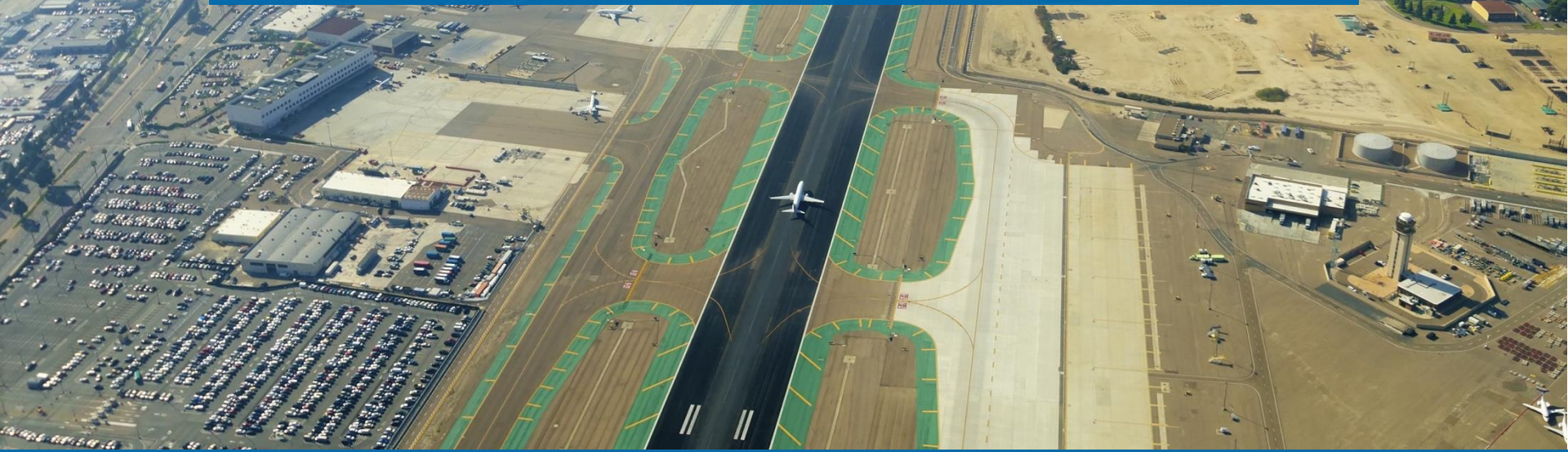


# Improving Airport Curbside and Roadway Operations

July 8, 2025



# Today's Learning Objectives

- (1) Estimate airport roadway requirements and analyze airport terminal area roadways**
- (2) Evaluate airport curbside operations**
- (3) Improve airport curbside and terminal area roadway operations with innovative strategies**

# American Association of Airport Executives (AAAE)

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your webinar control panel

We will read your questions out  
loud, and answer as many as  
time allows

**#TRBwebinar**

The screenshot shows a mobile application interface for a webinar Q&A session. At the top, a navigation bar contains several icons; a question mark icon is highlighted with a red box. Below this, the title 'Questions' is displayed next to a close button. The main content area features a large question mark icon and the text 'No questions yet' followed by 'Questions you send and answers from the staff will appear here'. At the bottom, a text input field with the placeholder 'Enter your question' is highlighted with a red box. Below the input field, the text 'Your question will be sent to staff' is shown, and a 'Send' button is located to the right.

# Abubaker Azam

## Moderator; San Francisco International Airport

- ➔ Director of Operations, Airport Services, San Francisco International Airport
- ➔ Has over thirty-three years of Aviation Management experience
- ➔ Board of Directors of the Airport Ground Transportation Association
- ➔ Chairman of the California Airports Council – Landside Committee and Ambassador Transportation Research Board, Airport Cooperative Research Program (ACRP)





# Today's Speakers



**Peter Mandle**

[peter.mandle@InterVISTAS.com](mailto:peter.mandle@InterVISTAS.com)

*InterVISTAS*



**Gavin Duncan**

[gavin.duncan@intervistas.com](mailto:gavin.duncan@intervistas.com)

*InterVISTAS*

## Improving Curbside and Roadway Operations

Peter Mandle and Gavin Duncan

**InterVISTAS**

A graphic element consisting of a curved line that transitions from blue on the left to green on the right, positioned beneath the word 'InterVISTAS'.



# Peter Mandle

## Principal Investigator

- Executive Vice President  
InterVISTAS Consulting
- Planned and improved  
curbsides and roads at  
over 60 major airports
- Served as P.I. for 12 ACRP  
projects
- Past Chair of TRB  
Aviation Group and  
Landside Committee



# Gavin Duncan

## Deputy Principal Investigator

- ➔ Senior Vice President  
InterVISTAS Consulting
- ➔ Planned and improved  
curbsides and roads at  
over 40 major airports
- ➔ P.I. or Deputy P.I. for 5  
ACRP projects
- ➔ Panel chair for ACRP 04-  
26 (Terminal Evacuations)
- ➔ Past member of TRB  
Landside Committee



# ACRP Report 266 Oversight Panel

Craig Leiner, Ricondo & Associates, Panel Chairman

Abubaker Azam, San Francisco International Airport

Kimberly Fabend, C&S Companies

Quinn Hatoff, Uber Technologies

Christopher R. Pheasant, Safety & Security Instruction

Dawoud Omar Stevenson, Savannah International Airport

William Reinhardt, FAA Liaison

Christopher J. Oswald, ACI-NA Liaison

Matthew Griffin, ACRP Senior Program Officer

# ACRP Report 266 Research Team

## InterVISTAS Consulting

- Peter Mandle, Principal Investigator
- Gavin Duncan, Deputy Principal Investigator
- Ernest Choi

## Kittelson & Associates

- Lee Rodegerdts, Deputy Principal Investigator
- Kush Bhagat

## Jacobsen Daniels

- Jacob Sotsky
- Kirkland Ellens

## ABM Aviation

- Jeff Cushman

# Background

- **ACRP Report 40: *Airport Curbside and Terminal Area Roadway Operations (2010)***
- **Focused on data gathering & analysis, less emphasis on modifying & operating roadways**
- **New providers have created opportunities and challenges**
- **Airports focusing on customer experience (CX) while seeking to accommodate increased traffic**
- **Many airports experiencing significant roadway and curbside congestion**
- **Challenging to expand capacity while providing acceptable CX**

# Research Objectives

- Publish an updated text based on the original guidebook
- Review/update associated analysis tools, including QATAR
- Present information on recently implemented ground transportation (GT) services
- Discuss how airports can anticipate & accommodate future services
- Identify scalable strategies for traffic demand and congestion management



# Contents of ACRP Report 266

1. Purpose and Organization of the Guide
2. Framework of Analysis of Airport Roadways and Curbsides
3. Estimating Airport Roadway Requirements
4. Analyzing Airport Terminal Area Roadways
5. Evaluating Curbside Operations
6. Improving Airport Curbside and Terminal Area Roadway Operations
7. Innovative Strategies
8. Appendices—glossary, bibliography, QATAR user's manual

# Today's Topics

1. Purpose and Organization of the Guide
2. Framework of Analysis of Airport Roadways and Curbsides
3. Estimating Airport Roadway Requirements
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6. Improving Airport Curbside and Terminal Area Roadway Operations
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# Airport Roadway Users

## Airport roadways accommodate a wide range of users

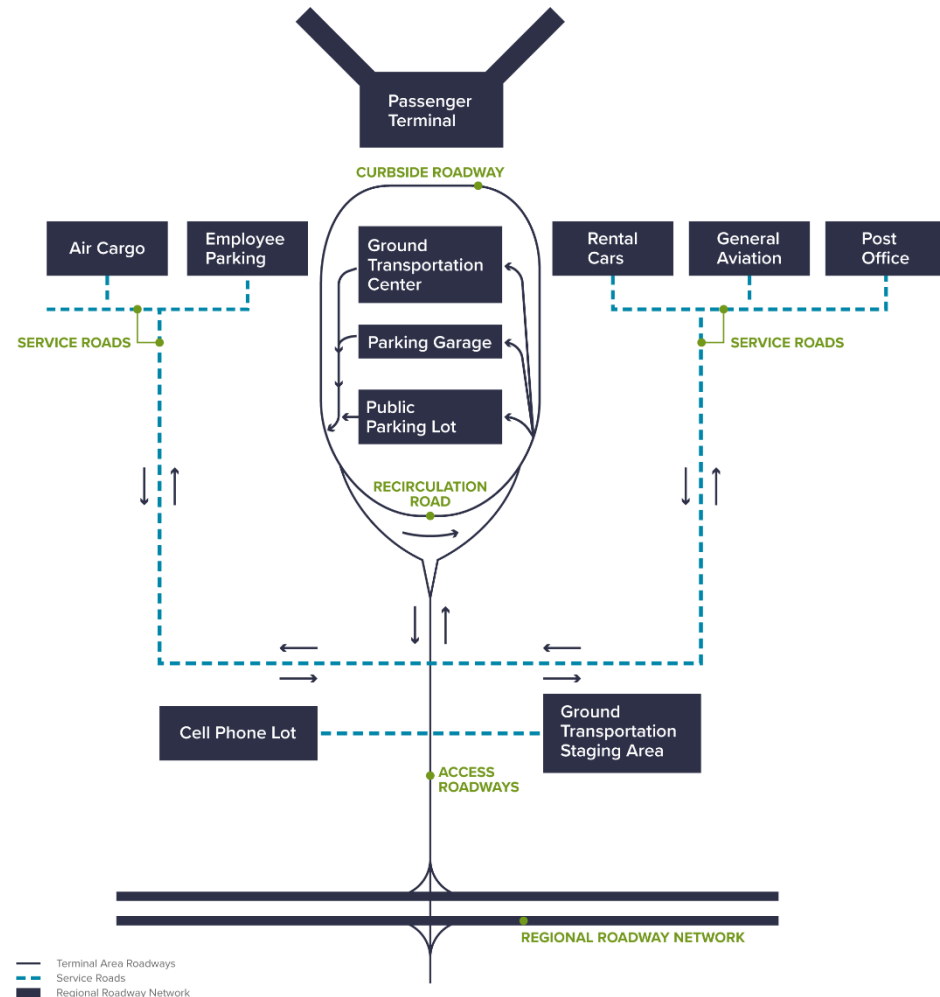
- Private vehicles
- Rental cars
- Taxicabs (prearranged and on-demand)
- Transportation Network Companies (TNCs, such as Lyft and Uber)
- Limousines (prearranged and on-demand)
- Scheduled vans and buses
- Courtesy vehicles
- Charter buses
- Public transit services
- Service and delivery vehicles
- Other



# Types of Airport Roadways

- Airport access
- Circulation and recirculation
- Curbsides
- Facility-specific access
- Service roads

*Non-terminal facilities can generate significant traffic volumes*



# What Makes Airport Roadway Operations Unique



- High proportion of unfamiliar users
- Many complex directional signs
- Stressful conditions
- High proportion of large vehicles
- Mix of experienced and inexperienced drivers
- Recirculating traffic

# Analysis of Uninterrupted and Interrupted Flows

- Updated Highway Capacity Manual (HCM) methods appropriate for analysis of airport roadways having:
  - ➔ Uninterrupted traffic flows of 35 mph and higher
  - ➔ Traffic flows controlled by signals and stop signs
- HCM methods were extrapolated to include 30 mph and 25 mph roadways with uninterrupted flow
- Updated method for low-speed weaving





# Evaluating Curbside Operations

## Quality of Service replaces Level of Service (LOS)



UNDER CAPACITY



NEAR CAPACITY



AT OR OVER CAPACITY

# Quick Analysis Tool for Airport Roadways (QATAR)

- Quick estimation tool to assess curbside operations and sufficiency
- Excel based, simpler to use than microsimulation tools
- Analyzes interaction between through and stopping traffic
- Updated to reflect user feedback on ACRP 40 version and additional data

## Quick Analysis Tool for Airport Roadways

QATAR v2.0 developed by Kittelson & Associates, Inc. in association with InterVISTAS Consulting, Inc.

### STEP 1: Describe the curbside and key global assumptions

[Next](#)[Export to File](#)

| General                        |                     |
|--------------------------------|---------------------|
| User name (optional)           | WGRD                |
| Date (optional)                | 2/8/2023            |
| Airport (optional)             | ABC                 |
| Roadway location (optional)    | Outer Roadway       |
| Scenario (optional)            | PAL 3.1             |
| Select level / type of roadway | Mixed               |
| Time period (optional)         | PM Peak             |
| Unit System                    | US Customary System |



# Quick Analysis Tool for Airport Roadways (QATAR)

- **Allows analysis of:**
  - 3, 4, or 5-lane curbsides
  - Alternative curbside allocations and curb lengths
  - Crosswalk volumes, operations, and locations
  - Double parking allowed?
  - Passenger and driver-side loading/unloading
- **Results:** tables and graphic depicting sufficiency of through and stopping lanes in each zone
- Also includes separate module for analysis of roadway weaving operations



# How to use QATAR

**Quick Analysis Tool for Airport Roadways**  
QATAR v2.0 developed by Kittelson & Associates, Inc. in association with InterVISTAS Consulting, Inc.

**STEP 2: Enter vehicle classification, curbside parking lengths, and dwell times**

[Previous](#) [Next](#) [Export to File](#)

**Enter adjustment factor**

|                                                         |     |
|---------------------------------------------------------|-----|
| Regional Adjustment Factor                              | 95% |
| Percent of 1st lane full when next vehicle double parks | 80% |
| Percent of 2nd lane full when next vehicle double parks | 80% |

**Select preferred data entry option**

Specify roadway traffic volumes by entering:

The total volumes of vehicles using the roadway, in vehicles per hour, and the percentage of total volume in each vehicle class. ☒

The volume of vehicles, in vehicles per hour, for each vehicle class. ☐

**Enter the total volume of traffic using the roadway**

Total roadway traffic volume in vehicles per hour (vph) **1,200**

This table provides an input for the vehicle class information required for the analysis. Users can enter vehicle class names, specify the volumes as direct values or percentages of total roadway volumes, and input parking lengths and dwell times.

| VEHICLE VOLUMES                     |                         |                                         | VEHICLE LENGTHS AND DWELL TIMES       |                                                      |                                      |                                             |
|-------------------------------------|-------------------------|-----------------------------------------|---------------------------------------|------------------------------------------------------|--------------------------------------|---------------------------------------------|
| PERCENTAGE OF TOTAL VOLUME BY CLASS |                         |                                         | ARRIVAL S ROADWAY                     |                                                      |                                      |                                             |
| Vehicle class                       | Vehicles per hour (vph) | Percent of total roadway traffic volume | Default Vehicle Parking Length (feet) | Optional User Override Vehicle Parking Length (feet) | Default Average dwell time (minutes) | Optional User Override dwell time (minutes) |
| Private vehicles                    | 660                     | 55.0%                                   | 25.0                                  |                                                      | 1.60                                 |                                             |
| Taxis -- On demand                  | 300                     | 25.0%                                   | 30.0                                  |                                                      | 1.90                                 |                                             |
| Taxis -- Pre-reserved               | -                       | 0.0%                                    | 30.0                                  |                                                      | 1.90                                 |                                             |
| Limousines -- On demand             | -                       | 0.0%                                    | 30.0                                  |                                                      | 5.50                                 |                                             |
| Limousines -- Pre-reserved          | -                       | 0.0%                                    | 30.0                                  |                                                      | 5.50                                 |                                             |
| TNCs -- On demand                   | 240                     | 20.0%                                   | 30.0                                  |                                                      | 2.70                                 |                                             |
| TNCs -- P/W System                  | -                       | 0.0%                                    | 30.0                                  |                                                      | 2.70                                 |                                             |
| Door-to-door vans                   | -                       | 0.0%                                    | 30.0                                  |                                                      | 2.70                                 |                                             |
| Courtesy vehicles                   | -                       | 0.0%                                    | 30.0                                  |                                                      | 2.80                                 |                                             |
| Courtesy bus                        | -                       | 0.0%                                    | 50.0                                  |                                                      | 3.50                                 |                                             |
| Charter vans                        | -                       | 0.0%                                    | 30.0                                  |                                                      | 2.70                                 |                                             |
| Charter minibus                     | -                       | 0.0%                                    | 30.0                                  |                                                      | 2.90                                 |                                             |
| Charter bus                         | -                       | 0.0%                                    | 50.0                                  |                                                      | 3.50                                 |                                             |
| Scheduled bus                       | -                       | 0.0%                                    | 50.0                                  |                                                      | 3.50                                 |                                             |
| Service and delivery vehicles       | -                       | 0.0%                                    | 30.0                                  |                                                      | 2.70                                 |                                             |
| Airport operated vehicles           | -                       | 0.0%                                    | 25.0                                  |                                                      | 1.60                                 |                                             |
| Autonomous shuttle vehicle          | -                       | 0.0%                                    | 30.0                                  |                                                      | 2.80                                 |                                             |
| Autonomous passenger vehicle        | -                       | 0.0%                                    | 25.0                                  |                                                      | 1.60                                 |                                             |
| <b>Total</b>                        | <b>1,200</b>            | <b>100.0%</b>                           |                                       |                                                      |                                      |                                             |

[Reset To Defaults](#)

## Vehicle Inputs

- Policy regarding use of 1<sup>st</sup> and 2<sup>nd</sup> lanes
- Hourly traffic by vehicle class: volume or percentage of total
- Vehicle length and dwell time (actual field data or defaults)
- Regional adjustment factor

# How to use QATAR

**Quick Analysis Tool for Airport Roadways**  
QATAR v2.0 developed by Kittelson & Associates, Inc. in association with InterVISTAS Consulting, Inc.

**STEP 3: Enter zone attributes and mix of vehicles stopping in each zone** Previous Next Export to File

**Enter number of zones:**  
Number of curbside zones (including crosswalks, no stopping zones, source zones, and sink zones)

**Enter zone attributes**

| Zone attributes                                   | Zone 1             | Zone 2                  | Zone 3             | Zone 4                | Zone 5             |
|---------------------------------------------------|--------------------|-------------------------|--------------------|-----------------------|--------------------|
| Name (optional)                                   |                    |                         |                    |                       |                    |
| Type                                              | active             | xwalk                   | active             | xwalk                 | active             |
| Curb length (feet)                                | 500                | 500                     | 500                | 500                   | 500                |
| Number of driver's side parking lanes             | 0                  | 0                       | 0                  | 0                     | 0                  |
| Number of through lanes                           | 3                  | 3                       | 3                  | 3                     | 3                  |
| Number of passenger's side parking lanes          | 2                  | 2                       | 2                  | 2                     | 2                  |
| Double parking allowed                            | yes                | yes                     | yes                | yes                   | yes                |
| Crosswalk thru lane capacity                      |                    | 1700                    |                    | 1700                  |                    |
| Crosswalk type                                    |                    | signal - timing unknown |                    | signal - timing known |                    |
| Crosswalk adjustment factor                       |                    | 65.0%                   |                    | 65.0%                 |                    |
| Cycle length (s)                                  |                    | 60                      |                    | 60                    |                    |
| Walk time (s)                                     |                    | 7                       |                    | 7                     |                    |
| Pedestrian clearance time (s)                     |                    | 10                      |                    | 10                    |                    |
| Vehicular lost time (s)                           |                    | 4                       |                    | 4                     |                    |
| Entering/leaving volume (+ for entry, - for exit) | <<Insert<br>Delete | <<Insert<br>Delete      | <<Insert<br>Delete | <<Insert<br>Delete    | <<Insert<br>Delete |

**Select preferred data entry option**

For each curbside zone and vehicle class enter:

The percentage of vehicles stopping at curbside ☐

The volume of vehicles stopping at curbside ☒

**Enter the volume of vehicles stopping at passenger's side curbside**

|                                          | Zone 1 | Zone 2 | Zone 3 | Zone 4 | Zone 5 | Curb total | Rdwy total |
|------------------------------------------|--------|--------|--------|--------|--------|------------|------------|
| Volume using passenger's side curb (vph) |        |        |        |        |        |            |            |
| Private vehicles                         |        |        |        |        |        |            | 660        |
| Taxis - On demand                        |        |        |        |        |        |            | 300        |
| TNCs - On demand                         |        |        |        |        |        |            |            |
| Total                                    |        |        |        |        |        |            |            |

**Enter the volume of vehicles stopping at driver's side curbside**

|                                       | Zone 1 | Zone 2 | Zone 3 | Zone 4 | Zone 5 | Curb total | Rdwy total |
|---------------------------------------|--------|--------|--------|--------|--------|------------|------------|
| Volume using driver's side curb (vph) |        |        |        |        |        |            |            |
| Private vehicles                      |        |        |        |        |        |            | 660        |
| Taxis - On demand                     |        |        |        |        |        |            | 300        |
| TNCs - On demand                      |        |        |        |        |        |            |            |
| Total                                 |        |        |        |        |        |            |            |

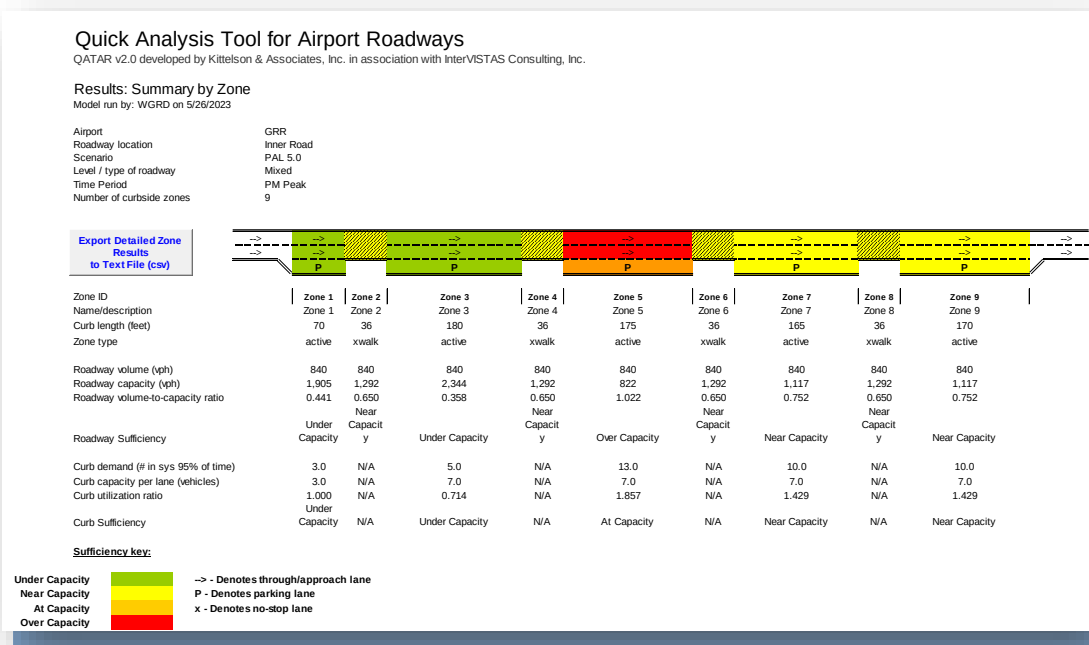
**Combined total volume of vehicles stopping curbside**

|                                   | Zone 1 | Zone 2 | Zone 3 | Zone 4 | Zone 5 | Curb total | Rdwy total |
|-----------------------------------|--------|--------|--------|--------|--------|------------|------------|
| Combined volumes using curb (vph) |        |        |        |        |        |            |            |
| Private vehicles                  |        |        |        |        |        |            | 660        |
| Taxis - On demand                 |        |        |        |        |        |            | 300        |
| TNCs - On demand                  |        |        |        |        |        |            |            |
| Total                             |        |        |        |        |        |            |            |

## Configuration Inputs

- Length and use of each zone
- Passenger vs. driver side curb
- Location and use of X-walks
- Taxi / TNC queues
- Mid-curb entries and exits

# Example of QATAR Products



## Outputs

- Quality of service for each zone presented in table and graphic
- Isolates challenges with loading/unloading lanes versus travel lanes
- Graphics easily exported
- Alternatives can be tested quickly and efficiently

# Innovative Strategies

## *Primary strategies*

1. Enforcement
2. Traffic demand management
3. Congestion management

## *Complimentary strategies*

4. Customer experience improvements
5. Sustainability
6. Accommodating TNCs
7. Accommodating autonomous vehicles
8. Supporting technologies



# Innovative Strategies

*For each strategy, the Guidebook presents:*

- Description and sub-categories
- Applicability
- Examples where strategy has been used
- Estimated costs
- Implementation considerations
- Complimentary strategies

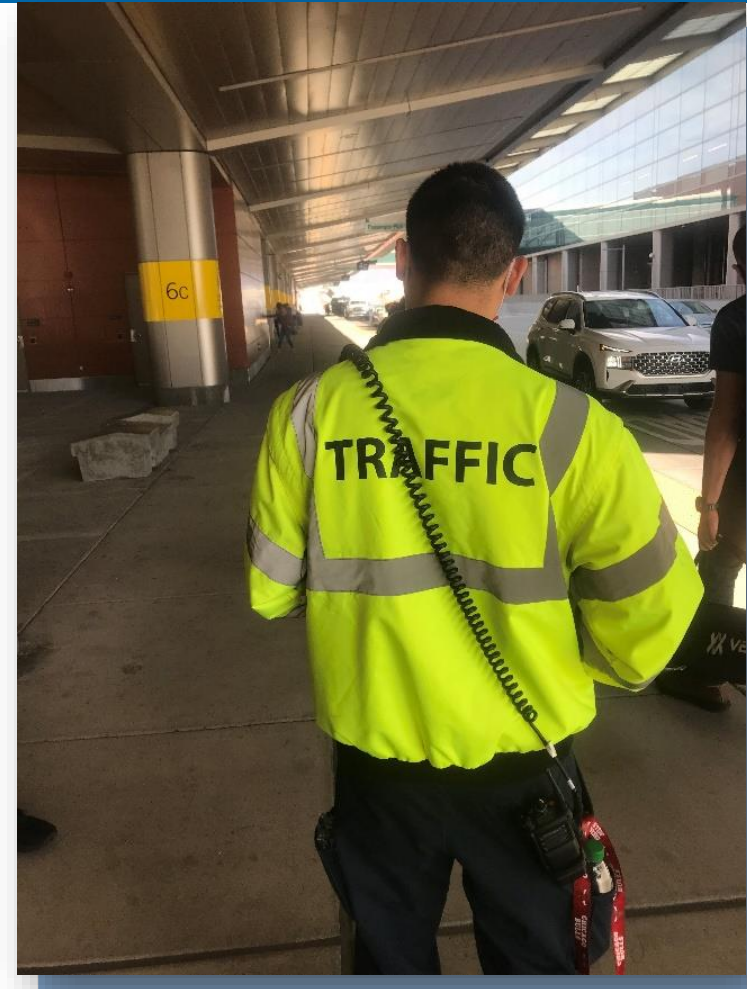


*About 100 pages devoted to strategies*



# Enforcement – LEOs vs. TCOs

- Use of sworn and civilian enforcement officers – costs, availability, back-up, appearance
- Number of officers required
- Active and consistent enforcement
- Balancing customer experience and strict enforcement
- Supporting technologies





# Enforcement – continued

- Control of crosswalks - Uncontrolled, STOP signs, signals, officers, others
- Regulatory sign messages and placement
- Warning messages, ticketing, and towing



# Traffic Demand Strategies

- Provide site away from terminal for:
  - ➔ Commercial vehicle boarding
  - ➔ Private vehicle pickup and drop-off
  - ➔ Employee parking
- Encourage motorists dropping off: and picking up to use
  - ➔ Cell phone lots
  - ➔ Hourly parking
  - ➔ Long-term parking
  - ➔ Transit or HOVs
- Use of less busy curbside levels
- Dynamic signs



Source: Sacramento International Airport

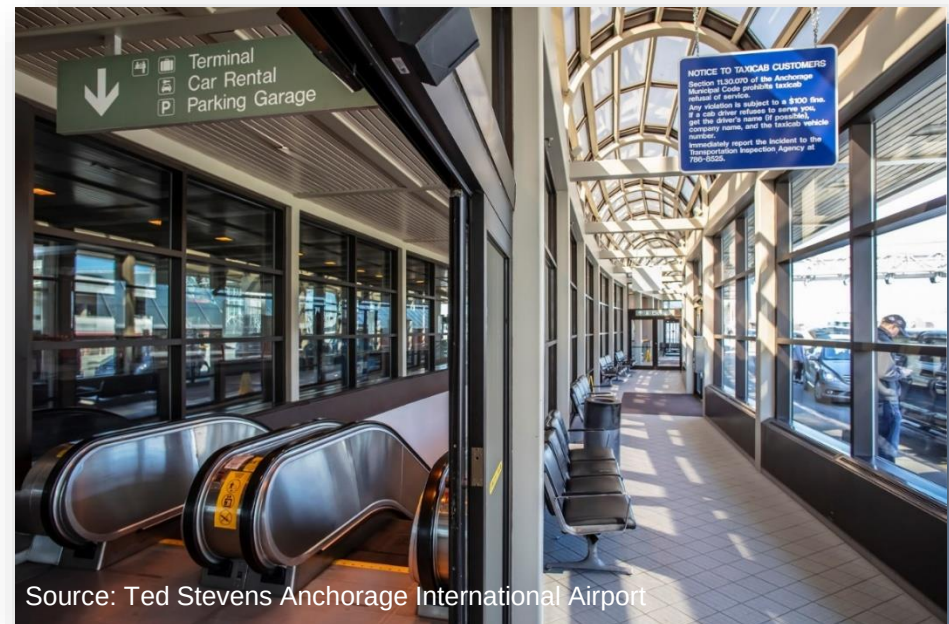
# Congestion Management Strategies

- **Crosswalks:**
  - ➔ Consolidate, coordinate, or remove crosswalks
  - ➔ Change crosswalk controls
  - ➔ Use raised crosswalks/speed platforms
- **Revise/reallocate curb space and layout**
- **Modify/lengthen roadway weaving area**
- **Provide virtual taxi queue/automated dispatching**
- **Establish new or increased fees:**
  - ➔ Demand management fees
  - ➔ Higher fees for curbside use by commercial vehicles
  - ➔ Private motorist access fees



# Customer Service Strategies

- Enclosed waiting areas
- Bus and shuttle arrival time info
- Schedule, fare, and route info
- PSAs at curbsides
- Enhanced safety



Source: Ted Stevens Anchorage International Airport

# Sustainability Strategies

Encourage use of:

- HOVs and transit
- Long-duration parking
- Electric vehicles



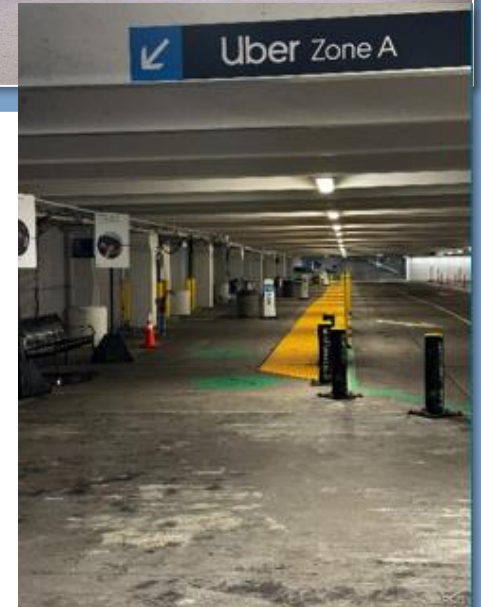
Closest Parking to STL. The boxes below show current availability at each location. Click for rates and details.

| T1  | T2 | LOT A | LOT B | LOT C | LOT D | LOT E |
|-----|----|-------|-------|-------|-------|-------|
| 32% | 1% | 30%   | 42%   | 41%   | 23%   | 4%    |



# Accommodating TNCs

- Improve waiting vehicle boarding areas/zoning
- Establish remote passenger boarding areas
- Establish geofence
- Review hold lot size and location
- Promote improved TNC company dispatching procedures

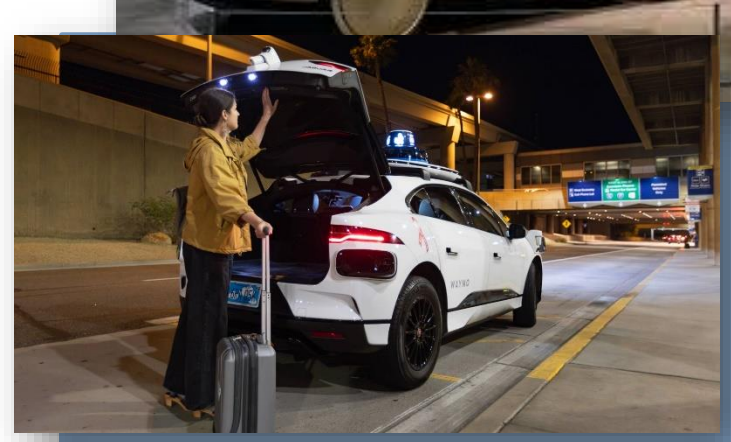


# Accommodating Autonomous Vehicles

- No examples when Guidebook prepared, but now at PHX
- Both “robotaxis” and shuttle vans

## Proposed strategies

- Separate AVs and non-AVs
- Update rules and regs (and fees)
- Prepare infrastructure





# FOR ADDITIONAL INFORMATION



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PROGRAM

# Today's Speakers



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**Gavin Duncan**

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## August 2025

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 Transportation Research Board

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- Networking opportunities
- May provide a path to Standing Technical Committee membership

**Join a Standing Committee** [bit.ly/TRBstandingcommittee](https://bit.ly/TRBstandingcommittee)

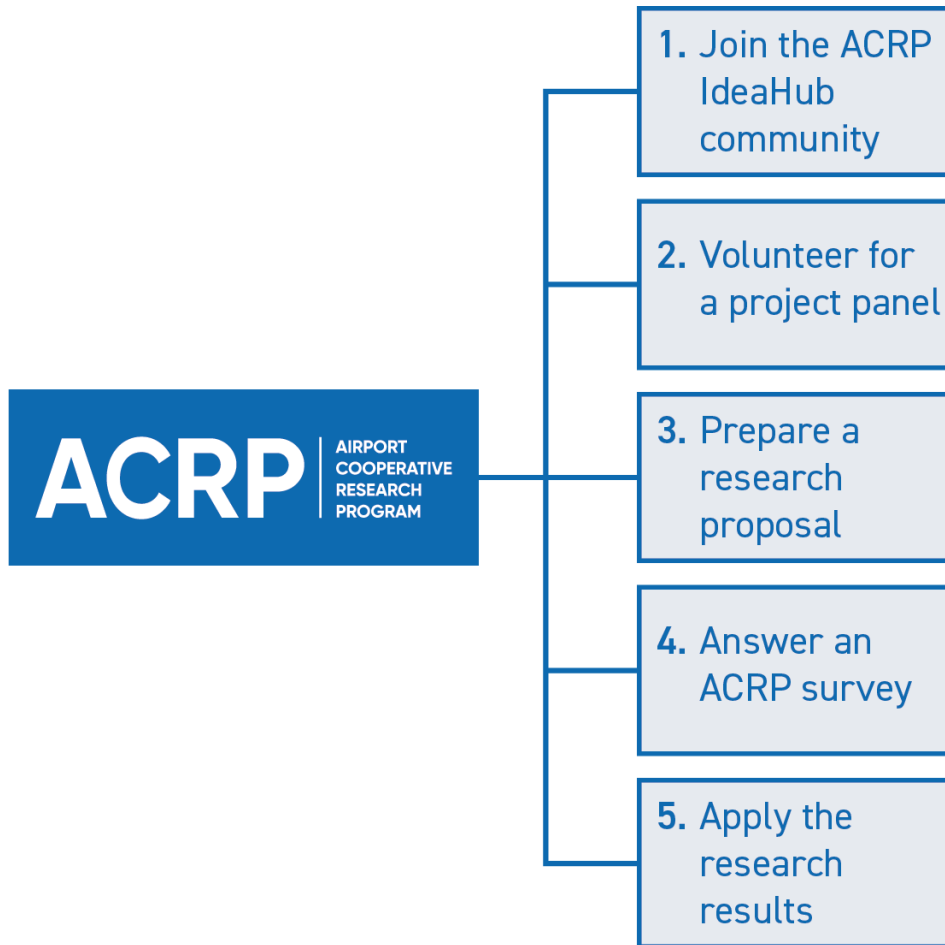
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*Getting involved is free!*



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