TRAFFIC CIRCULATION AND ACCESS

Shoreline Development CAC
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WALNUT DR
NEPTUNE DR
MARINA BLVD
WEST AVENUE 133RD
WEST AVENUE 134TH
WEST AVENUE 135TH
WEST AVENUE 136TH
DOOLITTLE DR
AURORA DR
FAIRWAY DR
JIBIRD
SAUSALITO RD
JAMAICA WAY
TAHITI RD
SAMOA RD
TORTUGA RD
FIJI WAY
SANTIAGO RD
MULFORD POINT DR
PESCADOR POINT DR
MONARCH BAY DR
BLUE WHALE ST
OUTRIGGER DR
SEAGATE DR
BERMUDA AVE
ACAPULCO RD
NASSAU RD
TRINIDAD RD
FLAGSHIP ST
BELVEDERE AVE
N
0 250 500 750 1,000 Feet
Development Opportunity Site

Traffic Circulation and Access

- Objective
  - Introduce transportation planning related issues of land development
  - Introduce traffic engineering related issues of site design
- Goal
  - Provide basics for potential identification of potential street network problems
  - Provide basics to allow cursory site plan review

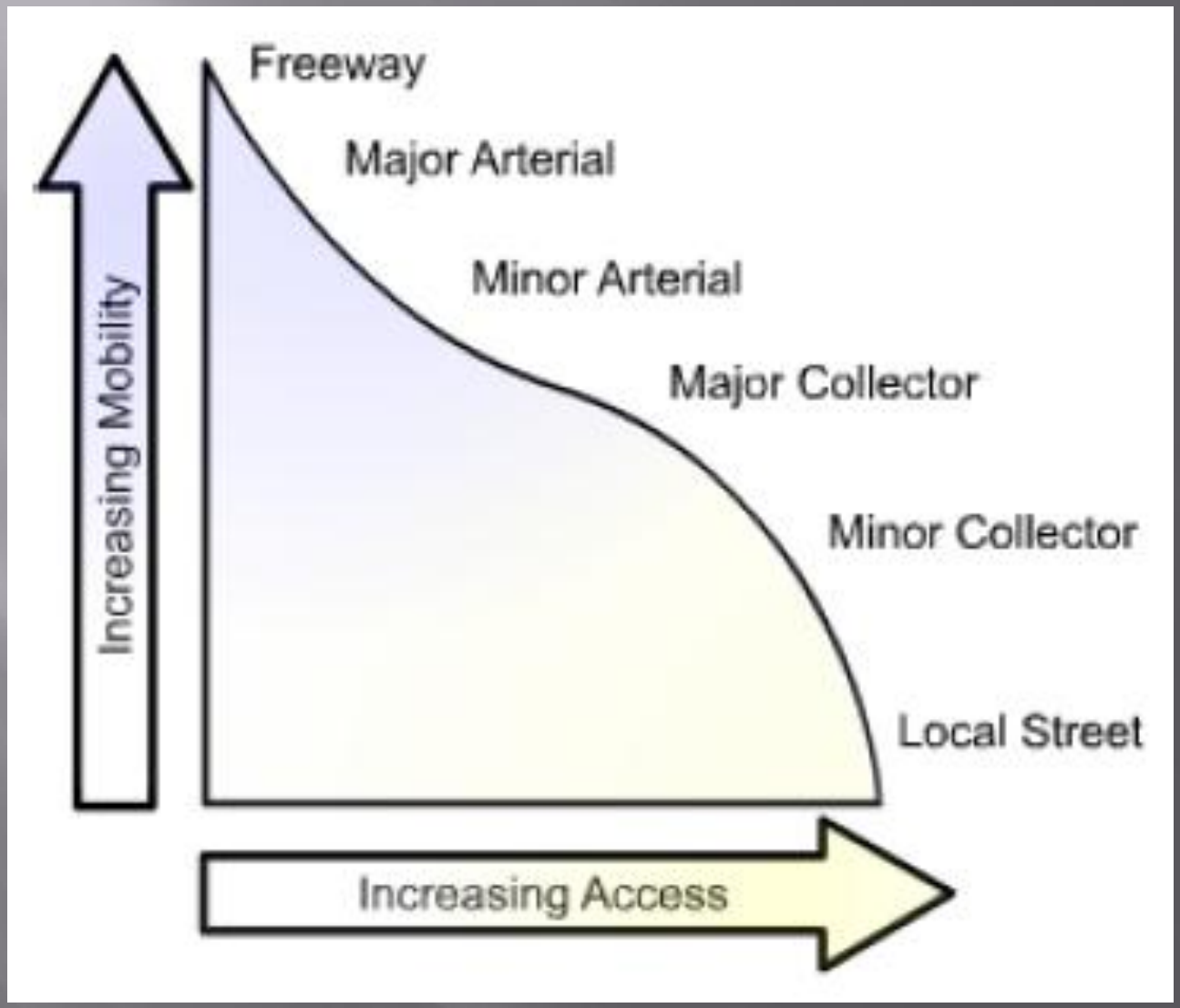
Agenda

- Key Background Information
  - Street Hierarchy
  - Trip Generation Rates
  - Design Vehicles
  - Level of Service
- Transportation Planning Process
- Site Planning Process

Street Hierarchy

- Movement Functions vs. Access Function
  - Principal Arterial – Expressway/Freeway
  - Arterial
  - Collector
  - Local/Residential

Street Hierarchy



Traffic Volumes/Parameters

- Average Daily Traffic (ADT)
  - Average number of vehicles in each direction passing a specific point in a 24-hour period
- Peak Hour Traffic
  - Part of day when largest volume of trips are generated

Traffic Volumes/Trip Generation Weekday Rates

		Daily			AM			PM		
		Daily	In	Out	Peak Hour	In	Out	Peak Hour	In	Out
Land Use		Rate	%	%	Rate	%	%	Rate	%	%
Single Family	unit	9.57	50	50	0.75	25	75	1.01	63	37
Apartments	unit	6.65	50	50	0.51	20	80	0.62	65	35
General Office	ksf	11.01	50	50	1.55	88	12	1.49	17	83
Shopping Center	ksf	42.94	50	50	1.00	61	39	4.89	52	48
Restaurant	ksf	89.95	50	50	0.85	N/A	N/A	7.49	67	33
Hotels	room	8.92	50	50	0.67	58	42	0.70	49	51

Note: *ITE Trip Generation Manual*, 8th edition average rates.

Traffic Volumes/Trip Generation Weekday Rates

		Daily			AM			PM		
		Daily	In	Out	Peak Hour	In	Out	Peak Hour	In	Out
Land Use		Rate	%	%	Rate	%	%	Rate	%	%
City Park	Acre	1.59	50	50	N/A	N/A	N/A	N/A	N/A	N/A
County Park	Acre	2.28	50	50	0.01	80	20	0.06	41	59
Regional Park	Acre	4.57	50	50	0.15	57	43	0.20	45	55
Beach Park	Acre	29.81	50	50	0.48	59	41	1.30	29	71
Marina	Berth	2.96	50	50	0.08	33	67	0.19	60	40
Golf Course	Acre	5.04	50	50	0.21	74	26	0.30	34	66

Note: *ITE Trip Generation Manual*, 8th edition average rates.

Traffic Volumes/Trip Generation Saturday Peak Hour Rates

		Saturday Peak Hour		
		Peak Hour	In	Out
Land Use		Rate	%	%
Single Family	unit	0.93	53	47
Apartments	unit	0.52	51	49
General Office	ksf	0.41	54	46
Shopping Center	ksf	4.89	52	48
Restaurant	ksf	10.82	59	41
Hotels	room	0.87	51	49

ITE Trip Generation Manual, 8th edition average rates

Traffic Volumes/Trip Generation Saturday Peak Hour Rates

Land Use		Saturday Peak Hour Peak Hour Rate	In %	Out %
City Park	Acre	N/A	N/A	N/A
County Park	Acre	2.24	59	41
Regional Park	Acre	0.34	48	52
Beach Park	Acre	1.18	46	54
Marina	Berth	0.27	44	56
Golf Course	Acre	0.64	52	48

ITE Trip Generation Manual, 8th edition average rates

Design Vehicle Characteristics

- Wider range of vehicles using arterial roads as compared to local streets
  - Large semitrailer only occasionally found on residential but is common on arterial
  - Streets higher in the functional hierarchy must be geometrically and structurally designed to accommodate larger vehicles
    - Bus
    - Car/Light truck with boat trailer
  - Residential Lane widths are less than arterials
  - Curve radii
  - Grades
  - Pavement Structure

Intersection Capacity/LOS Descriptions

- Level of Service (LOS) Descriptions
  - LOS A: Free Flow of traffic, users are minimally affected by the presence of others; an excellent general level of comfort and convenience to the users
  - LOS B: Reasonably free flow, operating speeds beginning to be restricted somewhat by traffic conditions. Drivers still have reasonable freedom to select their speed
  - LOS C: speeds remain near free flow, but freedom to maneuver is noticeably restricted
  - LOS D: high-density stable flow however speed begins to decline with increasing volume. Freedom to maneuver is further reduced and the traffic stream has little space to absorb disruptions
  - LOS E: Operating conditions at or near capacity; freedom to maneuver is extremely limited and driver and pedestrian frustration is generally high
  - LOS F: Forced or breakdown flow resulting in unstable flow; Both speeds and volumes can drop to zero

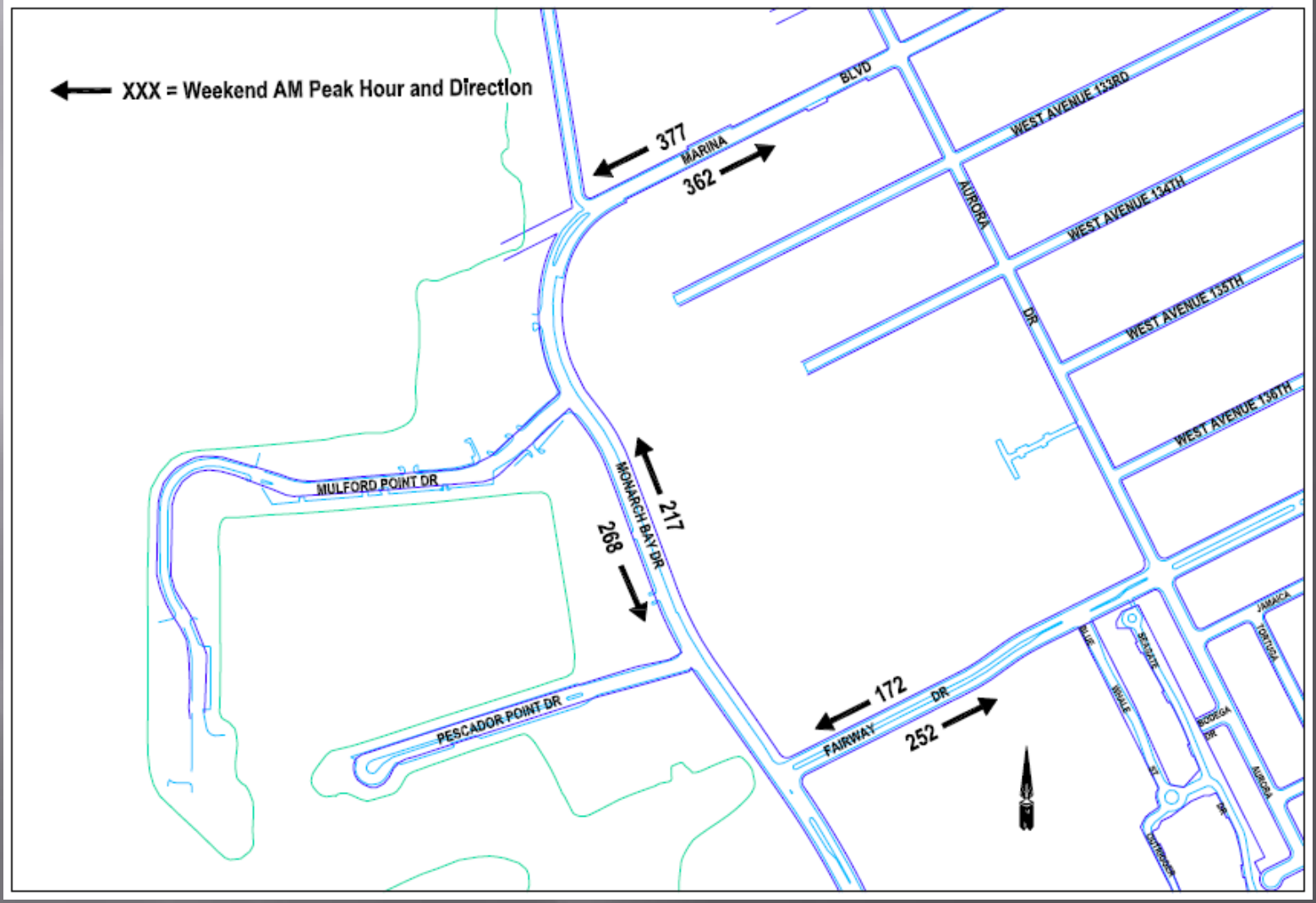
Transportation Planning

- Traffic Demand
  - Land use – Location and intensity of the activity
  - Socioeconomic conditions – magnitude and extent of population activity
  - Availability of alternative transportation modes
    - Traffic Studies
  - Existing Traffic
  - Future background traffic
  - Project traffic
  - Total future traffic

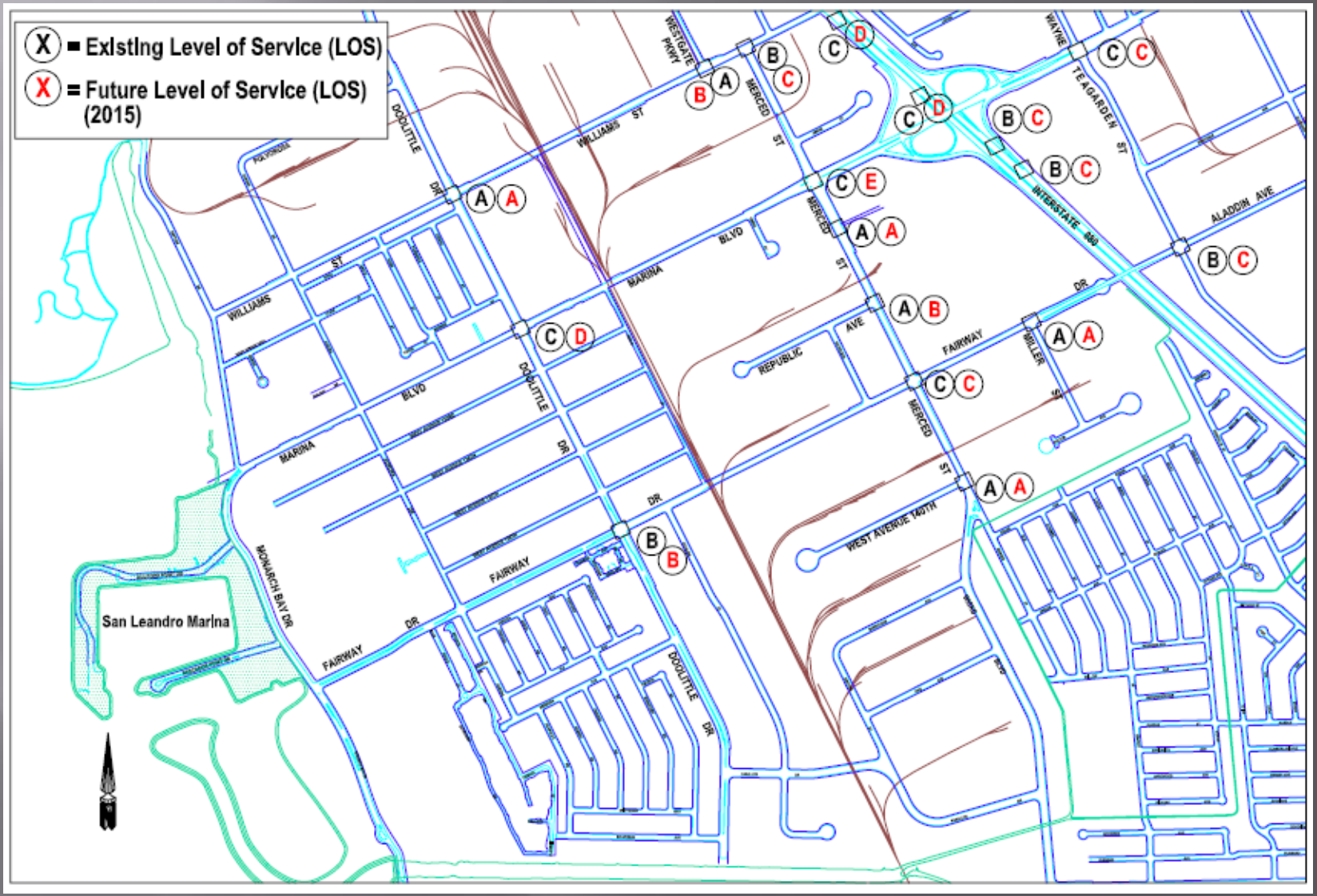
Traffic Volumes/Determine Project Impact

- New development generates more traffic and consequently may alter prevailing traffic patterns.
- Traffic volumes fluctuate daily and seasonally depending on the area served by the road.
- Major corridors serving commercial and business areas have peak volumes in the morning and late afternoon.
- Retail areas have peak volumes on weekends and evenings, especially during holidays
- Marina Park peak volume on weekends late morning

Weekend AM Peak Hour Traffic



Level of Service



Land Use Thresholds

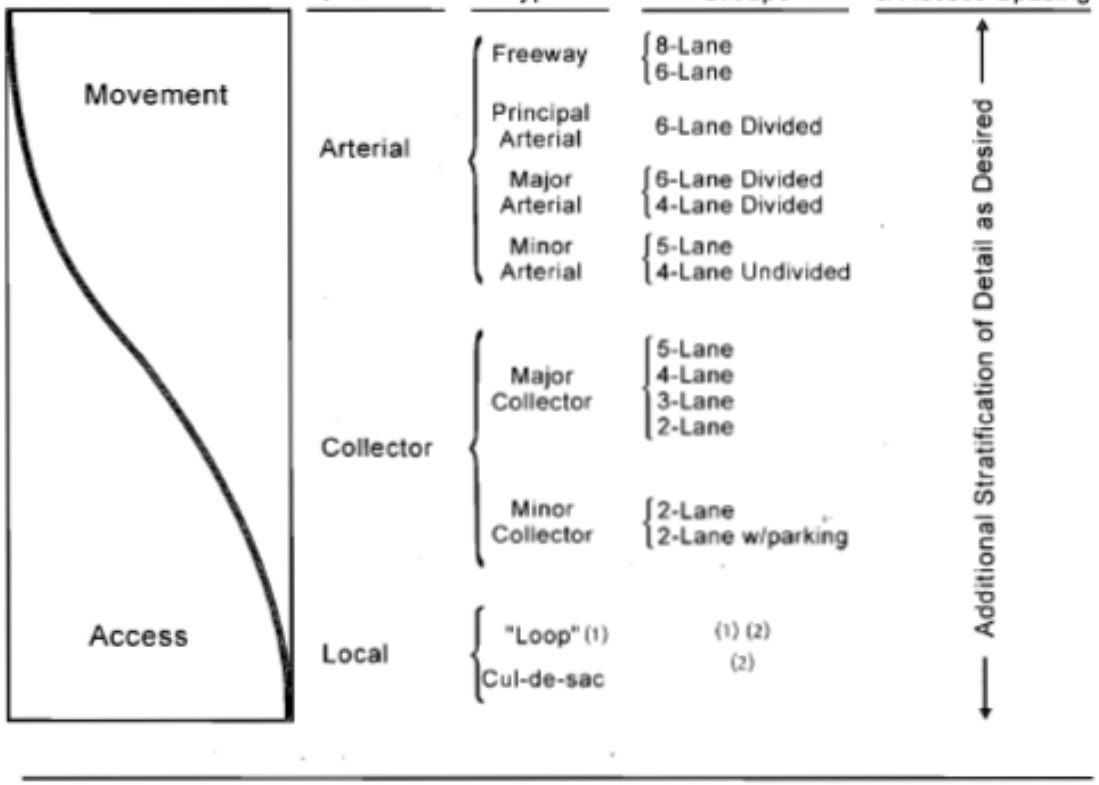
Land Use	≤ 100 Peak-Hour Trips[1]	≤ 500 Peak-Hour Trips
Residential:		
Single-family	90 units	550 units
Apartments	150 units	890 units
Condominiums/Townhouses	180 units	1,260 units
Mobile Home Park	180 units	1,070 units
Shopping Center (GLA)[2]	6,000 SF	70,700 SF
Fast-Food Restaurant with Drive-In (GFA)[3]	3,000 SF	N/A
Gas with Convenience Store (Pumps)	7 Pumps	N/A
Banks with Drive-In (GFA)[3]	2,000 SF	9,000 SF
General Office (GFA)[3]	67,000 SF	335,500 SF
Medical/Dentist Office (GFA)[3]	30,000 SF	N/A
Research and Development (GFA)[3]	71,000 SF	490,500 SF
Light Industrial (GFA)[3]	98,000 SF	463,000 SF
Manufacturing (GFA)[3]	145,500 SF	661,000 SF

[1] Rates/equations used to calculate the above thresholds are from ITE *Trip Generation*, 6th edition 1998 [7] for the p.m. peak hour of the adjacent street.
[2] GLA = Gross Leasable Area.
[3] GFA = Gross Floor Area.

Roadway Service Volumes/Capacities

Lane	Service Volumes (Veh/Hour)				
	LOS A	LOS B	LOS C	LOS D	LOS E
Class III (35 mph)					
1	N/A	N/A	480	780	850
2	N/A	N/A	1030	1600	1690
3	N/A	N/A	1560	2410	2540
4	N/A	N/A	2140	3220	3390
Class IV (30 mph)					
1	N/A	N/A	540	780	800
2	N/A	N/A	1200	1570	1620
3	N/A	N/A	1900	2370	2430
4	N/A	N/A	2610	3160	3250

Typical Cross-Sections



Basic Functional Classes	Functional Types	Typical Design Groups
Arterial	Freeway	8-Lane 6-Lane
	Principal Arterial	6-Lane Divided
	Major Arterial	6-Lane Divided 4-Lane Divided
	Minor Arterial	5-Lane 4-Lane Undivided
Collector	Major Collector	5-Lane 4-Lane 3-Lane 2-Lane
	Minor Collector	2-Lane 2-Lane w/parking
Local	"Loop" (1)	(1) (2)
	Cul-de-sac	(2)

Typical Cross-Section & Access Spacing

Additional Stratification of Detail as Desired

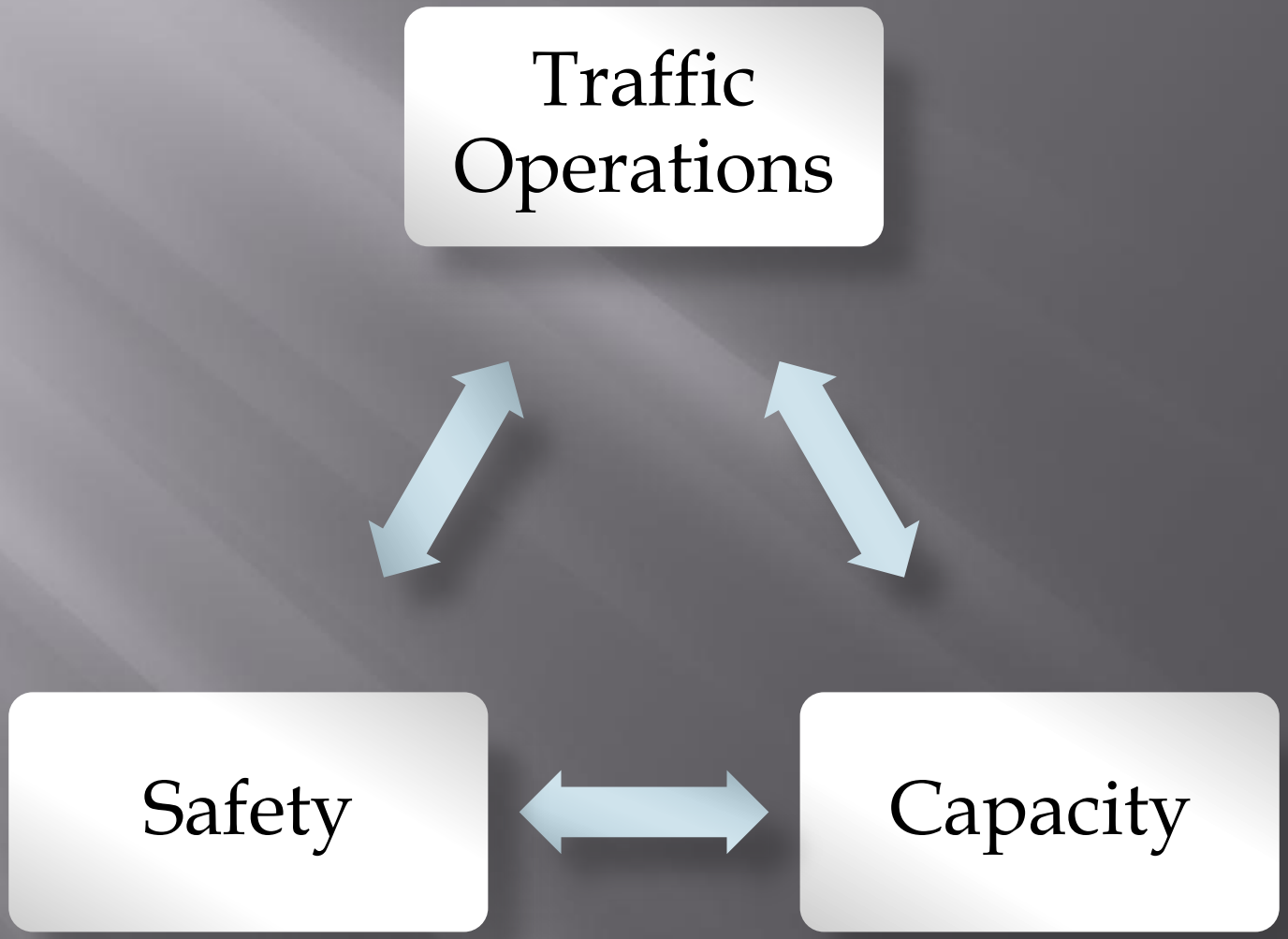
(1) Local streets that intersect a collector at each end.

(2) Local streets, both "loop" and cul-de-sac, are/should be defined by paved section, back-to-back of curbs, rather than number of lanes.

Site Planning

- Access to provide for convenient use of various facilities inherently site-oriented
  - Recreation area and activity layout
  - Topography
  - Noise levels
  - Accident Potential
- Typical Street Networks/Circulation System
  - Grid pattern – best for use in high-density area with widely distributed traffic flows
  - Discontinuous Streets – Reduces cut through traffic, increases walking distances
  - Discontinuous with Ped/Bike connections – Reduces cut through traffic and reduces walking distances

Site Access Elements



Development Planning Scales

Review progresses from broad-scale concerns to specific details

- Corridor Level
  - Arterial & Collector placement
  - Impacts on arterials and collectors
- Project Level
  - Impacts on adjacent properties and roadways
  - Access locations
- Site-Specific
  - Parking & building footprints
  - Site circulation
  - Access between site areas

Corridor Scale	*Project Scale*	*Site Scale*
1. Create shared marginal access to simplify highway movement and reduce number of access points.	1. Parking access system should be clear and simple, form circulation loops and avoid dead ends.	1. Parking modules should alternate with planted areas to break up parking expanse, provide safe pedestrian zones and help define the vehicular circulation system.
2. Highway access points must be 400 ft. minimum distance from a channelized intersection.	2. Parking modules should be used to break up parking lot expanse and create simple circulation patterns for parking search.	2. Parking module location can facilitate safe pedestrian movement if modules are oriented perpendicular to building entrance facades and to minimize the number of traffic aisles a pedestrian must cross.
3. Avoid "dog leg" situation by locating access point directly opposite another access point or at least 150 ft. away. (This applies at every level of scale.)	3. If parking is shared by two or more buildings, each should have equally convenient pedestrian and vehicle links to the parking area.	3. Circulation within modules should be simple and continuous. Avoid situations where driver must leave site and reenter to repeat parking search.
4. Site access should be shared whenever possible to reduce pavement, avoid duplication of roads and create efficient circulation.	4. Building forms should be used to define and emphasize entrances, which must be visible and easily accessible from related parking areas.	4. Delivery areas should be separate from parking area. Service driven should not enter parking modules.
5. Parking lots should be shared to reduce parking area. Adjacent uses that have different operating hours, peak hours or peak times should share parking.	5. Provide a continuous pedestrian system that links building entrances along a direct path, separate from vehicular right-of-ways and connects to pedestrian routes beyond the project.	5. Pedestrian walkways should be separate from vehicular right-of-ways and should follow direct routes between buildings or from parking area to building.
6. Separate incompatible uses with buffer zone or screen.	6. A system of bicycle routes should also be created, separate from auto traffic if possible, and linked to a community-wide bicycle system. Areas for convenient storage of bicycles should be provided.	
7. Size, shape and orientation of buildings should be designed to make them easily visible from highway, at highway speeds.	7. Buildings should be oriented to take advantage of pleasant views and to capture highway visibility.	
8. Locate buildings, parking areas and open space to create strong and varied mass/space relationships when viewed from highway.	8. Appropriate screens should be used to hide undesirable views.	
9. Site signage must be located where it is easily visible to highway traffic.	9. Some areas of natural open space should be created to provide relief from and contrast to built-up areas.	
10. Site uses along corridor should be land use types that benefit from highway visibility and complement adjacent corridor uses.	10. Use "green" space as a buffer zone between less compatible uses.	
11. Uses should take advantage of vistas and pleasant views where they are available.		
12. Uses adjacent to natural features must not endanger or encroach upon the feature.		

Source: Frank J. Koepke [1].

Access Management

- Network hierarchy planning
- Intersection planning
- Access location and design
- Medians and median openings
- Traffic signal/freeway interchange spacing
- Turn lane warrants and lengths
- Designing for human factors

Access Design Objectives

- Preserve function intent of street
- Minimize speed differential
- Adequate sight distance
- Minimize conflict points
- Accommodate turning radius of design vehicle
- Adequate storage for left and right-turning vehicles in driveways and turn lanes

Access Management Benefits

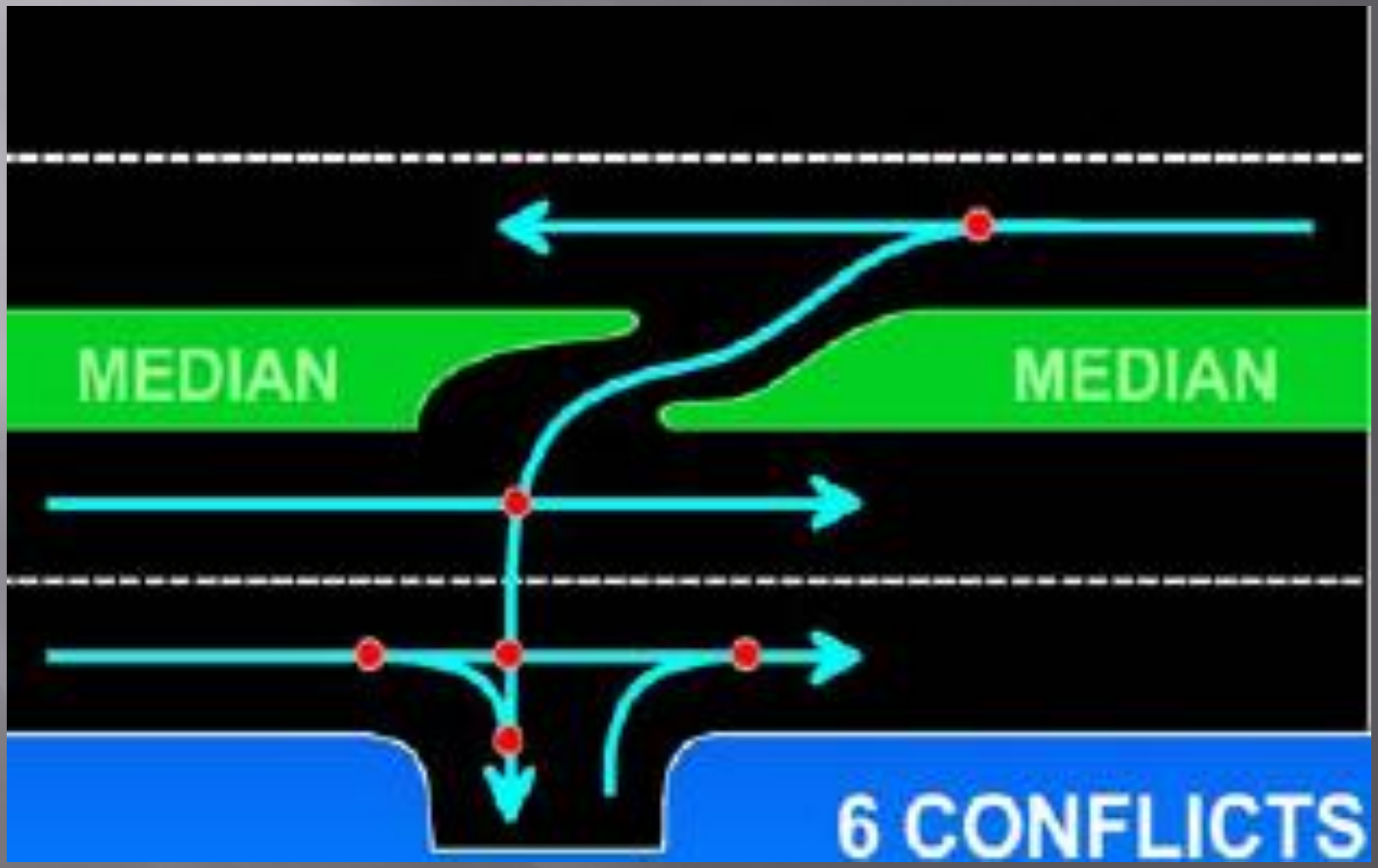
- Improved:
  - Roadway safety
  - Traffic operations
  - Business operations
  - System capacity preservation
  - Less environmental impacts
- Reduce collisions as much as 50%
- Increase roadway capacity by 23% to 45%
- Reduce travel time and delay by 40% to 60%

* S&K Transportation Consultants, Inc. Access Management, Location and Design. Class Notes for NHI Course 133078 (1998)

On-site Sight Distance

- Safety of vehicles leaving driveways
- Slows traffic exiting driveways
- Can cause delays for exiting traffic and on-site stacking problems
- Safety of pedestrians and bicyclist

Access Location Review



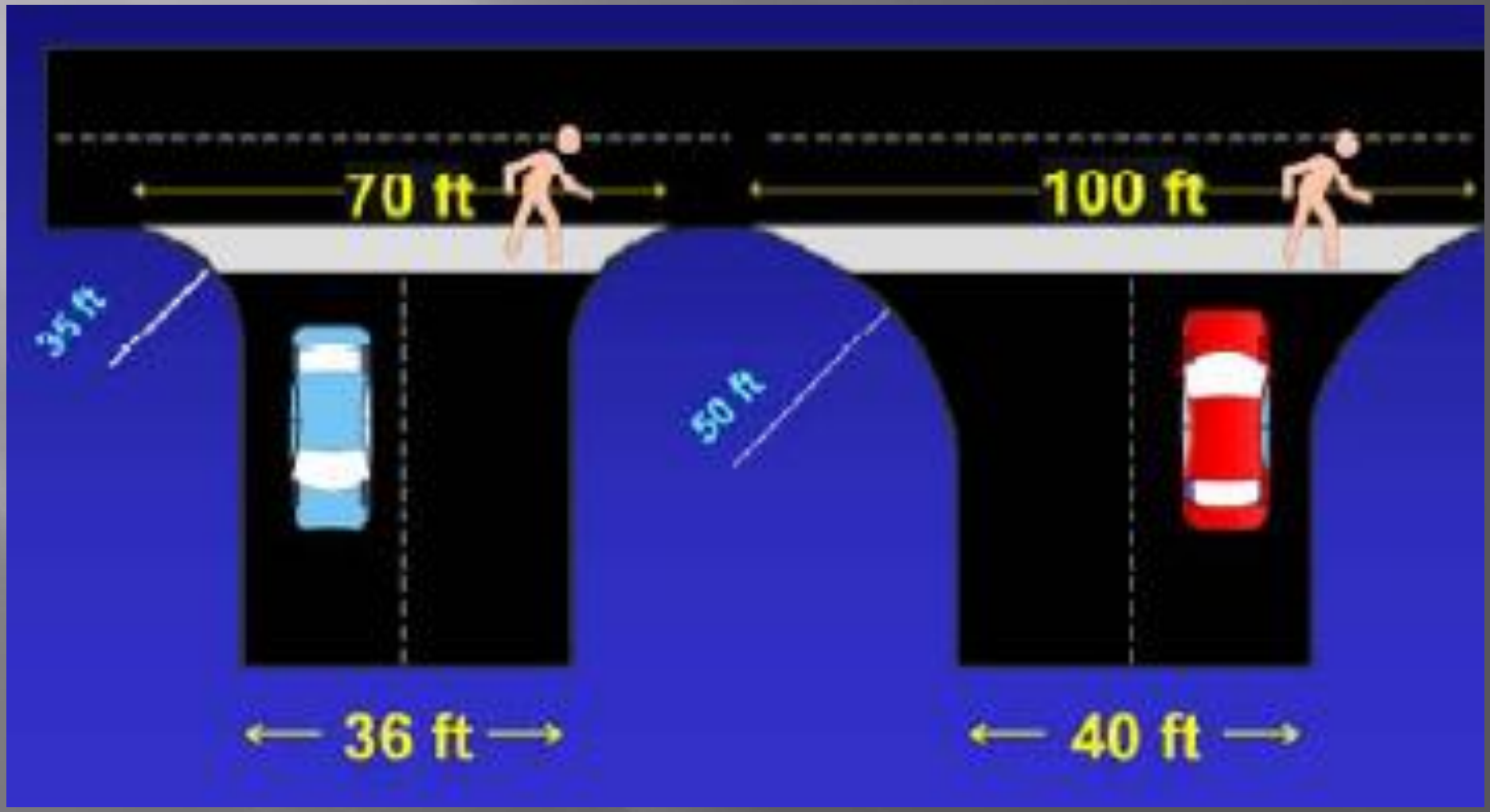
Pedestrian and Bicycle Concerns

- High Pedestrian density
- Child Safety
- Parking area safety
- Bicycle circulation and safety

Pedestrian Circulation Issues

- Short clear routes from transit stop to buildings
- Pedestrian crossings at critical locations
- Pedestrian bridges to traverse major barriers
- Guide signing

Pedestrian Issues



Incomplete sidewalk does not promote walking

Bicycle Circulation Issues

- Bicycle racks conveniently located
- Bike lanes or trails provided
- Guide signing

Parking

- Parking Requirements
  - Parking Generation Rates
  - Zoning Code
  - Shared Parking
- Parking Layout
- On-site Circulation

Parking Rates

Use	Unit	Space per Unit
Single Family Home	Living Unit	2
Multi-Family	Living Unit	1.5
Convenience Store	200 SQFT	1
Restaurant (<4,000 SQFT)	100 SQFT	1
Hotel	Room	1.1
Hotel Banquet Room	50 SQFT	1
Offices, Business & Professional	300 SQFT	1

Shared Parking

- Combined use of parking spaces by neighboring land uses
- Time of day considerations
- Reduce spaces required by stand alone uses
- Ideally suited for mixed use developments

Mixed use w/ shared parking

Angled Parking

- 90 Degree:
  - Pedestrian movement easier
  - Two-way aisle circulation
  - Most efficient use of land
  - More difficult for maneuvering
- 30-60 Degree
  - Easier to maneuvering
  - One-way circulation – often violated
  - Easier door opening
  - Ideally suited for high turn-over parking

Questions

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