



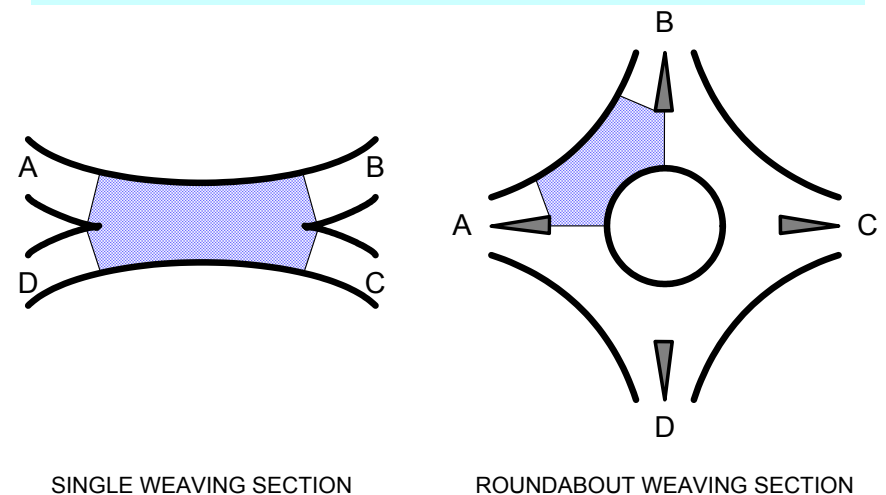
## Scope of Weaving Sections

- Basic Indonesian Traffic Code rule give-way to the left.
- Two types of weaving: **single weaving sections** and **roundabout weaving sections**
- Capacity estimate error  $\leq \pm 15\%$
- Valid for **Degree of Saturation** less than **0,8-0,9**

## Scope of Weaving Sections

Performance Measure	Weaving Section Type	
	Single	Roundabout
Capacity	Yes	Yes
Degree of Saturation	Yes	Yes
Delay	No	Yes
Queue Probability	No	Yes
Travel Speed	Yes	No
Travel Time	Yes	No

## Weaving Section Type and Measures



## Scope of Weaving Sections

Variable	Single Weaving Section		
	Min	Avg	Max
Approach Width	8	9,6	11
Weaving Width	8	11,5	20
Weaving Length	50	96	183
Width/Length	0,06	0,13	0,20
Weaving Ratio	0,32	0,74	0,95
Light Vehicle - %	49	63	81
Heavy Vehicle - %	0	3	13
Motor Cycle - %	16	32	45
Ratio Unmotorised/Motorised	0	0,02	0,06

## Scope of Weaving Sections

Variable	Roundabout		
	Min	Avg	Max
Approach Width	6	9	11
Weaving Width	9	12,6	20
Weaving Length	21	33,9	50
Width/Length	0,22	0,43	0,80
Weaving Ratio	0,32	0,76	0,94
Light Vehicle - %	35	60	75
Heavy Vehicle - %	0	2	3
Motor Cycle - %	20	33	55
Ratio Unmotorised/Motorised	0,01	0,05	0,18

## Objectives of Weaving Sections

- Design and traffic control features should be selected with the aim to ensure that Degree of Saturation during the peak hour does not exceed an acceptable value (**normally 0,75**).

## Definition of Roundabout Types in MKJI 1997

Roundabout Type	Center Island Radius (m)	No. of Entry Lanes	Entry Width $W_1$ (m)	Weaving Length $L_W$ (m)	Weaving Width $W_W$ (m)
R10-11	10	1	3,5	24	7
R10-22	10	2	7,0	27	9
R14-22	14	2	7,0	32	9
R20-22	20	2	7,0	43	9

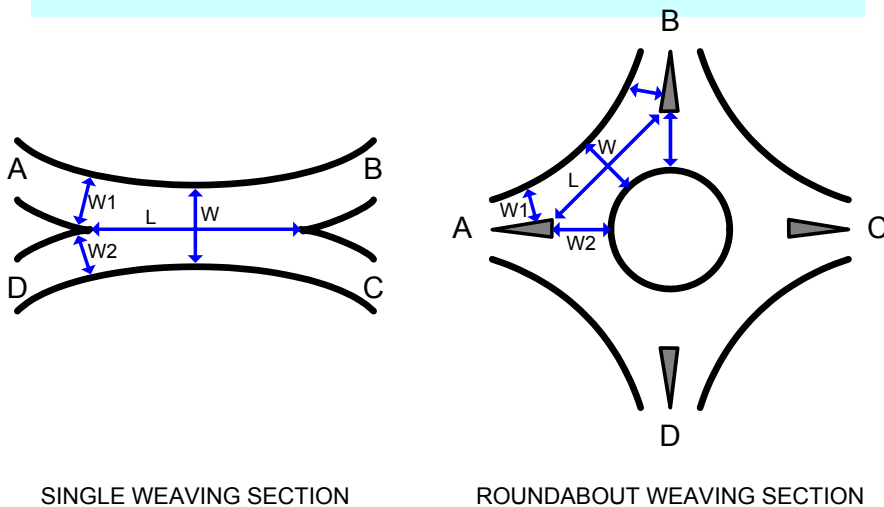
## Traffic Safety Considerations

The traffic accident rate for four-arm roundabouts has been estimated as 0,30 accidents per million incoming vehicles as compared to 0,43 for signalised intersections and 0,60 for unsignalised intersections.

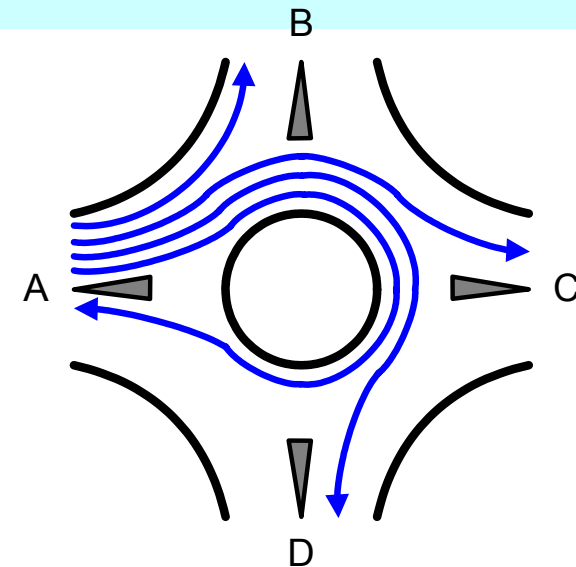
## Traffic Safety Considerations

Roundabouts are thus much safer than other at-grade intersection types, especially at high minor flow ratios, mainly due to small conflict angles and low conflict speeds.

### STEP A-1: Geometric Conditions



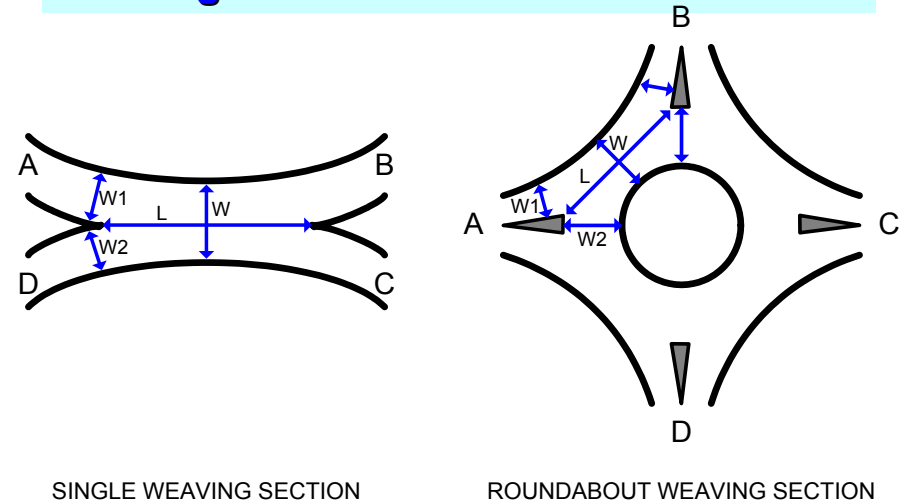
### STEP A-2: Traffic Conditions



## STEP A-3: Environmental Conditions

- City Size Class  
Table A:3-1 p. 4-28
- Road Environment Type  
Table A-3:2 p. 4-28
- Side Friction  
**defined qualitatively by traffic engineer!**

## STEP B-1: Geometric Weaving Section Parameters



## STEP B-1: Geometric Weaving Section Parameters

$$W_E = \frac{W_1 + W_2}{2}$$

If:

$$W_1 > W \rightarrow W_1 = W$$

$$W_2 > W \rightarrow W_2 = W$$

## STEP B-2: Base Capacity

$$C_0 = 135 \times W_w^{1.3} \times (1 + W_E/W_w)^{1.5} \times (1 - p_w/3)^{0.5} \times (1 + W_w/L_w)^{-1.8}$$

$W_w \rightarrow$  Figure B-2:1 p. 4-32

$W_E/W_w \rightarrow$  Figure B-2:2 p. 4-32

$p_w \rightarrow$  Figure B-2:3 p. 4-33

$W_w/L_w \rightarrow$  Figure B-2:1 p. 4-33

### STEP B-3: City Size Adjustment Factor

City Size	Inhab. (M)	$F_{CS}$
Very Small	$\leq 0,1$	0,82
Small	$> 0,1 - \leq 0,5$	0,88
Medium	$> 0,5 - \leq 1,0$	0,94
Large	$> 1,0 - \leq 3,0$	1,00
Very Large	$> 3,0$	1,05

### STEP B-4: Road Environment Type, Side Friction & Unmotorised Vehicle Adjustment Factor

Road Environment Type	Side Friction	Ratio of Unmotorised Vehicles						a	b	$R^2$	$P_{UM}$	$F_{RSU}$
		-	0.05	0.10	0.15	0.20	0.25					
COM	HIGH	0.93	0.88	0.84	0.79	0.74	0.70	0.9290	(0.9257)	0.9989	0.0198	0.9107
COM	MED	0.94	0.89	0.85	0.80	0.75	0.70	0.9410	(0.9543)	0.9989	0.0198	0.9220
COM	LOW	0.95	0.90	0.86	0.81	0.76	0.71	0.9510	(0.9543)	0.9989	0.0198	0.9320
RES	HIGH	0.96	0.91	0.86	0.82	0.77	0.72	0.9586	(0.9486)	0.9991	0.0198	0.9398
RES	MED	0.97	0.92	0.87	0.82	0.77	0.73	0.9681	(0.9714)	0.9988	0.0198	0.9488
RES	LOW	0.98	0.93	0.88	0.83	0.78	0.74	0.9781	(0.9714)	0.9988	0.0198	0.9588
RA	HIGH	1.00	0.95	0.90	0.85	0.80	0.75	1.0000	(1.0000)	1.0000	0.0198	0.9802
RA	MED	1.00	0.95	0.90	0.85	0.80	0.75	1.0000	(1.0000)	1.0000	0.0198	0.9802
RA	LOW	1.00	0.95	0.90	0.85	0.80	0.75	1.0000	(1.0000)	1.0000	0.0198	0.9802

$$F_{RSU} = a - b \times p_{UM}$$

### STEP B-5: Actual Capacity

$$C = C_0 \times F_{CS} \times F_{RSU}$$

$F_{CS}$  → Table B-3:1 p. 4-34

$F_{RSU}$  → Table B-4:1 p. 4-34

### STEP C-1: Degree of Saturation

$$DS = Q_{PCU} / C$$

$Q_{PCU}$  → actual total flow (pcu/h)

$$Q_{PCU} = Q_{veh} \times F_{PCU}$$

$F_{PCU}$  → PCU factor

C → actual capacity (pcu/h)

### STEP C-2: Delay for Roundabout Weaving Section

DS → degree of saturation

**DS ≤ 0,60**

$$DT = 2 + 2,68982 \times DS - (1 - DS) \times 2$$

**DS > 0,60**

$$DT = 1 / (0,59186 - 0,52525 \times DS) - (1 - DS) \times 2$$

### STEP C-3: Queue Probability for Roundabout Weaving Section

$$QP = (26,65 \times DS) - (55,55 \times DS^2) + (108,75 \times DS^3)$$

$$QP = (9,41 \times DS) + (29,967 \times DS^{4,619})$$

DS → degree of saturation

### STEP C-4: Travel Speed for Single Weaving Section

Free-flow speed  $V_0$

$$V_0 = 43 \times (1 - p_w / 3)$$

$p_w$  → ratio weaving flow/total flow

### STEP C-4: Travel Speed for Single Weaving Section

Estimate Travel Speed  $V$

$$V = V_0 \times 0,5 \times (1 + (1 - DS)^{0,5})$$

$V_0$  → free-flow speed (kph)

DS → degree of saturation

### STEP C-5: Travel Time for Single Weaving Section

$$TT = L_w \times 3,6/V$$

$L_w$  → weaving section length (m)

$V$  → travel speed (kph)

### STEP C-6: Evaluation of Traffic Performance

- Design and traffic control features should be selected with the aim to ensure that Degree of Saturation during the peak hour does not exceed an acceptable value (normally 0,75).