TECHNICAL APPENDIX
FOR
REPORT ON RED-LIGHT TRAFFIC CONTROL SIGNAL MONITORING SYSTEMS

Prepared by the New Jersey Department of Transportation

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DETERMINING YELLOW CHANGE INTERVAL

In New Jersey, yellow change intervals are determined by nationally accepted standards. The Department's guiding principle in determining the yellow change interval at traffic signals is the 2009 edition of the Manual on Uniform Traffic Control Devices for Streets and Highways (MUTCD), as amended and supplemented. Section 4D.26 of the MUTCD states: *The duration of the yellow change interval shall be determined using engineering practices*. The MUTCD is adopted in New Jersey through existing motor vehicle law, specifically Title 39 of the Revised Statutes.

The accepted engineering practice to determine yellow change intervals is from the Institute of Transportation Engineers (ITE) 1994 report titled "Determining Vehicle Signal Change and Clearance Intervals". The formula is: **y = t + (v / 2a + 2Gg)** where **y** is the length of the yellow interval, **t** is driver perception-reaction time (recommended as 1 second), **v** is the speed limit (feet per second), **a** is the deceleration rate (10 feet per second squared), **g** is gravitational acceleration (32 feet per second squared), and **G** is the approach grade, usually 0%. Using this formula, a speed limit of 45 MPH will result in 4.3 seconds of required yellow change interval time.

The Department utilizes a generally conservative form of the ITE formula: **y = v** (miles per hour) **divided by 10**. This formula demands a yellow change interval of 4.5 seconds for 45 MPH, but since tenths of seconds are not recognized by the Department, the time is increased, meaning 45 MPH results in 5 seconds of yellow change interval time.

Crash Data and Cost/Benefit Analysis

				Right Angle Crashes					Same Direction Crashes				
LOCATION	**MUNICIPALITY**	**COUNTY**	**SEVERITY**	Pre-Camera (2009)	Cost	Year 1	Cost	Difference Benefit (Loss)	Pre-Camera (2009)	Cost	Year 1	Cost	Difference Benefit (Loss)
Broad St. & Market St.	Newark City	Essex	K	0	$0	0	$0	$0	0	$0	0	$0	$0
			A	0	$0	0	$0	$0	0	$0	0	$0	$0
			B	0	$0	0	$0	$0	0	$0	0	$0	$0
			C	0	$0	1	($44,900)	($44,900)	3	($134,700)	3	($134,700)	$0
			O	1	($7,400)	1	($7,400)	$0	3	($22,200)	3	($22,200)	$0
						Total Cost/Benefit		($44,900)			Total Cost/Benefit		$0

				Right Angle Crashes					Same Direction Crashes				
LOCATION	**MUNICIPALITY**	**COUNTY**	**SEVERITY**	Pre-Camera (2009)	Cost	Year 1	Cost	Difference Benefit (Loss)	Pre-Camera (2009)	Cost	Year 1	Cost	Difference Benefit (Loss)
Broad St. & Raymond Blvd.	Newark City	Essex	K	0	$0	0	$0	$0	0	$0	0	$0	$0
			A	0	$0	0	$0	$0	0	$0	0	$0	$0
			B	0	$0	0	$0	$0	0	$0	0	$0	$0
			C	2	($89,800)	1	($44,900)	$44,900	2	($89,800)	0	$0	$89,800
			O	4	($29,600)	0	$0	$29,600	4	($29,600)	0	$0	$29,600
						Total Cost/Benefit		$74,500			Total Cost/Benefit		$119,400

				Right Angle Crashes					Same Direction Crashes				
LOCATION	**MUNICIPALITY**	**COUNTY**	**SEVERITY**	Pre-Camera (2009)	Cost	Year 1	Cost	Difference Benefit (Loss)	Pre-Camera (2009)	Cost	Year 1	Cost	Difference Benefit (Loss)
Broad St. & Kinney St.	Newark City	Essex	K	0	$0	0	$0	$0	0	$0	0	$0	$0
			A	0	$0	0	$0	$0	0	$0	0	$0	$0
			B	0	$0	0	$0	$0	0	$0	0	$0	$0
			C	0	$0	0	$0	$0	0	$0	2	($89,800)	($89,800)
			O	0	$0	1	($7,400)	($7,400)	3	($22,200)	2	($14,800)	$7,400
						Total Cost/Benefit		($7,400)			Total Cost/Benefit		($82,400)