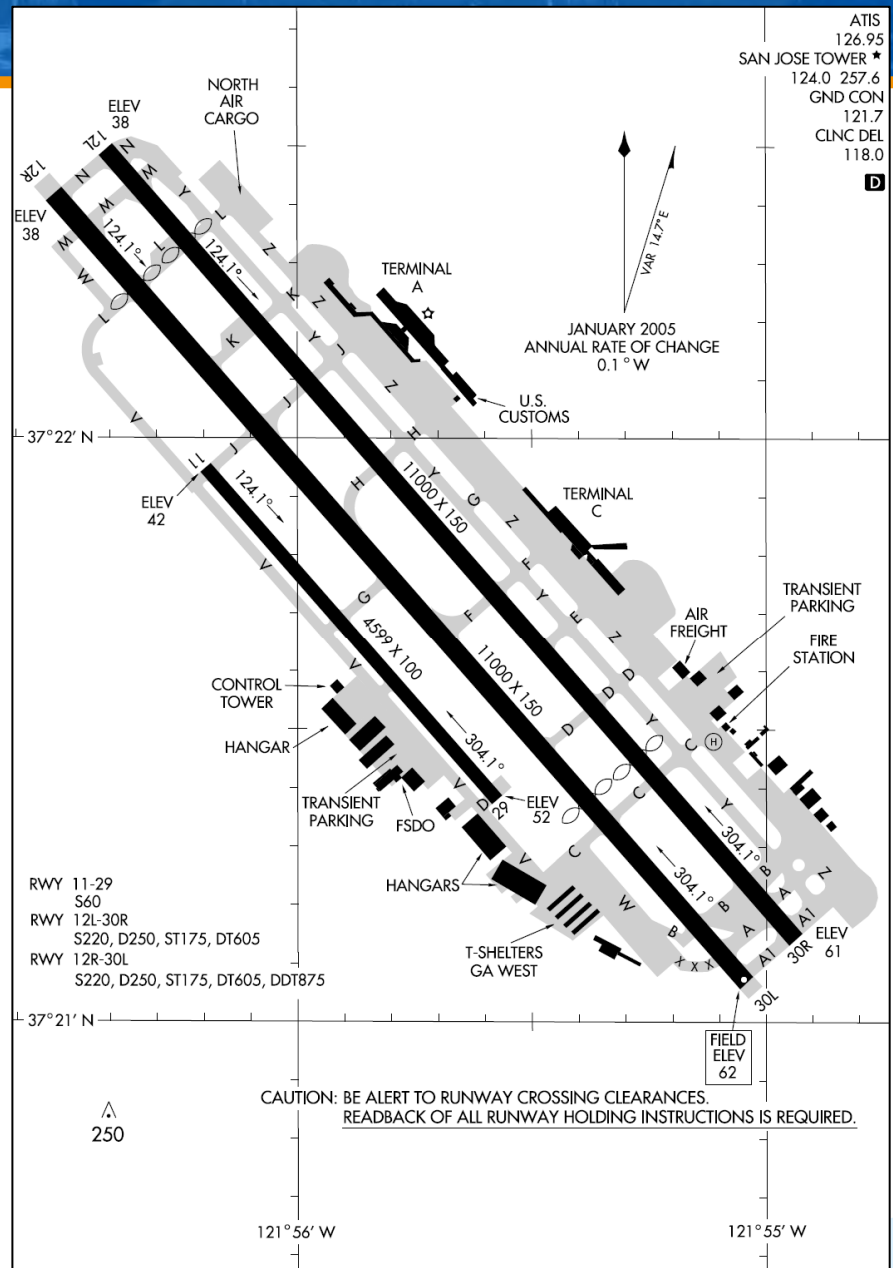
SFO is Forecast to Reach Airfield Capacity at 455,000 to 470,000 Operations – Well Before 2035



SFO Staff Suggests Using the Lower Threshold Since Arrivals Experience Significantly More Delays than Departures

San Jose (SJC): Airfield Layout and Key Operating Factors

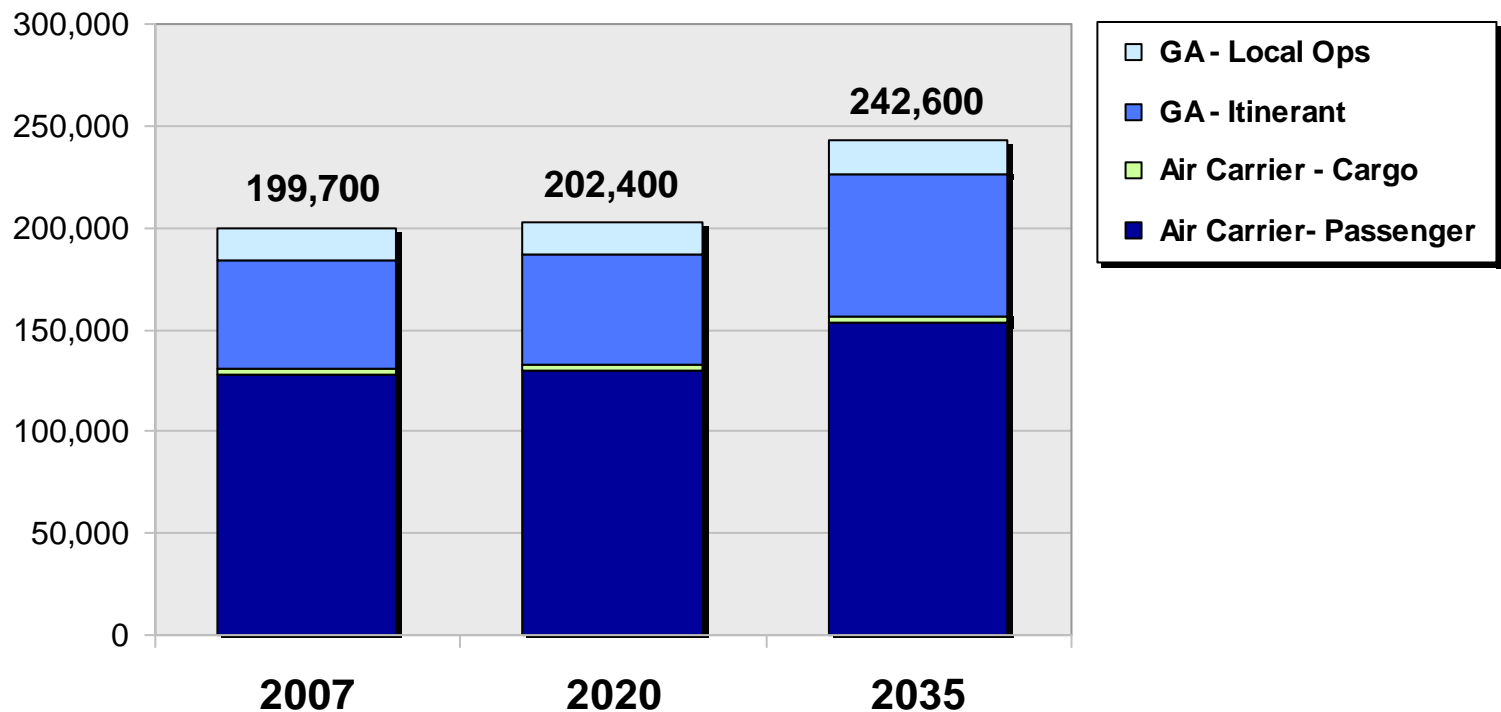
- ◆ Commercial jets arrive on 12R-30L and depart on 12L-30R
- ◆ All jet departures use runway 12L-30R
- ◆ Runway 11-29, on the south side of the airport, is used almost exclusively by GA operators



SJC's Runway Demand is Forecast to Increase by 21% from 2007 to 2035

Annual Aircraft Operations

Baseline 2007 and Base Case Forecast 2020 and 2035



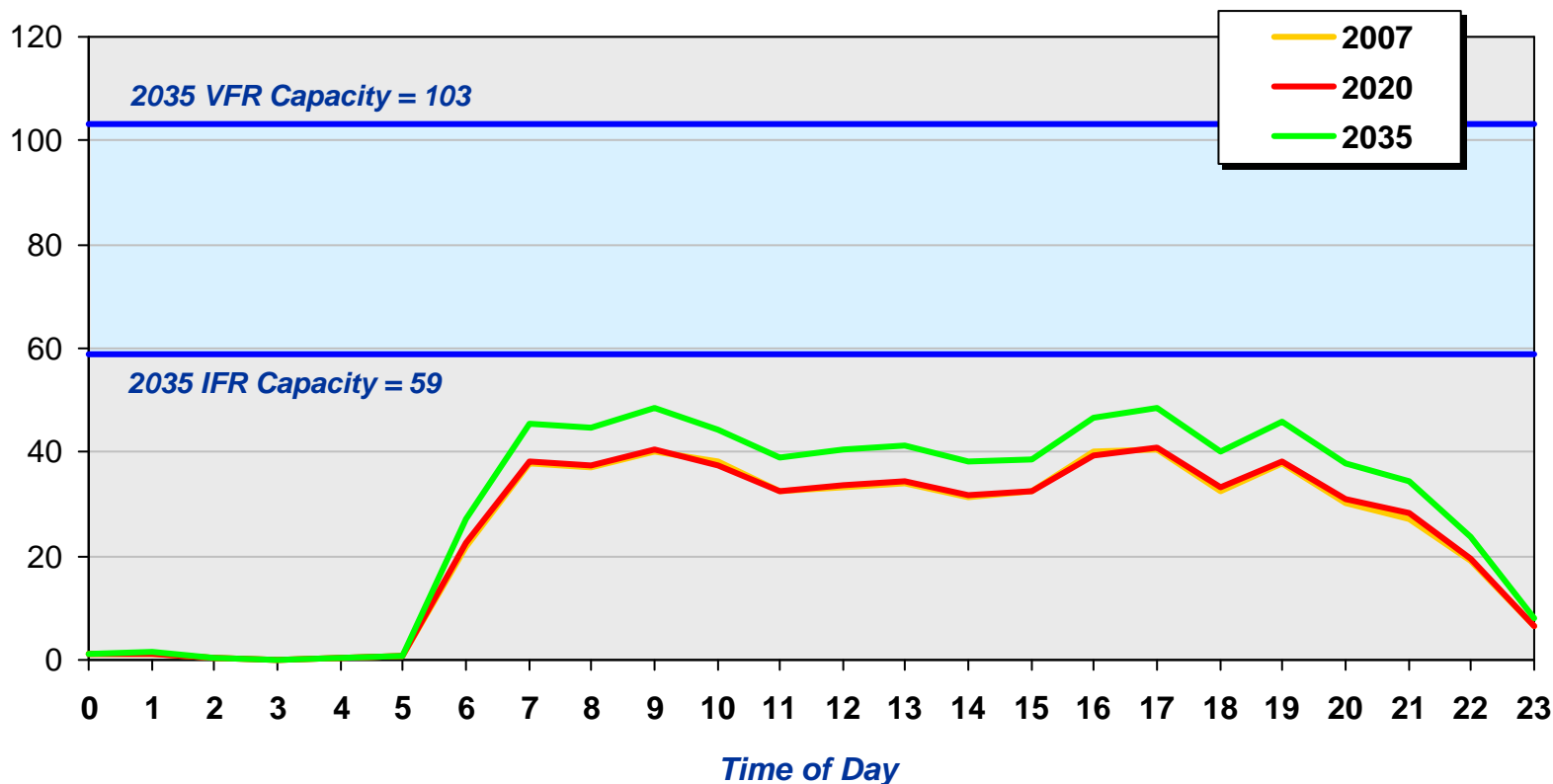
Note: Excludes military operations.

Source: Regional Airport System Plan Update – Baseline Aviation Activity Forecasts for the Primary Bay Area Airports, August 27, 2009

Excess Capacity is Forecast for SJC, with Projected Demand Well Below Representative VFR and IFR Capacities in 2035

Average Weekday Aircraft Operations by Hour
 Baseline 2007 and Base Case Forecast 2020 and 2035

Hourly Operations

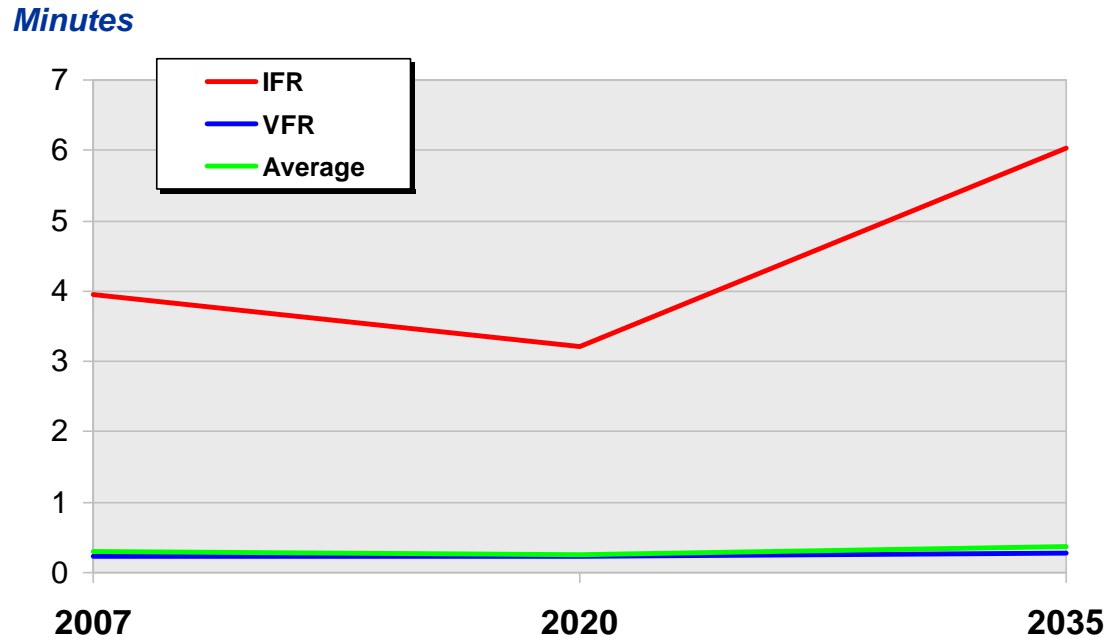


Notes: 2007 capacities = 92 VFR and 54 IFR; 2020 capacities = 98 VFR and 59 IFR

In 2035, SJC's Average Delay is Less Than 1 Minute per Operation

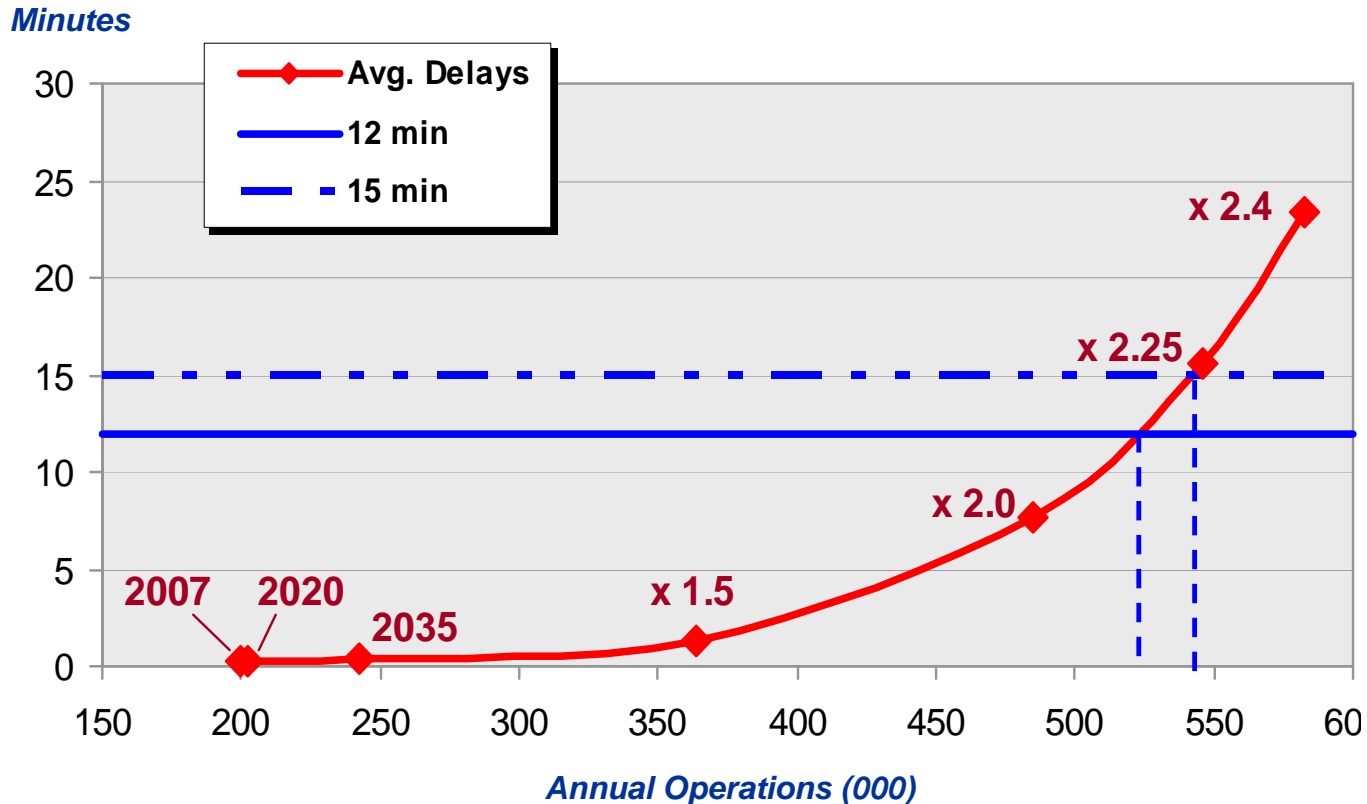
- ◆ SJC operates under VFR 97% of the time
- ◆ SJC has no Cat II or Cat III ILS approach

Average Minutes of Delays by Major Operating Conditions
Baseline 2007 and Forecast 2020 and 2035



Even at Double the Forecast 2035 Demand Level, SJC Would Still Not Reach its Full Capacity

SJC Average Delays



SJC has the Capacity to Accommodate Over 500,000 Operations

Notes: Capacities are for all three runways serving commercial air carrier and general aviation users.

"x1.5" = 1.5 times 2035 operations; "x2.0" = 2.0 times 2035 operations; etc.

Based on the Unconstrained Passenger Forecast, SFO Will Significantly Exceed Airfield Capacity in 2035, While OAK and SJC will Have Available Capacity

