

# HCM 2010: APPLICATIONS



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# OUTLINE

- ◆ **Different analysis levels**
- ◆ **Roadway system elements and service measures**
- ◆ **Operating conditions**
  - ◆ Uninterrupted vs Interrupted flow
  - ◆ Undersaturated vs Oversaturated flow
  - ◆ Queue discharge flow



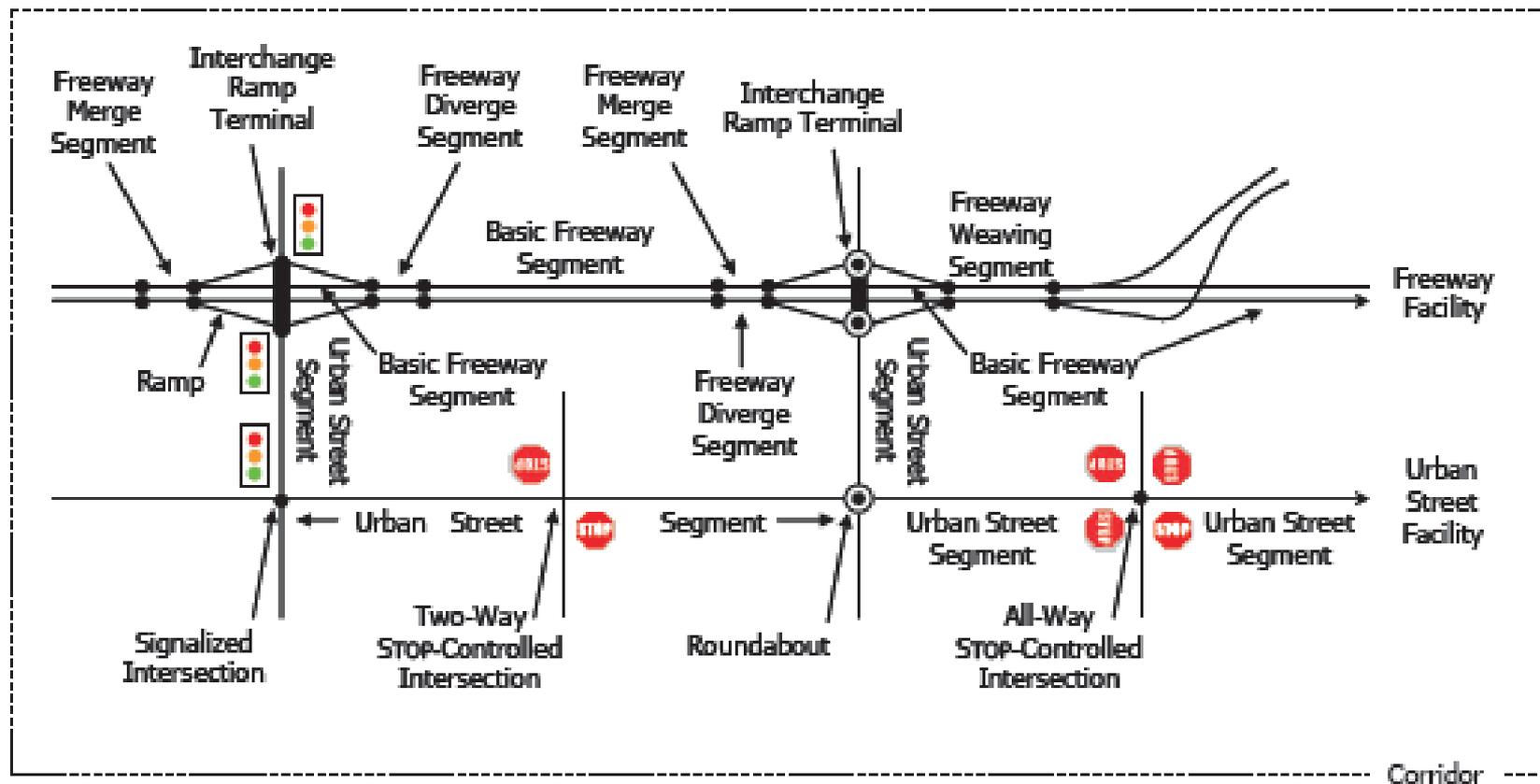
# ANALYSIS LEVELS

- ◆ **Four levels: Operational, Design, Preliminary Engineering, Planning Analysis**
- ◆ **Input data needs are same across the levels**
  - ◆ Use of default values instead of actual measured values differs
  - ◆ Also LOS is an output of operational, preliminary engineering, and planning analyses
  - ◆ Design analyses aimed at determining facility characteristics for a given LOS

# ROADWAY SYSTEM ELEMENTS

## ◆ Six main types of elements

- ◆ Points, segments, facilities, corridors, areas, systems



(a) Points, Segments, Facilities, and Corridors

# HCM SERVICE MEASURES

System Element	HCM Chapter	Service Measure(s)				Systems Analysis Measure
		Automobile	Pedestrian	Bicycle	Transit	
Freeway facility	10	Density	--	--	--	Speed
Basic freeway segment	11	Density	--	--	--	Speed
Freeway weaving segment	12	Density	--	--	--	Speed
Freeway merge and diverge segments	13	Density	--	--	--	Speed
Multilane highway	14	Density	--	LOS score <sup>a</sup>	--	Speed
Two-lane highway	15	Percent time-spent-following, speed	--	LOS score <sup>a</sup>	--	Speed
Urban street facility	16	Speed	LOS score <sup>a</sup>	LOS score <sup>a</sup>	LOS score <sup>a</sup>	Speed
Urban street segment	17	Speed	LOS score <sup>a</sup>	LOS score <sup>a</sup>	LOS score <sup>a</sup>	Speed
Signalized intersection	18	Delay	LOS score <sup>a</sup>	LOS score <sup>a</sup>	--	Delay
Two-way stop	19	Delay	Delay	--	--	Delay
All-way stop	20	Delay	--	--	--	Delay
Roundabout	21	Delay	--	--	--	Delay
Interchange ramp terminal	22	Delay	--	--	--	Delay
Off-street pedestrian-bicycle facility	23	--	Space, events <sup>b</sup>	LOS score <sup>a</sup>	--	Speed

Notes: <sup>a</sup> See Exhibit 2-3 for the LOS score components.

<sup>b</sup> Events are situations where pedestrians meet bicyclists.





# OPERATING CONDITIONS

## ◆ Uninterrupted Flow

- ◆ No fixed interruptions such as signals
- ◆ Freeways
- ◆ Speeds controlled by vehicle interactions and geometrics
- ◆ Freeway management has an effect
  - ◆ Ramp metering, variable speed limits
  - ◆ Truck lane restrictions, incidents
- ◆ Environmental conditions
  - ◆ Weather, lighting, pavement conditions



# OPERATING CONDITIONS

## ◆ Interrupted Flow

- ◆ Fixed interruptions due to traffic control
- ◆ Signals, STOP signs
- ◆ Urban streets
- ◆ Traffic flow depends on type of control
  - ◆ Signal generates platoons whereas STOP signs and roundabouts release traffic randomly



# OPERATING CONDITIONS

## ◆ Undersaturated flow (when following three conditions are satisfied)

1. Arrival flow rate  $<$  capacity of point/segment
2. No residual queue remains from a prior breakdown of facility
3. Traffic flow is unaffected by downstream conditions

◆ Uninterrupted flow facility: Travel speeds within 10 to 20% of free flow speed for undersaturated flow

◆ Interrupted flow facility: Travel speeds within 30 to 65% of free flow speed for undersaturated flow

- ◆ Due to expected queuing at signals



# OPERATING CONDITIONS

- ◆ **Oversaturated flow (when any of the following three conditions are satisfied)**
  1. Arrival flow rate  $>$  capacity of point/segment
  2. Residual queue remains from a prior breakdown of facility
  3. Traffic flow is affected by downstream conditions
- ◆ Uninterrupted flow facility: oversaturated conditions result from a bottleneck
- ◆ Interrupted flow facility: oversaturated conditions result when the intersection cannot process the demand over analysis period

# OPERATING CONDITIONS

## ◆ Queue discharge flow (applicable to uninterrupted flow facilities)

- ◆ Flow discharged from a bottleneck accelerates back to FFS in the absence of a downstream bottleneck
- ◆ Relatively stable flow
- ◆ Range from 2000 to 2300 pcphpl on freeways, speeds >35 mph to FFS,
- ◆ QDF usually accelerates back to FFS in 0.5 to 1 mi if no critical grades or curves present
- ◆ QDF is less than maximum pre-breakdown flows (PQF)

## ◆ QDF for interrupted flow facility is same as saturation flow rate

