

Faculty of Engineering Department of Civil Engineering



Intersections

21-12-2023

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At-Grade Intersection

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GRADE SEPARATION

- High flows
- Minimal delays
- Expensive



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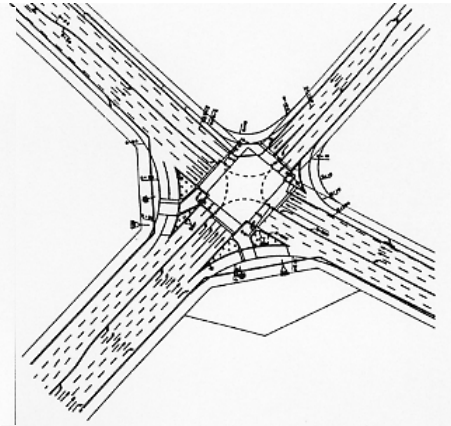
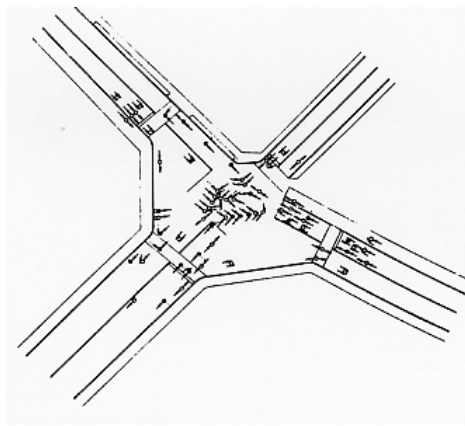


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BEFORE

AFTER

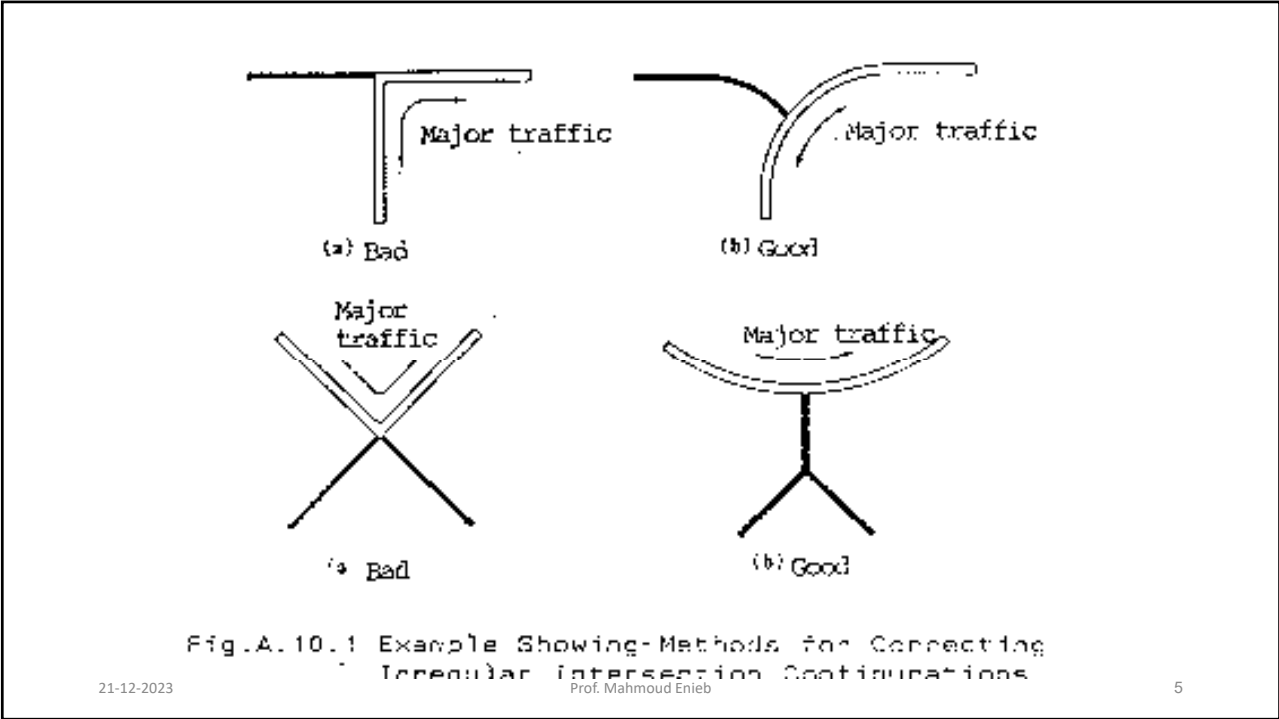


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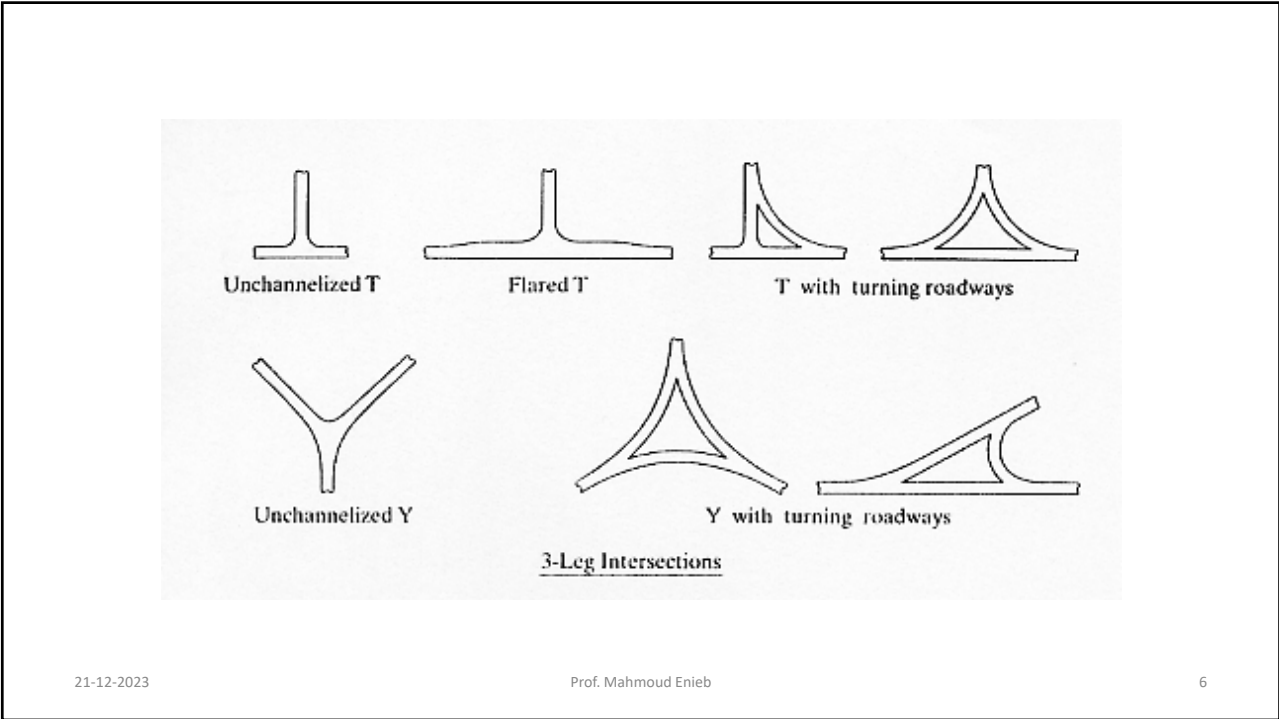
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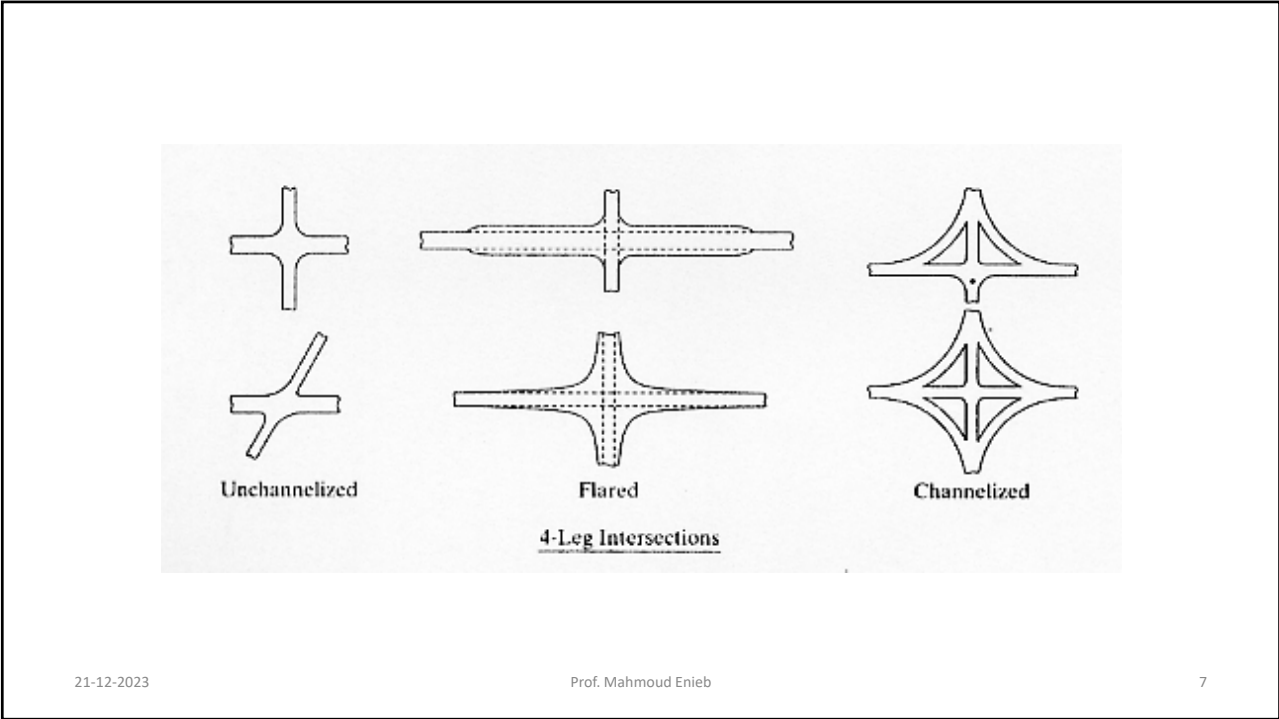
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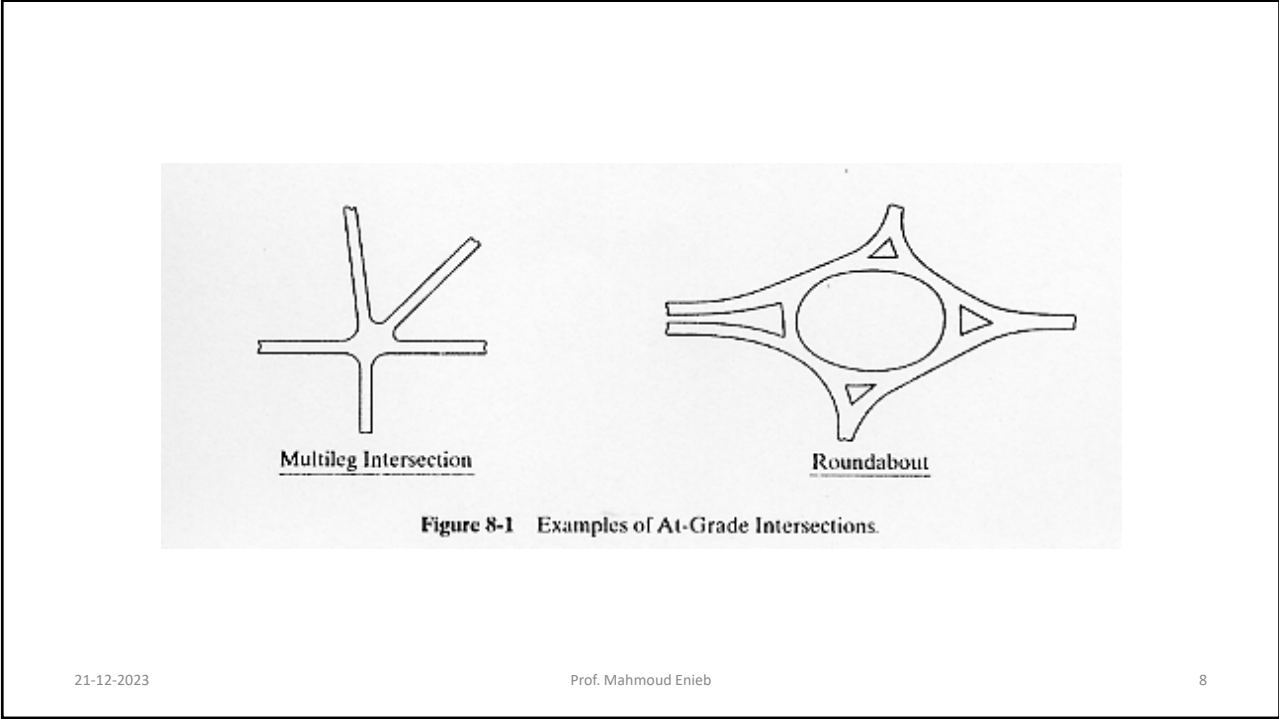
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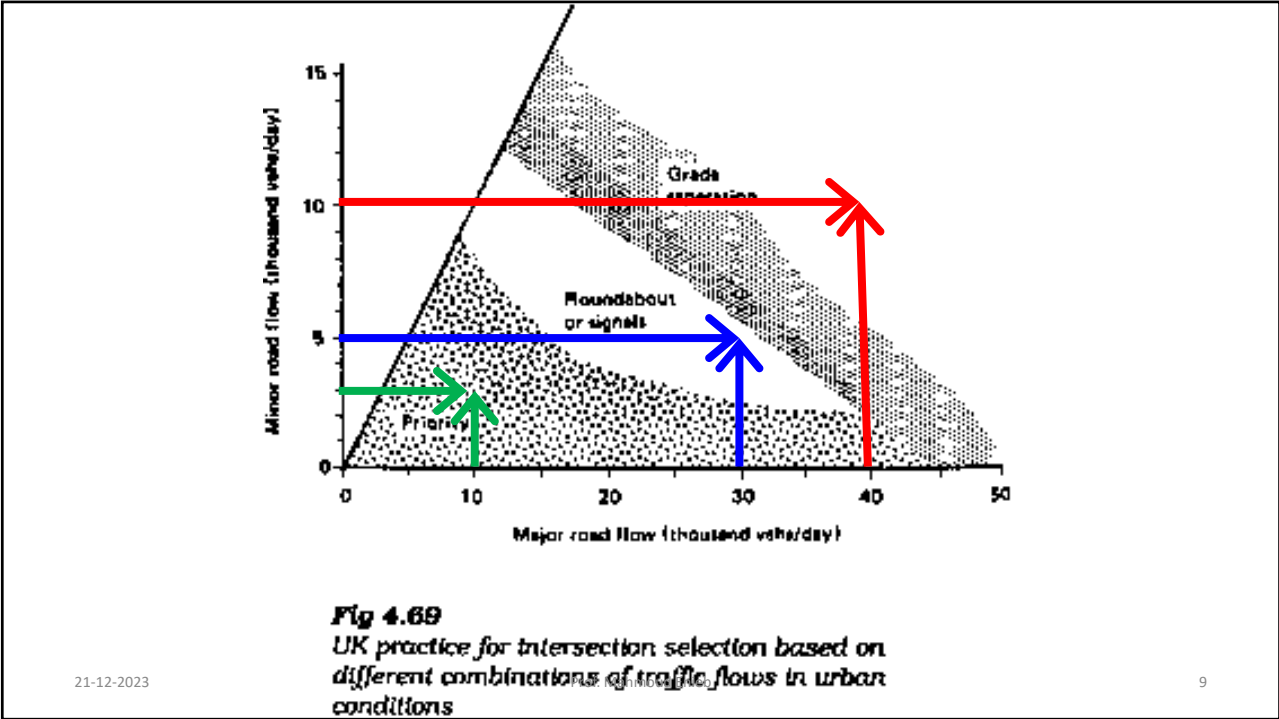
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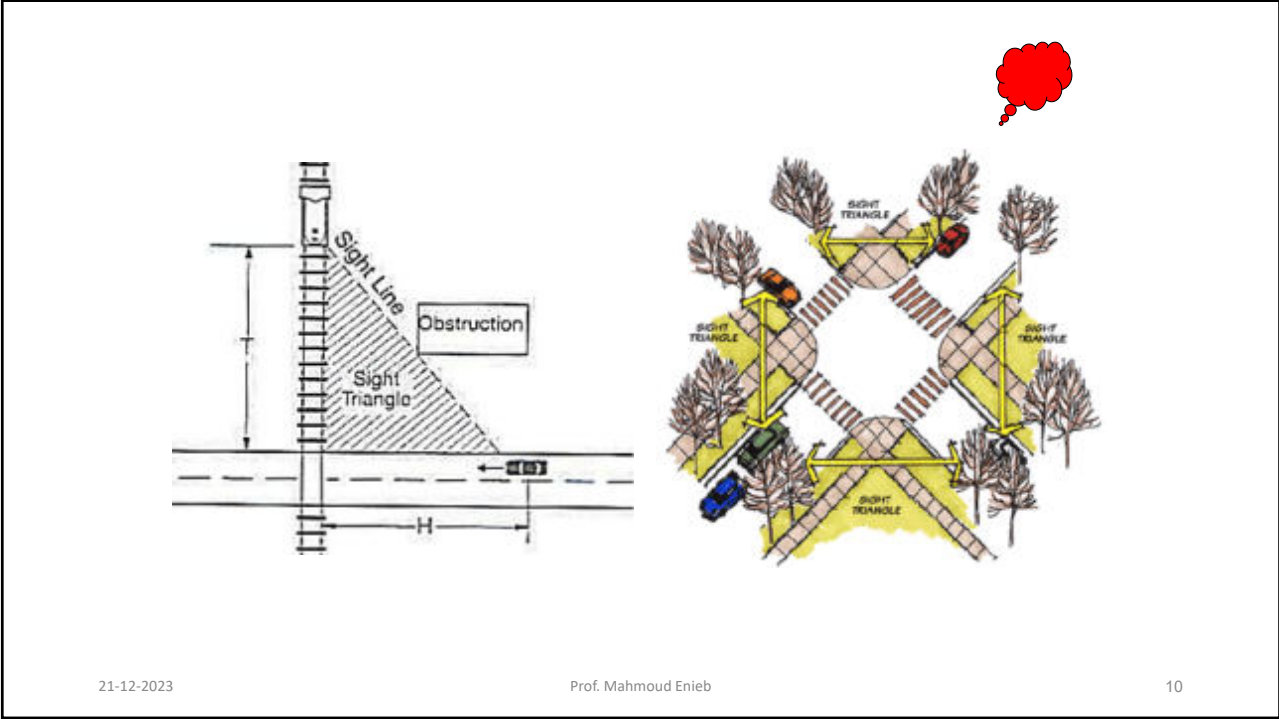
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2. JALUR PERLAMBATAN DENGAN JALUR TUNGGU (Storage)

DENGAN JALUR PERCEPATAN DAN TUNGGU

JALAN UTAMA (MAJOR ROAD)

JALUR TUNGGU (STORAGE)

JALUR PERLAMBATAN

KECEPATAN V (KM/J)	JALUR PERLAMBATAN M.(N) [M]	PANJANG MIN.TAPER L = V x dw/6 m
40	15	20
60	30	30

* Bila panjang taper > dari jalur perlambatan maka panjang taper dianggap sebagai jalur perlambatan.

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Continuous Left-Turn Lanes

(a) Typical multilane highway with painted left turn lane channelization into cross streets.

(b) Typical multilane highway with flush or transversable lane at midblock.

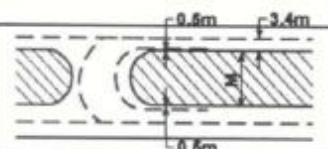
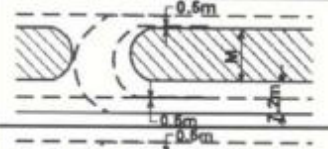

Exhibit 9-94. Flush or Transversable Median Lane Markings

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Minimum Design for U-Turns

Exhibit 9-92

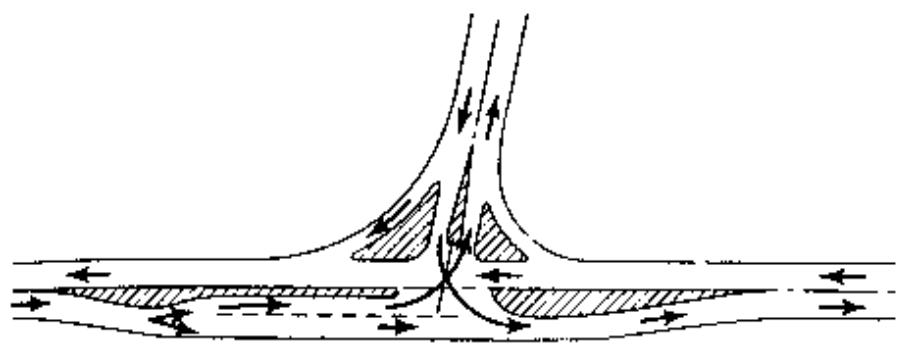
TYPE OF MANEUVER		M - MIN. WIDTH OF MEDIAN (m) FOR DESIGN VEHICLE						
		P	WB-12	SU	BUS	WB-16	WB-18	TDT
		LENGTH OF DESIGN VEHICLE (m)						
		5.7	16.0	9.0	12.0	16.5	19.5	36.4
INNER LANE TO INNER LANE		9	18	19	19	21	21	30
INNER LANE TO OUTER LANE		6	16	16	16	18	18	27
INNER LANE TO SHOULDER		2	12	12	12	16	16	24

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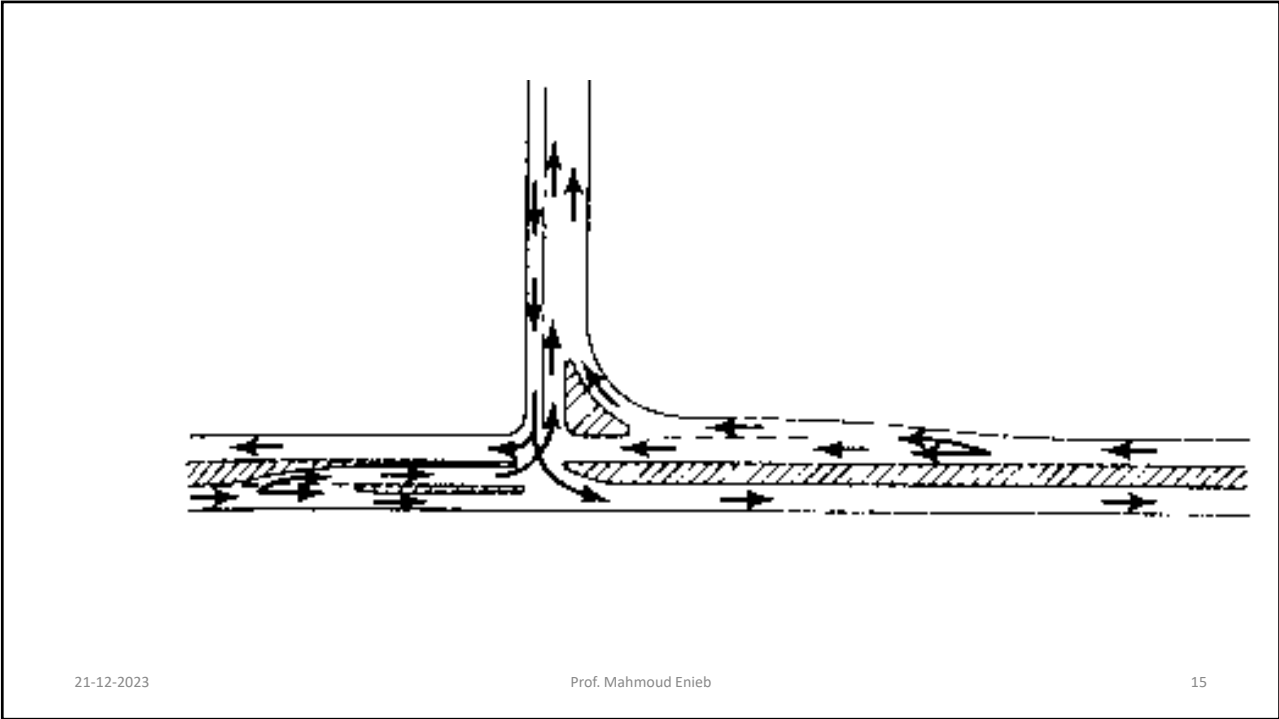


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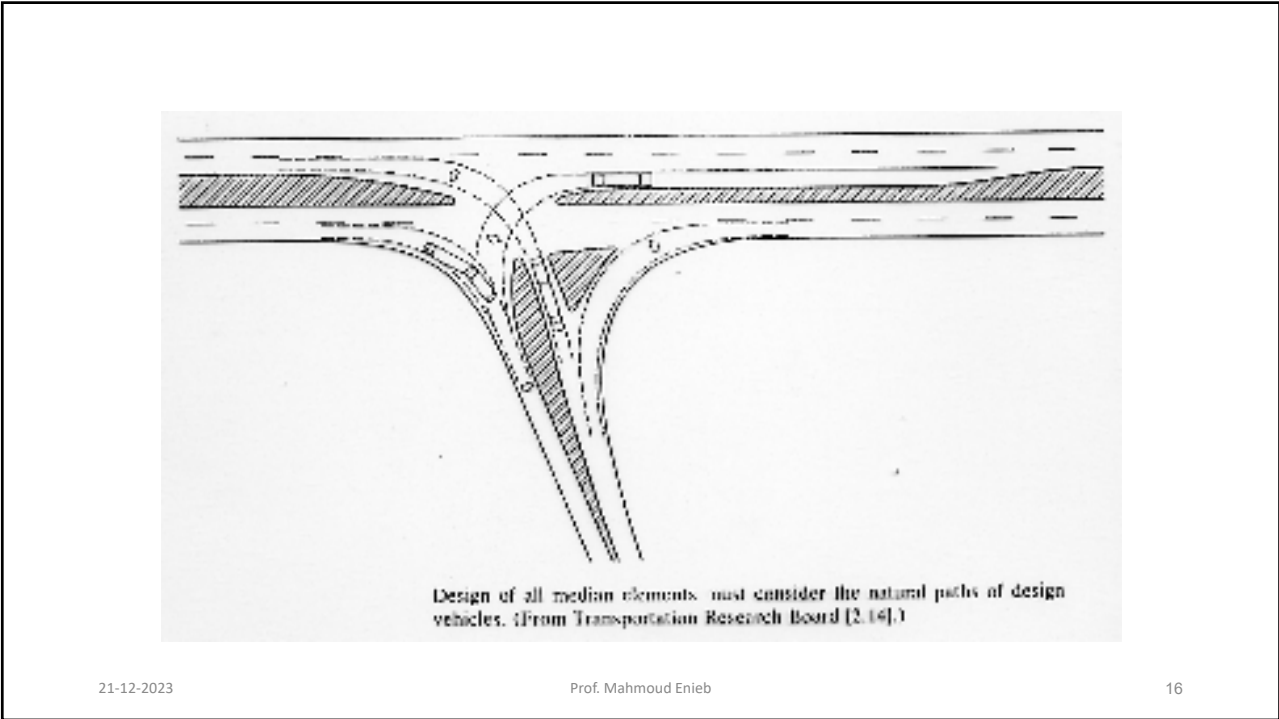


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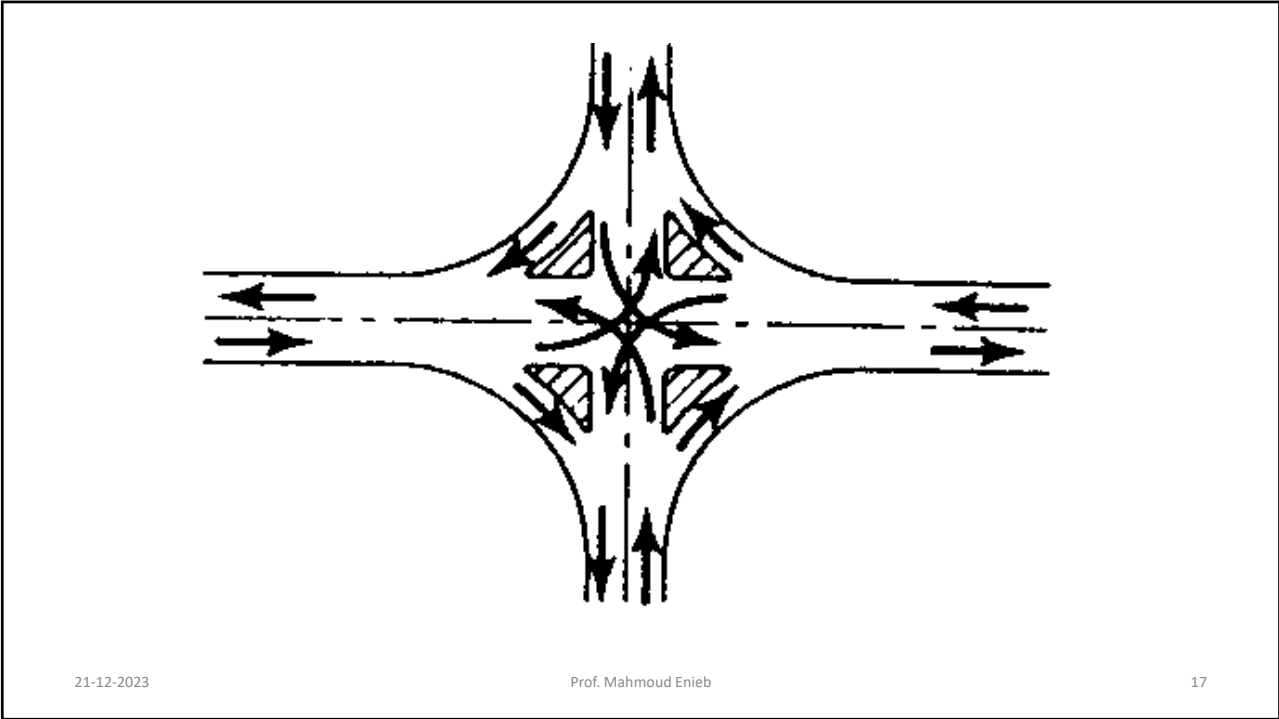


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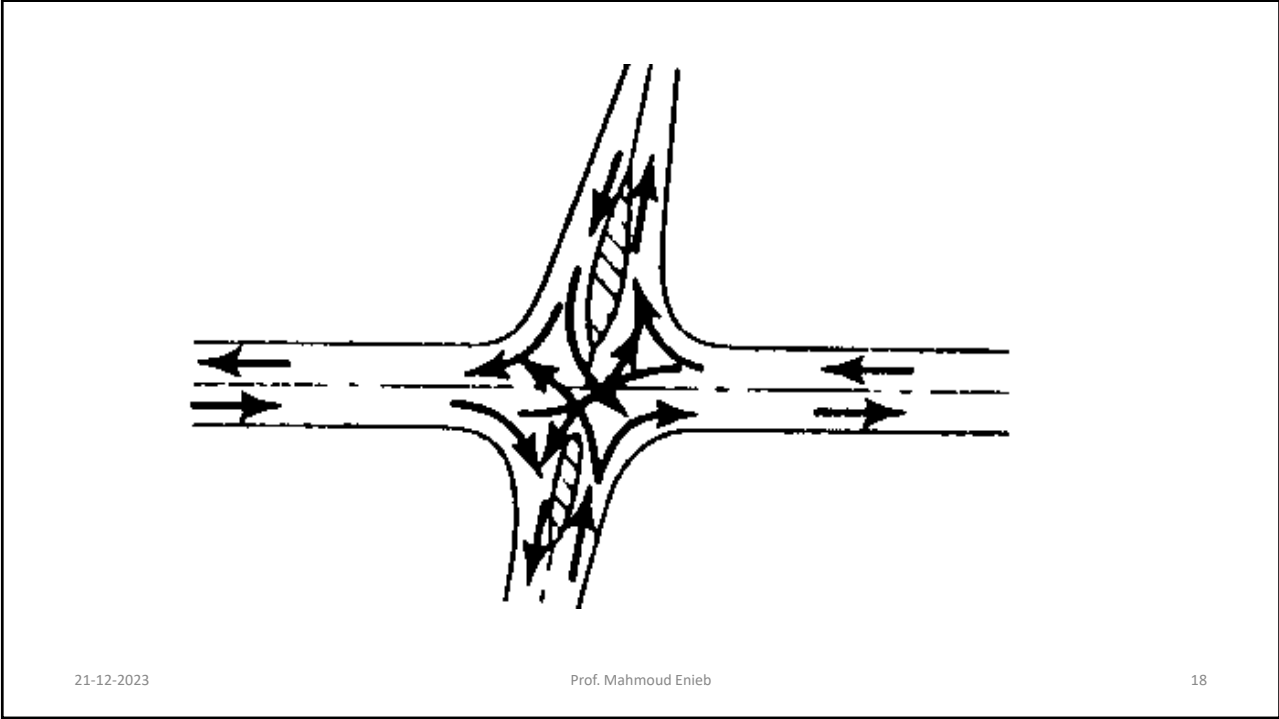
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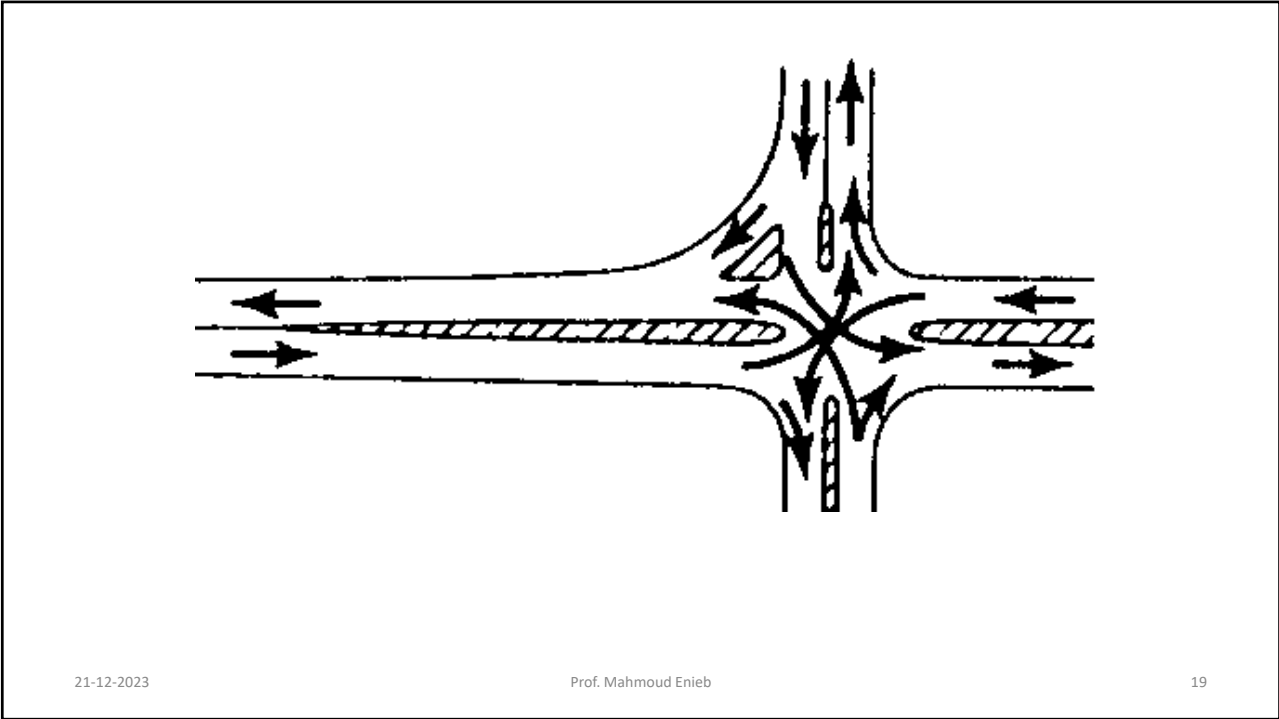
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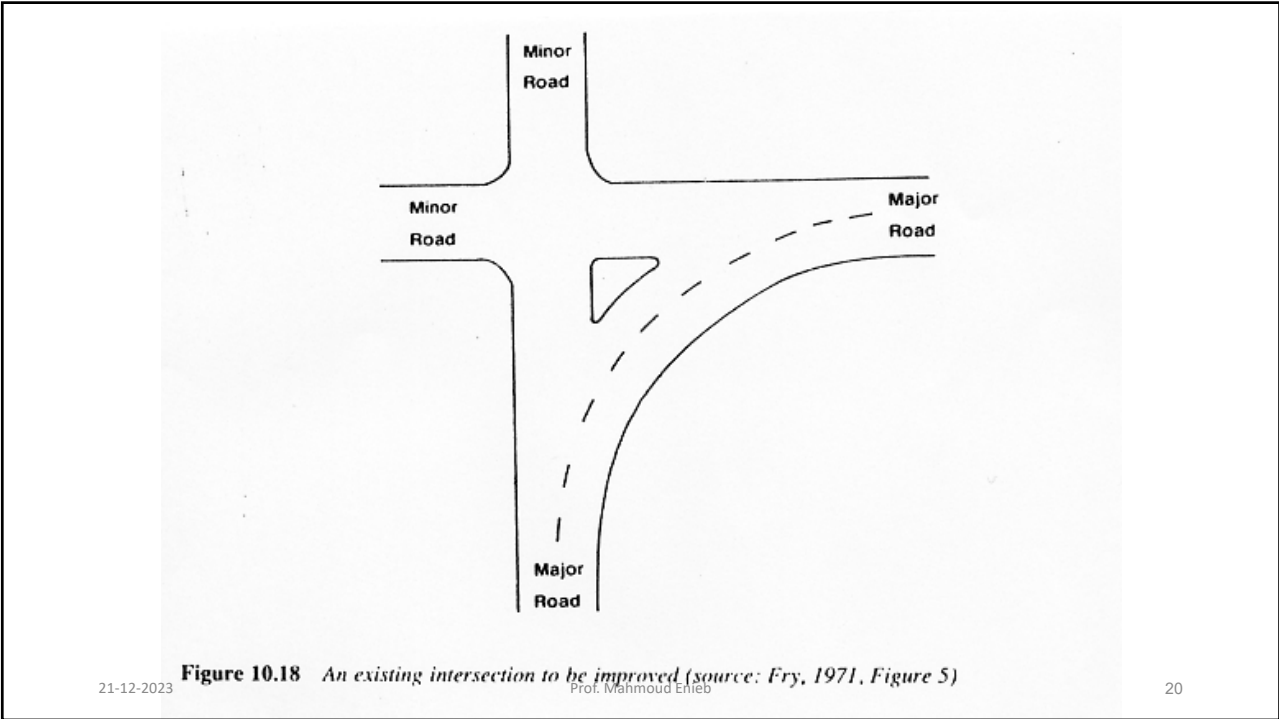


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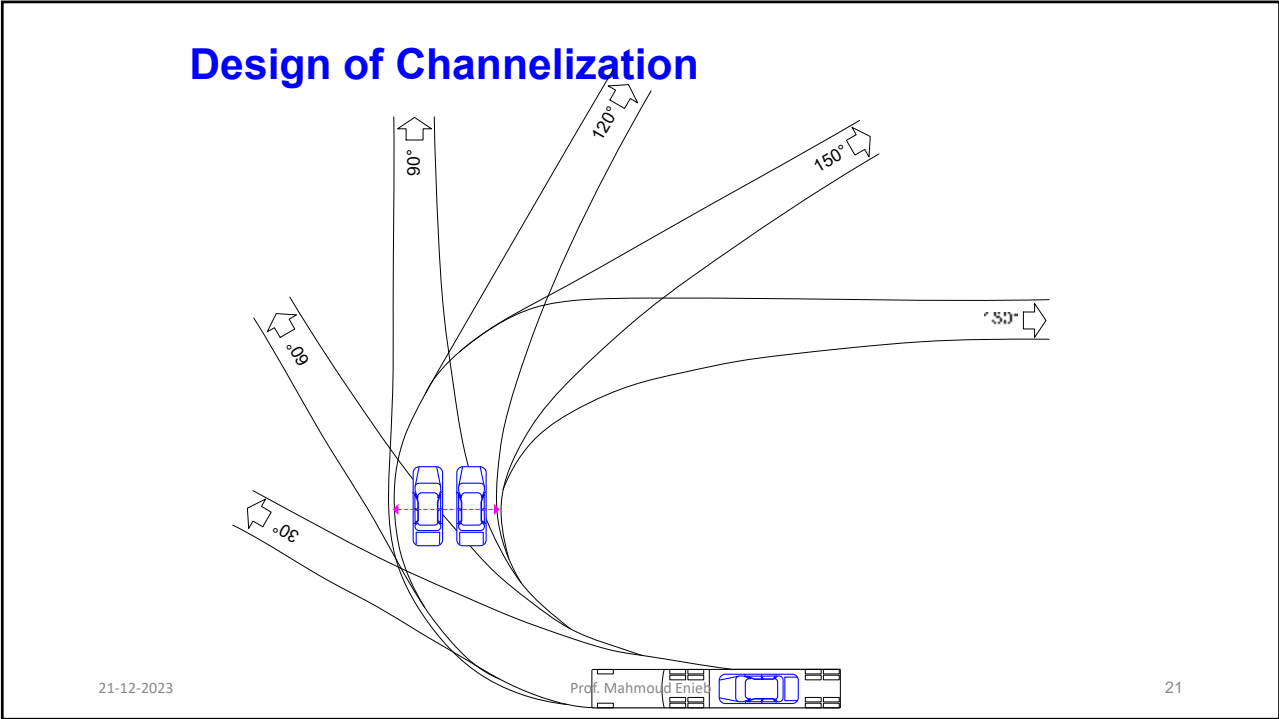
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Figure 10.18 An existing intersection to be improved (source: Fry, 1971, Figure 5)

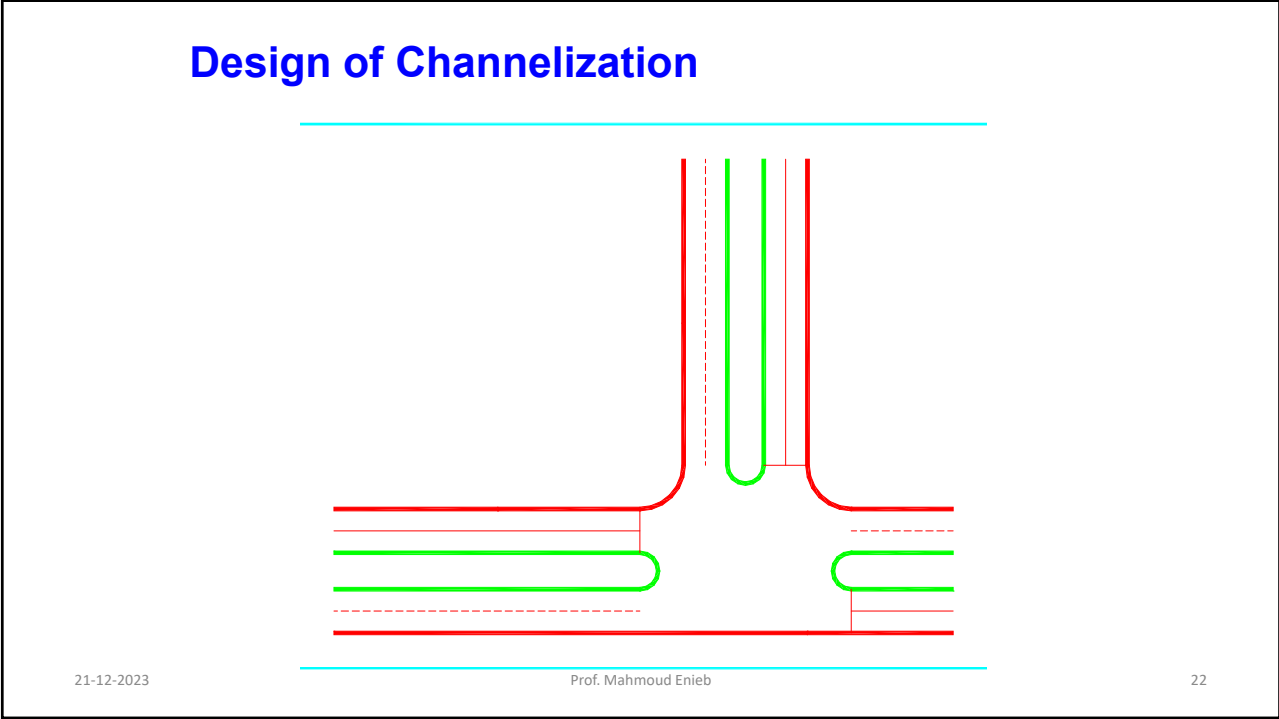
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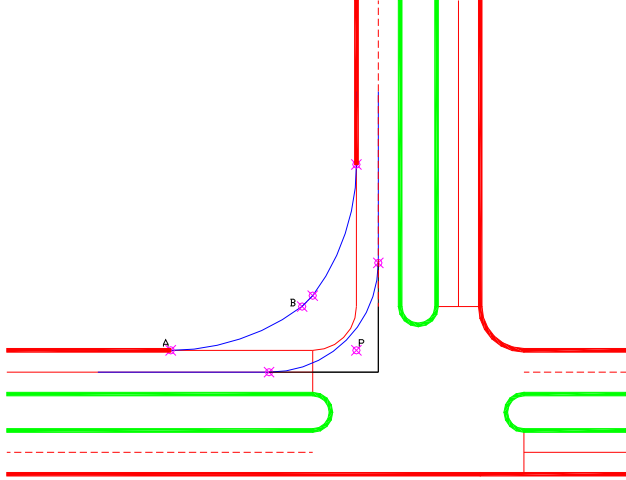


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Design of Channelization (Type 1)



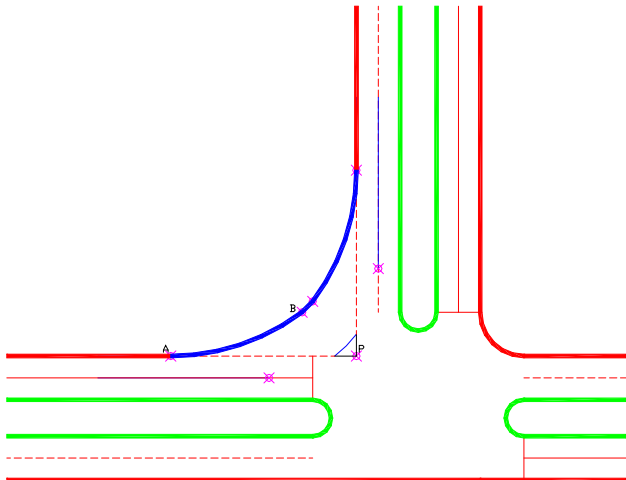
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Design of Channelization (Type 1)

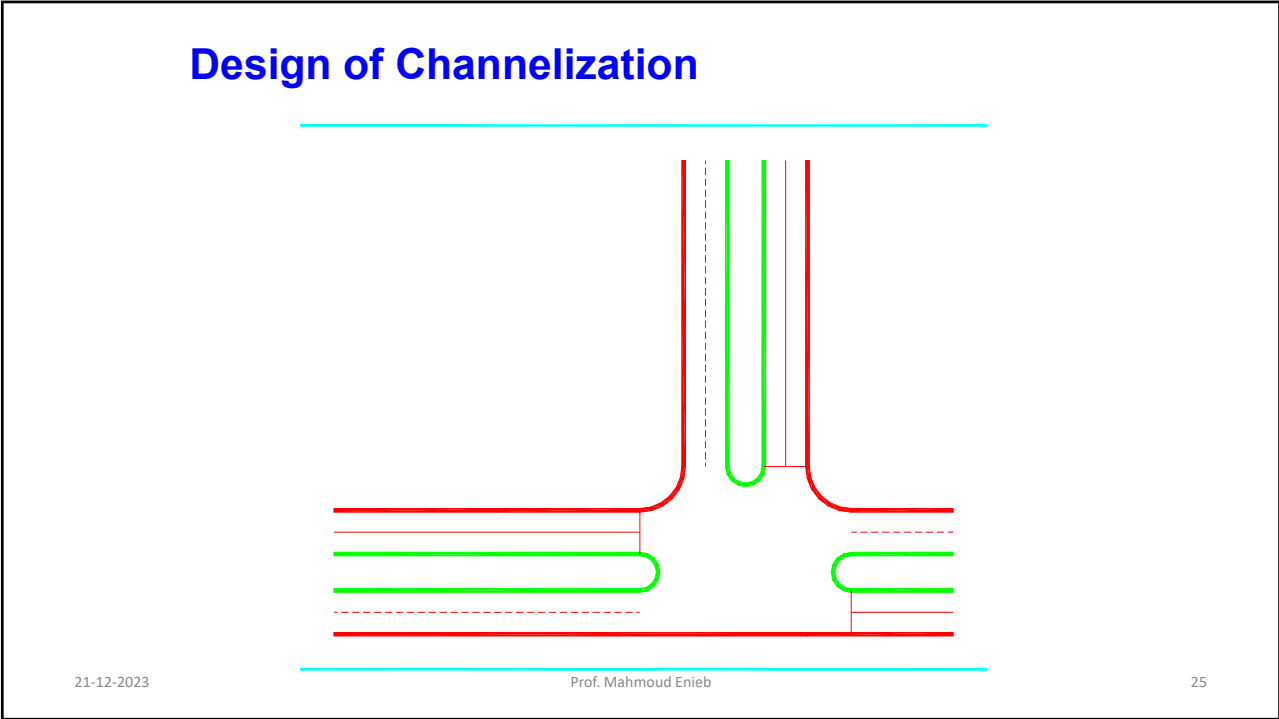


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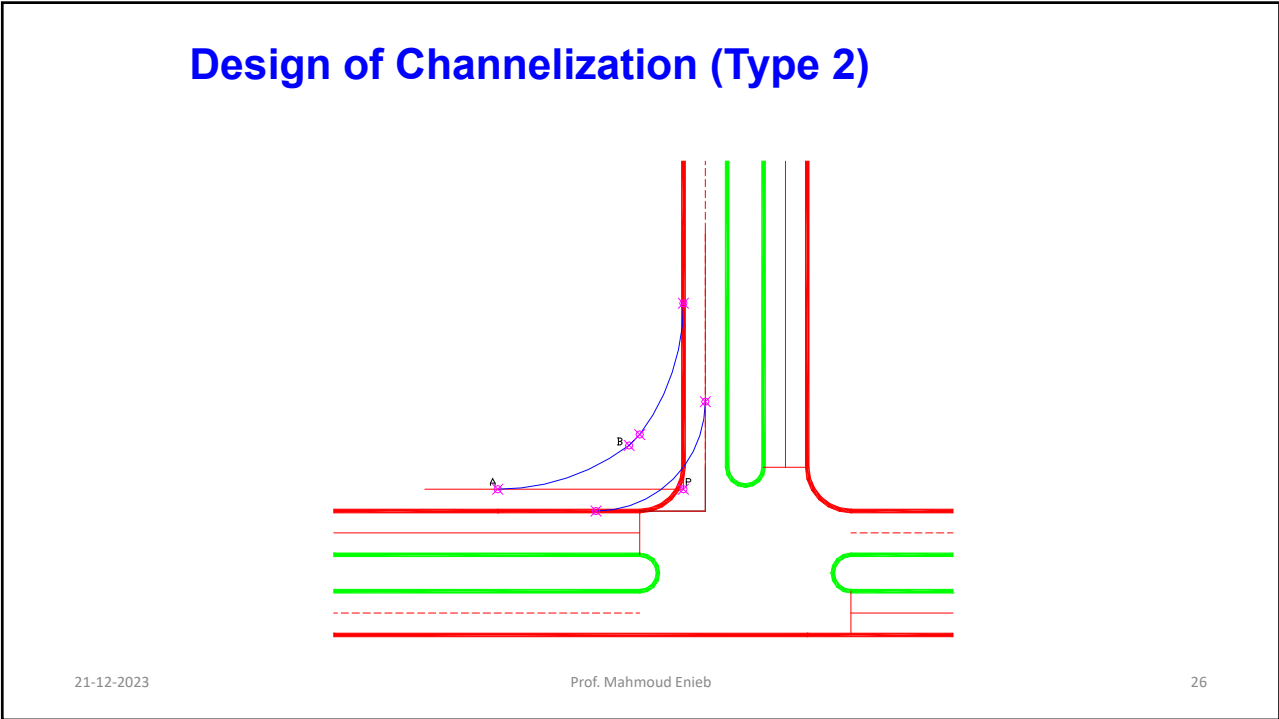
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Design of Channelization (Type 2)

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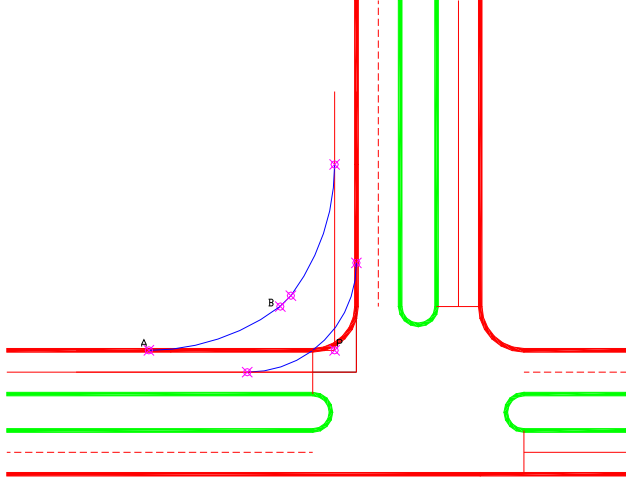
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Design of Channelization

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Design of Channelization (Type 3)



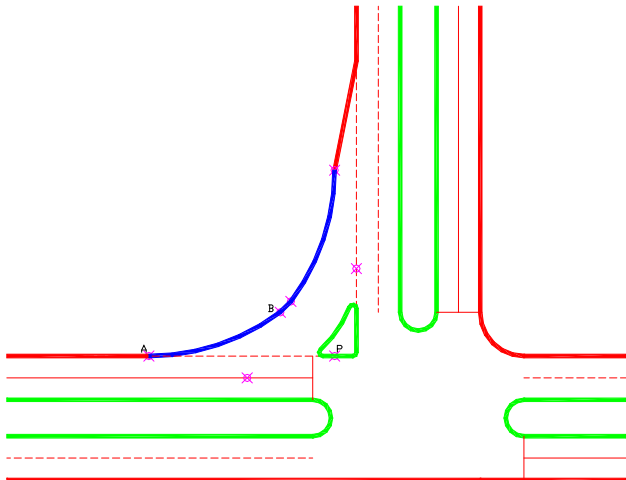
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Design of Channelization (Type 3)

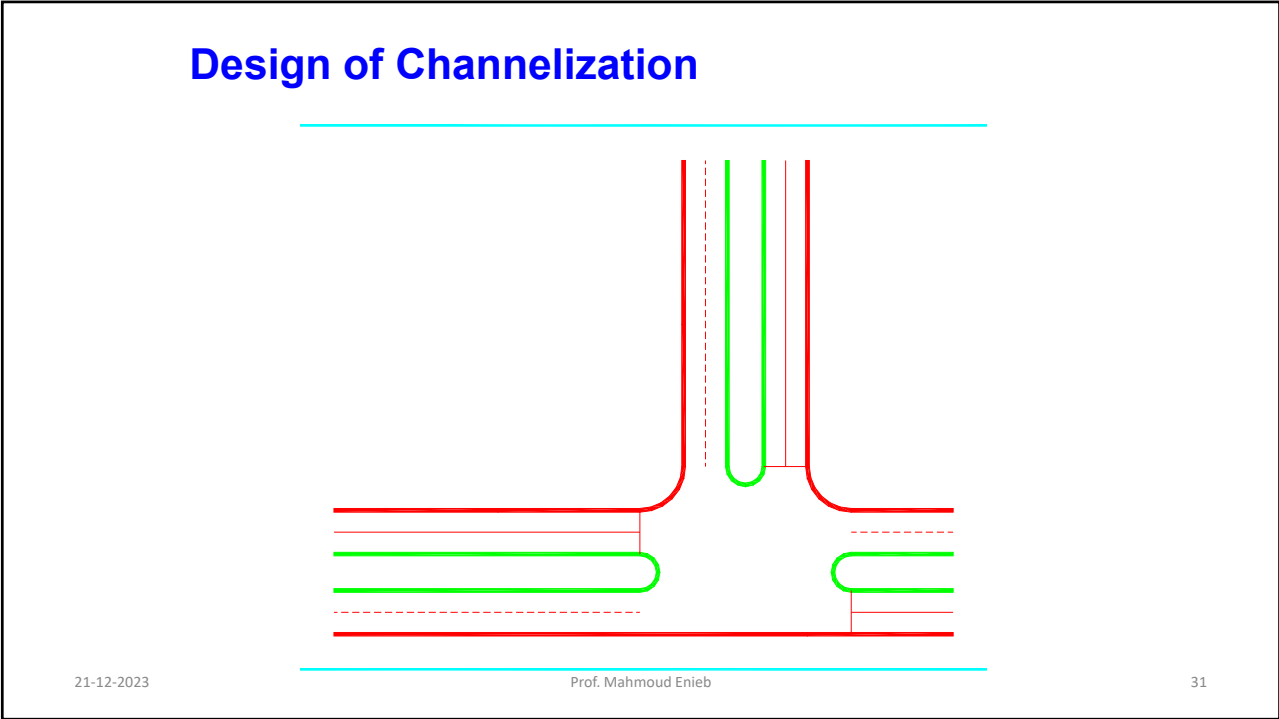


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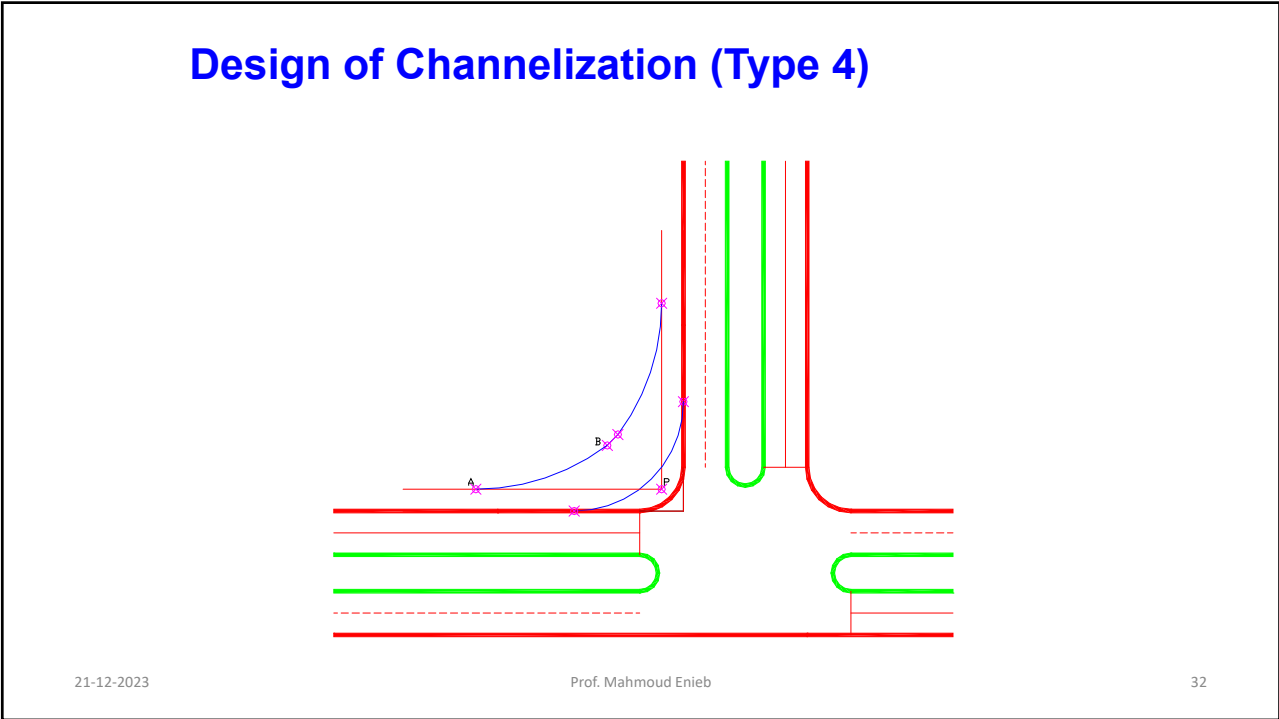
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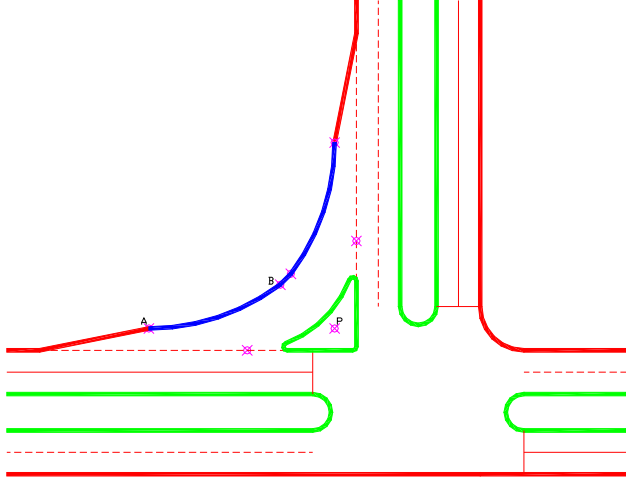


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Design of Channelization (Type 4)



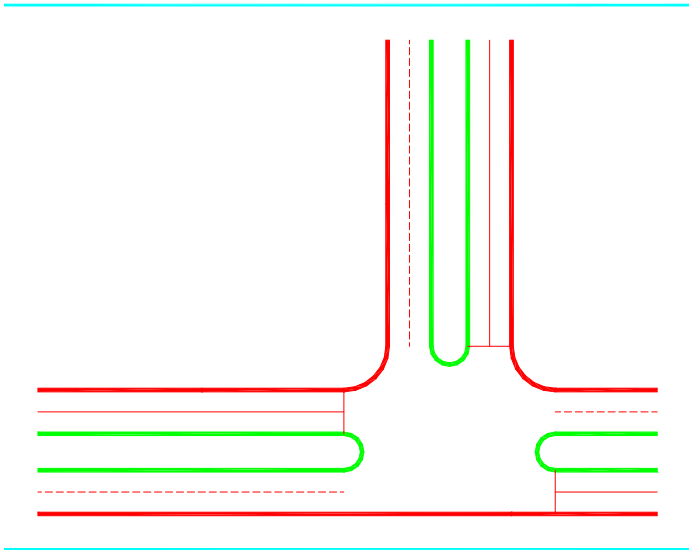
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Design of Channelization



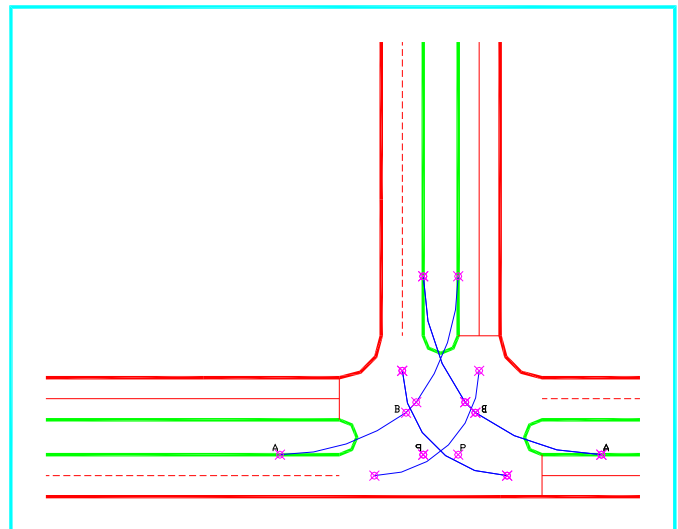
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Design of Channelization



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Traffic Island

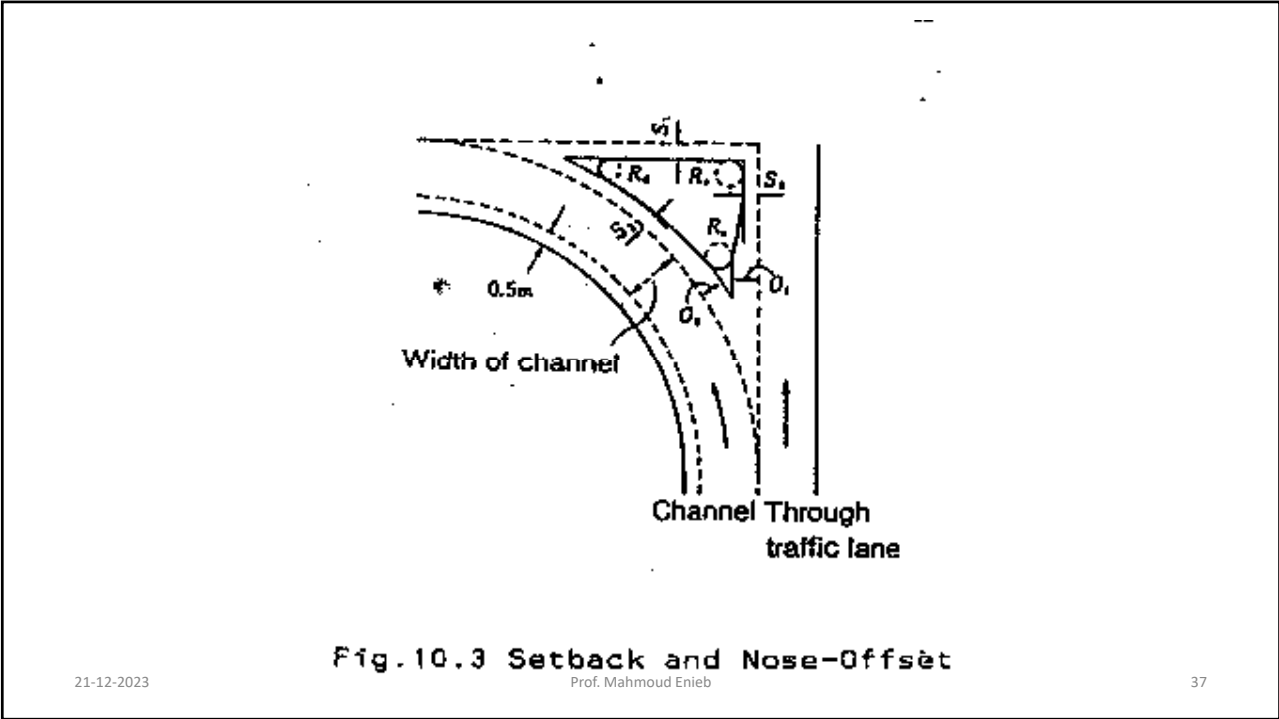


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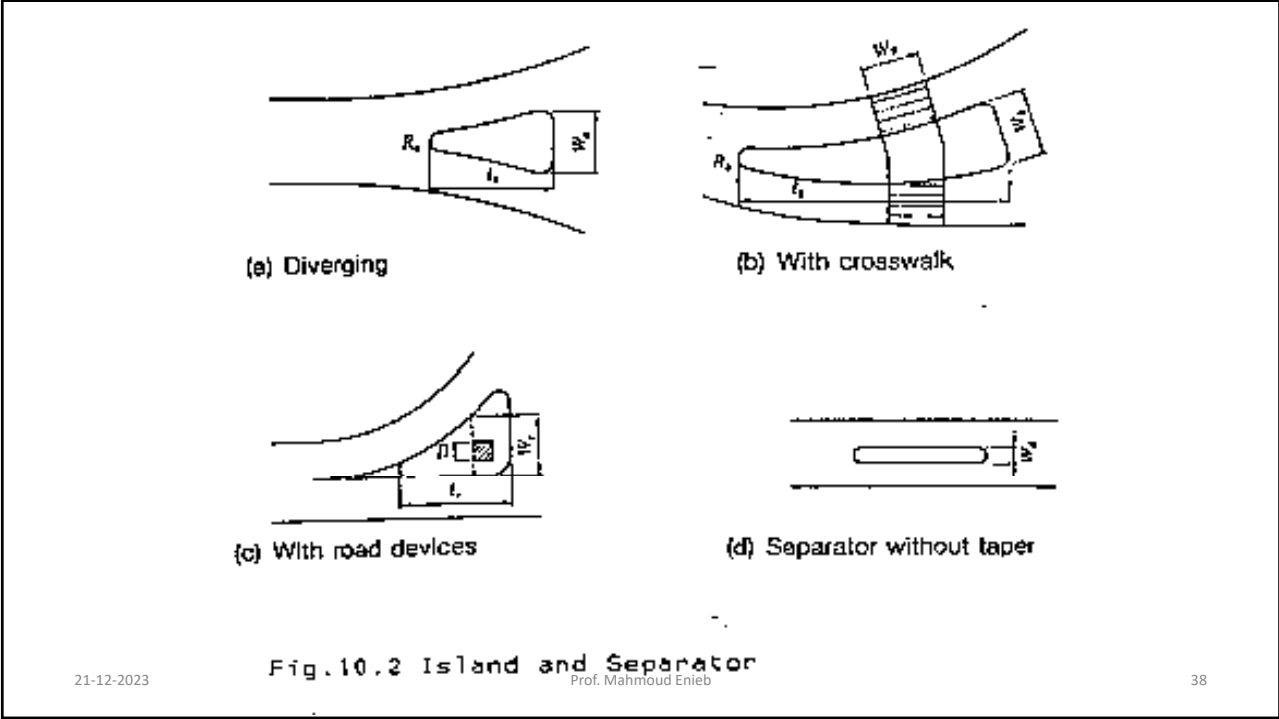
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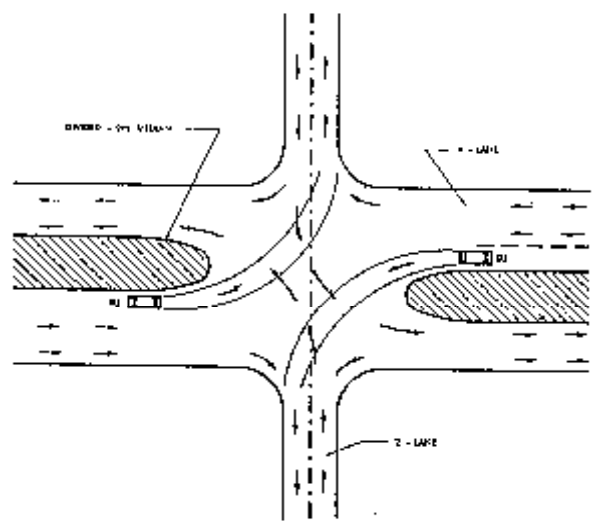


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Simultaneous Left-Turn Lanes



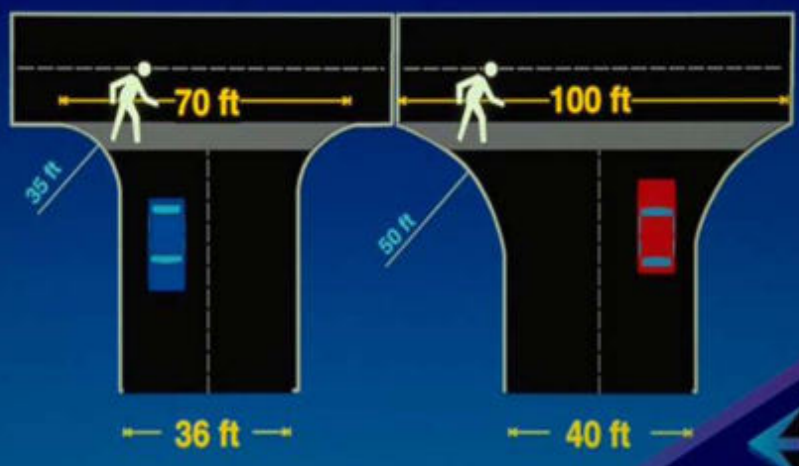
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Exhibit 9-99 Four-leg intersection providing simultaneous left turns. Prof. Mahmoud Enieb

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Pedestrian exposure due to very large radii



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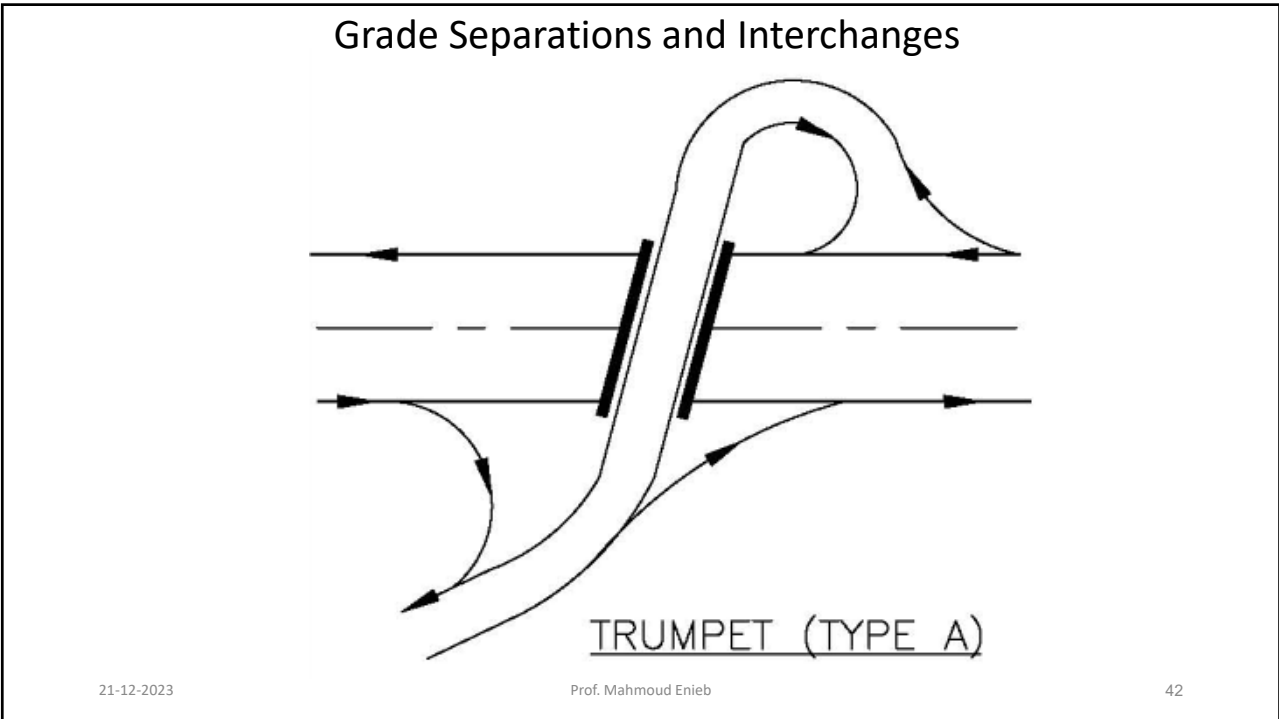


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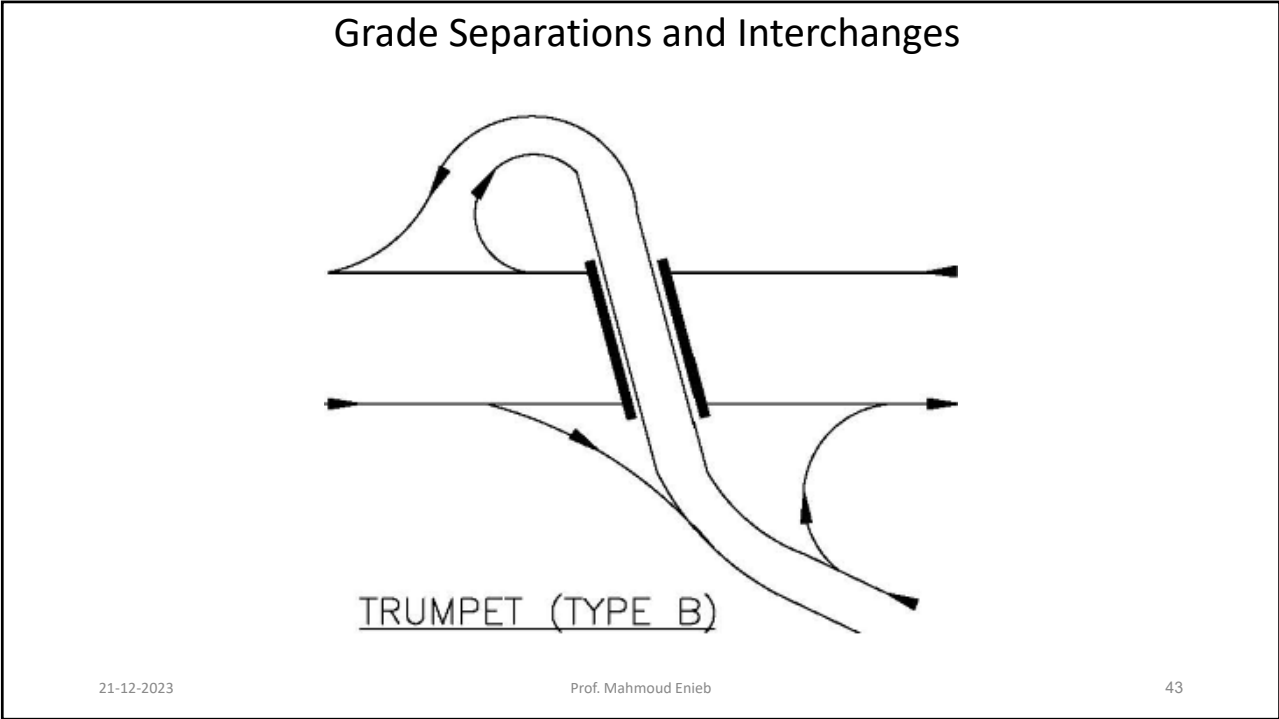
TRUMPET (TYPE A)

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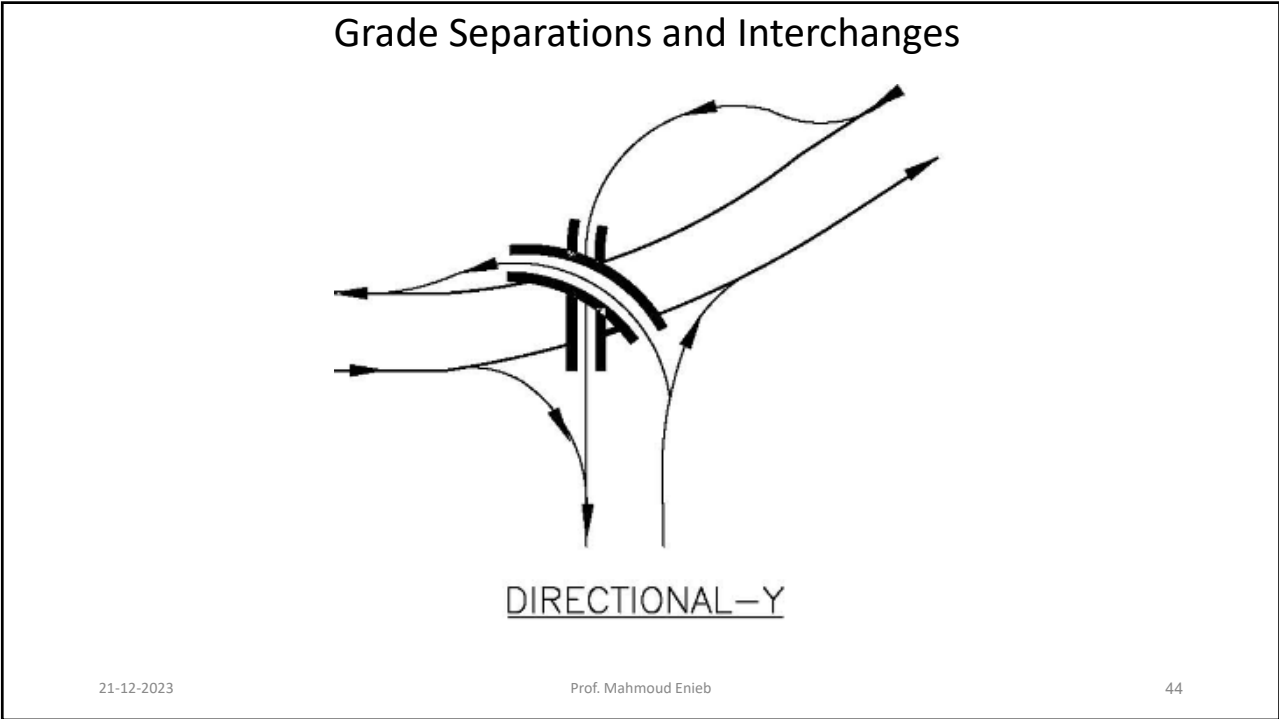
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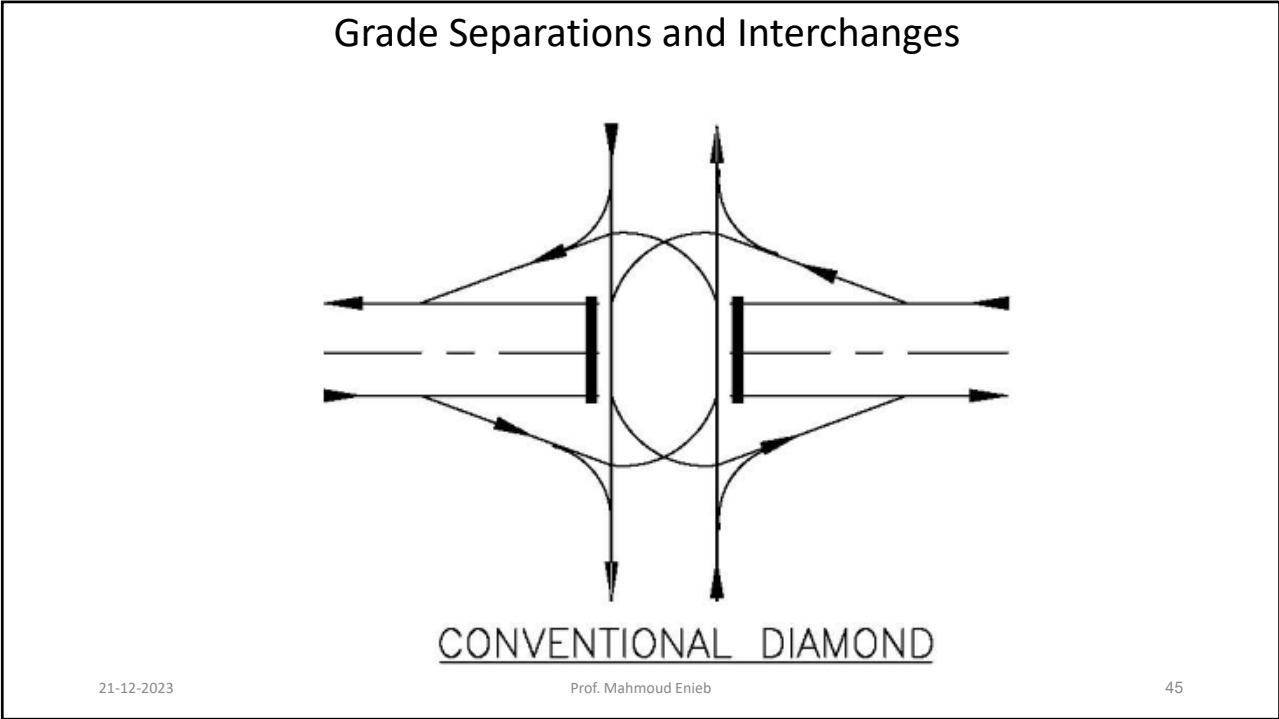
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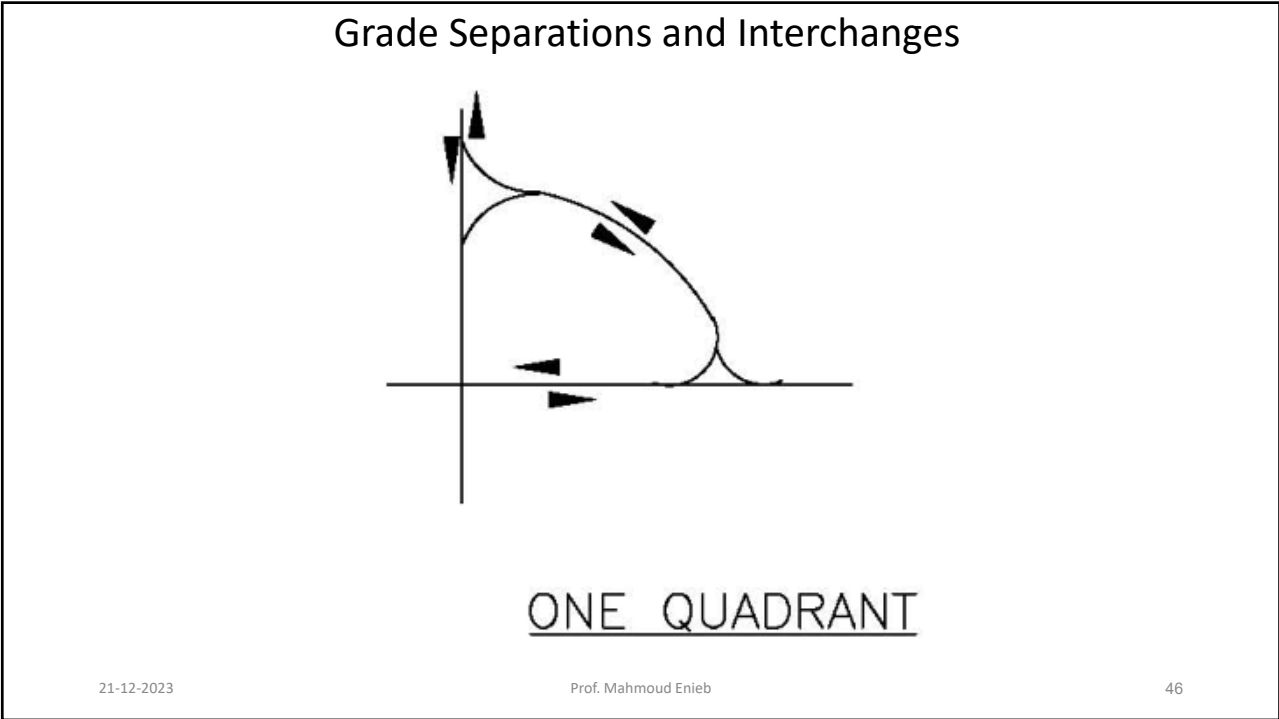
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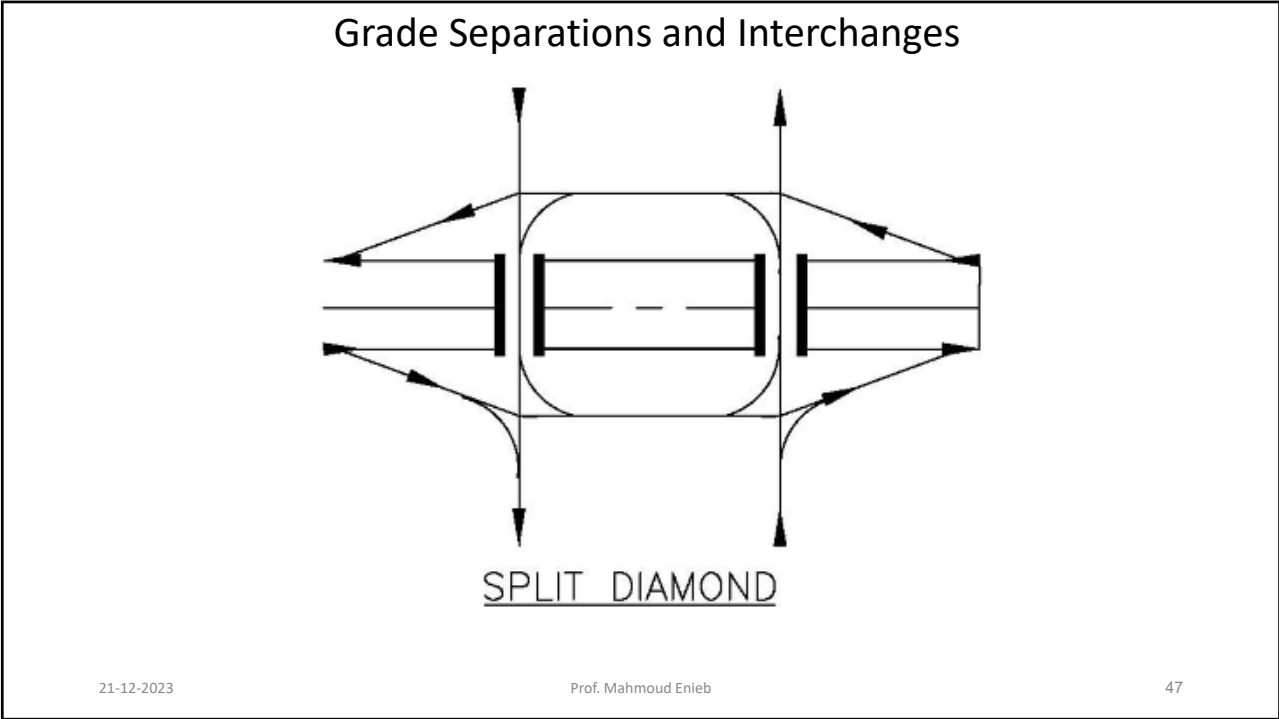
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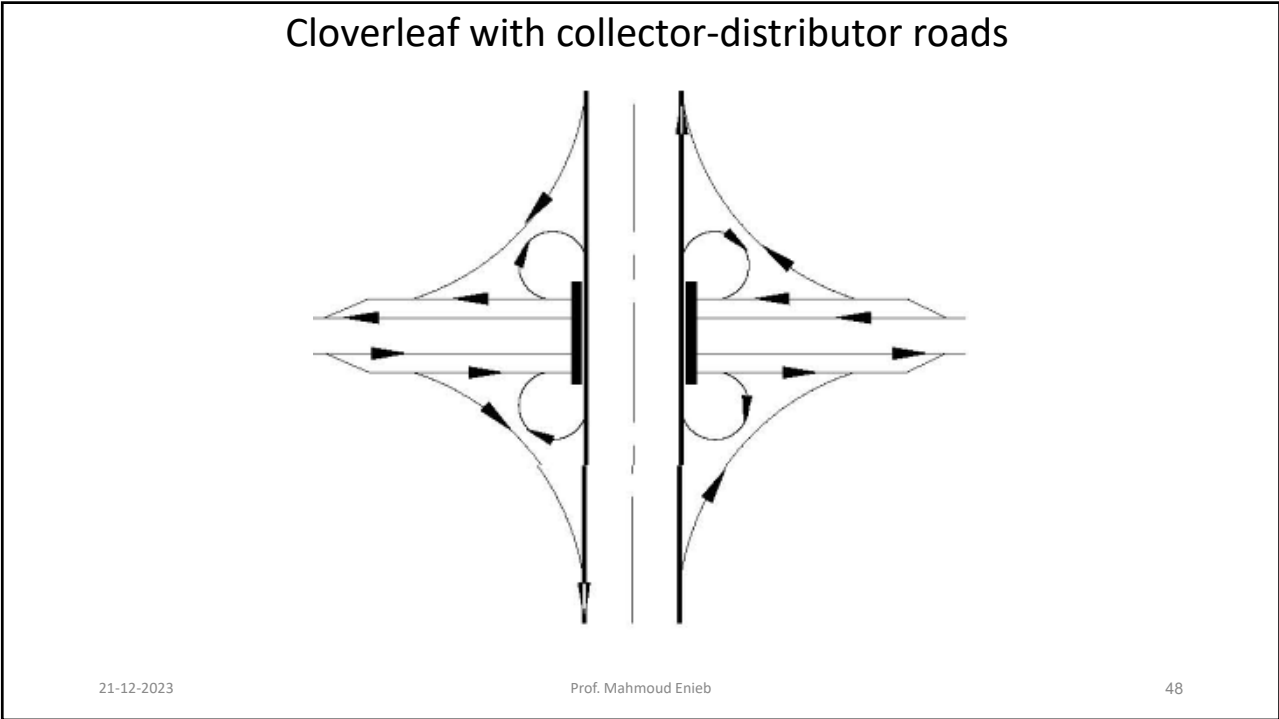
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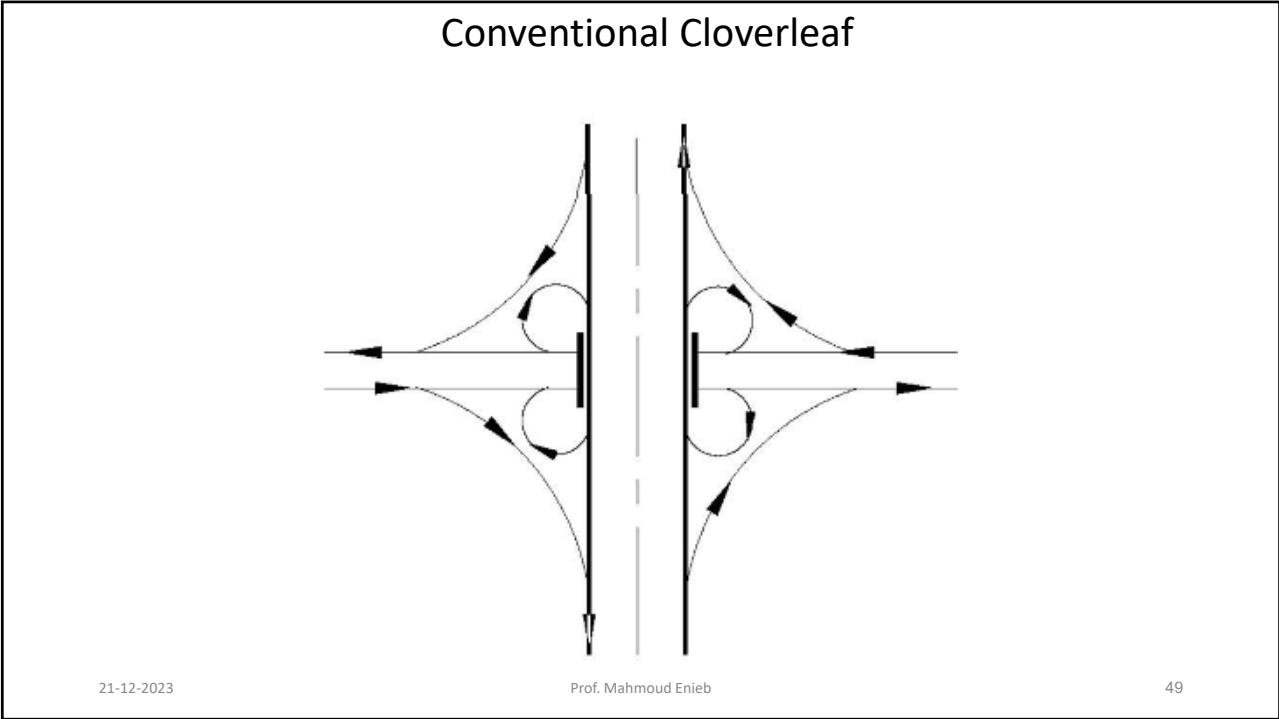
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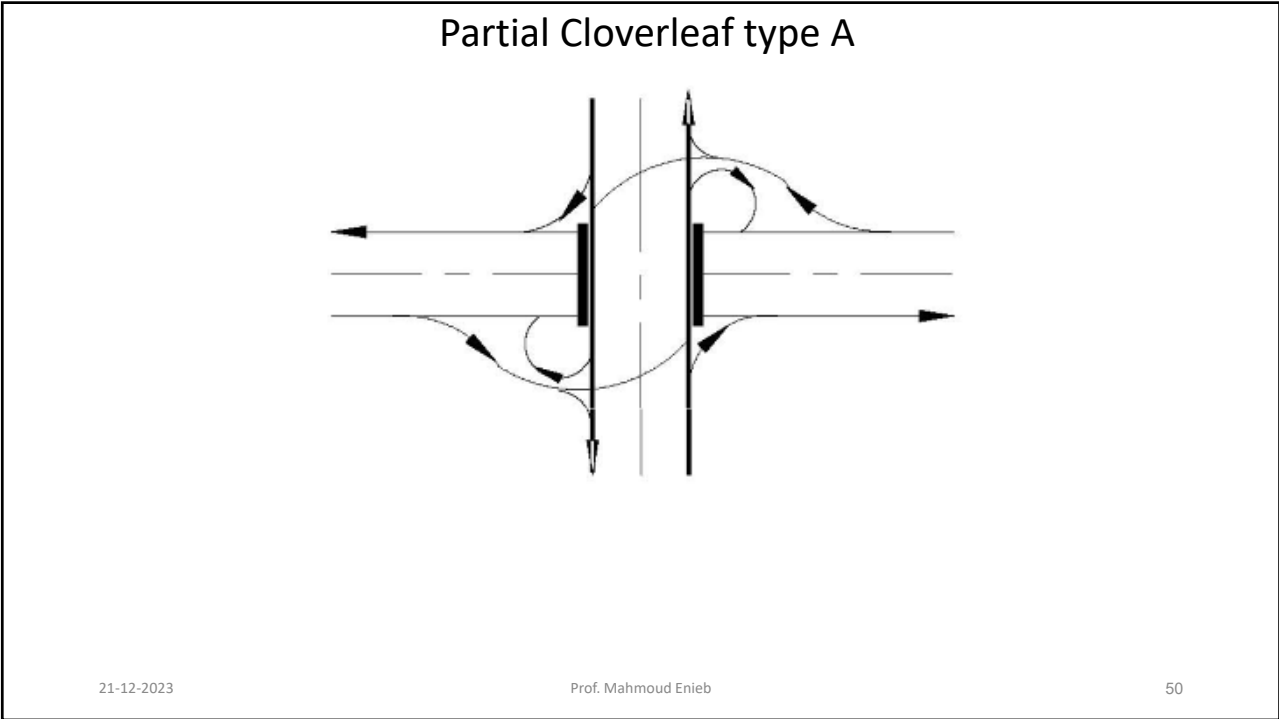
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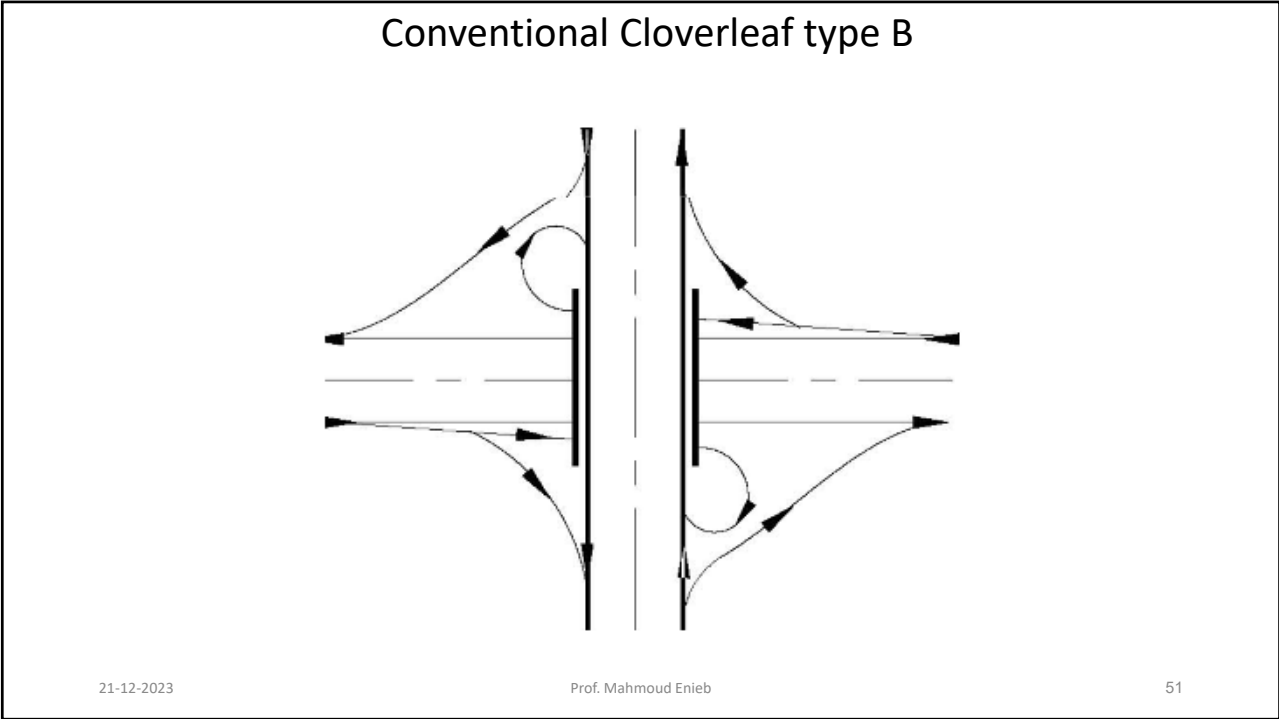
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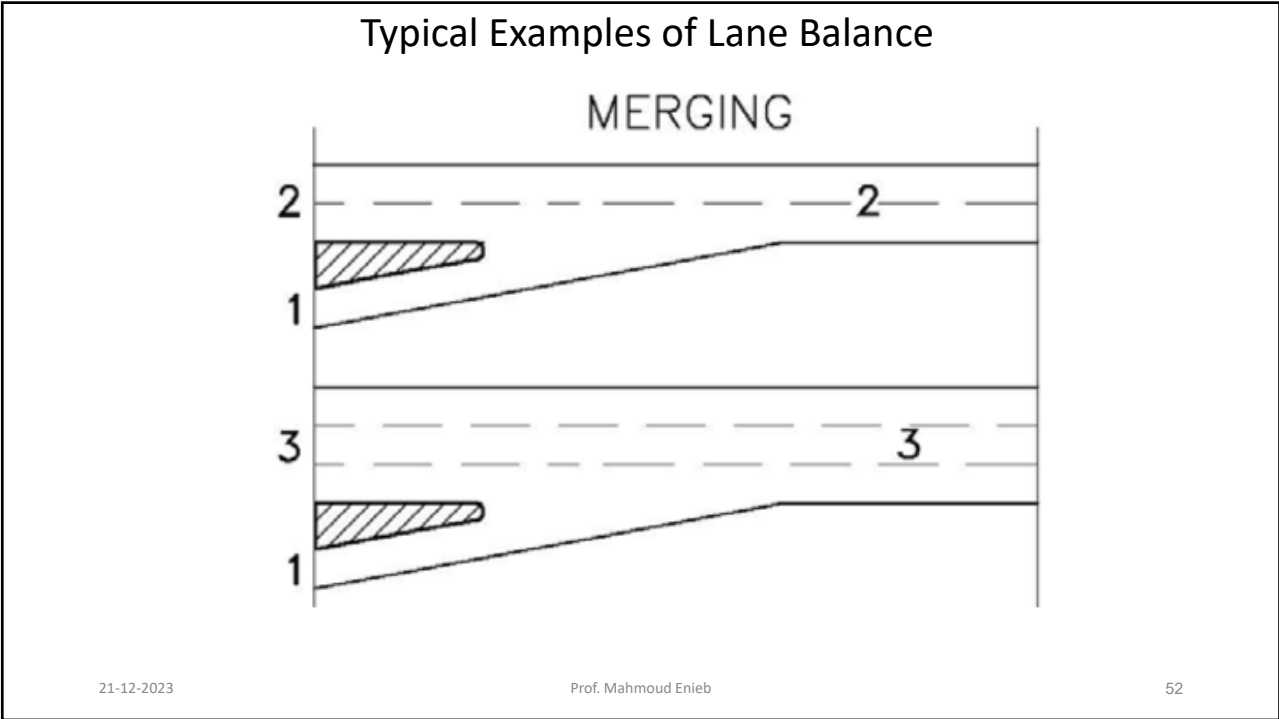
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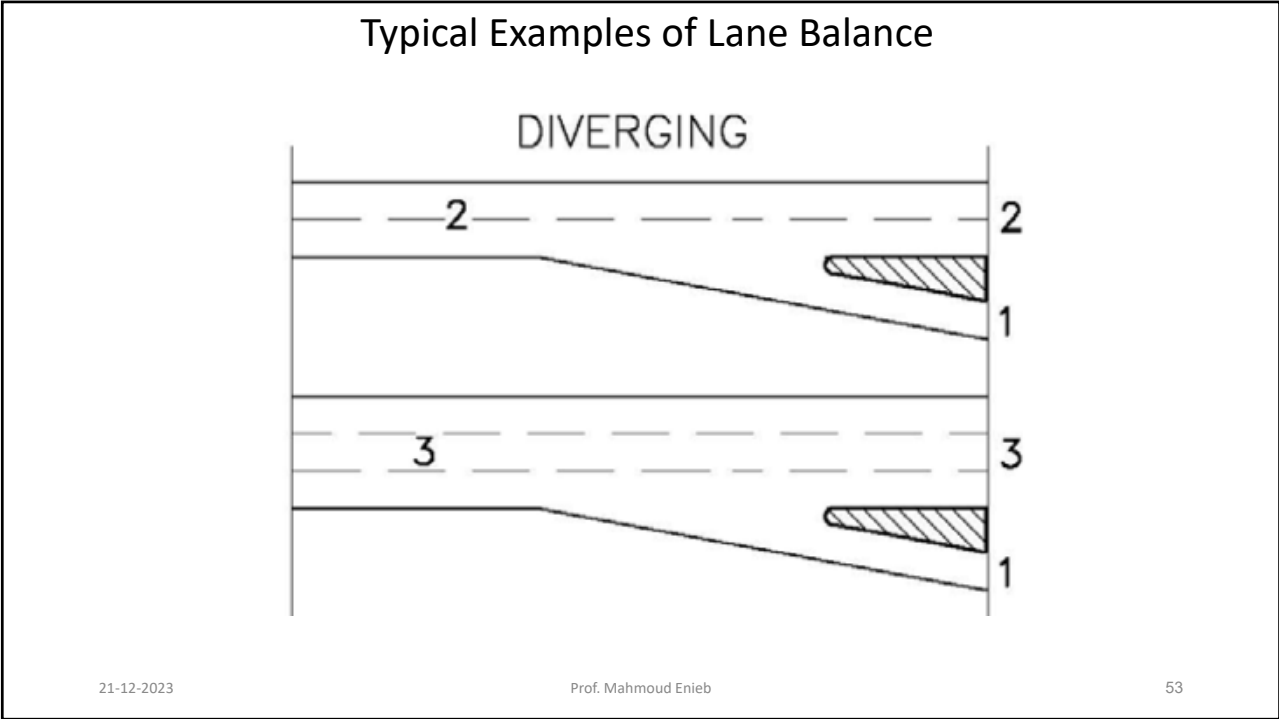
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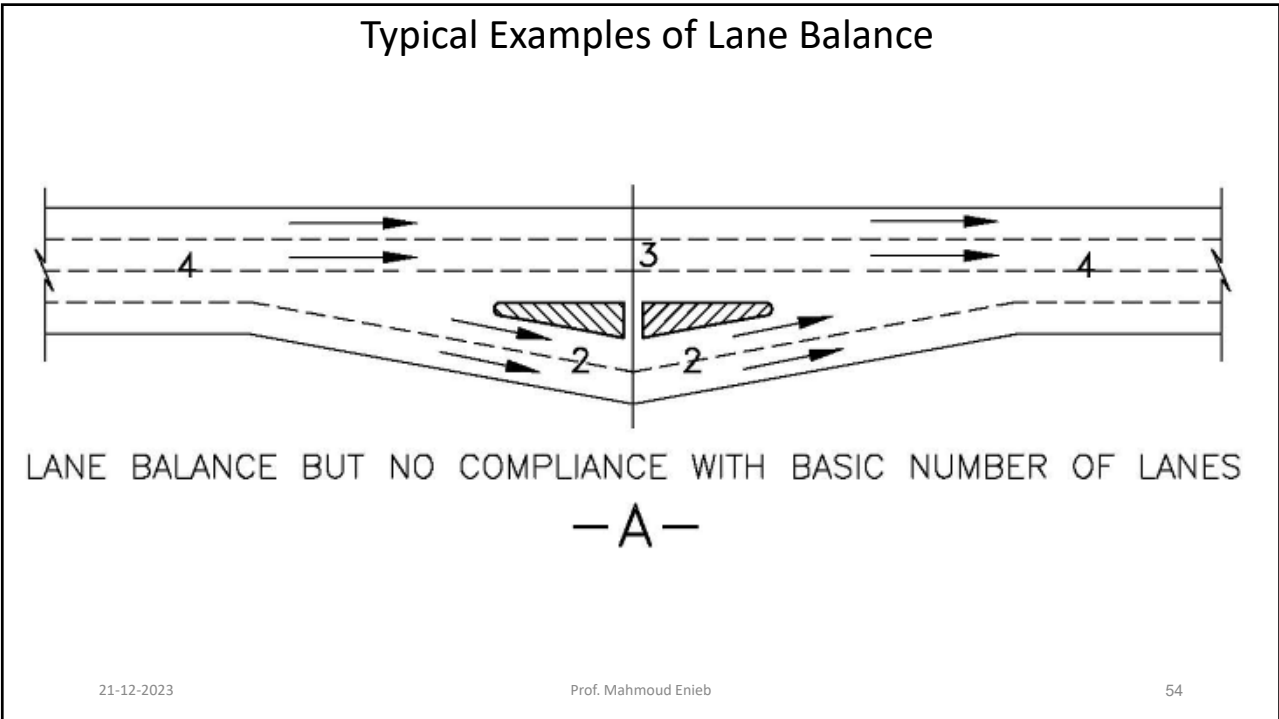
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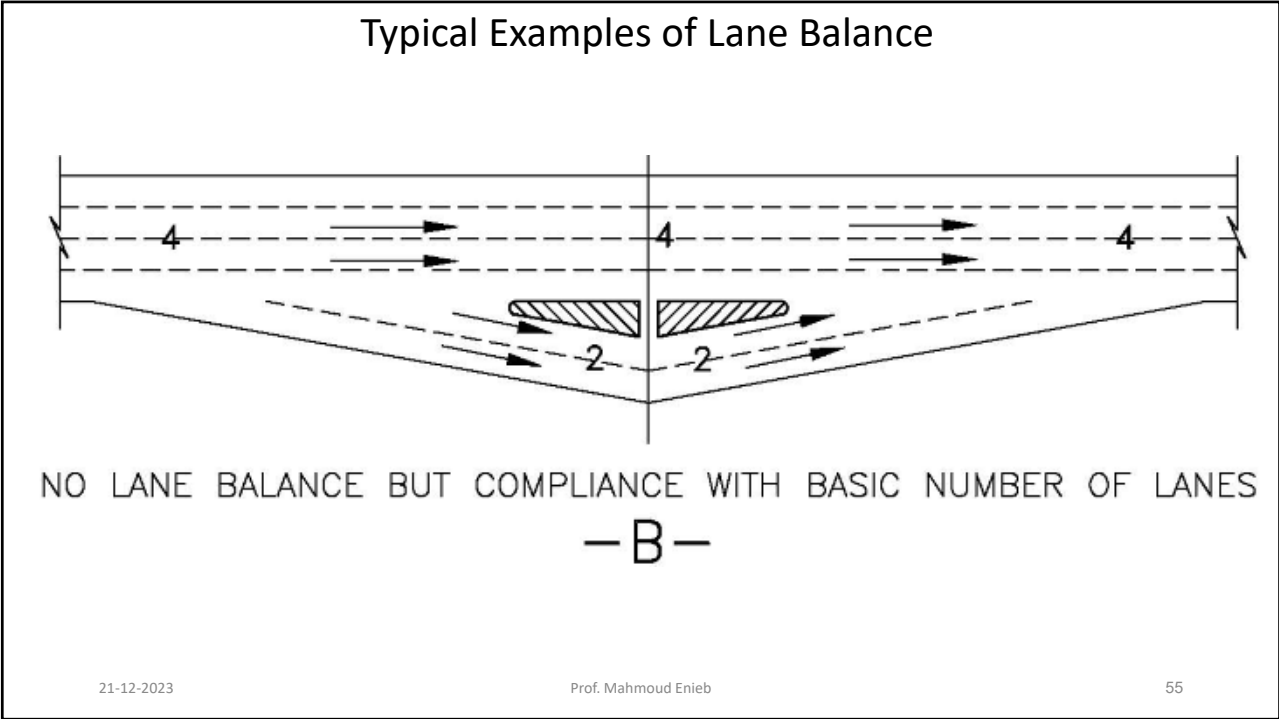
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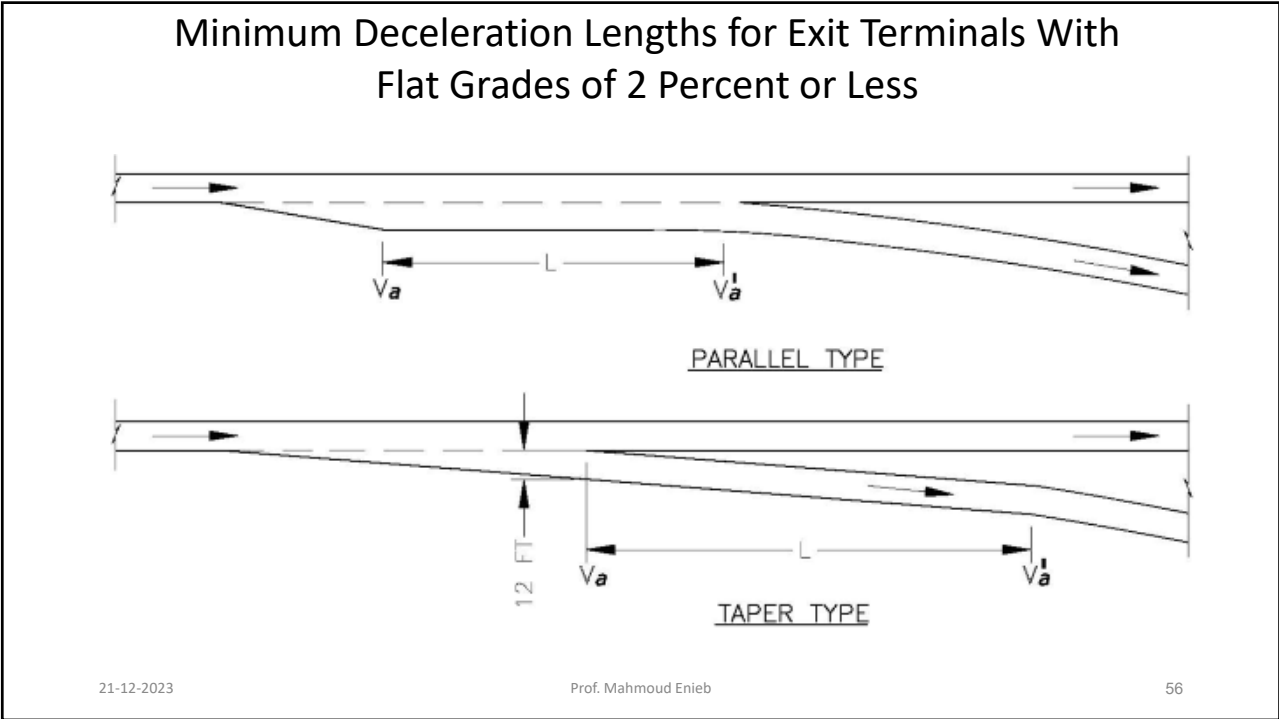
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Minimum Deceleration Lengths for Exit Terminals With Flat Grades of 2 Percent or Less

Highway Design Speed, mph (V)	Speed Reached, mph (V _a)	L = Deceleration Length, (ft) for Design Speed of Exit Curve, mph (V')								
		Stop Condition	15	20	25	30	35	40	45	50
		For Average Running Speed on Exit Curve, mph (V' _A)								
		0	14	18	22	26	30	36	40	44
30	28	235	200	170	140	---	---	---	---	---
35	32	280	250	210	185	150	---	---	---	---
40	36	320	295	265	235	185	155	---	---	---
45	40	385	350	325	295	250	220	---	---	---
50	44	435	405	385	355	315	285	225	175	---
55	48	480	455	440	410	380	350	285	235	---
60	52	530	500	480	460	430	405	350	300	240
65	55	570	540	520	500	470	440	390	340	280
70	58	615	590	570	550	520	490	440	390	340
75	61	660	635	620	600	575	535	490	440	390

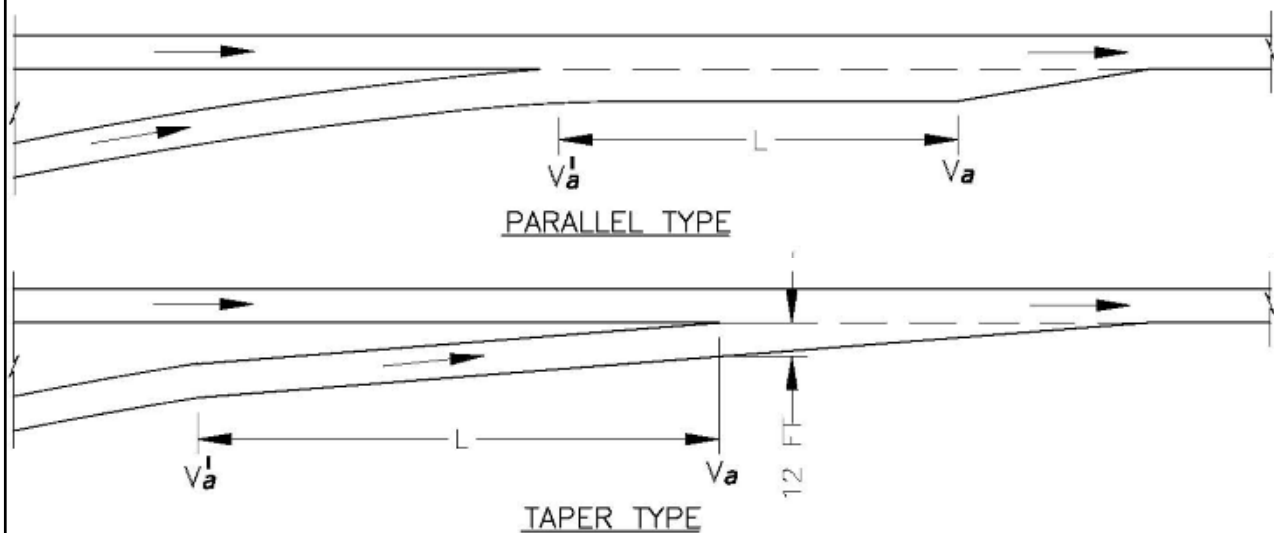
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Minimum Acceleration Lengths for Exit Terminals With Flat Grades of 2 Percent or Less



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Minimum Deceleration Lengths for Exit Terminals With Flat Grades of 2 Percent or Less

Highway Design Speed, mph (V)	Speed Reached, mph (V _s)	L = Acceleration Length, (ft) for Design Speed of Entrance Curve, mph								
		Stop Condition	15	20	25	30	35	40	45	50
		and initial speed, mph (V _i)								
		0	14	18	22	26	30	36	40	44
30	23	180	140	---	---	---	---	---	---	---
35	27	280	220	160	---	---	---	---	---	---
40	31	360	300	270	210	120	---	---	---	---
45	35	560	490	440	380	280	160	---	---	---
50	39	720	660	610	550	450	350	130	---	---
55	43	960	900	810	780	670	550	320	150	---
60	47	1200	1140	1100	1020	910	800	550	420	180
65	50	1410	1350	1310	1220	1120	1000	770	600	370
70	53	1620	1560	1520	1420	1350	1230	1000	820	580
75	55	1790	1730	1630	1580	1510	1420	1160	1040	780

Uniform 50:1 to 70:1 tapers are recommended where lengths of acceleration lanes exceed 1,300 ft.

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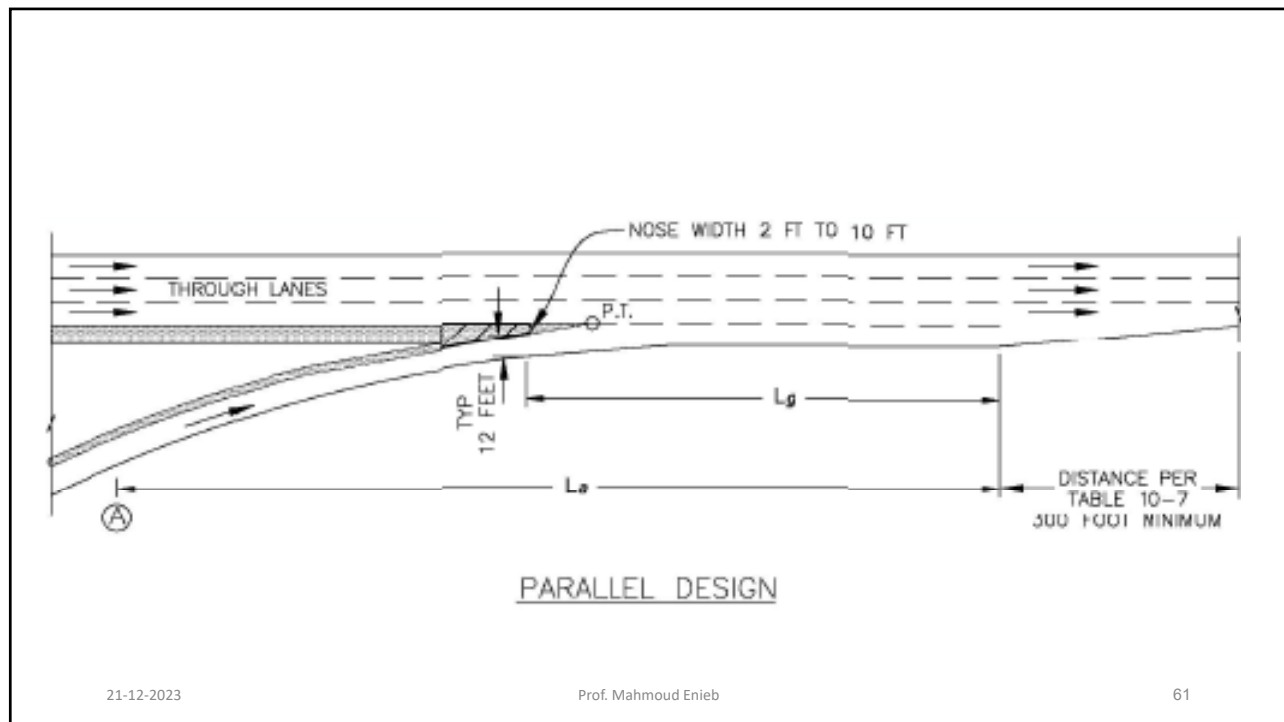
DESIGN SPEED OF HIGHWAY (mph)	DECELERATION LANES				
	Ratio of Length on Grade to Length on Level for Design Speed of Turning Curve (mph) ¹				
All speeds	3 to 4% UPGRADE		3 to 4% DOWNGRADE		
	0.9		1.2		
All speeds	5 to 6% UPGRADE		5 to 6% DOWNGRADE		
	0.8		1.35		
DESIGN SPEED OF HIGHWAY (mph)	ACCELERATION LANES				
	Ratio of Length on Grade to Length of Level for Design Speed of Turning Curve (mph) ¹				
	DESIGN SPEED OF TURNING ROADWAY CURVE, mph				
	20	30	40	50	All speeds
40	3 to 4% UPGRADE				3 to 4% DOWNGRADE
	1.3	1.3	---	---	
45	1.3	1.35	---	---	0.675
50	1.3	1.4	1.4	---	0.65
55	1.35	1.45	1.45	---	0.625
60	1.4	1.5	1.5	1.6	0.6
65	1.45	1.55	1.6	1.7	0.6
70	1.5	1.6	1.7	1.8	0.6
40	5 to 6% UPGRADE				5 to 6% DOWNGRADE
	1.5	1.5	---	---	
45	1.5	1.6	---	---	0.575
50	1.5	1.7	1.9	---	0.55
55	1.6	1.8	2.05	---	0.525
60	1.7	1.9	2.2	2.5	0.5
65	1.85	2.05	2.4	2.75	0.5
70	2.0	2.2	2.6	3.0	0.5

¹ Ratio from this table multiplied by length in Table 10-9 of 104 ft (31.6 m) for speed-change lane on grade.

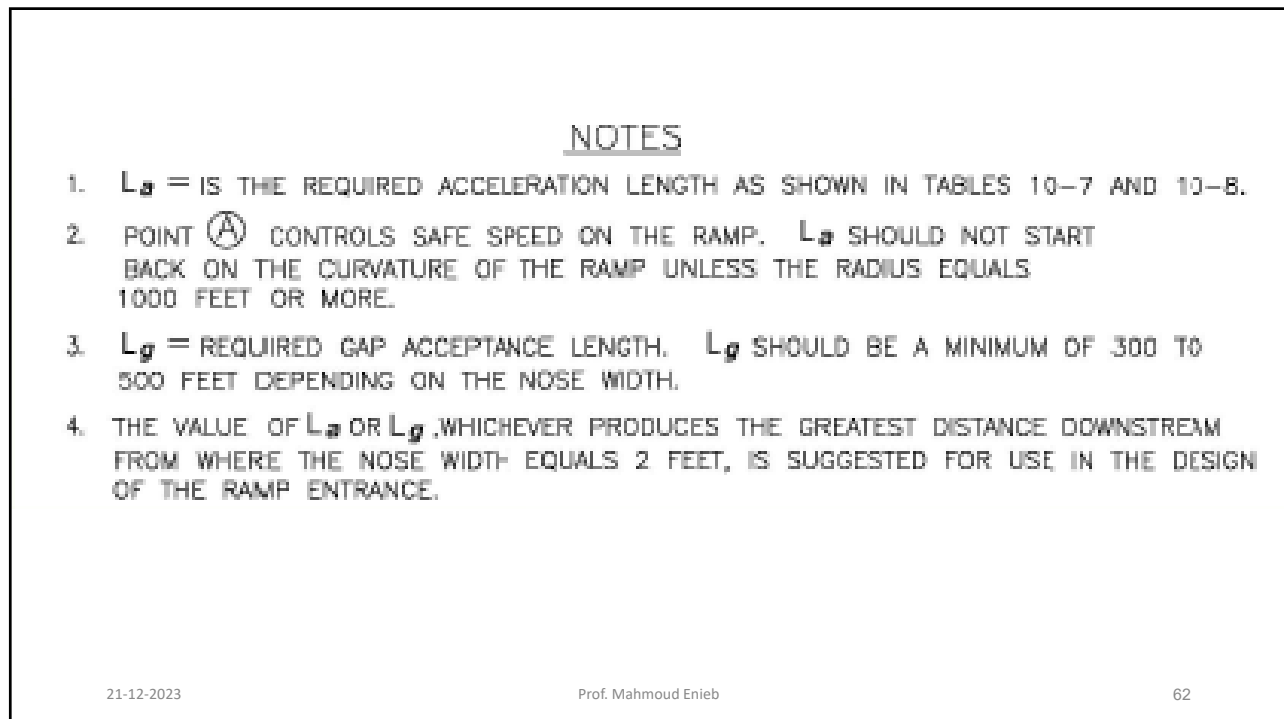
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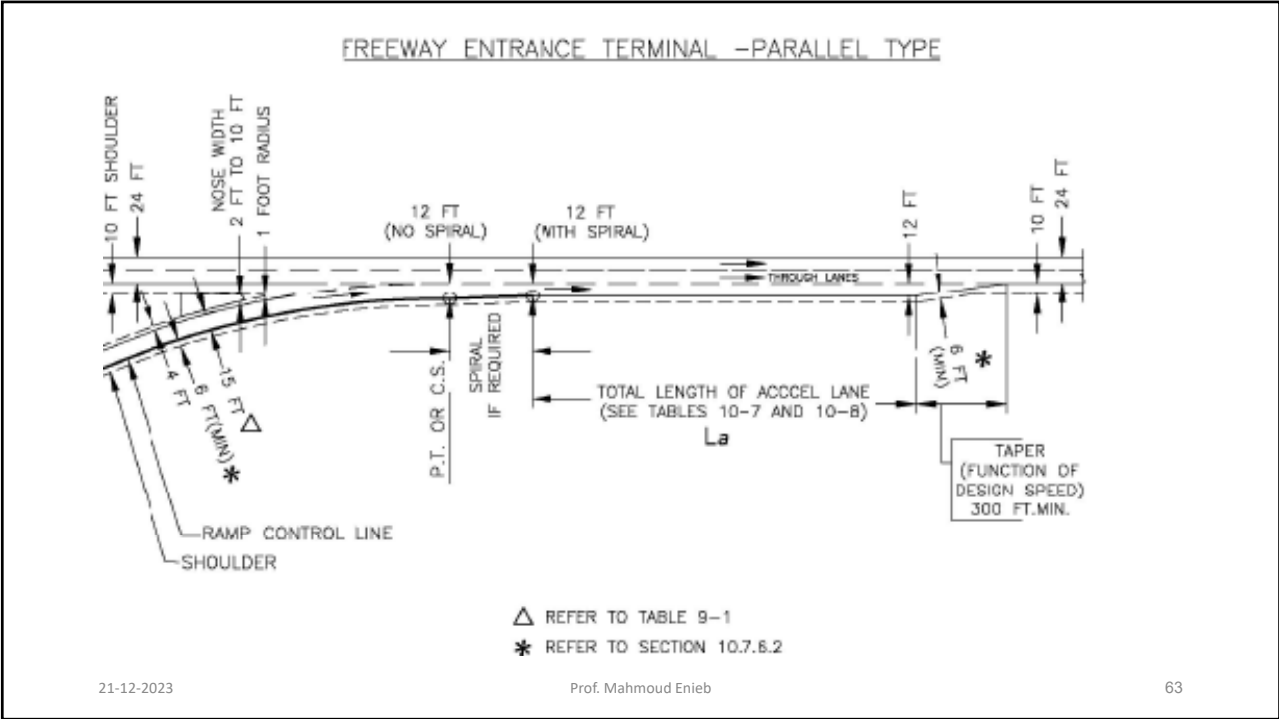
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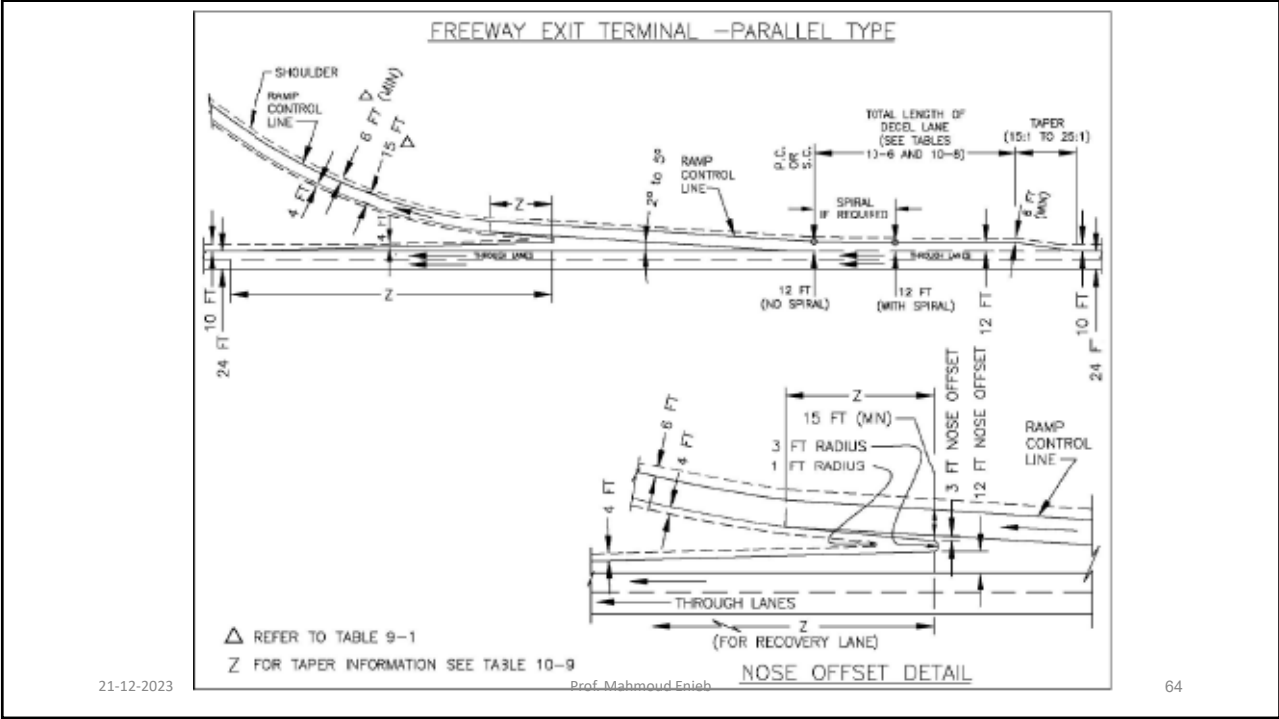
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