Lecture 5
(Handouts)

Diamond Interchanges
At Grade Interchange Types

- Diamond Interchange (>70%)
- Partial Cloverleaf
- Single-point Urban Interchange (SPUI)
Diamond Interchange

- Tight Diamond (<400 ft)
- Compressed (400~800 ft)
- Conventional (>800 ft)
Partial Cloverleaf
Diamond Interchange

Standard Intersection

Diamond Interchange

Left Turns do not Interlock

Median Wide Enough to Require Two Sets of Signals

CROSS STREET
Signal Phases at a Diamond Interchange

\[ A = \phi_1 + \phi_2 \]
\[ B = \phi_5 + \phi_6 \]
Basic Three-Phase Operation

Traffic Progression Line

Distance

Time

A

\( \phi_1 \)

A

\( \phi_2 \)

\( \phi_4 \)

\( \phi_5 \)

\( \phi_6 \)

\( \phi_8 \)

\( TT_{1,2} \)

\( TT_{2,1} \)
Phase Split and Capacity
Basic Three Phase

\[ \phi_1 + \phi_2 + \phi_4 = C \]

\[ \phi_5 + \phi_6 + \phi_8 = C \]

\[ g_4 = g_8 = \max \left[ \frac{y_4}{y_1 + y_2 + y_4} \times (C - 3l), \frac{y_8}{y_5 + y_6 + y_8} \times (C - 3l) \right] \]

\[ g_i = \begin{cases} 
\frac{y_i}{y_1 + y_2} \times (C - g_4 - 3l), & \text{for } i = 1,2 \\
\frac{y_i}{y_5 + y_6} \times (C - g_8 - 3l), & \text{for } i = 5,6 
\end{cases} \]
Example: Three Phase
# Example: Three Phase

<table>
<thead>
<tr>
<th>Movement</th>
<th>Demand vph</th>
<th>Sat. Flow vph</th>
<th>Flow Ratio</th>
<th>Phase Time, sec</th>
<th>Capacity vph</th>
<th>v/c Ratio</th>
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Other Three Phase
Favor West Side
Other Three Phase
Favor East Side
TTI-4 Phase

\[ \phi_4 = \phi'_4 + \Phi \]

\[ \phi'_4 \]

\[ \Phi (\phi_{12}) \]

\[ \Phi (\phi_{16}) \]

\[ \phi_8 = \phi'_8 + \Phi \]

\[ \phi_2 \]

\[ \phi_1 \]

\[ \phi_5 \]

\[ \phi_6 \]

\[ \phi_8 \]

\[ A = \phi_1 + \phi_2 \]

\[ B = \phi_5 + \phi_6 \]
TTI-four-Phase Operation

\[ \phi_8 = \phi'_8 + \Phi \]
\[ \phi_4 = \phi'_4 + \Phi \]

*Overlap = T.T. - 2*
Phase Split and Capacity

Four Phase

\[ \phi_2 + \phi_4 + \phi_6 + \phi_8 = C + \Phi + \Phi = C + 2\Phi \]

\[ \phi_1 + \phi_5 = C - 2\Phi \]

\[ \phi_1 + \phi_2 + \phi_4 + \phi_5 + \phi_6 + \phi_8 = 2C \]

\[ \phi_1 + \phi_2 + \phi_4 = \phi_5 + \phi_6 + \phi_8 = C \]

\[ g_i = \frac{y_i}{y_2 + y_4 + y_6 + y_8} \times (C + 2\Phi - 4l) = \frac{y_i}{Y} \times (C + 2\Phi - 4l), \quad \text{for } i = 2,4,6,8 \]

\[ g_1 = C - \phi_2 - \phi_4 - l \]

\[ g_5 = C - \phi_6 - \phi_8 - l \]
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