### Signal Optimization using PTV Vistro for a Major BRTS Corridor in Pimpri – Chinchwad, Maharashtra

औंध हॉस्पिटल AUNDH HOSPITAL

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### **Overview**

Project Information
Signal Optimization using Vistro
Case Study
Findings



### **Project Partners**



#### Pimpri Chinchwad Municipal Corporation (PCMC)



#### **Pune Traffic Police**



#### JP Traffic Automation Pvt. Ltd.



#### **Global Traffic Solutions**

### **Project Location**



### **PCMC BRT Corridor - 1**



### **Signal Timing Analysis**



Traffic police provide the signal timings based on their experience and observing the amount of traffic

PCMC (Pimpri Chinchwad Municipal Corporation) with the recommendation of the World Bank opted to design their signal timing plans in a more scientific manner



### **Signal Timing Analysis Tools**

- ✤ Manually by IRC SP 41
- PTV Vissim

### PTV Vistro

(Signal Timing Optimization)

Synchro etc.



### Signal Timing Analysis by PTV Vistro



### **Junction Coordination**















### **BRT Signal Phasing & Timing Plan**





# **Case Study**





### D A N G E

### C H O W K





### Dange Chowk



### **Aerial View**



### The Real Challenge !!!!!!!!!!



### The Real Challenge !!!!!!!!!!



### **Video Showing Queue Length**

# GLEBAL RAFFIC 5:58:49PM 2017-3-23

### **Vistro Analysis**

Analysis were conducted for 3 scenarios:

- Scenario A 120 sec Cycle (IRC/HCM/Default)
- Scenario B 120 sec Cycle (Field Observations)
- ✤ Scenario C 180 sec Cycle (Field Observations)



# Scenario A - As per IRC & HCM (120 sec Cycle Length & standard saturation flow (540veh/hr/m))

**Lane Configuration** 





10.5 m

# Scenario A - As per IRC & HCM (120 sec Cycle Length & standard saturation flow (540veh/hr/m))

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 $\times$ 

🙋 PTV Vistro 4.00-07 - F:\Hyderabad PPT\Vissim\New folder\Dange Chowk IRC - HCM.vistro



### Saturation Flow (IRC SP: 41 – 1994)

Width w in metre	3.0	3.5	4.0	4.5	5.0	5.5	
Saturation flow(s) (PCUs) per hr.	1850	1890	1950	2250	2550	2990	

7.6.1.2. Effect of Gradients: For each 1 per cent of uphill gradient, the saturation flow decreases by 3 per cent and for each 1 per cent of downhill gradient, saturation flow increases by 3 per cent. The gradient shall be the average slope between the stop line and a point on the approach 60 m before it.

7.6.1.3. Effect of right turning traffic : If the right turning movements from opposite directions cause the intersection to lock, then the capacity of the intersection cannot be easily assessed. Under non-locking conditions, the effects of right turning traffic depend on whether or not conflicting traffic, moves on the same phase and on whether or not the right turning traffic is given exclusive lanes. There are four possibilities.

- (i) No opposing flow, no exclusive right turns : The saturation flow can be obtained as from 7.6.1.1.
- No opposing flow, exclusive right-turning lanes : The saturation flow(s) depends on the radius of curvatures (r) and is given by :

 $s = \frac{1800}{1 + \frac{1.52}{r}}$  PCUs/m for single file streams  $d \quad s = \frac{3000}{1.52}$  PCUs/m for double file streams

where r is radius of curvature in metres of the right turning steam through a right angle.

(iii) Opposing flow, no exculsive right turning lanes : The maximum number of right turning vehicles per cycle that can take advantage of gaps in the opposite stream can be determined from the following equations.

$$n_r = s_r \frac{(g \times s) - (g \times c)}{s - g}$$

1+ ----

Where s = right turning saturation flow

q = flow in opposing arm

s = saturation flow for opposing arm

g = green time

c = cycle time

(iv) Opposing flow, exclusive right turning lanes : There should be no delay to the straight ahead traffic using the same approach as the right turners, but there will be an effect on the cross phase and this

Width w in metre	3.0	3.5	4.0	4.5	5.0	5.5
Saturation flow(s) (PCUs) per hr.	1850	1890	1950	2250	2550	2990

# Scenario A - As per IRC & HCM (120 sec Cycle Length & standard saturation flow (540veh/hr/m))

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### **Scenario A - Inference**

	0																	
	aneGrou	p Results																
X, volume	/ capacity				2.28			2.37		2.30	1.12	1.35	2.23		1.55			
d, Delay fo	or Lane Gr	oup [s/veh	]		624.75			656.80		661.12	163.57	235.46	630.2	3	313.34			
Lane Grou	IP LOS				F			F		F	F	F	F		F			
Critical La	ne Group			5/		5/1			5/1			54			5/			
50th-Perce	entile Que	ue Length	[veh]	80.48 141.41 31.32 9.85 14.05			14.05	29.91	1	18.97								
50th-Perce	entile Quer	ue Length	[m]		613.28			1077.5	1	238.66	75.04	107.05	227.9	0	144.51			
95th-Perce	entile Que	ue Lenath	[veh]		128 77			226.25		50.17	17 13	23.32	47.93	2	30.77			
95th-Perce	entile Que	ue Length	[m]		981.25			1724.01 382.32 130.54 177.72 3						365.22 234.48				
V M	lovement	, Approa	ch, & Inter	section Re	sults													
d_M, Delay	y for Move	ment [s/ve	eh]	624.75	624.75	624.75	656.80	656.80	656.80	661.12	163.57	235.46	630.23	313.34	1 313.3	4		
Movement	LOS			F	F	F	F	F	F	F	F	F	F	F	F			
Critical Mo	ovement									52								
d_A, Appro	oach Delay	/[s/veh]			624.75			656.80			370.10			412.30	1			
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d_l, Interse	ection Dela	ay [s/veh]					1		55	7.37								
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Ring 4	-	-	-	-	-	-	-	-	-	-			-	-		-		
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SG: 1 33s				SG: (	2 14s	SG: 3	47s					SG	:4 16s		SG: 9 1	0s		

### Scenario B - As per Calibrated Lane Geometry (120 sec Cycle Length & standard saturation flow (720veh/hr/m))

**Lane Configuration** 





### Scenario B - As per Calibrated Lane Geometry (120 sec Cycle) Length & standard saturation flow (720veh/hr/m)) X

😥 PTV Vistro 4.00-07 - F:\Hyderabad PPT\Vissim\New folder\Dange Chowk Research.vistro\*

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### Scenario B - As per Calibrated Lane Geometry (120 sec Cycle Length & standard saturation flow (720veh/hr/m))



### **Scenario B - Inference**

▼ L	ane Group F	Results															
X, volume	/ capacity				1.24			1.24		0.9	90	1.09		1.20		1.03	
d, Delay fo	or Lane Group	p [s/veh]			158.32			149.49		74.	70	130.40		160.38	?	134.44	
Lane Grou	up LOS				F			F		E		F		F		F	
Critical La	ane Group				1			5/			1	1		1			
50th-Perce	entile Queue	Length [ve	eh]		32.41			55.74		7.7	71	10.91		13.06		8.48	
50th-Perce	entile Queue	Length [m	]		246.97			424.75		58.	75	83.15		<i>99.55</i>		64.62	
OFIL Dare		l angli fa	-11		51.01			00 10		12	00	10.00		21.00		15 12	
95th-Perce	entile Queue	Length (m	]		395.53			679.61		106.	57	142.41	,	166.58	?	115.25	
► V M	novement, A	oproaci	o inters	ection riest	ans -												
d_M, Dela	ay for Moveme	ent [s/veh]		<i>158.32</i>	<i>158.32</i>	<i>158.32</i>	149.49	149.49	149.49	74.70	74.7	70 130	40	160.38	160.38	134.	44
Movement	t LOS			F	F	F	F	F	F	E	E	F		F	F	F	
Critical Mo	ovement												1		5/		
d_A, Appro	oach Delay [s	s/veh]			158.32			149.49			99.6	8			155.80	1	
Approach	LOS				F			F			F				F		
d_I, Inters	ection Delay	[s/veh]					•		14	8.24							
										F							
Intersectio	on LOS																
Intersection	on LOS on V/C								<i>0</i>	935							+
Intersection	on LOS on V/C Sequence								О.	935							•
Intersection	on LOS on V/C Sequence	2	3	4	9	-	-	-	-	-	-	-	-	-		-	
Intersection Intersection Ring 1 Ring 2	on LOS on V/C Cequence	2	3	4	9	-	-	-	0. - -	935 -	-	-	-	-		-	- -
Intersection Intersection Ring 1 Ring 2 Ring 3	on LOS on V/C Gequence 1 -	2 -	3	4	9	- -	- -	-	- - -	935	- - -	- - -		-		-	- -
Intersection Intersection Ring 1 Ring 2 Ring 3 Ring 4	on LOS on V/C equence 1 - -	2 - -	3	4	9 - -	- - -	- - -	- - -	0. -   -   -	935	- - -	- - - -	- - -	-			- - - -
Intersection Intersection Ring 1 Ring 2 Ring 3 Ring 4 SG: 1 30s	on LOS on V/C Gequence 1 - -	2 - -	3 - -	4 - - - SG: 2	9 - - -	- - - SG: 3 5	- - -	-	0. -   -   -	935	-	-	- - - SG:	   4 15s		-   -   -   SG: 9 11	- - - - Ds

# Scenario C- Existing Condition (180 sec Cycle Length & measured saturation flow rate)

File       Edit       View       Signal control       Simulation       Help       Scenario:       Base Scenario       Intersection:         Image: Simulation       Image: Simulation	1 Dange Chow	vk 🔹
I My Network,Internet Map I → ↓ ↓ ↓ ↓ ↓ ↓ ↓ ↓ ↓ ↓ ↓ ↓ ↓ ↓ ↓ ↓ ↓ ↓		<b>S</b>
Traffic Control	- E	ð O 🖪
Number 1		*
Intersection Dange Chowk		0
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Analysis Method HCM 2000		
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Approach Northeastbound Southwestbound Northwest	estbound So	outheastbound
Lane Configuration <b>HIIIPP 711111 711</b>	ltr 7	ı <del>dike</del>
ROUTE Left Thru Right Left Thru	ihru Right Left	ft Thru Right
Base Volume Input [veh/h] 218 1907 659 871 3139 800 296 17	70 379 287	7 470 162
Total Analysis Volume [veh/h] 218 1907 659 871 3139 800 296 17	70 379 287	7 470 162
▼     Intersection Settings		
Priority Scheme Major Major Min	inor	Minor
Analyze Intersection?		
Analysis Period 15 minutes		
T I Located in CBD I		
Controller ID 1		
Signal Coordination Group		
Cycle Length [s] 180		
Coordination Type Time of Day Pattern Isola	ated	
Actuation Type Fixed time		· ·
▼ Sequence		
Ring1     1     2     3     4     9     -     -     -		
Ring2         - <th></th> <th></th>		
30-20 Ring 3		
50 m SG: 2 25s SG: 3 60s	SG: 4	25s SG: 9

### **Scenario C - Inference**

. ⊤ La	ane Group	Results													
X, volume	/ capacity				1.24			2.01		1.0.	3	1.10	1.33		1.01
d, Delay fo	or Lane Gro	up [s/veh]			176.26			518.86		129.	94	157.57	239.0	9	152.38
Lane Grou	up LOS				F			F		F		F	F		F
Critical La	ane Group				5/			54				5/	5/		
50th-Perce	entile Queu	e Length [v	eh]		41.96			101.62		12.2	6	14.72	18.4	7	11.39
50th-Perce	entile Queu	e Length (m	1]		319.70		774.38			93.4	5	112.16	140.8	6	86.81
Obin Percentile Quese Longil (reil)					07.77			100.00		- 20 (	2	21.00			10.00
95th-Percentile Queue Length [m]					511.60			1239.01		157.:	56	185.36	228.8	6	147.79
· · ·	iovenient,	мрргоаса	, or mucas	Section nest	ino -										
d_M, Delay	y for Mover	nent [s/veh]	]	<i>176.26</i>	176.26	176.26	518.86	518.86	<i>518.86</i>	129.94	129.94	157.57	239.09	239.09	9 152.38
Movement	t LOS			F	F	F	F	F	F	F	F	F	F	F	F
Critical Mo	ovement								5/						
d_A, Appro	oach Delay	[s/veh]		176.26				<i>518.86</i>			142.33			223.8	1
Approach	105				F			F			F			F	
d_I, Interse	ection Dela	y [s/veh]							35.	3.96			'		
Intersectio	on LOS									F					
Intersectio	on V/C								1.	277					
	equence														
Ring 1	1	2	3	4	9	-	-	-	-	-	-	-	-   -		
Ring 2	-	-	-	-	-	-	-	-	-	-	-	-			
Ring 3	-	-	-	-	-	-	-	-	-	-	-	-			
Ring 4	-	-	-	-	-	-	-	-	-	-	-	-			
SG: 1 60s					SG	:2 25s	2	5G: 3 60s					SG: 4 25	S	SG: 9 10s

### **Inference Summary**

Economio	Queue L	ength (m)	Delay	V/C Datia	
Scenario	Towards Hinjewadi	Towards Chinchwad	(sec/veh)	V/C Ratio	LUS
A (120 CL & std. saturation flow)	1724	981	597	1.776	F
B (120 CL & field saturation flow)	680	395	148	0.935	F
<b>C</b> (180 CL & field saturation flow)	1239	512	354	1.277	F

### **Video Showing BRT Bus Bunching**



### Queuing



### Queuing



### **Export to Vissim**





### **Signal Program**





### Recommendations



### Traffic Signal Priority for Buses

### Recommendations

### Junction Improvements





# **Thank You**

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