VEHICLE-MILES-OF-TRAVEL

A Primary Measurement Tool for TRAFFIC IMPACT MITIGATION and GROWTH MANAGEMENT

Workshop Materials

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Renton, Washington

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1. BASIC CONCEPTS

A. WHY VMT

1. Directly relates system capacity (size of the system) to growth (size of the economy)
2. Simple to measure, monitor, forecast
3. Easy for laymen to understand
4. Supports a variety of approaches to "adequacy"
5. Supports multi-modal planning
6. Works for rural and urban areas alike.

California adopted VMT statewide for impact analysis

B. WHY NOT LOS?

1. Operational concept, not directly linked to size factors
2. Difficult and costly to measure, monitor, forecast
3. Difficult for laymen to understand
4. Presupposes the operational approach to "adequacy"
5. Poor support for multi-modal planning
6. Poor support for differences between rural and urban road systems.

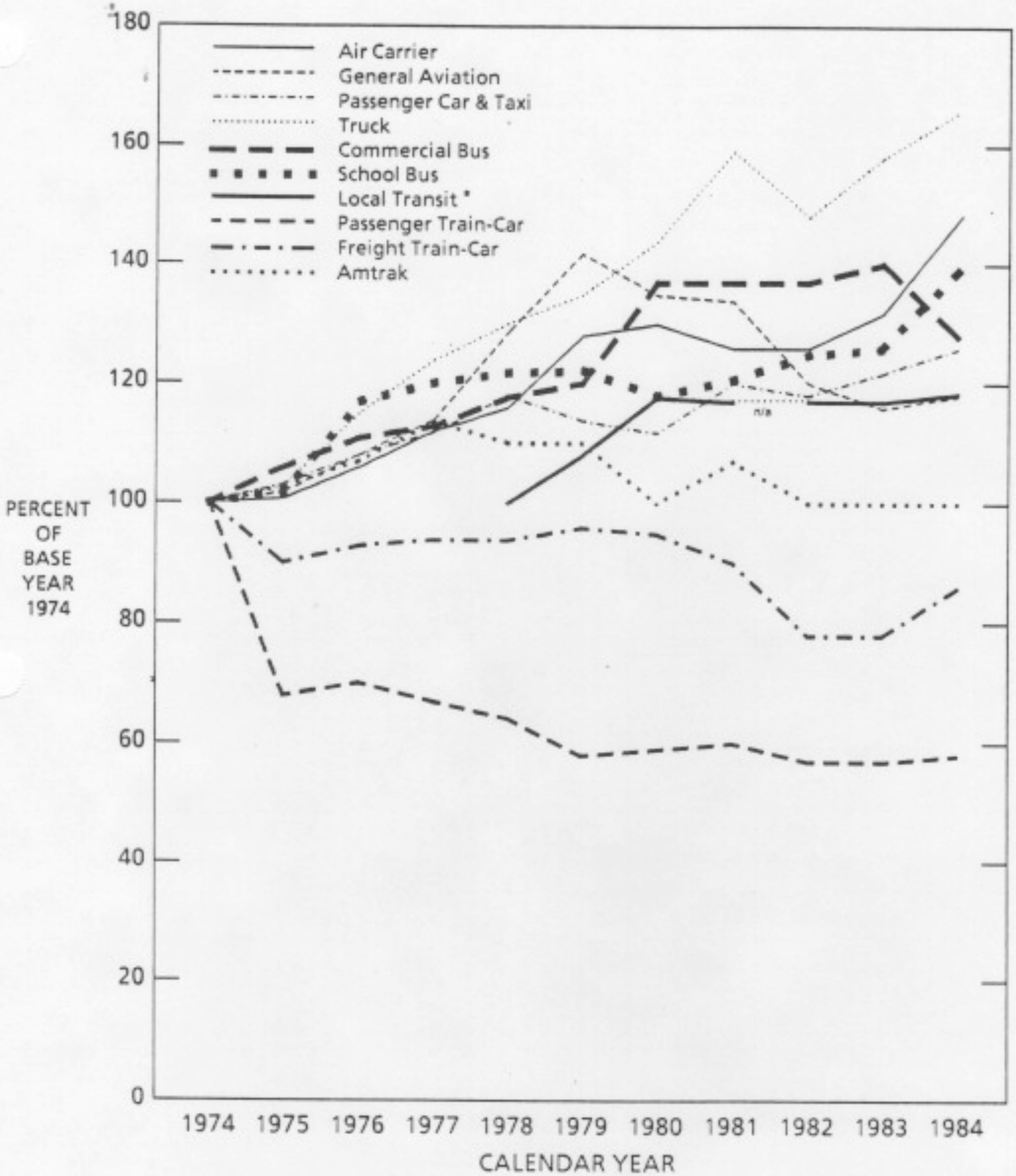


Figure 12. Vehicle-Miles, 1974-1984

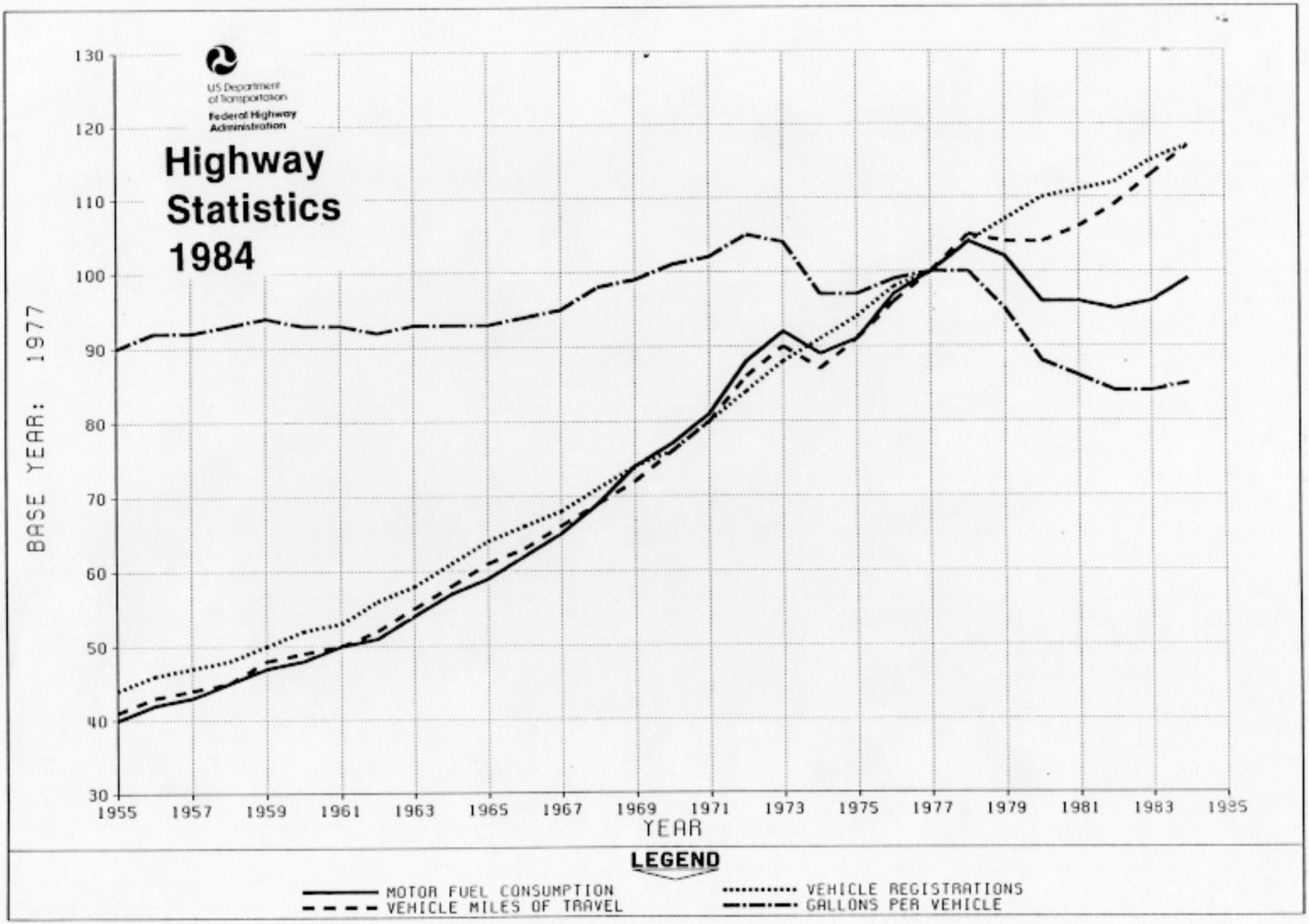
* Base year equals 1978.
n/a = not available.

U.S. Department of Transportation
Research and Special Programs Administration

National Transportation Statistics

Annual Report July 1986

VARIOUS INDEXES USING 1977 AS A BASE YEAR



C. SEPA CONTEXT

Historical Development of SEPA Practice:

1. SEPA does not define in specifics what a transportation "impact" is.

2. By custom, lawyers rely on "experts" in technical disciplines to define "impacts" for SEPA purposes, since lawyers' expertise is procedural not technical.

3. Traffic engineers *chose* to define "impacts" of development by reference to common practices of traffic operations (operational level-of-service) *rather* than in terms of cumulative growth forecasting. Local ordinances reflect this viewpoint.

4. Some results: public confusion over technical definitions, and dissatisfaction with the overall results

The VMT Alternative, under SEPA:

1. By local ordinance, define "impact" to be the aggregate vehicle-miles of travel generated by the development (assuming no demand reduction or non-vehicular modes apply), with reference to the total system.

2. Require mitigation in terms of replacement of a like amount of VMT benefits, in the aggregate.

3. Select specific mitigation actions based on local priorities, matching the aggregate VMT amount to be mitigated.

4. Allow and encourage alternative modes and demand management strategies as mitigation, on the basis of VMT-equivalencies.

5. "Adequacy" or "level of service" is not used to define "impacts", but only to select and prioritize mitigation actions. There is room to apply common sense. An adopted level-of-service standard is not required, per se.

6. Impact fees by formula are possible but hard to apply under SEPA; emphasis is instead on a negotiated list of mitigation actions by the developer, or voluntary payments in lieu of same. Assigning VMT-equivalencies for all actions useful to provide fairness and equity without using a monetary fee system.

D. GMA CONTEXT

1. GMA impact fees are optional, not mandatory. SEPA alone can be relied upon if local jurisdiction prefers.

2. GMA encourages monetary impact fees, but with significant restraints:

   a. Based on adopted transportation plan;

   b. For growth-related projects only;

   c. Based on adopted level-of-service standards;

   d. Same l-o-s standards must be applied to existing deficiencies at public taxpayer expense;

   e. Significant bookkeeping requirements;

   f. Same rules for small cities as for large ones;

3. VMT-based fee schedule fits within GMA framework for fees. Use dollar values for VMT-equivalency with greater ease than under SEPA .

4. Regional consistency and coordination under GMA may lead to negotiated understandings as to VMT impacts on "regional" versus "local" facilities or corridors.

5. VMT measures can be assembled by corridor or by sub-areas, and used to compute area average volume/capacity ratios for GMA purposes.

6. Policy standards which include shoulders and sidewalks as critical determinants of allowable lane capacity are consistent with the GMA requirement for attention to pedestrian safety.

7. Level-of-service measures can be defined from the lane-capacity approach, especially using VMT as the areawide averaging tool.

8. VMT measures can be expressed in multi-modal form, for more sophisticated measures in metropolitan areas.

9. VMT-based fees satisfy the proportionality requirements of GMA.

10. Using VMT to define impacts, there is more freedom to allocate the fee paid to high-priority projects. This in turn makes it easier to "use up" developer payments within the allotted six year window than if developer funds are piece meal distributed to many projects.

E. AVERAGE COST PER VMT

1. The VMT impact of a new development represents the potential use by newcomers of existing road capacity provided by previous public expenditures.

2. It is reasonable to base mitigation on a fee per VMT for the cost to supply that capacity.

3. The unit cost per VMT to provide new capacity is a fairly stable number, within broad categories of facilities (freeways, arterials, local roads).

4. Reasonably similar values of unit cost per VMT may be estimated from any of:

   a. Current six-year TIP project list

   b. Long-Range Transportation Plan project list

   c. Other representative groups of projects

   d. Regional average sources

   e. Local jurisdiction sources

5. Unit cost may reasonably be aggregated for a whole jurisdiction, or separated by functional class (freeways, arterials and collectors, local roads)

SIX-YEAR TRANSPORTATION IMPROVEMENT PROGRAM
EXAMPLE CITY, WA (1992-1998)

PROJECT DESCRIPTION		COST ANALYSIS			BENEFITS ANALYSIS		
		Project Cost, $Millions			Hourly Lane Capacity	Hourly VMT Capacity	Cost Per
Route Name	Length (Miles)	ROW	Construction	Total	Increase	Added	VMT
Abernathy Drive *City Limits to Third Avenue*	0.88	$0.00	$0.91	$0.91	800	704	$1,293
McGill Street *Ninth Avenue to 30th Avenue*	1.25	$1.58	$1.93	$3.51	1,800	2,250	$1,560
Ninth Avenue *McGill Street to Main Street*	0.36	$0.00	$0.66	$0.66	1,100	396	$1,667
Fignewton Road *Chestnut Street to Apple Way*	1.25	$0.00	$0.66	$0.66	600	750	$880
Abernathy Drive *Third Avenue to 10th Avenue*	0.45	$0.00	$0.80	$0.80	800	360	$2,222
Grand Avenue *Main Street to City Limits*	1.42	$0.00	$0.80	$0.80	800	1,136	$704
Main Street *First Avenue to SR-943*	0.75	$2.22	$4.13	$6.34	2,000	1,500	$4,228
Third Avenue *Main Street to Excalibur Road*	0.27	$0.00	$0.45	$0.45	1,100	297	$1,515
TOTALS/Averages	**6.63**	**$3.80**	**$10.33**	**$14.13**		**7,393**	**$1,911**
		Citywide Average Cost Per VMT of Gain =					**$1,911**

F. POLICY CAPACITY VALUES

1. Can be set equivalent to engineering capacity. This is suggested to apply only to freeways and major arterials, however.

2. For lesser roads, policy values of lane capacity should supersede engineering capacity to provide for pedestrian mobility and other issues, based on local preferences.

3. A policy declaration of "acceptable" lane volumes for local roads and collector roads may be important under GMA to prevent the (inappropriate) legal conclusion that full-scale arterial capacity values must be applied even to local roads for level-of-service and other regulatory decisions. (A road is a road is a road...)

4. Attached Table gives suggested values, to be adopted (or modified) by local ordinance.

5. Policy capacity may be expressed in terms of daily or peak hour or peak period (two or three hours), and directional or not, by local decision. Just make ally procedures consistent.

6. Attached Table uses two-way peak hour values, for greatest simplicity and stability.

   a. Most road-miles to be inventoried are on two-way, two-lane roads.

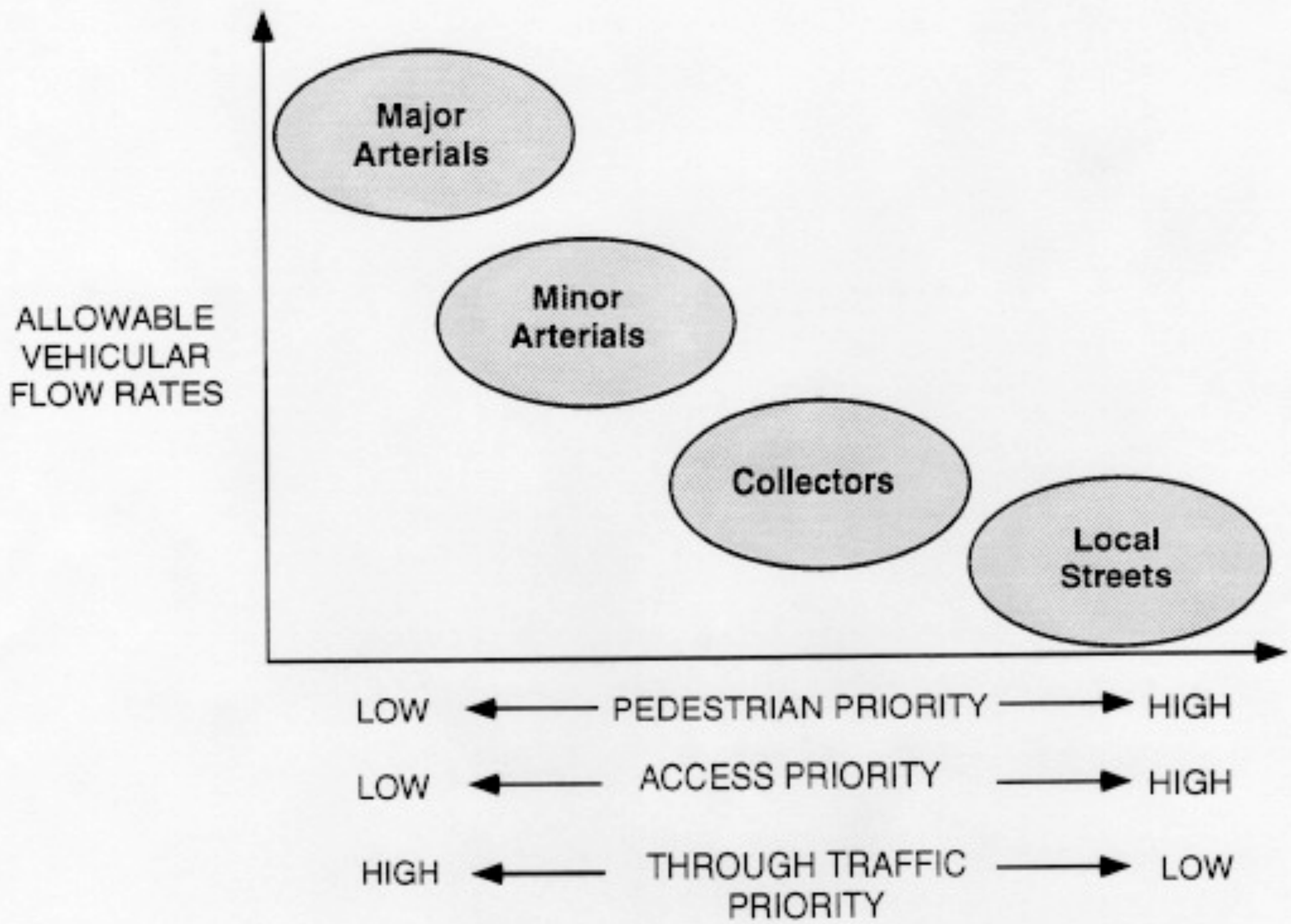
   b. Other road capacities can be derived from that starting point.

   c. Two-way total volumes are simpler to inventory and interpret than directional volumes, with little loss of accuracy for growth planning purposes.

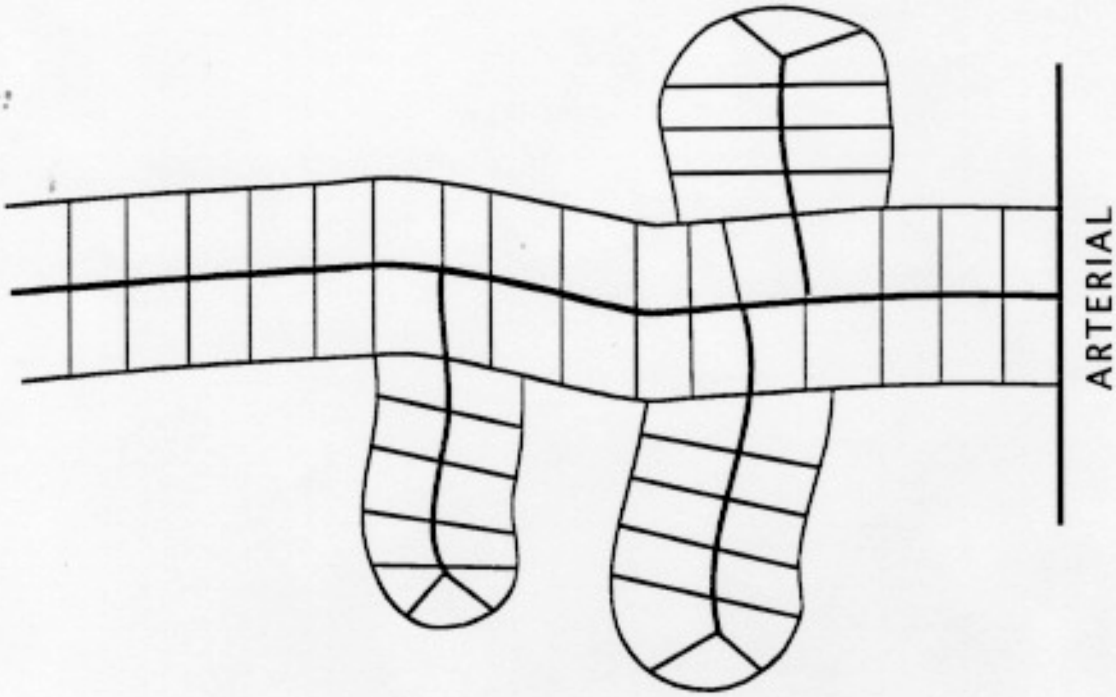
   d. Citizens' perceptions of congestion and growth impacts are adequately addressed by two-way volumes.

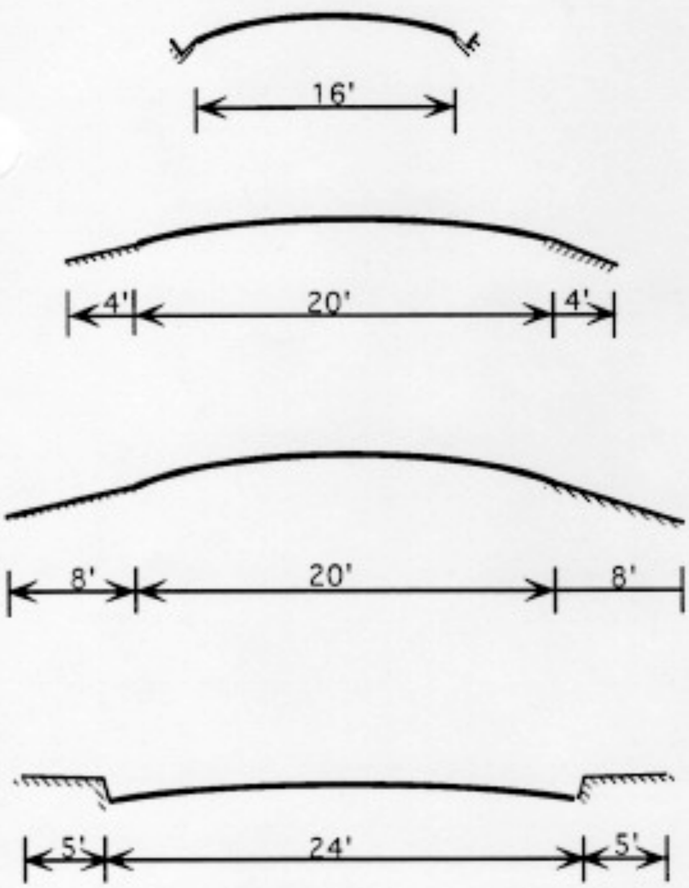
   e. Peak hour volumes relate better to congestion than daily volumes, especially in a demand-management setting.

   f. Additional considerations may encourage peak-period (2 or 3 hour) analysis in some places.



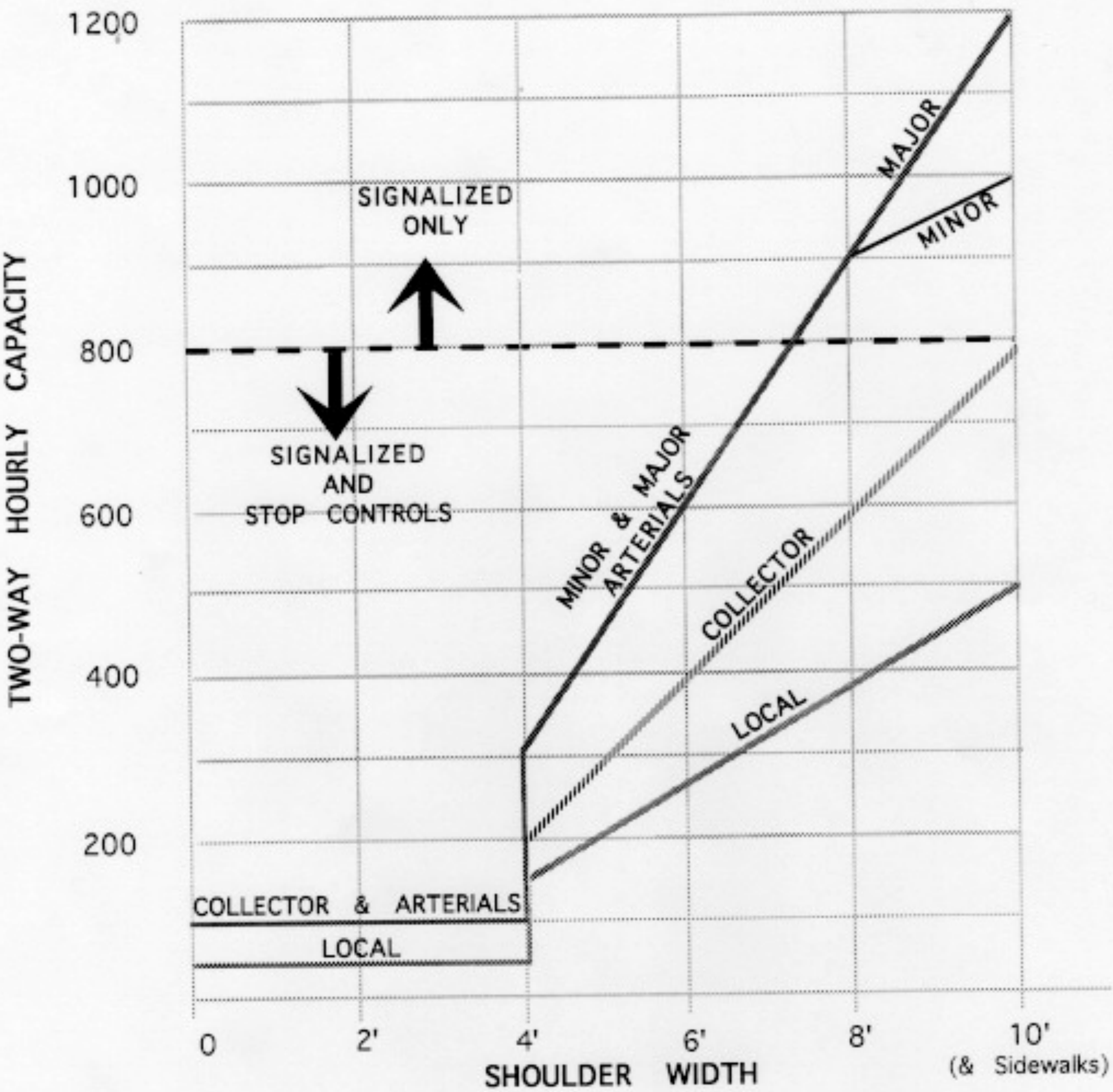
Functional Classification Hierarchy





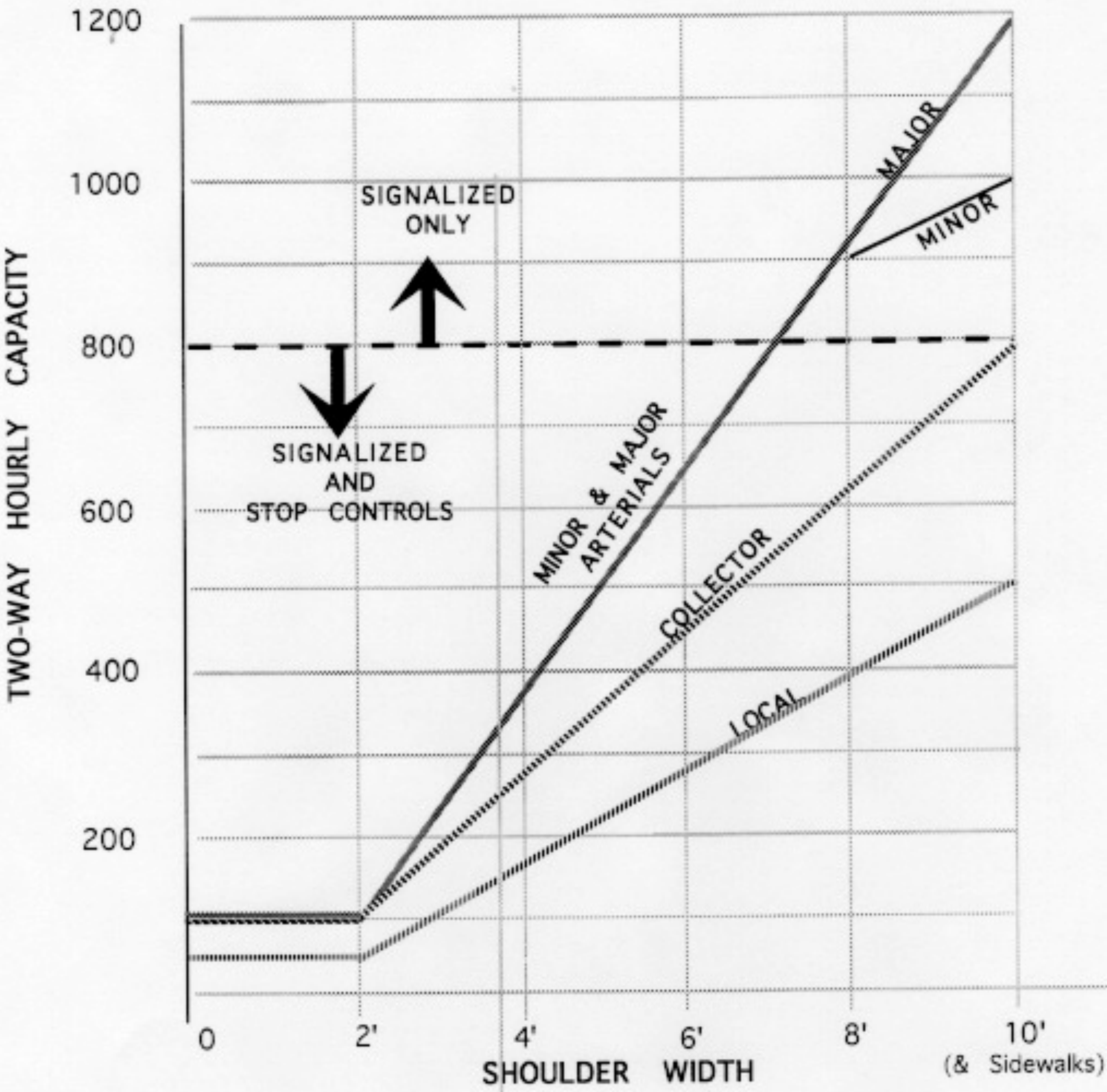
	Local Street	Residential Collector: 4-Way Stop	Residential Collector: Signal Control
NARROW ROAD WITH NO SHOULDERS	12	40	40
STANDARD ROAD WITH MINIMAL SHOULDERS	30	150	150
STANDARD ROAD WITH WIDE SHOULDERS	80	300	400
GOOD URBAN STREET WITH SIDEWALKS	100	360	500

Suggested Plan Capacity of Residential Streets



Two-Way, Two Lane Operation Assumed.

Suggested Plan Capacity of Non-Residential Streets



Two-Way, Two Lane Operation Assumed.

(Alternative Form)

Suggested Plan Capacity of Non-Residential Streets

Table 1
PLAN CAPACITY VALUES
(Hourly Two-Way Volumes for Two-Lane Streets)

Road Section Governed by Signalization or 4-way stop at Controlling Intersection:

Road Classification	Assumed Lane Width (feet)	NO SIDEWALKS OR PATHS (Shoulder Width, in feet) <4'	4'	6'	8'	10'	WITH SIDEWALKS OR PATHS
Local - Residential	10	15	30	50	80	100	100
Local - Nonresidential	10	50	150	300	400	500	500
Collector - Residential	10	50	150	300	400	500	500
Collector - Nonresidential	11	100	200	400	600	800	800
Arterial - Minor	11	100	300	600	900	1000*	1000*
Arterial - Major	11	100	300	600	900	1200*	1200*

* Maximum value for 4-way stop = 800.

Road Section Governed by 2-way stop at Controlling Intersection:

Road Classification	Assumed Lane Width (feet)	NO SIDEWALKS OR PATHS (Shoulder Width, in feet) <4'	4'	6'	8'	10'	WITH SIDEWALKS OR PATHS
Local - Residential	10	15	30	50	80	100	100
Local - Nonresidential	10	50	150	300	300	300	300
Collector - Residential	10	50	150	300	300	300	300
Collector - Nonresidential	11	100	200	400	400	400	400
Arterial - Minor	11	100	300	400	400	400	400
Arterial - Major	11	100	300	500	500	500	500

Notes:

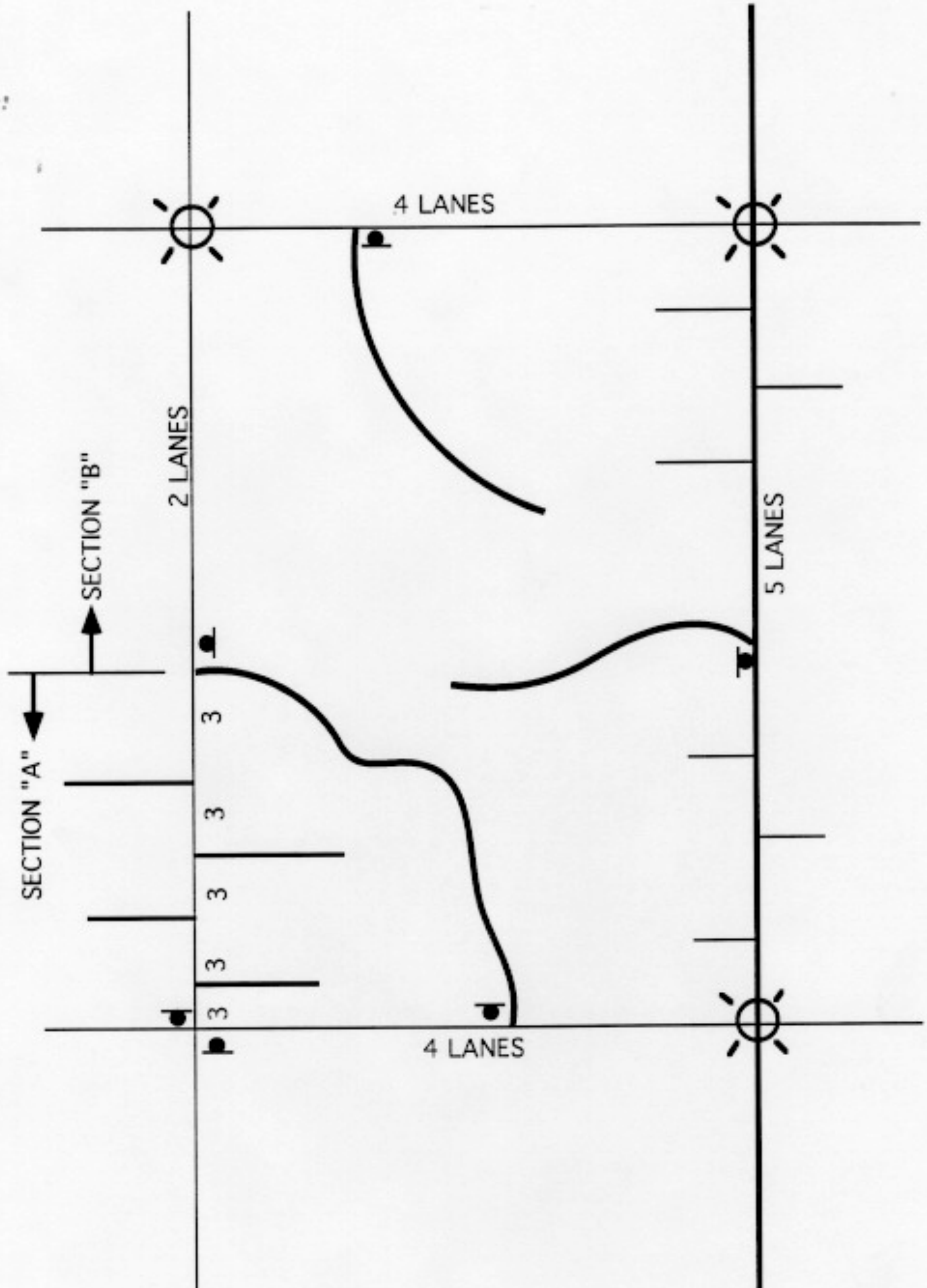
1. Table's purpose is to determine before/after effects of changes in allowable vehicular capacity due to improvements added Table does not specify acceptable standards for improvements, nor suggest preferred solutions to specific situations.

2. Values given represent maximum allowable hourly volumes, for planning purposes, of two-way, two-lane streets of good design in good condition, at stated lane width. Adjust for other conditions as required. See text.

3. Sidewalks and paths must provide at least a five-foot paved width for pedestrian travel, with a raised curb or other physical separation from the traffic lane.

4. Parking lanes are not counted as moving lanes.

5. Interpolate as required for shoulder widths not shown.



Identifying Controlling Intersections

Capacity Adjustments
(HCM Table 8-5)

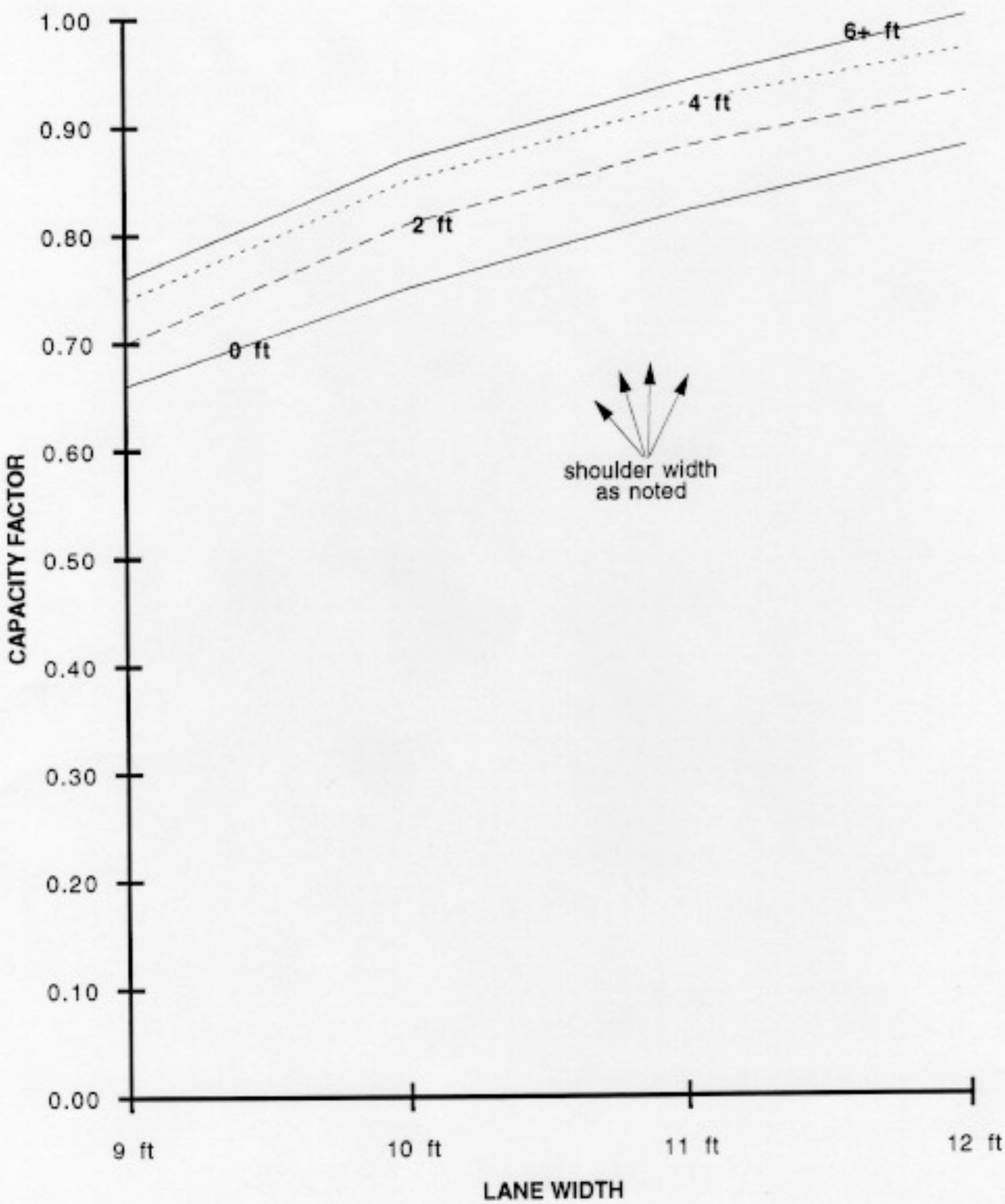
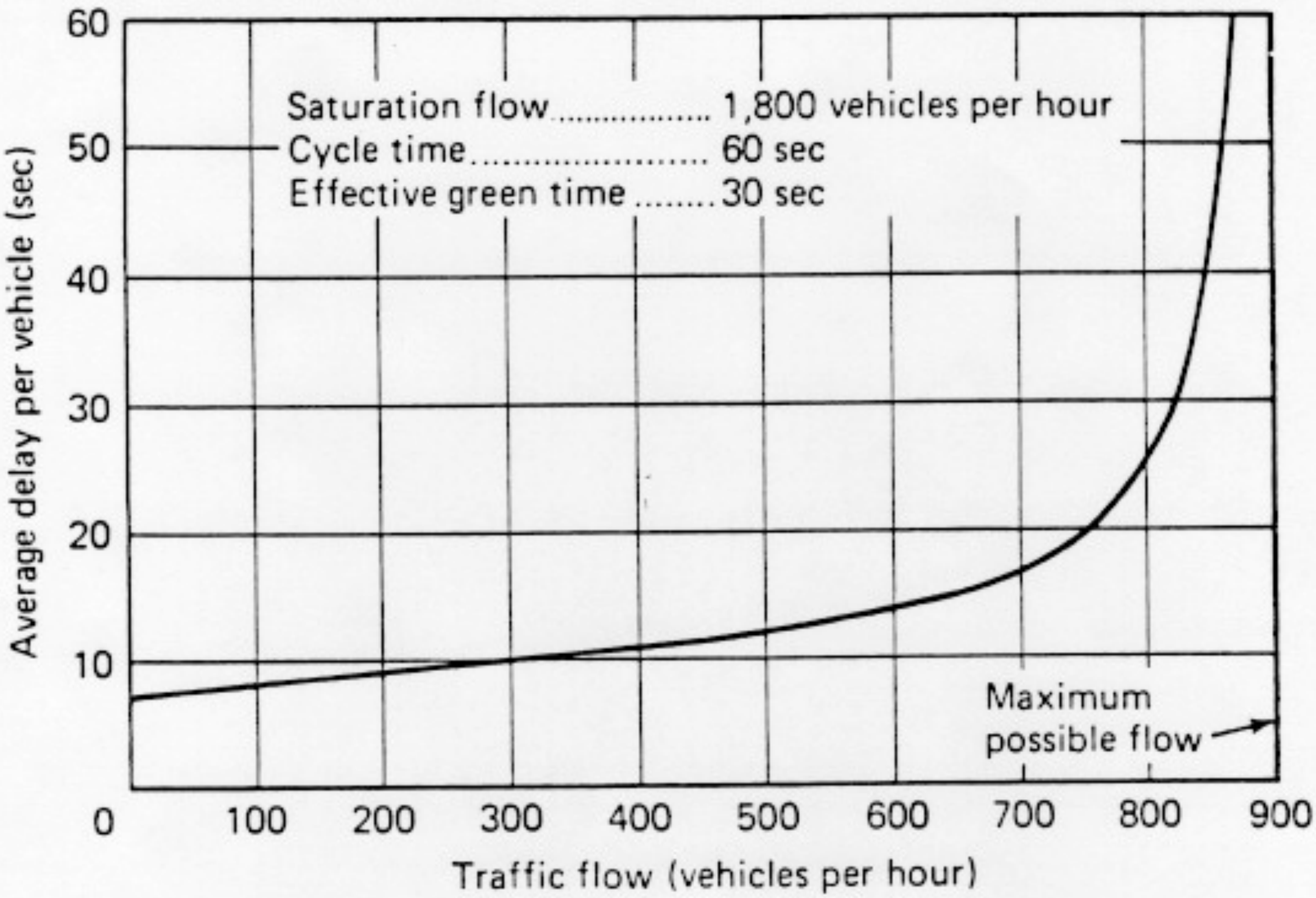
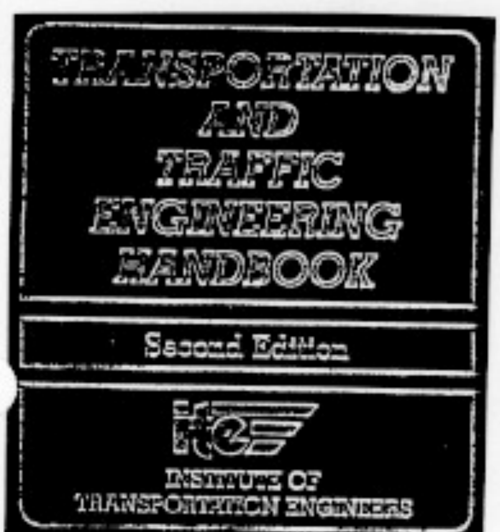


Figure 16.21. Typical delay/volume curve relationship on a signalized approach (British). SOURCE: *Research on Road Traffic*, London: with permission of the Controller of Her Majesty's Stationery Office, 1965, p. 304.





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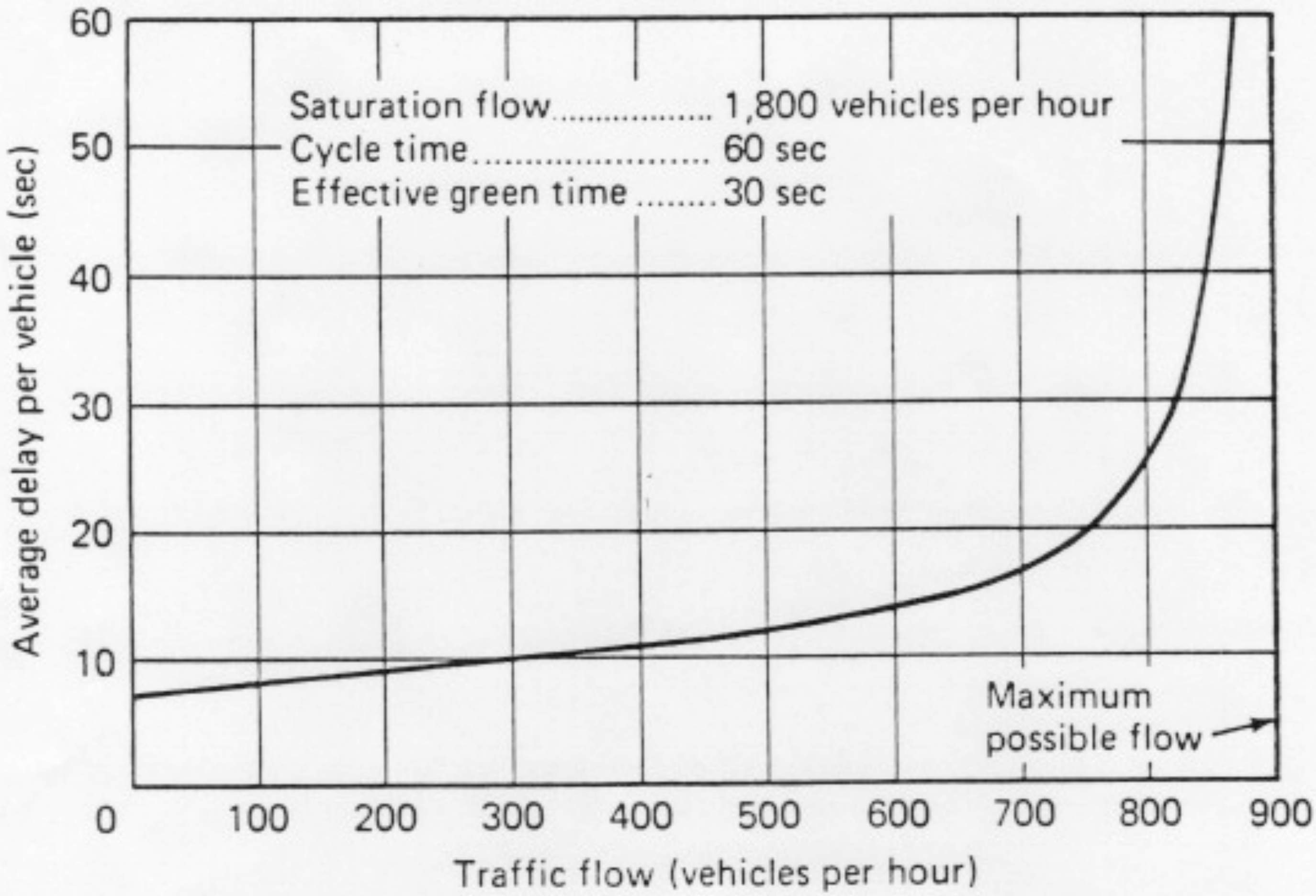


TRANSPORTATION AND TRAFFIC ENGINEERING HANDBOOK

Second Edition

INSTITUTE OF TRANSPORTATION ENGINEERS

2. VMT AND SITE IMPACT ASSESSMENT

A. OBJECTIVES OF IMPACT ASSESSMENT

1. Assure essential improvements (concurrency)

2. Obtain pro-rata contributions (cumulative needs)

3. Enforce site development standards (regulatory adequacy)

4. Influence site design (policy promotion)

B. LINKING THE LAND USE PLAN AND TRANSPORTATION PLAN

1. Assumption:
Land Use Plan is balanced with cumulative transportation improvement plan.

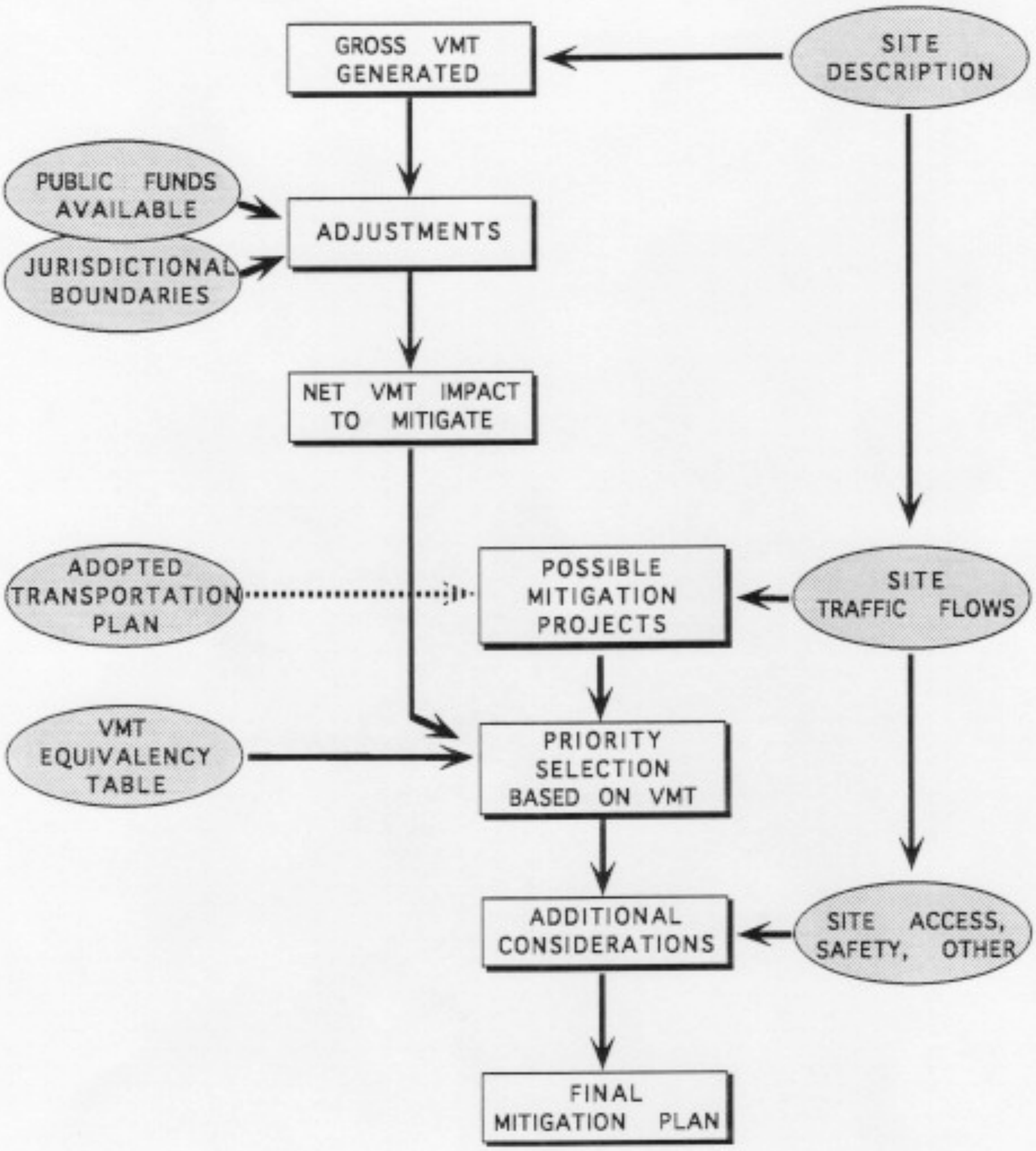
2. Principle:
As far as traffic issues are concerned, any development is consistent with land use plan if:
  (a) proportional traffic impacts are mitigated;
  (b) special impacts are mitigated.

3. Application:
  (a) Use VMT analysis to determine the amount of mitigation due
  (b) Use trip distribution to determine where best to apply that amount of mitigation toward implementing the transportation plan.
  (c) Use special analysis to determine concurrency requirements and any site-specific safety or minimum adequacy issues.
  (d) Arrange compensation to developer if disproportional mitigation is necessary for safety and concurrency.

C. TRIP GENERATION CALCULATIONS

- Residential Example
- Retail Example
- Non-Retail Example
- Mixed-Use Example

TRAFFIC IMPACT ANALYSIS BASED ON VMT



D. TRAFFIC DISTRIBUTION FORECAST

- With a Traffic Model
- Manual Method
- Regionally Coordinated Basis + Local Factors

E. MEASUREMENT OF VMT IMPACTS

- In-City Portion
- Intra-City Portion
- State Highways
- Neighbor Jurisdictions
- Credit for Demand Reduction Efforts

F. CALCULATION OF VMT MITIGATION REQUIREMENT

- Public Sector Share
- In-City Portion

G. SELECTION OF VMT MITIGATION PROJECTS

- Credit for Developer Contributions
- Transportation Plan Priorities
- Off-Site Impacts
- Adequacy Issues

H. VMT VALUE OF IMPROVEMENT PROJECTS

- Road Improvements
- Non-Motorized Improvements
- Transit/HOV Lanes
- Demand Management Programs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SITE TRIP DISTRIBUTION
MICHAEL BIRDSALL ASSOC., ISSAQUAH, WA

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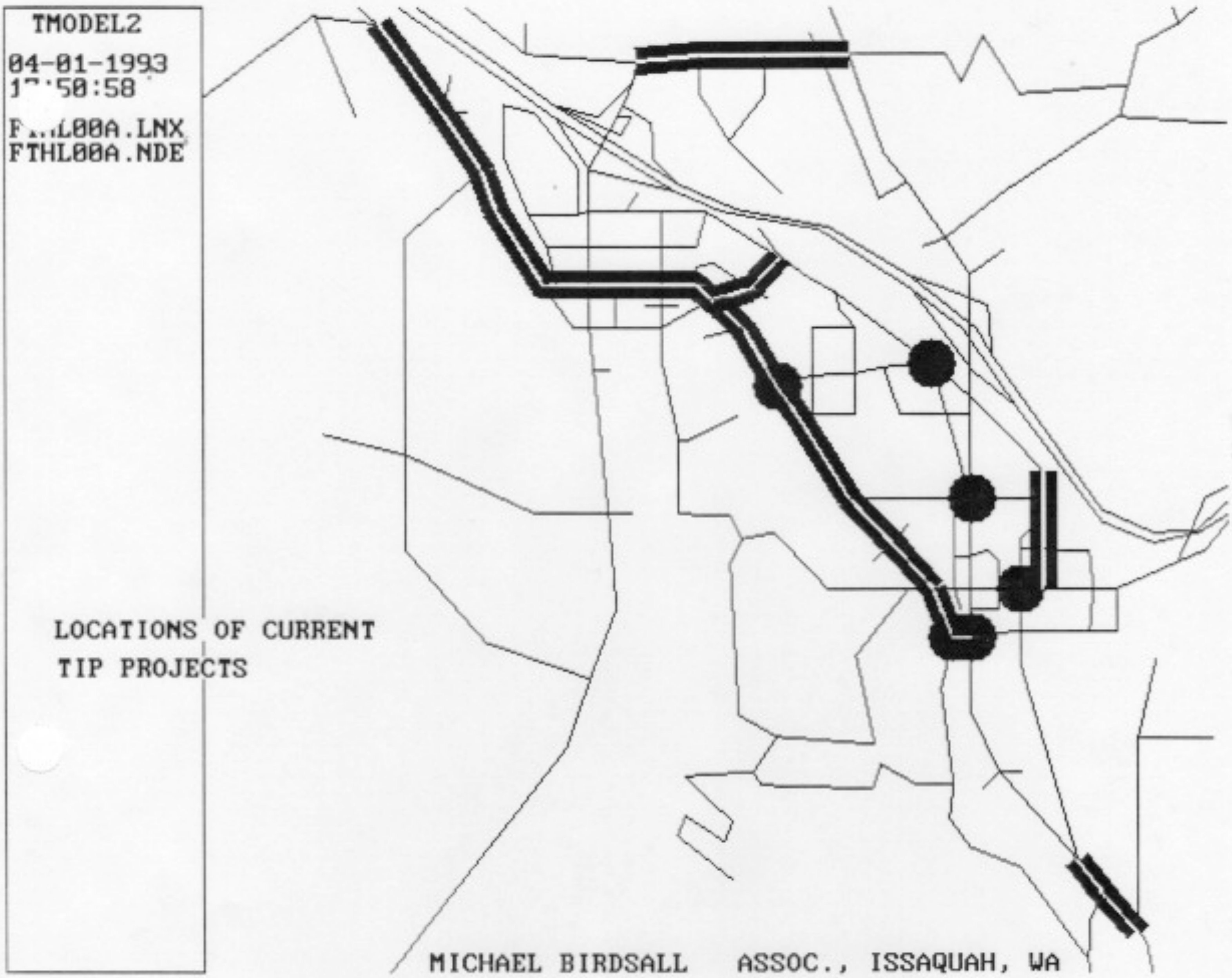
SITE-GENERATED
REGIONAL
TRIP DISTRIBUTION

MICHAEL BIRDSALL ASSOC., ISSAQUAH, WA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LOCATIONS OF CURRENT
TIP PROJECTS
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I. SPECIAL IMPACTS

- Vehicular Safety
- Non-Vehicular Mobility
- Other Critical Locations
- Site Access
- Site Design

J. DRAFT MITIGATION PLAN

- Right-of-Way Donations
- Frontage Improvements
- Off-Site Improvements
- Site Plan
- Demand Reduction Plan

K. IMPLEMENTATION

- Administrative Review
- Simplified Option for Small Developments
- Cash Fee Alternative
- Service Fees
- Disputes

OUTLINE OF VMT-BASED SITE ANALYSIS
(Example)

GROSS SITE IMPACT

Development Proposal:	**300**	Multi-family dwellings
Traffic Generation:	**180**	Peak Hour Trips
Average Trip Length:	**6.8**	Miles
Vehicle-Miles Generated per Peak Hour	**1,224**	VMT

ADJUSTMENTS TO VMT IMPACT

Public Funds available:	16%	Unfunded Needs	= **84%**
Impacts Beyond City Limit	54%	In-city Impact	= **46%**
Proportion of VMT to Mitigate:		84% x 46%	= **39%**
NET VMT TO MITIGATE:	**1,224 x 39% =**	**477**	VMT

POSSIBLE MITIGATION PROJECTS:	VMT BENEFIT	CITY'S SELECTION
1. Sidewalk, north side of 46th Street, Site to McPhee Blvd	**178**	●
2. Sidewalk, south side of 46th Street, Site to McPhee Blvd	**178**	●
3. Left Turn Pockets at 46th Street and McPhee Blvd	**144**	●
4. Signalize 46th Street & McPhee Blvd	**376**	
5. Prepaid transit passes for all tenants	**150**	
6. Widen 46th Street, from 2 lanes to 5 lanes	**627**	
7. Widen McPhee Blvd, from 2 lanes to 5 lanes	**1,475**	

ADDITIONAL CONSIDERATIONS

1. Site entrance design for eventual 5-lanes on 46th Street
2. Internal Road system design to city standards
3. Remove trees and earth for safe sight distance at site entrance

EXAMPLE OF SITE VMT ANALYSIS FROM TRAFFIC MODEL DATA

SITE VMT CALCULATION:		EXAMPLE CITY ONLY		
Road Class	Road Description	No. of Links	Road Miles	Site VMT
5	Ramps	4	1	4
4	Freeways	8	2	24
3	Major Arterials	114	8	363
2	Minor Arterials	47	4	26
1	Collectors	28	4	83
0	Local Streets	26	4	38
	Totals	227	23	538

SITE VMT CALCULATION:		ALL ROADS REGIONWIDE		
Road Class	Road Description	No. of Links	Road Miles	Site VMT
5	Ramps	20	4	22
4	Freeways	73	96	579
3	Major Arterials	161	89	564
2	Minor Arterials	54	14	39
1	Collectors	28	4	83
0	Local Streets	26	4	38
	Totals	362	211	1,325

SITE VMT SUMMARY BY JURISDICTION:			
Jurisdiction	No. of Links	Road Miles	Site VMT
EXAMPLE CITY	227	23	538
NEARBY COUNTY	32	61	143
FARAWAY CITY	9	23	54
WSDOT-Freeways	81	97	573
WSDOT-Arterials	13	7	17
Totals	362	211	1,325

3. VMT AND PLANNING FOR GROWTH MANAGEMENT

A. DEFINITION OF "SYSTEM"

- Freeways
- Arterials
- Collectors
- Local Streets
- Other Modes

B. SYSTEM INVENTORY

- By Lane-miles
- Volumes
- Pedestrian Features
- Transit/HOV Features
- Controls at Intersections

C. ADEQUACY STANDARDS

- Inventory Deficiencies
- Alternative Approaches to Defining Adequacy

D. GROWTH PROJECTIONS

- Traffic Models
- Summarize VMT by Subsystems

3. VMT AND PLANNING FOR GROWTH MANAGEMENT (Continued)

E. ADEQUACY ASSESSMENTS

- Areawide Adequacy Standards
- Subsystem VMT vs. Standards

F. VMT VALUE OF PROJECTS

- Before/After Capacity of Segment
- Segment Length
- Capacity Gain x Length = VMT Value

G. ALTERNATIVE MODES

- Affect on Demand
- Affect on Capacity

H. DEMAND MANAGEMENT

- Trips Removed x Length = VMT Benefit

ANALYSIS OF SYSTEM ADEQUACY

MAJOR ARTERIALS SUBSYSTEM

Example City, Washington

STREET	SEGMENT	LENGTH (miles)	LANES	INT'N CONTROL	PED. WIDTH	PLAN CAPACITY	EXIST'G VOLUME	EXIST'G PLAN V/C	EXIST'G VMT	VMT CAPACITY
Brown Ave	NE 1st - SE33rd	2.13	5	Signal	S/W	2760	2460	0.89	5240	5879
Brown Ave	NE 45th - NE 1st	2.75	3	Signal	S/W	1560	1050	0.67	2888	4290
Brown Ave	SE33rd - SE60th	1.69	2	Signal	S/W	1200	1190	0.99	2011	2028
Main St.	W. Smith - W. 3rd	3.00	2	Signal	4'	300	820	2.73	2460	900
Main St.	W. 3rd - Brown	0.44	4	Signal	S/W	2400	1850	0.77	814	1056
Main St.	Brown - E. 28th	1.50	3	Signal	6'	600	650	1.08	975	900
Subtotals, Major Arterials		11.51							14387	15053

SUMMARY ANALYSIS:

Percentage above Adequacy Threshold	Threshold Measure V/C = 1.00	V/C = 1.10
Based on Route Miles	0.39	0.26
Based on Lane Miles	0.32	0.21
Based on VMT	0.24	0.17

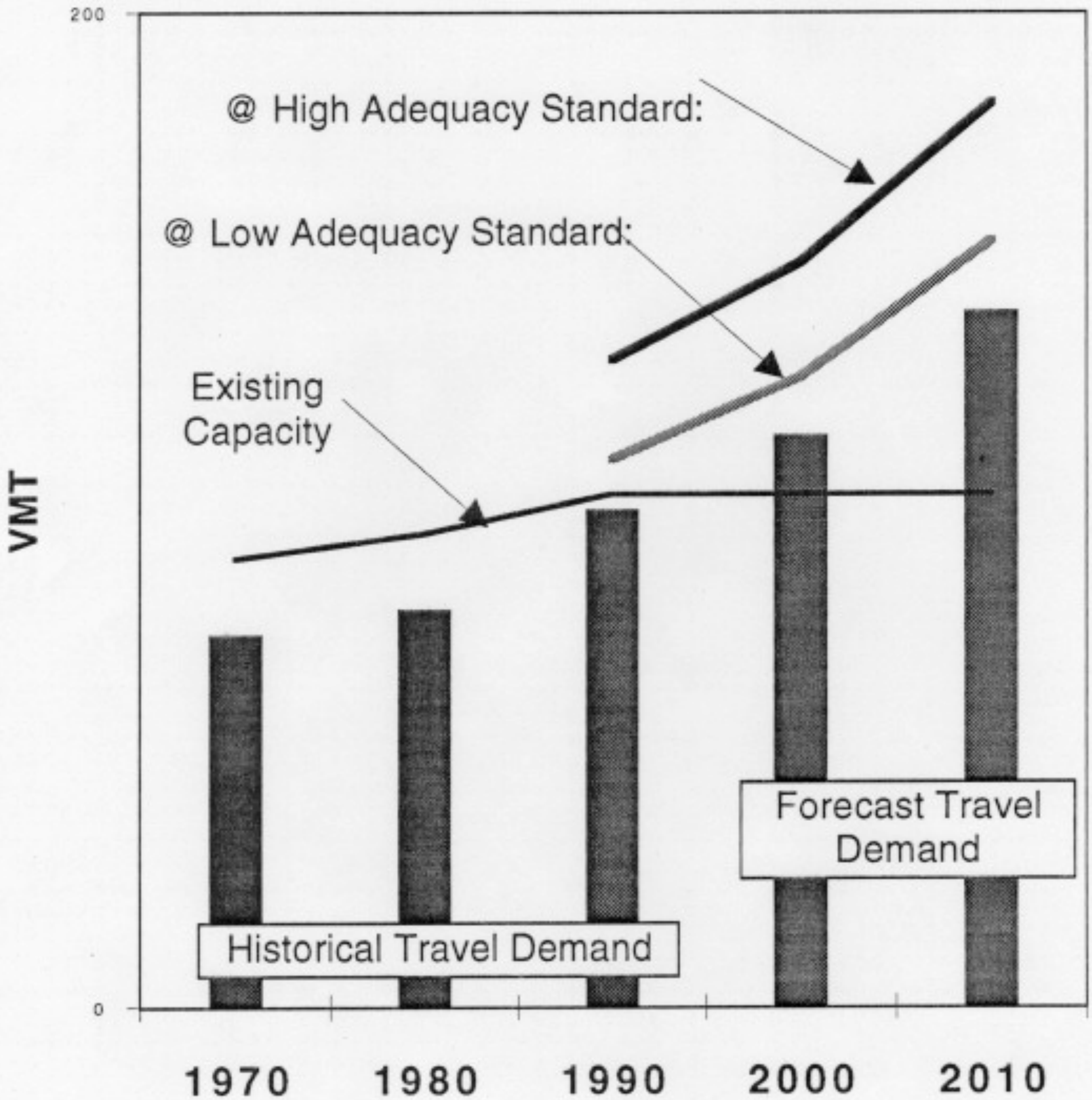
VMT-Weighted Average V/C =	0.96

SUMMARY OF EXISTING ROAD SYSTEM USE
EXAMPLE CITY, WASHINGTON

PERCENT OF VEHICLE-MILES OF TRAVEL
BY LOAD FACTORS (V/C)

Road Class	V/C <80%	V/C 80%- 90%	V/C 90%-100%	V/C >100%
Major Arterial	45%	36%	14%	5%
Minor Arterial	67%	29%	4%	0%
Residential Collector	86%	14%	0%	0%
Other Collector	77%	23%	0%	0%

CAPACITY NEEDED



(Alternative Form#1)

ROAD ADEQUACY STANDARDS
for
GROWTH MANAGEMENT

SUBSYSTEM	**ALLOWABLE PERCENTAGE OF SUBSYSTEM VMT ON LINKS IN EXCESS OF PLAN CAPACITY**		
	NON-CBD	CBD	HI-TRANSIT CORRIDOR
Major Arterials	0%	10%	20%
Minor Arterials	0%	10%	20%
Collector, Non-Residential	30%	30%	
Residential	30%	30%	
Local, Non-Residential	100%	100%	
Local, Residential	100%	100%	

Actual percentages may vary base on local priorities and fiscal resources.

(Alternative Form#2)

ROAD ADEQUACY STANDARDS
for
GROWTH MANAGEMENT

SUBSYSTEM	ALLOWABLE AVERAGE V/C VMT-Weighted x Plan Capacity		
	NON-CBD	CBD	HI-TRANSIT CORRIDOR
Major Arterials	1.0	1.2	1.2
Minor Arterials	1.0	1.2	1.2
Non-Res'l Collector	1.2	1.5	N/A
Res'l Collector	1.2	1.5	N/A
Non-Res'l Local	1.5	2.0	N/A
Res'l Local	1.5	2.0	N/A

ADEQUACY MEASURES
for
MULTI-MODAL L-O-S

1. Add Transit Ridership to Plan Capacity:

Arterial Capacity	= 3,000	
Volume/Hour	= 2,900	v/c = 0.97
Transit Riders/Hour	= 600	
Adjusted Capacity	= 3,600	v/c = 0.81

2. Add Transit Riders to Volume; Add Transit Seat-Supply to Capacity:

Arterial Capacity	= 3,000	
Volume/Hour	= 2,900	v/c = 0.97
Transit Riders/Hour	= 600	
Transit Seats/Hour	= 1,500	
Adjusted Volume	= 3,500	
Adjusted Capacity	= 4,500	v/c = 0.78

3. Same as Above Using x% of Reserve Transit Capacity (less than 100%):

4. Change Road Adequacy Threshold Based on Transit Availability:

No Transit Service:	Allowable	v/c =	1.0
Low Transit Frequency	"	"	1.1
High Transit Frequency	"	"	1.3

PUBLIC TRANSIT STANDARDS

CRITERION	STANDARD
ACCESS TO TRANSIT	Of all locations within 1/4 mile of a fixed transit route or other transit facility, 90% of the dwelling units and 90% of the employment at those locations should be connected to a transit stop by continuous, adequate pedestrian facilities. Continous means there is no break or discontinuity of pedestrian facilities. Adequate pedestrian facilities are defined in the Traffic Volume Standard, meaning sidewalks, paths, or shoulders of certain size in relation to the volume of traffic.
AVAILABILITY OF TRANSIT	Public transit service is available to 50% or more of the City's dwelling units and 50% or more of the City's employment, by any combination of fixed route and demand-responsive service. Qualifying transit service must meet or exceed these minimums: 1. Duration - at least twelve hours per weekday and eight hours on Saturdays. 2. Fixed Routes - hourly frequency; within 1/4 mile of counted dwellings and jobs. 3. Demand Responsive - arrive within two hours of telephone call; curbside service.

The Transit Access Standard is within the City's control, and focuses simply on pedestrian accessibility to bus stops.

The Transit Availability Standard is not directly within the City's control, but establishes a direction to be achieved by the regional transit authority. The City can stimulate efforts to achieve this goal by various means.

Developers may choose to support either or both standards as mitigation efforts.

EXAMPLE CITY, WASHINGTON
ORDINANCE NO. _____

AN ORDINANCE PROVIDING FOR
MITIGATION OF TRAFFIC IMPACTS DUE TO DEVELOPMENT

WHEREAS, existing and foreseeable public sector resources are inadequate to improve the transportation system of the City concurrently with the impacts of foreseeable growth; and

WHEREAS, the City desires to mitigate the transportation impacts of growth in a manner which is fair and equitable to all developers and guided by the City's Comprehensive Plan; and

WHEREAS, the City desires to plan for growth within the City in a manner which is adequate for the long-range future, and consistent and cooperative with the plans and policies of the surrounding region to the extent required by state laws, and to document its plans in the Transportation Element of the Comprehensive Plan; and

WHEREAS, the State Environmental Protection Act (SEPA) authorizes the City to evaluate the impacts of development and to determine mitigation requirements as a condition of its approval of development; and

WHEREAS, the City is authorized to establish and operate a traffic impact mitigation system under the State Local Transportation Act of 1988 and under the Growth Management Act (GMA) of 1990;

NOW THEREFORE, THE CITY COUNCIL OF THE EXAMPLE CITY, WASHINGTON, DOES ORDAIN AS FOLLOWS:

Sample text available from
Michael Birdsall

WHAT OTHERS HAVE SAID

Roadway Levels of Service in an Era of Growth Management

REID EWING

The tendency in growth management is to focus on roadway level-of-service standards. However, the methods used to determine roadway levels of service may affect conclusions about road adequacy as much as do the standards to which they are compared. The specific method used to analyze roadway levels-of-service can make at least a two-letter grade difference in the outcome; so can the choice of analysis period or peak hour. Although harder to quantify, the effect of averaging levels-of-service across facilities could be of comparable magnitude. In determining roadway levels of service, most Florida jurisdictions go by the book. They analyze the 30 highest hourly volumes roadway by roadway, using methodology from the 1985 *Highway Capacity Manual*. A few jurisdictions have opted for innovative but unconventional approaches. Although it is tempting to reject these approaches as "not professionally accepted," the "book" was written for applications other than areawide growth management. This relatively new area of application requires fresh thinking. In the context of growth management, the use of the following is recommended: (a) simple regression models to estimate average travel speeds and, from them, arterial levels of service; (b) average levels of service to determine adequacy of facilities within travel corridors; and (c) the 100th rather than the 30th highest hourly traffic volumes as the basis for roadway level-of-service determinations.

PLANNING PRACTICE

LOS Leaders

New level-of-service standards allow a little more congestion in return for a lot more transit.

By Joseph P. Savage, Jr.

Traffic congestion is a sure sign of growth—and a source of irritation to a great many people. As a result, growth management laws in Washington, Florida, California, and elsewhere now require local governments to prohibit new development until "adequate" transportation infrastructure is in place.

The standard used to judge adequacy is the "level of service" provided—LOS. Traditionally, LOS standards have been set by traffic engineers using complex models of traffic flow. But the engineers focus on the needs of single-occupant vehicles. For the most part, they have paid little attention to other transportation options—rail and bus transit, ride sharing, cycling, or walking. Today, more and more communities are seeking to build such options into their LOS standards.

The basics

Unlike more objective standards for residential development—for parks or potable water, for instance—transportation service standards have always varied greatly from community to community. That makes setting LOS standards a highly subjective procedure that depends in part on drivers' perceptions.

The Transportation Research Board's 1985 *Highway Capacity Manual* (the traffic engineer's bible) notes that drivers' perceptions of traffic flow are an important part of LOS measures. What is considered a "good" LOS on freeways in Los Angeles, Chicago, or Boston may be considered intolerable in Seattle, Houston, or Atlanta.

Even in an urban area, drivers who accept stop-and-go traffic on downtown streets become irate when they can't maintain a steady 35 miles an hour on suburban arterials. Crafting measures to reflect these differences is more art than science. But the results are often underpinned by complex mathematical theories and computer data that give the impression of exactness where none exists.

Service levels are based on average travel speeds or delays and are given letter grades like a school report card. LOS A, which is the best, means that motorists can travel at or near the speed limit, and encounter only occasional short delays at traffic signals. LOS F, the most congested condition, implies a stop-and-go situation. Travel times on major arterials may range from two minutes per mile (30 to 35 miles per hour) at LOS A to more than eight minutes per mile (7 miles per hour) at LOS E or F.

Our firm recently conducted a nationwide survey of five states and 25 cities and counties and found that all of them based their LOS standards on the 1985 *Highway Capacity Manual* or its equivalent. This auto-oriented approach can run counter to transit and ride-sharing goals by insisting on too much capacity in certain areas. Thus, most communities have standards that allow greater congestion downtown or on principal arterials than in rural areas or on collector arterials.

For instance, Bellevue, Seattle's major "edge city," reported that it allows an LOS E standard in its central business district but requires LOS D elsewhere. Kitsap County—west of Seattle—said it recently proposed a three-tiered service standard: LOS B in rural areas, LOS D in suburban areas, and LOS E in central business districts and commercial activity centers.

Some locales did report that they allow greater congestion in areas with high levels of transit service or special high-occupancy vehicle or transit facilities. Montgomery County, Maryland, and the Florida Department of Transportation both relax their roadway standards in areas with pedestrian or bike paths, or transit stations, and high-occupancy vehicle lanes. Dade County in South Florida allows roads to handle up to 150 percent of their calculated vehicle capacity in corridors served by a rail line or express buses.

Wider lens

Most jurisdictions use LOS standards to review impacts on a particular facility or intersection. From a growth management perspective, however, it's better to take in a broader area.

One way to do that is by "summing," adding up the traffic volumes and capacities in one area or along major corridors. In Lee County, on Florida's west coast, planners use this approach to determine surplus capacity within the entire county. Pierce County, Washington, a rapidly urbanizing county south of Seattle, applies it to major travel corridors. The advantage of the technique is that it can be applied to a multimodal transportation corridor (using a person-carrying rather than a vehicle-carrying measure of supply and demand). The problem is that planners using this technique may overstate available road capacity.

Other jurisdictions designate performance levels for a particular area, specifying the percentage of roads within the area that must be at or above a particular LOS.

A third approach may be the best, suggests Reid Ewing, senior research associate at the University of South Florida's Center for Urban Transportation Research. He recommends averaging travel speeds on a single arterial or in several locations and then setting an average service level. Snohomish County, Washington, north of Seattle, uses this approach to compute the LOS on each of its freeway and arterial segments. Brevard County, Florida, around Melbourne, does the same for parallel arterials. Montgomery County, Maryland, part of the Washington suburban area, does it for the county.

The advantage to this approach, Ewing notes, is that it gives greater weight to the most congested intersections or arterials. It also better reflects the congestion typically faced by motorists as they move through a corridor. The drawback is that it is not easily applicable to multimodal situations because there are no agreed-upon relationships between roadway and transit LOS measures.

What's new

Montgomery County is a leader in its attempt to use LOS to achieve a jobs-housing balance by linking building permits to service levels. The county is divided into 17 policy areas; within each, the LOS is determined by such factors as the availability of transit, high-occupancy vehicle lanes, and pedestrian and bicycle paths. In recent years, this system has led to development moratoriums in several of the policy areas. There have also been

PLANNING PRACTICE

The Firm Behind the Facts

In conducting a nationwide survey of LOS standards, Joe Savage got two surprises. First, nearly all 27 agencies that his firm contacted had the same problems. Second, nearly all of them were relying on the 1985 *Highway Capacity Manual* for solutions. His conclusion: Regardless of geographic location, transportation experts were seeking technical answers but failing to take "the big picture"—land use—into account.

"I had hoped that cutting-edge places like Florida and California were doing things differently," he says. "But everyone had the same problems, and no one had the 'right' answers.

"I was also surprised by the reliance on the manual to determine level-of-service standards because it uses extremely technical and complicated mathematical formulas that depend on minute measurements that are impossible to forecast 20 years into the future. Many jurisdictions," he adds, "are basing long-range decisions on short-term factors like signal timing."

Savage's firm, KJS Associates, Inc., conducted its survey in December 1991 and January 1992 by telephoning city, county, and state agencies in five states. "The aim was not to collect a scientific sample but to gather information on LOS innovations," he says.

The survey was done on behalf of Pierce County, Washington, which, along with 25 other counties in the state, faces a July deadline for creating a countywide concurrency management plan (including LOS standards). Unlike Florida, Washington does not provide guidelines to help agencies comply with the state's growth management laws. They must create their own standards—often with the help of firms like Savage's. KJS has contracts with Pierce and Kitsap counties and with the marine division of the Washington Department of Transportation—the state ferry system.

Partly because the growth laws have generated work for planners, KJS now gets 80 percent of its business from public agencies, Savage says. He and his wife, Karen Savage, his partner in the firm, have increased their staff from eight to 27 in the last six years. One KJS project now in the works is a transit plan for the northern leg of a proposed light rail system that would link the Puget Sound cities of Everett, Seattle, Tacoma, Bellevue, and Redmond. Savage says a policy group representing all the local jurisdictions will decide next month just what type of system to try to sell to the voters in the region.

Sylvia Lewis, Planning

complaints that it has increased the amount of time required for the development approval process. On the whole, however, the system has proved to be a good tool for managing growth.

Miami's innovation is the notion of "practical capacity," defined as a corridor's people-carrying capacity. That means that the city takes all modes of transportation into account in considering adequacy. Local transportation planners base their calculations on two assumptions: that each car will carry an average of 1.6 individuals (instead of the traditional figure of 1.2 per vehicle), and that a certain amount of transit service will be available. They then compare the number of people using or expected to use a particular corridor with its practical capacity, allowing new development to proceed if practical capacity exceeds projected volume.

Orlando gives us yet another new idea—a district-level report card. The downtown area, with its dense development and traditional street pattern, has been divided into three districts for concurrency management. Within each district, developments are approved as long as 85 percent of the lane-miles in the district meet the city's LOS standard. This approach promotes infill, redevelopment, and transit use in the city center, even though some individual streets may be highly congested.

In the Northwest

Washington State's 1990 Growth Management Act has spurred much discussion of LOS standards—and how to improve them. Pierce County considered an areawide method of determining LOS but found that most models were too complex to be readily understood by elected officials and too cumbersome to be applied to individual developments without costly computer programs.

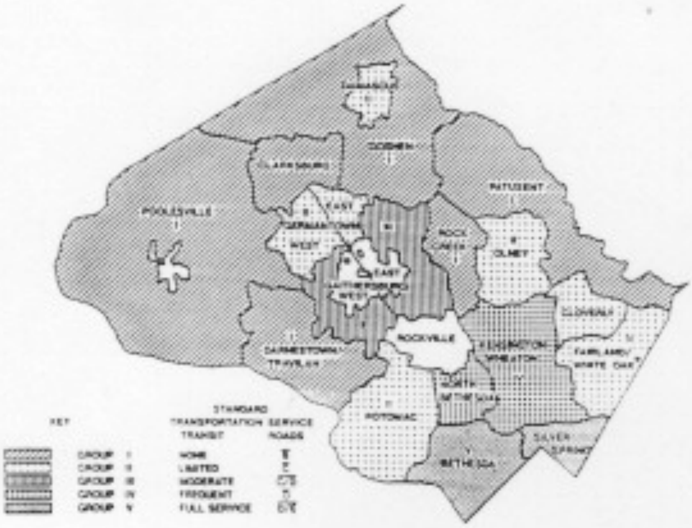
Stevan Gorcester, the transportation manager for the public works department, says his department has recommended an alternative: basing service levels on the sum total of volumes and capacities along 30 screenlines throughout the county. (A screenline is an imaginary line that cuts across a corridor's parallel routes.) That would allow planners readily to identify the countywide impacts of new development and to summarize the cumulative effects of growth by means of traditional transportation models.

Pierce County plans to publish an annual report with baseline traffic volumes and capacities for each of the screenlines. The report will include short-range forecasts of traffic growth and identify planned improvements along each screenline.

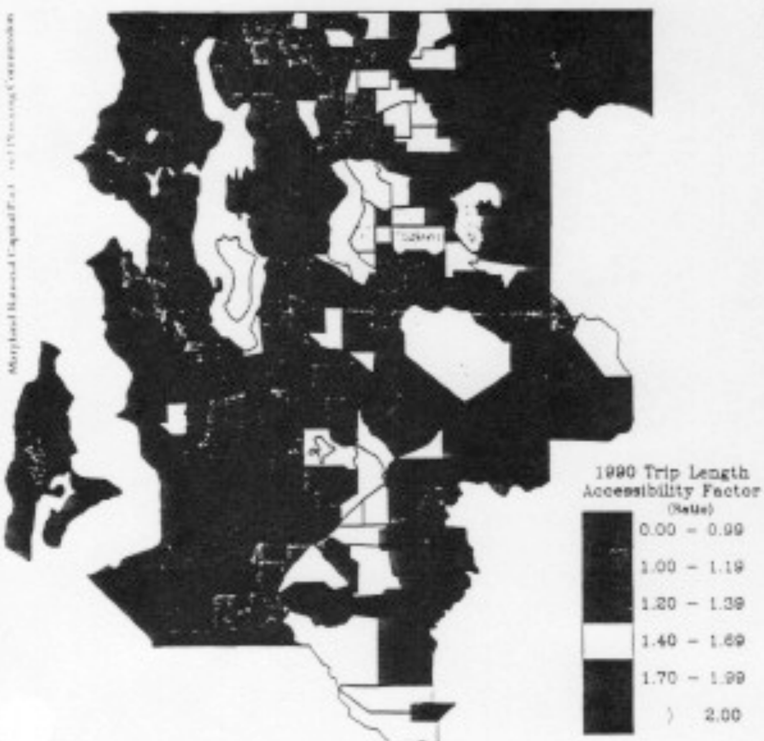
King County, which includes Seattle and its suburbs, is noteworthy for its attempts to forge a strong link between transportation and land use. "Our transportation planners have worked on many community comprehensive plans in recent years, and we bring a strong land-use perspective to LOS issues," says Donald Ding, an assistant transportation planning manager who is leading the county's LOS efforts.

The basic tool in this case is the "transportation adequacy measure," which has been computed for each of the county's 475 districts. The TAM offers a rule of thumb—a weighted average of volume-to-capacity ratio for all trips to and

PLANNING PRACTICE



Montgomery County, Maryland (above), takes road capacity and transit service into account when classifying county subareas by levels of service. King County, Washington (below), compares trip length for each district to a regional average; the goal is to allow for greater congestion in certain areas.



from a district. It also allows adjustments for the relative average length of trips and the expected increases in transit use resulting from added transit service or new ride-sharing measures.

The adjustment factors allow for greater congestion in those districts that are most centrally located (those with the lowest relative average trip length) or those expected to have the greatest shifts from single-occupant vehicles to transit and ride sharing. The TAM indicates whether there is enough capacity to accommodate future travel demand generated by expected development in a given district.

Snohomish County has devised a matrix of 37 LOS standards related to land use, road classification, and projected average vehicle occupancy within a particular transportation service area (TSA). Service levels in the matrix range from C to F. Recently, the county added two new levels, F1 and F2, to apply to cases where congestion lasts longer than the one-hour peak indicated by LOS F.

TSAs that achieve their projected average vehicle occupancy through transit use and ride sharing are granted lower LOS standards—at least for mixed-traffic lanes. The county uses a volume-weighted average volume-to-capacity ratio to compute the LOS on each of its freeway and arterial segments.

Pitfalls

Ironically, strict LOS standards may actually encourage sprawl rather than prevent it. In parts of Florida, strict standards have pushed development from densely populated areas to less developed parts of the state. Broward County's uniform LOS D resulted in deferrals of plat approvals in urban and suburban areas, while allowing development to proceed in outlying rural areas. Consistency of standards throughout a state or metropolitan area is essential to avoid "jurisdiction shopping" among developers.

Complexity is another bugaboo. A sophisticated LOS system means considerable expense, particularly in areas with growth management and concurrency requirements. Montgomery County, Maryland, for example, has spent nearly two decades refining its system, but not every jurisdiction has the money or expertise to take on such a complex task.

Another danger is that, in stressing LOS in growth management ordinances, communities may be overlooking another way of reducing traffic: changing land-use patterns to reduce the need for travel. In my opinion, it is a mistake to look to conventional technology for solutions to traffic problems. We must begin to apply what we know about how land uses affect transportation and vice versa.

Finally, failure to involve developers or to address equity issues in setting LOS standards can lead to lawsuits and delays in implementing growth management practices. "Our LOS standards were produced in cooperation with the development community," notes Tanya Goff, strategic planning and research coordinator with the city of Orlando. "We urge other communities to forge a public-private partnership in implementing their own standards, and to be flexible in dealing with the competing goals of affordable housing, economic growth, environmental quality, and transportation."

Joseph Savage is the vice-president of KJS Associates, Inc., a transportation consulting firm in Bellevue, Washington.

Transportation Planning, Level of Service Analysis in the 1990's

by Claudia Scrivanich, CH2M Hill, Bellevue, WA

The 1990's is becoming a decade of transition and professional challenge for transportation planning and traffic engineering. Traditional methods of project prioritization and congestion analysis are being questioned: can they lead to cost-effective decision making that evaluates not only congestion but air quality and environmental factors, land use plans, and even quality of life?

As levels of service (LOS) fall increasingly below E for several hours each day in our urban areas, many other factors than LOS are involved in evaluating project priority. Under these conditions, project prioritization should occur based on the most cost-effective solution, considering mobility, multi-modal alternatives, social, environmental, and economic factors.

Transportation decision making has begun to focus on mobility and direct comparisons of multi-modal alternatives. This focus is reinforced by the Intermodal Surface Transportation Efficiency Act (ISTEA). The purpose of the act is:

> "... to develop a National Intermodal Transportation System that is economically efficient, environmentally sound, provides the foundation for the Nation to compete in the global economy, and will move people and goods in an energy efficient manner."

Within the Act, state and local governments are given more flexibility in determining transportation solutions, whether transit or highways. Examples of changes under the new act are:

> Transit capital improvements are eligible under the Surface Transportation Program (STP). Also, transit projects (and non-NHS highway projects) are eligible for NHS funds, under certain conditions, in the corridor of fully access-controlled NHS routes.
>
> The Federal share of Interchange Construction (IC funds) is 90 percent, except that for projects adding new capacity other than high-occupancy lanes the federal share is 80 percent.
>
> Participation in wetland mitigation efforts is an eligible use of NHS and STP funds.
>
> Start up costs for traffic management and control is eligible for both NHS and STP funds.
>
> Improvements necessary to accommodate other transportation modes are eligible uses of both NHS and STP funds.

The Clean Air Act Amendments (CAAA) are now linked closely with transportation planning. The Metropolitan Planning Organization's (MPO) transportation plan must be in conformance with the State Implementation Plan (SIP) prepared by the local air quality control agency. Eligible projects for funding must come from a transportation plan that is in conformance with the SIP and air quality goals. Previously, projects were only required to show conformance on a project-by-project basis.

Within the ISTEA provisions, the MPO is responsible for developing, in cooperation with the State and affected transit operators, a long-range transportation plan and a Transportation Improvement Program (TIP) for the region. The TIP must be consistent with the transportation plan and must include all projects in the metropolitan area that are proposed for funding with either Title 23 or Federal Transit Act monies.

The new ISTEA funding framework, CAAA regulations, environmental constraints, and public policy will require a multi-modal transportation planning approach at the regional, corridor and project level. Multi-modal planning will require us to evaluate a mobility index rather than a congestion index. Comparing the effectiveness of modes is a lot like comparing apples and oranges within the traditional transportation planning framework. From a technical standpoint, an analysis leading to multi-modal project prioritization will be difficult for traffic engineers and transportation planning professionals.

As a technical society of transportation professionals, we should focus our efforts in the 1990's on developing a measurement of mobility. This would include technical guidelines regarding data collection, reporting, calculation procedures, and application to a cost-effective evaluation of multiple modes.

The changes and challenges of this new direction will require increased regional planning and cooperation. Jurisdictional traffic congestion problems will require a regional approach and cooperation to secure funding. We, as professionals, should initiate and showcase programs and projects that are an example of interagency cooperation.

There is a role for our Institute to lead the way in developing a mobility index and to conduct multi-modal, multi-jurisdictional project planning. This could be through an evaluation of the institutional structure from the traffic engineer's point of view, adoption of mobility standards, and/or recommendations of LOS standards that vary by agency and facility and that address regional transportation goals. ■

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THE SERVICE LEVEL ORDINANCE AS A GROWTH MANAGEMENT TOOL

Gerard Walters and John B. Peers
Principals, Fehr & Peers Associates, Inc., Lafayette, CA

(This article was written in September 1988 and does not reflect the results of the November election nor other developments since that date.)

INTRODUCTION

California's growth-control movement has become a vehicle of enormous latent power, uncertain of its agenda but hellbent on ending the insult of traffic and other growth-caused inconveniences.
—*San Francisco Examiner, May 22, 1988*

In 1986 and 1987 alone, California growth control advocates generated over 60 local voter initiatives and other measures designed to limit development. About 75% of these passed. One increasingly common type of growth control measure is the traffic Service Level Ordinance (SLO). Such ordinances are intended to transform the public's desire for freedom from traffic congestion into enforceable growth management policies. Typically, they state that development will be approved only if it will not cause any street or intersection to operate at worse than a certain "acceptable" level of service.

California's experience with SLO's has been varied and generally negative. However, SLO measures can be useful under certain circumstances and for certain purposes. This paper reviews several representative cases. It discusses the effectiveness of the SLO as a means of protecting a community's desire for reasonable levels of traffic service. It considers the advantages of setting specific standards versus more flexible guidelines. It also presents alternatives to the SLO as means of incorporating traffic service goals in a community's planning policies.

WHAT IS AN SLO?

Service Level Ordinances have the following three characteristics.

1. Consequence of Public Pressure

They are the direct result of public outcry over the amount of development taking place and the resulting traffic conditions. In California, pressure is brought to bear either through the voter initiative process or through the election of a no-growth city council. In some cases, the threat of traffic initiative or development moratorium results in council adoption of an SLO.

2. Strict Performance Criteria

An SLO requires that a fixed traffic level of service be met on all of the community's streets. Such ordinances are usually quite specific in terms of the performance measures and on the type of analysis method which must be used. They require that volume/capacity ratios and vehicle delays be estimated with high levels of precision even in long-range planning scenarios. SLO's are often adopted in communities where one or more intersections are already at unacceptable levels of service or will become so following already-approved development, and can therefore be viewed as no-growth ordinances.

3. Responsibility on Developer

SLO's place the responsibility for identifying and paying for needed mitigation measures on the individual land developers. Development projects can be denied under an SLO if they impact locations where service levels cannot be made acceptable.

THREE EXAMPLES

The three cases described below give examples of SLO's that are currently in effect in California.

Example 1: Newport Beach

Newport Beach is an affluent Southern California community of almost 70,000 people, which has experienced considerable residential and commercial growth in the past 15 years. In 1978 under pressure from community groups, the city council adopted a Traffic Phasing Ordinance. The measure states that no development will be permitted that will cause or make significantly worse an unacceptable level of service on one of the city's major streets. The maximum acceptable level of service is defined as LOS D or intersection capacity utilization greater than 90%. A significant impact is defined as an increase in peak hour traffic on any intersection approach of 1% or more. Exemptions are granted for projects that offer overriding public benefit, including trip generation reductions.

The ordinance applies to commercial or industrial projects larger than 10,000 square feet or which generate more than 130 ADT (average daily traffic), and residential projects of more than 10 dwelling units. Its implementation procedures allow the City Traffic Engineer to determine the scope of the traffic impact study and the trip generation rates to be used, but specifically define the time periods to be analyzed and the LOS calculation method. The procedures call for the evaluation of the project in the contest of cumulative development expected within five years.

Future traffic system improvements may be included in the analysis only if the improvement is included in the Circulation Element of the City's General Plan or has been approved by the City Council, and will be completed within one year of construction of the proposed development project. Even if a traffic improvement meets these criteria, it can be credited for only 70% of its expected capacity until post-installation counts confirm the expected value.

Between 1978 and 1985, over 70 projects were evalutated under the Newport Beach ordinance. In the opinion of city staff, the ordinance did not serve to inhibit development but to assure that traffic improvements were made in a timely manner. Application of the ordinance during that period resulted in improvements to 18 intersections costing over $3 million.

By the mid-eighties it had become apparent that the ordinance was unable to deal with situations where required street improvements were either not possible or were too expensive for the project which triggered the unacceptable service level. In 1984, a Fair Share Traffic Contribution Ordinance was adopted to provide funds to build out the circulation elements of the General Plan. In 1986, the Traffic Phasing Ordinance was amended to permit projects even if certain intersections would operate unacceptably as long as the project installed improvements sufficient to produce a net benefit to the circulation system as a whole, or it contributed its fair share of the costs of jointly funded major improvements.

The changes were not well received by certain citizens groups, however. They have placed an initiative on the November 1988 ballot that would re-instate the strict upper limit on the volume/capacity ratio and amount of delay tolerated in the city and would eliminate the concept of "net benefit to the system."

Example 2: Walnut Creek

Walnut Creek is a rapidly developing satellite city in the San Francisco Bay Area. Its population and employment have both grown by 2% to 3% a year from 1980 to 1985. Presently, its population exceds 60,000 and its employment exceeds 40,000. Its central area streets have been severely impacted by a combination of downtown office development, residential development in the city itself and in adjacent communities whose access involves travel through Walnut Creek, and congestion on the freeway that runs adjacent to the downtown area.

In 1985 the citizens of Walnut Creek passed Measure H, a traffic control initiative. The measure prohibits the construction of any commercial buildings greater than 10,000 square feet and any residential projects greater than 30 units unless all of the city's principal street intersectons can be guaranteed to operate at service level D (volume/capacity 0.85) or better. Because a number of intersections already exceeded this level and there was no means to mitigate these conditions within the city's short-range or mid-range circulation plans, the measure constituted a long-term development moratorium.

Measure H was challenged legally, and in February 1987 it was declared invalid by the Superior Court of the State of California. The basis for the decision was that the measure was inconsistent with the city's General Plan. The city is appealing the ruling to the State Appellate Court, arguing that the measure should be considered a general plan amendment and an interim moratorium that does not contradict any of the general plan's provisions.

During the appeal process, the city has enacted an interim development moratorium on all projects other than those exempted under Measure H. At the same time, it is updating its general plan to bring it into agreement with the intent of the measure.

The preliminary finding of the traffic circulation study for the general plan update is that it may be infeasible for the city to meet the intent of Measure H under H's current land use plan if growth in surrounding communities continues to add traffic to Walnut Creek streets. These findings suggest that to comply with the Measure H Service Level Ordinance, the city must revise its general plan to limit medium and large-scale development projects for the forseeable future. In rewriting its general plan, the city is taking strong direction from Measure H, but may be willing to compromise in certain respects if other planning goals would be significantly threatened. For example, the Planning Commission is supporting the Measure H ceiling on commercial development but is proposing new parcel-specific allocation principles. and it has recommended raising the Measure H residential plan in order to meet the city's projected housing needs.

Example 3: Larkspur

Larkspur is a city of about 11,000 people located adjacent to U.S. Route 101, the only freeway corridor serving the northern suburbs of San Francisco. A significant amount of the traffic on Larkspur's only major arterial is through traffic generated in communities further from the freeway. Service levels on the arterial and on nearby sections of the freeway reached D and E in the mid- eighties, and through traffic began spilling over onto minor arterials, impacting Larkspur's residential areas and historic downtown.

In 1985, other communities along the freeway in southern Marin County began adopting growth moratoria, primarily out of frustration over increasing traffic congestion. One of the first was adopted by Larkspur's neighbor, Corte Madera, through a voter initiative. To avoid a similar ballot box moratorium, and to tailor a growth management process to match the community's desires, the city council of Larkspur passed a moratorium. One of the stated reasons for this moratorium was that Larkspur's principal arterials would soon reach levels of service E and F.

To address this condition of the moratorium, Larkspur adopted a Circulation Assessment Permit (CAP) Ordinance in June 1986. The CAP Ordinance was patterned after the Newport Beach ordinance, but is more conservative regarding exemptions, analysis techniques, and the types of traffic mitigations that can be considered. The Larkspur Ordinance exempts only individual single-family dwelling units, and commercial projects which are both smaller than 5000 square feet and generate less than 100 ADT.

The ordinance requires that level of service D or better be maintained on all principal street segments and intersections, taking into account the proposed project and five-year cumulative development. The analysis must include any location at which the proposed project generates either 100 ADT or a 1% traffic increase on any approach. These requirements have lead to extremely far- reaching traffic analyses even for relatively small projects. It has often been found that a needed traffic improvement would be more expensive than the project that "triggered" it could afford. Furthermore, some impacted locations could not be mitigated because improvements were physically impossible or politically unacceptable.

These problems led to the development of a Traffic Impact Fee Ordinance in early 1988, which requires developers to pay $2500 for each peak hour trip they are predicted to generate. The fees are intended to cover improvements to local streets, the reconstruction of the freeway interchanges serving the city and adjacent mainline freeway segments, and transit improvements in the 101 Corridor. The fee ordinance does not replace the city's Service Level Ordinance, however. Each development is still required to perform a cap analysis to demonstrate that its required mitigation measures are included in the list of improvements funded through the fee.

PROBLEMS WITH SLO's

Although SLO's are a reasonable political response to pressures to deal with growing traffic congestion, there are a number of problems associated with implementing and applying SLO's. Many of these are reflected in the experiences of Newport Beach, Walnut Creek, and Larkspur and in the steps that these communities have taken to improve their approach. Some of these problems are listed below.

- SLO ordinances do not allow for strategic planning, but result in reactive decision-making without realistic long-term goals.
- They do not set reasonable methods for funding needed transportation improvements.
- They lead to an inequitable evaluation of development proposals, penalizing larger projects and those located in congested areas.
- They place too much emphasis on individual traffic problem locations, without looking at the condition of the system as a whole.
- They take a parochial view of traffic congestion problems, looking only at problems within the local community and without evaluating the effects on neighboring communities or the freeway system.
- They do not allow for a cooperative approach to solving transportation problems; the development project which triggers an unacceptable condition is often wholly responsible for correcting it, without the support of other development or the community at large.
- They lock the community into making development decisions substantially based on a single evaluation criterion which does not necessarily benefit the community as a whole.

A BETTER APPROACH

Based on the experiences cited above, SLO's provide limited benefit as a means of dealing with traffic and growth management issues. They serve as quasi-moratoria, limiting development approvals to those cases in which lack of traffic impact can be clearly demonstrated. As such, they are best suited as temporary measures, or as measures to coordinate the timing of development approvals and transportation improvements. While these development restrictions are in effect, or preferably before the pressure for the SLO is generated, it is incumbent on the community to develop a comprehensive long-range planning process.

The permanent growth management process should center around a strategic transportation improvement program, which is thoughtfully plannned, flexible, well funded, and regularly updated. It should have the following features:

- Flexibility in identifying impacts, with emphasis on the serviceability of the transportation system as a whole rather than spot problems.
- An integrated transportation improvements program linked to the land use element of the General Plan and to expected development thresholds.
- Attention to freeway conditions and to the effects of through traffic from other communities.
- A financing plan.
- A regional approach to solutions and to funding.
- A phasing plan and growth monitoring process.
- Regular updates.

The plan should be flexible and realistic concerning its transportation goals and policies. It may not be reasonable to expect every intersection within a community to operate at a desirable level of service in peak hours. Given funding and political constraints affecting certain traffic improvements, it may be necessary to accept that certain locations will operate at "unacceptable" service levels, as long as parallel corridors operate at better than the acceptable levels. All motorists can be given the opportunity to travel at reasonable service levels by providing reasonable alternate routes where traditional favorites do not meet service level standards. The plan may protect "acceptable" average travel speeds for the city or street system as a whole, instead of placing too much emphasis on individual locations.

Developing the plan may require a cooperative effort of neighboring communities whose overlapping travel demands require a careful analysis of through as well as local traffic. One key element of the strategic plan is the location of high capacity transportation corridors. These corridors should have adequate rights- of-way set aside for major limited access arterials or expressways. Regional and sub-regional conditions should be evaluated to identify and solve freeway corridor problems as well, especially those which cause traffic spill-over onto local streets.

Funding the plan is also a complex issue. California law requires that there be a clearly defined connection (a "rational nexus") between the amount an individual is required to pay for infrastructure improvements and that individual's use of the specific facilities being financed. Therefore, developer funding may not be a solution to pre-existing traffic problems. To cover the public share, a number of counties in California have recently passed local sales tax increases for specific highway improvements. In addition, a variety of complex and comprehensive developer charges have been designed and accepted.

Compromise, community acceptance, and sensitivity to changing conditions over time are important elements of effective planning. The concept of a plan as a static final solution is antithetical to acceptance and compromise. The focus should therefore, be on "planning" rather than the "plan." This requires that planning and public works staff constantly monitor and update the plan. Continuous attention to the progress of growth and development under the plan will move staff and decision makers to a position of active rather than reactive planning.

Key elements of the process should be: (1) the ability to continuously monitor development and traffic growth within the community, (2) a phasing plan for implementing transportation improvements contingent on development thresholds; and (3) regular updates to the plan as a whole.

Transportation planners have now experienced more than 20 years of transportation plans. The one certainty we all have is that our forecasts of land development and travel, though the best estimate at the time, are not likely to be accurate throughout the life of the plan. We need, therefore, to build in the ability to re-orient the plan on a regular basis through continuing monitoring and updates. Without these elements, the planning process moves from a "virtuous" cycle of on-going refinements to a "vicious" cycle of repeated failures to anticipate problems. It is such failures which lead to poorly considered reactive measures such as Service Level Ordinances.