Capture the Data – Quantifying Airport Ground Access Vehicle Activity

Thursday, September 26, 2019
2:00-3:30 PM ET
Purpose

Learning Objectives
At the end of this webinar, you will be able to:
• Determine the appropriate level of emissions data needed to model GAV emissions for airport projects
• Apply methods available for quantifying airport GAV activity for the purposes of emissions modeling
• Identify how to collect and develop GAV data for emissions modeling
ACRP Webinar
Capture the Data – Quantifying Airport Ground Access Vehicle Activity
September 26, 2019
Manager, Environmental Air Quality and Energy
Oversee Port’s development of Airport and Marine Emissions Inventories
Five Ways to Get Involved!

1. Join the ACRP IdeaHub community
2. Volunteer for a project panel
3. Prepare a research proposal
4. Answer an ACRP survey
5. Apply the research results

Visit us online: www.trb.org/ACRP
Today’s Speakers

Robbie Gross and Mike Kenney
KB Environmental Sciences

Presenting

ACRP Report 180 and Web-Only Document 26:
Guidebook for Quantifying Airport Ground Access Vehicle Activity for Emissions Modeling
Guidebook for Quantifying Airport Ground Access Vehicle Activity for Emissions Modeling

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KB Environmental Sciences

September 26, 2019
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- 39 years of air quality consulting experience

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Presenter

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- Paola Pringle
- Justin Godin
- Wayne Arner
- Cristina Schoonard

Vanasse Hangen Brustlin (VHB)
- Mike Regan
- Laura Castelli

Sierra Research
- Jim Lyones
- Alex Marcucci
- Sung-Hoon Yoon
ACRP Report 180 Panel

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David Breen, Portland International Airport, Chair
Jay Brolin, Rhode Island Airport Corporation
Nicholas Kozlik, RS&H
Scott A. Peterson, Boston Region Metropolitan Planning Organization
Alice J. Price, Atkins
Mohammed Majeed, FAA Liaison
Christine Gerencher, TRB Liaison
ACRP Report 180: Goals and Objectives

**Goal:** Obtain appropriate ground access vehicle (GAV) data for input into and use with emissions models (e.g. MOVES, EMFAC, AEDT)

**Objectives:**
- Clear and consistent GAV quantification methods
- Guidance for airports to collect and develop data accurately, and cost effectively

**Guidance:**
- Defining GAV types at airports
- Identifying sources and methods for obtaining data
- Setting boundaries for computing GAV emissions
Presentation Roadmap

Section 1 - Research Results and Outcomes

Section 2 - Tutorial Overview

Section 3 - Practical Applications
Key Premises

- GAVs generate emission of criterial air pollutants and greenhouse gases
- Emissions estimates are needed for:
  - Assessing effects of airport improvements
  - In support of NEPA documents
  - Can be included in SIPs
- Data is collected by traffic analysts, not air quality analysts
- Air quality analyst’s input early in the project is “key”
Guidebook Structure

1. Understand the Need for GAV Data
2. Identify Characteristics of GAV Data
3. Determine Important Factors for GAV Emissions
4. Understand GAV Infrastructure
5. Identify GAV Data Requirements
6. Determine GAV Data Collection Method
Guidebook Structure

1. Understand the Need for GAV Data
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The Need: Input for Computer Models

Emission rate models
- MOVES
- EMFAC

Dispersion models
- AEDT (contains AERMOD)

Hot-spot models
- CAL3QHC
- CAL3QHCR (more refined)

Computer Modeling
Guidebook Structure

1. Understand the Need for GAV Data
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GAV Fleet & Operational Characteristics

GAV users include passengers, entities transporting passengers, airport employees, tenants, and airport support vehicles.

- Private vehicles/Rental cars
- Transportation Network Company Vehicles (Uber, Lyft)
- Taxicabs
- Limousines
- Courtesy Vehicles
- Shared Ride Vans
GAV Fleet and Operational Characteristics

Continued ...

• Scheduled buses
• Service and Delivery Vehicles
• Air cargo vehicles
Guidebook Structure

1. Understand the Need for GAV Data
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Factors that Determine Emissions from GAVs

Fuel use type

- Gasoline, diesel, LPG, propane, natural gas, biodiesel, electric

Operating speed

- Lower speeds $\Rightarrow$ higher emissions
- Higher speeds $\Rightarrow$ lower emissions

Idle time

- Emissions rates are highest when a GAV is not moving

Emissions vs. Speed

Emission-Speed Plot of Individual Trips or Trip Segments (Source: Traffic Congestion and Greenhouse Gases, University of California, Riverside, 2016)
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Airport GAV Infrastructure

Infrastructure

- Roadways
- Parking Facilities
- Staging Areas
- Other

Data

- Volumes
- Fleet mix
- Speeds
- Idle times

Airport Terminal Egress Drives

San Francisco International

Washington Dulles International
Guidebook Structure

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6. Determine GAV Data Collection Method
Emissions Model Data Requirements

- Three tiers for GAV data requirements
  - Tier 1: Basic
  - Tier 2: Intermediate
  - Tier 3: Advanced
- Choose highest tier

See Chapter 5 of the Guidebook for more information.
### Example Project Types & Tier Level

<table>
<thead>
<tr>
<th>Project/Action Category</th>
<th>Model GAV(^a)</th>
<th>Tier I</th>
<th>Tier II</th>
<th>Tier III</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Example Project Types</strong></td>
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<tr>
<td>New Airport</td>
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<tr>
<td>New Runway</td>
<td>M</td>
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<td>X</td>
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<tr>
<td>Major Runway Extension</td>
<td>M</td>
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<td>X</td>
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<tr>
<td>New/Expanded Terminal</td>
<td>H</td>
<td></td>
<td></td>
<td>X</td>
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<tr>
<td>Roadway Modifications</td>
<td>H</td>
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<td>X</td>
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<tr>
<td>New or Expanded Parking</td>
<td>H</td>
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<td>X</td>
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<tr>
<td>Runway Rehabilitation</td>
<td>L</td>
<td>X</td>
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<tr>
<td>Obstruction Removal</td>
<td>L</td>
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<tr>
<td><strong>Example Action Types</strong></td>
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<tr>
<td>Increase in Operations</td>
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<td>X</td>
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<tr>
<td>Change in Vehicle Mix</td>
<td>M</td>
<td></td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>Increase Motor Vehicle Trips</td>
<td>H</td>
<td></td>
<td></td>
<td>X</td>
</tr>
</tbody>
</table>

\(^a\) Indicates likelihood that GAV emissions will be modeled  
H = High  
M = Medium  
L = Low
## Tier I - Basic

<table>
<thead>
<tr>
<th>Infrastructure</th>
<th>Required Data</th>
<th>Fleet Mix</th>
<th>Speed</th>
<th>Idle/Dwell Time</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>General</strong></td>
<td><strong>Volume</strong></td>
<td><strong>Fleet Mix</strong></td>
<td><strong>Speed</strong></td>
<td><strong>Idle/Dwell Time</strong></td>
</tr>
<tr>
<td>Parking Facilities</td>
<td>Average daily trips to facility.</td>
<td>Assume a 50/50 fleet split and composite fuel.</td>
<td>Assume 10 mph.</td>
<td>Not applicable.</td>
</tr>
<tr>
<td>Vehicle Staging/Queuing Areas</td>
<td>Average daily trips to area.</td>
<td>Assume a 50/50 fleet split and composite fuel for taxi/limo and TNC areas.</td>
<td>Assume 10 mph.</td>
<td>Dwell times are assumed.</td>
</tr>
</tbody>
</table>
## Tier II - Intermediate

<table>
<thead>
<tr>
<th>Infrastructure</th>
<th>Required Data</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>General</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Roadways</strong></td>
<td></td>
</tr>
<tr>
<td>Average daily trips for each area.</td>
<td>Vehicle mix percentages for each area.</td>
</tr>
<tr>
<td><strong>Parking Facilities</strong></td>
<td></td>
</tr>
<tr>
<td>Average daily trips to lot.</td>
<td>Assume a 50/50 fleet split and composite fuel.</td>
</tr>
<tr>
<td><strong>Vehicle Staging/Queuing Areas</strong></td>
<td>Average daily trips to area of interest.</td>
</tr>
</tbody>
</table>
## Tier III - Advanced

<table>
<thead>
<tr>
<th>Infrastructure</th>
<th>Required Data</th>
<th>Idle/Dwell Time</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>General</strong></td>
<td><strong>Volume</strong></td>
<td><strong>Fleet Mix</strong></td>
</tr>
<tr>
<td><strong>Roadways</strong></td>
<td>Peak hour data and temporal factors.</td>
<td>Vehicle fleet mix for each area.</td>
</tr>
<tr>
<td><strong>Parking Facilities</strong></td>
<td>Peak hour data and temporal factors.</td>
<td>Assume a 50/50 fleet split using a composite fuel.</td>
</tr>
<tr>
<td><strong>Vehicle Staging/Queuing Areas</strong></td>
<td>Peak hour data and temporal factors.</td>
<td>Assume a 50/50 fleet split and composite fuel for taxi/limo and TNC areas.</td>
</tr>
</tbody>
</table>
Guidebook Structure

1. Understand the Need for GAV Data
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6. Determine GAV Data Collection Method
Data collection methods were rated based on the method’s ability to obtain GAV volume, mix, speed and other factors.

Collection methods were considered simple, automated, and intelligent.
Existing Condition Data Collection

Methods

Simple
- Manual traffic counts

Automated
- Pneumatic road tubes
- Video image processors and recording data collection

Intelligent
- Inductive loop detectors
- Magnetic sensors
- Microwave radar sensors
- Active infrared sensors
- Passive infrared sensors
- Piezo-electric sensors
Manual Traffic Counts

Pros:
- Easy to set up
- Accurate classification
- Can also measure speed with handheld radar
- No installation costs

Cons
- Labor intensive
- Weather restricted
- High staffing requirements
Pneumatic Road Tubes

Air tubes over the roadway detect changes in pressure when compressed by a passing vehicle.

Pros:

- Automated collection 24 hours a day
- Temporary or permanent installation
- Low staffing requirements

Con:

- Can’t determine classification at level needed for air quality analysis
Video cameras linked to a computer process digital imagery and record passing vehicle characteristics.

**Pros:**
- Non-destructive installation
- Classify speed/category/volume

**Cons:**
- Weather can interfere
- Cost
- Vehicle classification may require manual intervention for air quality level detail
Future Conditions Data Development

Step 1: Estimate Trip Generation

Step 2: Determine Trip Distribution

Step 3: Analyze Travel Modes

Step 4: Distribute Volumes

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Step I – Trip Generation

The factors that influence future passenger-related GAV are:

- **Growth in Passengers**
- **Originating and Destination (O-D) Passengers**
- **Passenger Characteristics**
- **Lead and Lag Times**
- **Travel Mode Choices**
- **Vehicle Occupancy**
- **Traffic Circulation Patterns**
Step I – Trip Generation: Passenger Growth

- A function of future flight schedule, aircraft size (number of seats) and anticipated percentage load factor.
- Timeframe of growth important, is it distributed or focused?

- Tier 1 and 2:
  - FAA Terminal Area Forecast (TAF), airport master plan, or documented growth forecast

- Tier 3:
  - Airport-specific future flight schedule, aircraft size, and load factor
Step 2 – Trip Distribution

Non-Hub/Small Airports

- Usually only have a single entry/exit point
- Vehicles enter/exit on a single roadway

Large Airports

- Often have multiple entry/exit points
- More advances data collection techniques are needed
Step 3 – Analyze Travel Mode Choice

- Conducted using sophisticated travel demand forecasting models.
- Rarely required in an airport setting.
- Only necessary if major changes to travel modes are proposed
  - Scheduled public bus, rail service or expansion of an existing service.
- Common to use existing conditions
Step 4 – Trip Assignment

Assigning the traffic volumes requires information from three basic categories:

1. Where vehicles enter or exit the airport
2. Final and interim destination or origination points
3. Routes and paths available to the vehicles
GAV Data Collection Summary

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Presentation Roadmap

Section 1 - Research Results and Outcomes

Section 2 - Tutorial Overview

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ACRP 02-63: QUANTIFYING AIRPORT GROUND ACCESS VEHICLES (GAV) ACTIVITY FOR EMISSIONS MODELING Tutorial
INSTRUCTIONS

- This button will move you forward a step in the Tutorial.
- This button will take you back a step.
- And this one will take you to the next section.

At any time, you can press the button to return to the slide index.

Throughout this Tutorial there are underlined terms, click on these terms for more information.

For more information on any topic, please refer to the ACRP 02-63 Guidebook.
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- GAV Categories
- Operational Characteristics
- GAV Infrastructure and General Emission Model Data Requirements
- Specific Data Requirements
- Collecting Existing Conditions Data
- Deriving Future Conditions
- Regional (Off-Airport) Data
- Acknowledgments

For information on a particular subject, hover over and click on the provided links.
On an airport’s landside, most GAV operate in the following areas:

- Roadways
- Parking facilities
- Hold areas

If an airport has such services/areas, GAV may also operate in locations such as a transit bus stop or a “Kiss-n-Fly” drop-off location.

The table on the next slide lists the general and specific areas at which GAV operate at an airport and the types of vehicles in each area. General emission model data requirements are also provided for each area.
<table>
<thead>
<tr>
<th>GAV Infrastructure</th>
<th>Required Data</th>
<th>Volume</th>
<th>Fleet Mix&lt;sup&gt;a&lt;/sup&gt;</th>
<th>Average Speed&lt;sup&gt;b&lt;/sup&gt;</th>
<th>Idle/ Dwell Time</th>
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<td><strong>General</strong></td>
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<td>Access</td>
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<td>Curbside</td>
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<td>Circulation</td>
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<td>Service</td>
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<td>Cargo</td>
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<td>Airfield</td>
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<td><strong>Roadways</strong></td>
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<td>Surface</td>
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<td>Multi-level</td>
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<td>Employee</td>
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<td><strong>Parking Facilities</strong></td>
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<td>Surface</td>
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<td><strong>Vehicle Staging/Queuing Areas</strong></td>
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<td>On Demand Taxi/Limo</td>
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<td>Limo</td>
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<td>Door-to-door/ Shared Ride</td>
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<td>Hotel/Motel Shuttles</td>
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<td>Parking Shuttles (on airport)</td>
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<td>Parking Shuttles (off airport)</td>
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<td>TNC</td>
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<td><strong>Other</strong></td>
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<td>Kiss-n-Fly</td>
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<td>Transit Stop</td>
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<td>Pre-arranged Taxi/Limo</td>
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<td>Charter Bus</td>
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<tr>
<td>Cargo Facilities</td>
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</table>

<sup>a</sup> A GAV fleet mix is not required in areas where only one group of GAV operate (e.g., it can be assumed that only a private vehicles operate in an airport parking facility).

<sup>b</sup> A nominal vehicle speed of 20 miles-per-hour or less can be assumed for all parking facilities, vehicle staging/queueing areas and other areas of an airport.
INDEX

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- GAV Infrastructure and General Emission Model Data Requirements
- Specific Data Requirements
- Collecting Existing Conditions Data
- Deriving Future Conditions
- Regional (Off-Airport) Data
- Acknowledgments

For information on a particular subject, hover over and click on the provided links.
For the purpose of emissions modeling, various data collection methods have been rated by each method’s ability to collect GAV volume, mix, and speed, among other factors.

See Chapter 6 of the 02-63 Guidebook for more information.
This table lists methods to collect existing volumes, mixes and speeds. The ability of each option to do so is also indicated.

To view the pros and cons of a method, click on the method.

<table>
<thead>
<tr>
<th>Simple</th>
<th>Automated</th>
<th>Intelligent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Manual Traffic Counts (V, C, T)</td>
<td>Pneumatic road tubes (V, C, S, T)</td>
<td>Inductive loop detectors (V, C, S, P)</td>
</tr>
<tr>
<td></td>
<td>Video image processors and recording data collection (V, S, C, P/T)</td>
<td>Magnetic sensors (V, S, P)</td>
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<td></td>
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<td>Microwave radar sensors (V, C, S, P)</td>
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<td>Active infrared sensors (V, C, S, P)</td>
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<td>Passive infrared sensors (V, S, P)</td>
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<td>Laser radar sensors (V, C, S, P)</td>
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<td>Acoustic array sensors (V, S, P)</td>
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<td>Pulse/Doppler ultrasonic sensors (V, S, P)</td>
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<td>Piezo-electric sensors (V, C, S, P)</td>
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<td>Bending plates (V, C, P)</td>
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<td>Sub-pavement magnetometers (micro-loops) (V, S, P)</td>
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<td>Weigh-in-motion sensors (V, C, P)</td>
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<tr>
<td></td>
<td></td>
<td>GPS cell phone data collection (V, C, T)</td>
</tr>
</tbody>
</table>

Application: \(V = \) Volume, \(C = \) Vehicle Classification, \(S = \) Speed, \(P = \) Permanent and \(T = \) Temporary.
Video cameras linked to a computer process digital imagery and record passing vehicle characteristics.

**Pros:**
- Non-destructive installation
- Classify speed/category/volume

**Cons:**
- Weather can interfere in collection
- Cost
- Vehicle classification may require manual intervention for air quality level detail
Practical Applications

• GAV data collection has been streamlined for:
  - Assessing effects of airport improvements
  - In support of NEPA documents
  - Can be included in SIPs

• Airports are collecting and developing data accurately, and cost effectively
  - GAV types are being better defined at airports
  - Sources of data are more easily identified
  - GAV data requirements have been set based on project need
  - Infrastructure for GAV is known
Guidebook & Tutorial

Robert Gross
rgross@kbenv.com
Today’s Speakers

• David Breen, Port of Portland, David.Breen@portofportland.com
• Robbie Gross, KB Environmental Sciences, rgross@kbenv.com
• Mike Kenney, KB Environmental Sciences, mkenney@kbenv.com
ACRP is an Industry-Driven Program

- Managed by TRB and sponsored by the Federal Aviation Administration (FAA).
- Seeks out the latest issues facing the airport industry.
- Conducts research to find solutions.
- Publishes and disseminates research results through free publications and webinars.
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