The National Academies of
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TRANSPORTATION RESEARCH BOARD

Capture the Data – Quantifying Airport Ground Access Vehicle Activity

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

Purpose

To discuss ACRP Research Report 180: Guidebook for Quantifying Airport Ground Access Vehicle Activity for Emissions Modeling.

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

TRB

ACRP AIRPORT COOPERATIVE RESEARCH PROGRAM

David Breen
Port of Portland

- Manager, Environmental Air Quality and Energy
- Oversee Port's development of Airport and Marine Emissions Inventories

Five Ways to Get Involved!

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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

ACRP REPORT 180

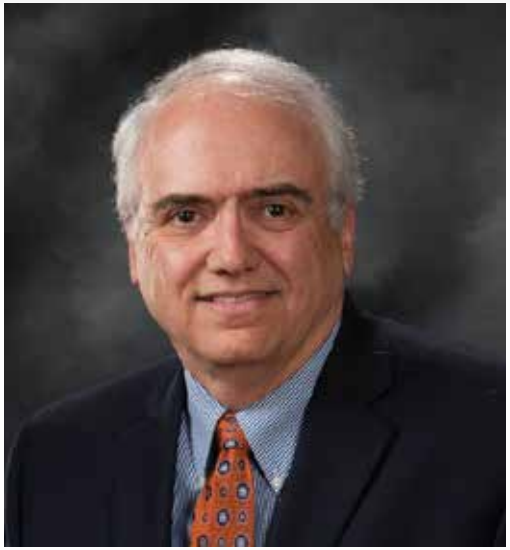
Guidebook for Quantifying Airport Ground Access Vehicle Activity for Emissions Modeling

Robert Gross, Ph.D.
Mike Kenney, QEP

KB Environmental Sciences

September 26, 2019

Michael A. Kenney, QEP
Principal Investigator



- Vice President, KB Environmental Sciences
- 39 years of air quality consulting experience

Robert N. Gross, Ph.D.
Presenter

- Air Quality Scientist, KB Environmental Sciences
- 6 years of research and air quality consulting experience

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- Mike Regan
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- Jim Lyones
- Alex Marcucci
- Sung-Hoon Yoon

ACRP Report 180 Panel

Joe Navarrete, ACRP Program Manager

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:

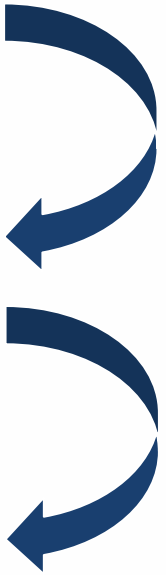
- Defining GAV types at airports
- Identifying sources and methods for obtaining data
- Setting boundaries for computing GAV emissions

Presentation Roadmap

Section 1 - Research Results and Outcomes

Section 2 - Tutorial Overview

Section 3 - Practical Applications



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

Airport GAVs

- 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

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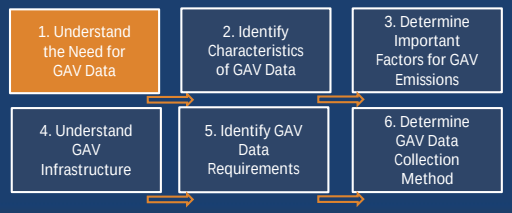
The Need: Input for Computer Models



Emission rate models

- MOVES
- EMFAC

Dispersion models

- AEDT (contains AERMOD)

Hot-spot models

- CAL3QHC
- CAL3QHCR (more refined)

Computer Modeling

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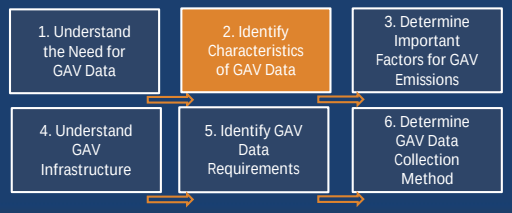
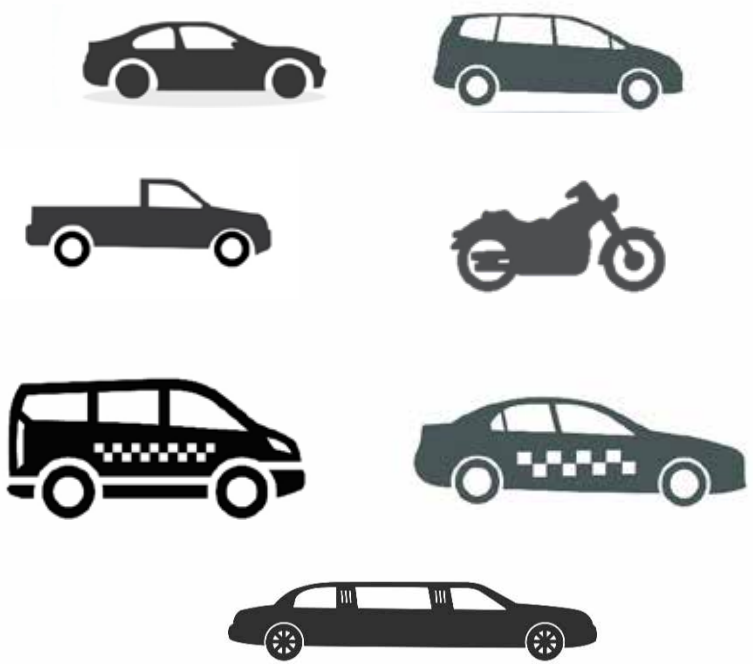
GAV Fleet & Operational Characteristics

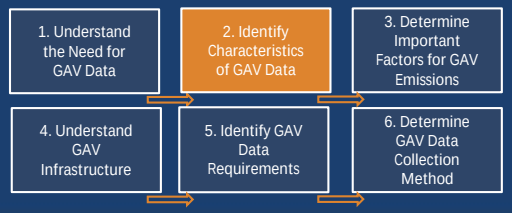


GAV users include passengers, entities transporting passengers, airport employees, tenants, and airport support vehicles.

- 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

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Factors that Determine Emissions from GAVs

Fuel use type

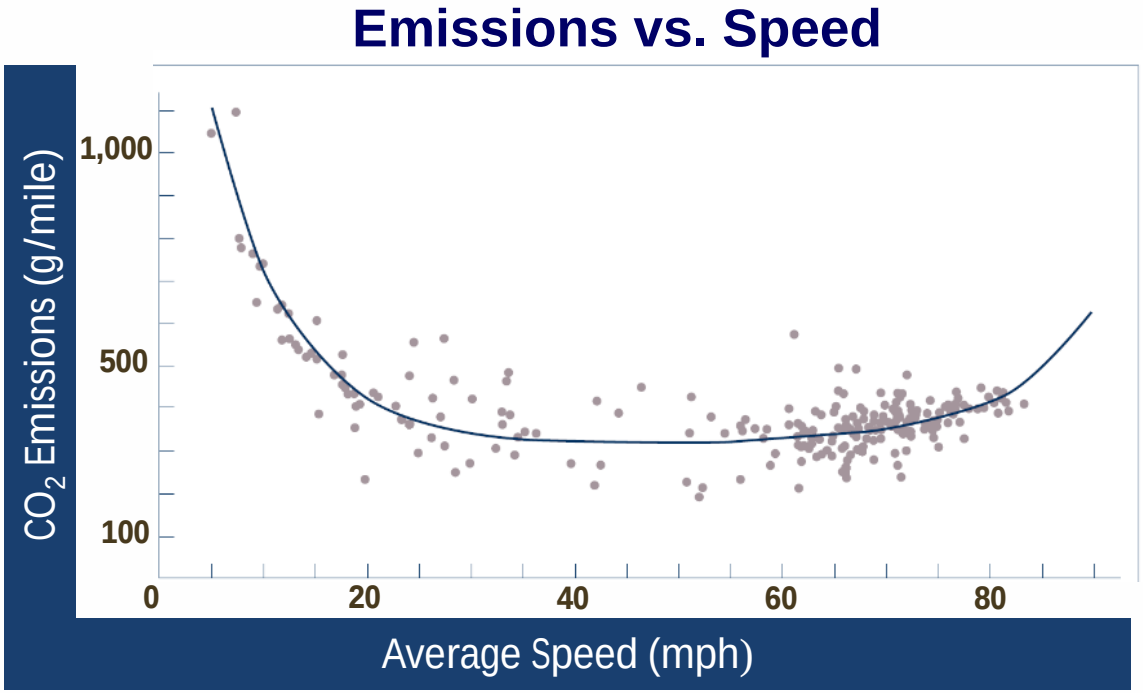
- Gasoline, diesel, LPG, propane, natural gas, biodiesel, electric

Operating speed

- Lower speeds è higher emissions
- Higher speeds è lower emissions

Idle time

- Emissions rates are highest when a GAV is not moving



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

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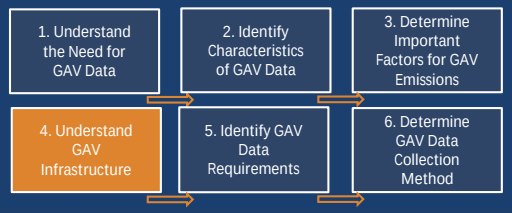
Airport GAV Infrastructure



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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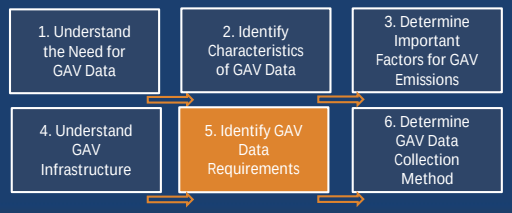
Emissions Model Data Requirements



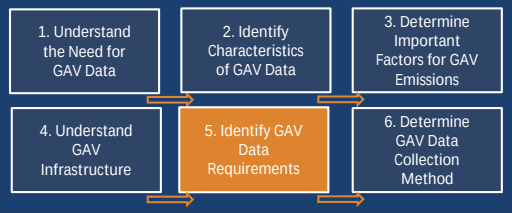
- Three tiers for GAV data requirements
  - Tier 1 è Basic
  - Tier 2 è Intermediate
  - Tier 3 è Advanced
- Choose highest tier

Tier Approach

	Tier I (Basic)	Tier II (Intermediate)	Tier III (Advanced)
Document Type	CATEX	EA	EIS
Attainment Status	Attainment	Maintenance/ Nonattainment	Serious to Extreme Nonattainment
Public Interest	Low	Medium	High

See Chapter 5 of the Guidebook for more information.

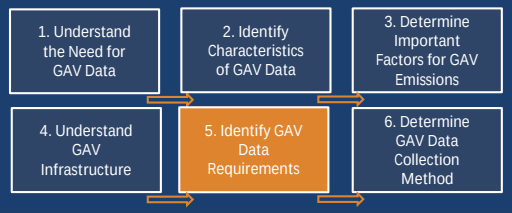
Example Project Types & Tier Level



Project/Action Category	Model GAV[a]	Tier I	Tier II	Tier III
Example Project Types				
New Airport	H			X
New Runway	M		X	
Major Runway Extension	M		X	
New/Expanded Terminal	H			X
Roadway Modifications	H			X
New or Expanded Parking	H			X
Runway Rehabilitation	L	X		
Obstruction Removal	L	X		
Example Action Types				
Increase in Operations	H			X
Change in Vehicle Mix	M		X	
Increase Motor Vehicle Trips	H			X

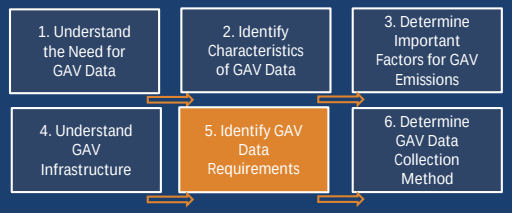
[a] Indicates likelihood that GAV emissions will be modeled **H = High** **M = Medium** **L = Low**

Tier I - Basic



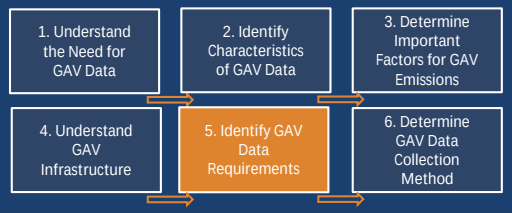
Infrastructure	Required Data			
General	**Volume**	**Fleet Mix**	**Speed**	**Idle/Dwell Time**
Roadways	Average daily trips.	Assume a 50/50 fleet split and composite fuel.	Assume 20 mph.	Not considered.
Parking Facilities	Average daily trips to facility.	Assume a 50/50 fleet split and composite fuel.	Assume 10 mph.	Not applicable.
Vehicle Staging/ Queuing Areas	Average daily trips to area.	Assume a 50/50 fleet split and composite fuel for taxi/limo and TNC areas.	Assume 10 mph.	Dwell times are assumed.

Tier II - Intermediate



Infrastructure	Required Data			
General	**Volume**	**Fleet Mix**	**Speed**	**Idle/Dwell Time**
Roadways	Average daily trips for each area.	Vehicle mix percentages for each area.	Posted speeds for roads. Assume 20 mph curbside/cargo.	Not considered.
Parking Facilities	Average daily trips to lot.	Assume a 50/50 fleet split and composite fuel.	Assume 10 mph.	Not applicable.
Vehicle Staging/ Queuing Areas	Average daily trips to area of interest.	Assume a 50/50 fleet split and composite fuel for taxi/limo and TNC areas.	Assume 10 mph.	Dwell times are assumed.

Tier III - Advanced



Infrastructure	Required Data			
General	**Volume**	**Fleet Mix**	**Speed**	**Idle/Dwell Time**
Roadways	Peak hour data and temporal factors.	Vehicle fleet mix for each area.	Use observed, measured actual or derived speeds.	Airport-specific idle/dwell times for curbside.
Parking Facilities	Peak hour data and temporal factors.	Assume a 50/50 fleet split using a composite fuel.	Assume 10 mph.	Not applicable.
Vehicle Staging/ Queuing Areas	Peak hour data and temporal factors.	Assume a 50/50 fleet split and composite fuel for taxi/limo and TNC areas.	Assume 10 mph.	Dwell times are assumed.

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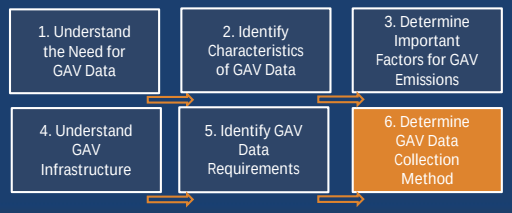
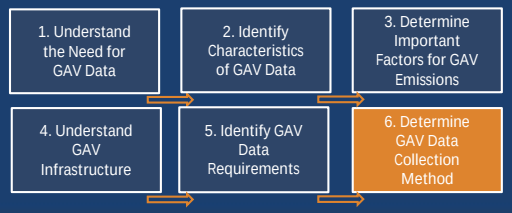
Collecting Existing Condition Data



- 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

Automated Traffic Counter

Existing Condition Data Collection Methods



Simple

- Manual traffic counts

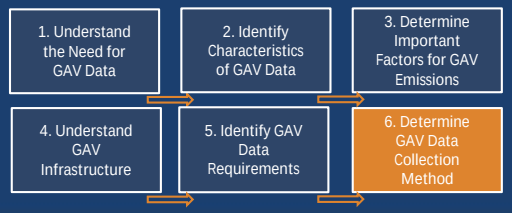
Automated

- 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:

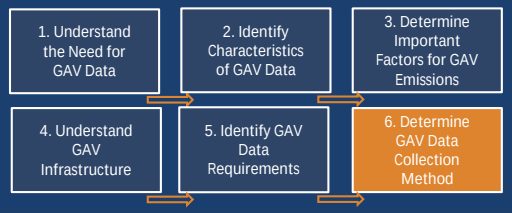
- Easy to set up
- Accurate classification
- Can also measure speed with handheld radar
- No installation costs

Cons

- Labor intensive
- Weather restricted
- High staffing requirements

Manual Counter

Pneumatic Road Tubes



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

Pros:

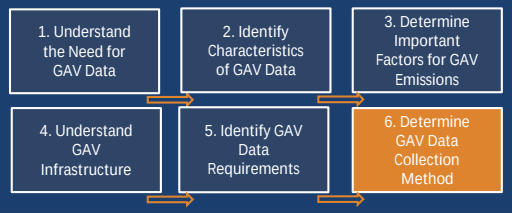
- Automated collection 24 hours a day
- Temporary or permanent installation
- Low staffing requirements

Con:

- Can't determine classification at level needed for air quality analysis

Pneumatic Tubes

Video image processors and recording data collection



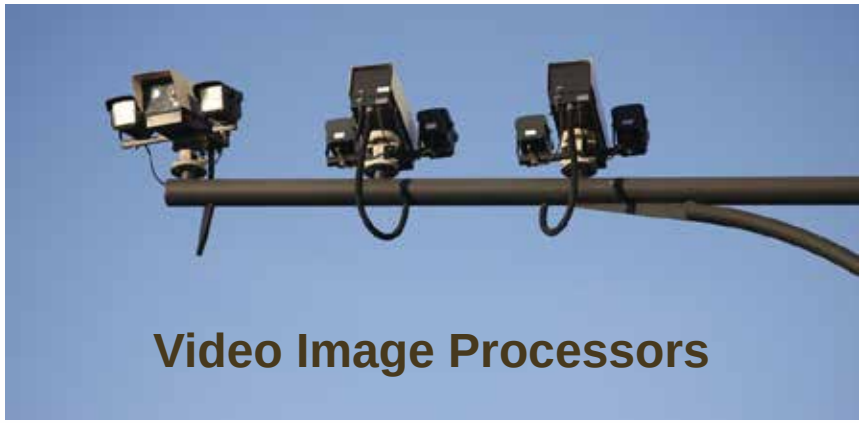
Video cameras linked to a computer process digital imagery and record passing vehicle characteristics.

Pros:

- Non-destructive installation
- Classify speed/category/volume

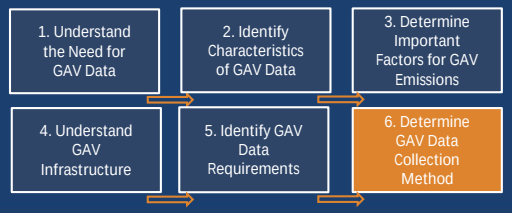
Cons:

- Weather can interfere
- Cost
- Vehicle classification may require manual intervention for air quality level detail



Video Image Processors

Future Conditions Data Development



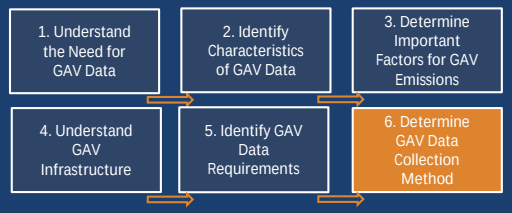
Step 1 Estimate Trip Generation

Step 2 Determine Trip Distribution

Step 3 Analyze Travel Modes

Step 4 Distribute Volumes

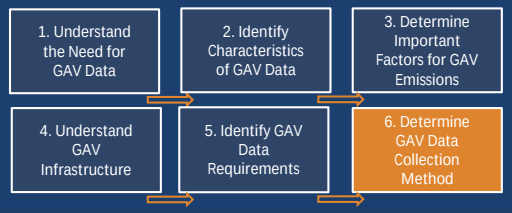
Step I – Trip Generation



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

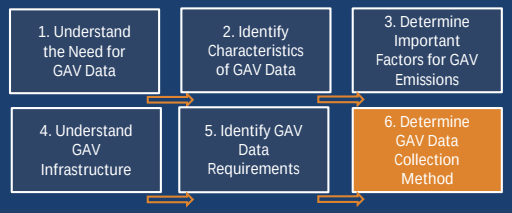
Step I – Trip Generation: Passenger Growth



- 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



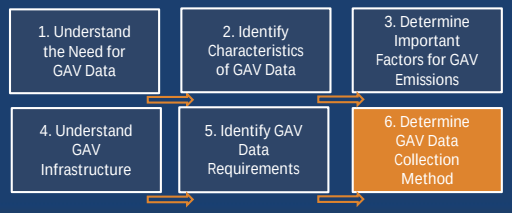
Non-Hub/Small Airports

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

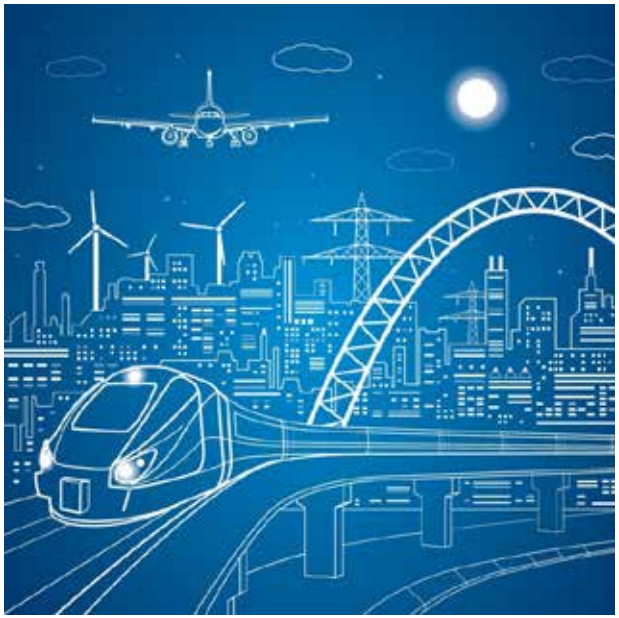
Large Airports

- Often have multiple entry/exit points
- More advances data collection techniques are needed

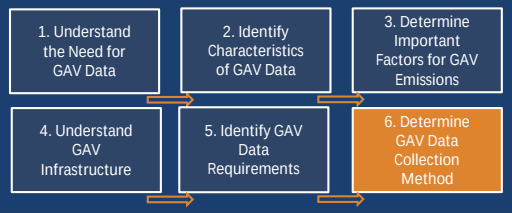
Step 3 – Analyze Travel Mode Choice



- 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

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

Presentation Roadmap

Section 1 - Research Results and Outcomes

Section 2 - Tutorial Overview

Section 3 - Practical Applications

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

CLICK HERE TO BEGIN

INSTRUCTIONS

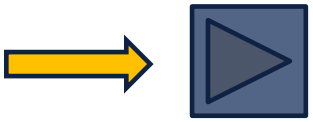
- This button will move you forward a step in the *Tutorial.* 
- This button will take you back a step. 
- And this one will take you to the next section. 

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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First example

GAV INFRASTRUCTURE AND GENERAL EMISSION MODEL DATA REQUIREMENTS

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.

GAV Infrastructure		Required Data				
		Volume				
General	Specific	Entering	Exiting	Fleet Mix[a]	Average Speed[b]	Idle/ Dwell Time
Roadways	Access	X		X	X	
	Curbside	X		X		X
	Circulation	X		X	X	
	Service	X		X	X	
	Cargo	X		X	X	X
	Airfield	X		X	X	
Parking Facilities	Surface	X	X			
	Multi-level	X	X			
	Employee	X	X			
	Cell Phone	X	X			X
	Hotel	X	X			
Vehicle Staging/ Queuing Areas	On Demand Taxi/Limo	X	X			X
	Limo	X	X			X
	Door-to-door/ Shared Ride	X	X			X
	Hotel/Motel Shuttles	X	X			X
	Parking Shuttles (on airport)	X	X			X
	Parking Shuttles (off airport)	X	X			X
	TNC	X				X
Other	Kiss-n-Fly	X				X
	Transit Stop	X				X
	Pre-arranged Taxi/Limo	X				X
	Charter Bus	X			X	X
	Cargo Facilities	X		X	X	X

[a] 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).**

[b] A **nominal vehicle speed of 20 miles-per-hour or less can be assumed for all parking facilities, vehicle staging/queuing areas and other areas of an airport.**

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For information on a particular subject, hover over and click on the provided links.

Second example

COLLECTING EXISTING CONDITION DATA

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.

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DATA COLLECTION METHODS FOR EXISTING CONDITIONS

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.

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

Application: V = Volume, C = Vehicle Classification, S = Speed, P = Permanent and T = Temporary.

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Next Section

VIDEO IMAGE PROCESSORS AND RECORDING DATA COLLECTION

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

Presentation Roadmap

Section 1 - Research Results and Outcomes

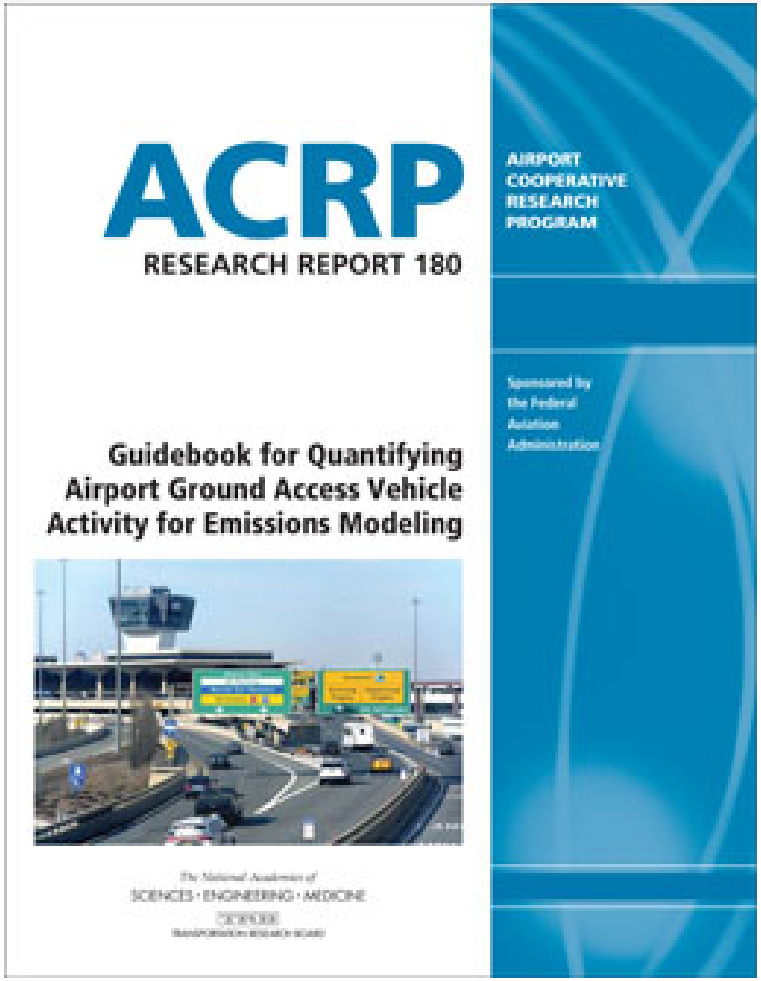
Section 2 - Tutorial Overview

Section 3 - Practical Applications

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



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Today's Speakers

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- Robbie Gross, *KB Environmental Sciences*, rgross@kbenv.com
- Mike Kenney, *KB Environmental Sciences*, mkenney@kbenv.com

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