

NRO Change and Clearance Interval Data Collection & Processing Best Practices 2.0

This document serves as additional guidance to Traffic Engineering Memorandum 306.1 and NRO Traffic Engineering Practice 406.2 in order to provide a consistent approach to clearance interval data collection and processing within the VDOT Northern Region. Practices described below do not supersede any portion of the aforementioned memorandums.

- **Approach speed:** For approaches with no posted speed limit and posted speeds limits that are not representative of the approach, engineering judgment should be used to determine the appropriate approach speed for calculations. It is suggested that the Engineer perform a speed study or “rideability review” and/or judge based on the “street and land-use type” to determine the appropriate speed under unconstrained, free flow conditions. All speeds selected using engineering judgment should be adequately documented.
- **Grade:** Grades are measured using either of the two procedures as outlined below:
 - i) Using elevation information: Grade is determined 100 ft, 200 ft, 300 ft and 400 ft from the stop bar by measuring the elevation at each point. The intention behind measurements at multiple points is to study any significant change in profile patterns along the 400 ft distance from the stop bar.
 - If a steady profile pattern is observed, grade is calculated using elevation points at the stop bar and 400 ft from the stop bar.
 - If any significant change in grade is observed within 400 ft, appropriate engineering judgment should be used in selecting the grade. All grades used outside of the prescribed 400 ft measurement should be documented with appropriate engineering judgment.
 - ii) Field measurement: This method is used in case a change in geometric features is observed or a change in grade profile is expected (due to intersection modifications) between the existing and future conditions at the location. Point grades are collected in field at the Stop Bar, 100 ft, 200 ft, 300 ft and 400 ft back from the stop bar. The remaining procedure for grade selection is same as discussed in the above case (i).

The grade to be used in the calculation should be rounded down to the nearest whole percent (i.e. 2.3% should be rounded to 2% and -3.4% should be rounded to -4%).

- **Red Clearance Times for Left Turns:** If the Engineer feels large intersection widths and/or the prescribed policy approach left turn speed is not representative of the approach and could result in inappropriately long red clearance times, a space mean speed study or “rideability review” can be performed to document actual observed clearance times by recording safe intersection passage time on an adequate sampling of vehicles in order to determine the appropriate speed.
- **Short Approaches:** On short approaches where the Engineer determines unconstrained, free flow speeds can’t be obtained due to limited storage capacity, extremely low volumes and/or limited signal sight distance, a space mean speed study or “rideability review” can be performed

to determine speeds for safe intersection passage for the through movement. In these cases, the through or left turn approach speed used for clearance interval calculation should not exceed the determined speed to safely pass through the intersection. Any speed determined using engineering judgment should be adequately documented.

- **Width:** For cases of unusual geometry (such as but not limited to skewed intersections, two 'T' intersections operating with one controller, or intersections where one of the side-street approaches is an off-ramp and the opposite side-street approach has only a receiving lane and no approach movement/lane), the intersection width (w) is measured from the back (upstream) edge of the approaching movement stop line and the end point of measurement is to be determined based on engineering judgment considering conflicting movement paths. Appropriate documentation is to be provided in such cases.
- **Yellow and Red Interval Threshold for Additional Study:** In accordance with the third paragraph of "Minimums, Maximums, and Rounding" section of TE-306.1, Northern Region Operations asserts that if the total of Yellow change and Red clearance interval are equal or greater than 10 seconds, the Engineer should perform an additional speed study to determine whether the calculated clearance interval is appropriate for operating conditions. If the Engineer interprets that the data collected from the field study does not coincide with policy guidance, any variance or conclusions should be documented, with a professional engineering recommendation, if necessary. The engineer should complete preliminary clearance and change calculations prior to field investigation in order to minimize the number of trips.
- **Rounding:** For type 2070 controller signals, the rounding of calculated intervals shall be based on the procedure specified in the TE 306.1 memorandum. For type 170 controller signals, the rounding of calculated intervals shall be based on the procedure specified in the NRO TEP 406.2 guidelines. A table of calculated intervals, after rounding, is attached to this document as an additional resource for both type 2070 and type 170 controller signals.
- **Change and Clearance Intervals for Proposed Traffic Signals:** Intervals for proposed traffic signals shall be calculated based on proposed pavement marking locations, approach grades and speed limits using field data or project plans as appropriate. For movements where approach speed cannot be verified under conditions prior to traffic signal control, the Engineer should use engineering judgment to determine approach speed. Once the traffic signal is under normal operating conditions, all assumptions and engineering judgment shall be field verified and adjusted as needed.
- **Speed Calculations for U-Turn Movements:** In cases of 'T' intersections with presence of lanes for 'U' turning traffic, NRO suggests that the engineer perform a speed study or "rideability review" to determine the actual turning speed for "U" turns (for use in red clearance interval calculations) as applicable.
- **Intersection width measurement for left-turn movements:** When measuring the intersection width for left-turn movements, NRO suggests considering the distance along natural turning path of vehicles. In cases where a puppy track exists for left-turn movement, longest turning distance in reference to the puppy track is to be used.

Type-2070 Controller

Yellow Change Interval

(based on TE 306.1)

Movement	Speed Limit	V (MPH) (based on TE 306.1)	G (%)																				
			-10	-9	-8	-7	-6	-5	-4	-3	-2	-1	0	1	2	3	4	5	6	7	8	9	10
Left	10	5	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	
	15	10	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	
	20	15	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	
	25	20	3.2	3.1	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	
	30	25	3.7	3.6	3.5	3.4	3.3	3.2	3.1	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	
	35	30	4.3	4.1	4.0	3.8	3.7	3.6	3.5	3.4	3.4	3.3	3.2	3.1	3.1	3.0	3.0	3.0	3.0	3.0	3.0	3.0	
	40	35	4.8	4.6	4.5	4.3	4.2	4.1	4.0	3.8	3.7	3.7	3.6	3.5	3.4	3.3	3.3	3.2	3.2	3.1	3.0	3.0	
	45	40	5.3	5.1	5.0	4.8	4.6	4.5	4.4	4.3	4.1	4.0	3.9	3.8	3.8	3.7	3.6	3.5	3.5	3.4	3.3	3.3	
	50	45	5.9	5.7	5.5	5.3	5.1	4.9	4.8	4.7	4.5	4.4	4.3	4.2	4.1	4.0	3.9	3.8	3.8	3.7	3.6	3.6	
	55	50	6.4	6.2	6.0	5.7	5.6	5.4	5.2	5.1	4.9	4.8	4.7	4.6	4.5	4.4	4.3	4.2	4.1	4.0	3.9	3.8	
	60	55	7.0	6.7	6.4	6.2	6.0	5.8	5.6	5.5	5.3	5.2	5.0	4.9	4.8	4.7	4.6	4.5	4.4	4.3	4.2	4.1	
65	60	7.5	7.2	6.9	6.7	6.5	6.3	6.1	5.9	5.7	5.6	5.4	5.3	5.1	5.0	4.9	4.8	4.7	4.6	4.5	4.4		
Thru	10	17	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0		
	15	22	3.4	3.3	3.2	3.1	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0		
	20	27	3.9	3.8	3.7	3.6	3.5	3.4	3.3	3.2	3.1	3.1	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0		
	25	32	4.5	4.3	4.2	4.0	3.9	3.8	3.7	3.6	3.5	3.4	3.4	3.3	3.2	3.1	3.1	3.0	3.0	3.0	3.0		
	30	37	5.0	4.8	4.7	4.5	4.4	4.2	4.1	4.0	3.9	3.8	3.7	3.6	3.6	3.5	3.4	3.3	3.3	3.2	3.2		
	35	42	5.6	5.3	5.2	5.0	4.8	4.7	4.5	4.4	4.3	4.2	4.1	4.0	3.9	3.8	3.7	3.7	3.6	3.5	3.5		
	40	47	6.1	5.9	5.7	5.5	5.3	5.1	5.0	4.8	4.7	4.6	4.5	4.3	4.2	4.2	4.1	4.0	3.9	3.8	3.7		
	45	52	6.6	6.4	6.1	5.9	5.7	5.6	5.4	5.2	5.1	4.9	4.8	4.7	4.6	4.5	4.4	4.3	4.2	4.1	4.0		
	50	57	7.2	6.9	6.6	6.4	6.2	6.0	5.8	5.6	5.5	5.3	5.2	5.1	4.9	4.8	4.7	4.6	4.5	4.4	4.3		
	55	62	7.7	7.4	7.1	6.9	6.6	6.4	6.2	6.0	5.9	5.7	5.6	5.4	5.3	5.2	5.0	4.9	4.8	4.7	4.6		
	60	67	8.3	7.9	7.6	7.4	7.1	6.9	6.7	6.5	6.3	6.1	5.9	5.8	5.6	5.5	5.4	5.2	5.1	5.0	4.9		
65	72	8.8	8.5	8.1	7.8	7.6	7.3	7.1	6.9	6.7	6.5	6.3	6.1	6.0	5.8	5.7	5.6	5.4	5.3	5.2			

Legend:

- Values lesser than 3s for yellow change interval are increased to 3s (minimum value for yellow change interval based on TE 306.1 memorandum)
- Values greater than the 'maximum' threshold for yellow change interval (thresholds based on NRO Best Practices Guidelines)

Type-2070 Controller

Red Clearance Interval

(based on TE 306.1)

Movement	Speed Limit	V (MPH) (based on TE 306.1)	w (ft)																				
			20	25	30	35	40	45	50	55	60	65	70	75	80	85	90	95	100	105	110	115	120
Thru	n/a	20	1.0	1.0	1.0	1.0	1.0	1.2	1.4	1.6	1.7	1.9	2.1	2.2	2.4	2.6	2.7	2.9	3.1	3.3	3.4	3.6	3.8
	10	17	1.0	1.0	1.0	1.2	1.4	1.6	1.8	2.0	2.2	2.4	2.6	2.8	3.0	3.2	3.4	3.6	3.8	4.0	4.2	4.4	4.6
	15	22	1.0	1.0	1.0	1.0	1.0	1.0	1.2	1.3	1.5	1.6	1.8	1.9	2.1	2.2	2.4	2.6	2.7	2.9	3.0	3.2	3.3
	20	27	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.1	1.3	1.4	1.5	1.6	1.8	1.9	2.0	2.1	2.3	2.4	2.5
	25	32	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.1	1.2	1.3	1.4	1.6	1.7	1.8	1.9	2.0
	30	37	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.1	1.2	1.3	1.4	1.5	1.6
	35	42	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.1	1.2	1.3
	40	47	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
	45	52	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
	50	57	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
	55	62	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
60	67	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	
65	72	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	

Movement	Speed Limit	V (MPH) (based on TE 306.1)	w (ft)																				
			125	130	135	140	145	150	155	160	165	170	175	180	185	190	195	200	205	210	215	220	225
Thru	n/a	20	3.9	4.1	4.3	4.4	4.6	4.8	5.0	5.1	5.3	5.5	5.6	5.8	6.0	6.1	6.3	6.5	6.7	6.8	7.0	7.2	7.3
	10	17	4.8	5.0	5.2	5.4	5.6	5.8	6.0	6.2	6.4	6.6	6.8	7.0	7.2	7.4	7.6	7.8	8.0	8.2	8.4	8.6	8.8
	15	22	3.5	3.6	3.8	3.9	4.1	4.3	4.4	4.6	4.7	4.9	5.0	5.2	5.3	5.5	5.6	5.8	6.0	6.1	6.3	6.4	6.6
	20	27	2.7	2.8	2.9	3.0	3.2	3.3	3.4	3.5	3.7	3.8	3.9	4.0	4.2	4.3	4.4	4.5	4.7	4.8	4.9	5.0	5.2
	25	32	2.1	2.2	2.3	2.4	2.5	2.6	2.7	2.8	2.9	3.0	3.1	3.3	3.4	3.5	3.6	3.7	3.8	3.9	4.0	4.1	4.2
	30	37	1.7	1.8	1.8	1.9	2.0	2.1	2.2	2.3	2.4	2.5	2.6	2.7	2.8	2.9	3.0	3.0	3.1	3.2	3.3	3.4	3.5
	35	42	1.3	1.4	1.5	1.6	1.7	1.8	1.8	1.9	2.0	2.1	2.2	2.2	2.3	2.4	2.5	2.6	2.6	2.7	2.8	2.9	3.0
	40	47	1.1	1.2	1.2	1.3	1.4	1.5	1.5	1.6	1.7	1.8	1.8	1.9	2.0	2.0	2.1	2.2	2.3	2.3	2.4	2.5	2.5
	45	52	1.0	1.0	1.0	1.1	1.2	1.2	1.3	1.4	1.4	1.5	1.6	1.6	1.7	1.7	1.8	1.9	1.9	2.0	2.1	2.1	2.2
	50	57	1.0	1.0	1.0	1.0	1.0	1.0	1.1	1.1	1.2	1.3	1.3	1.4	1.4	1.5	1.6	1.6	1.7	1.7	1.8	1.9	1.9
	55	62	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.1	1.1	1.2	1.2	1.3	1.4	1.4	1.5	1.5	1.6	1.6	1.7
60	67	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.1	1.1	1.2	1.2	1.3	1.3	1.4	1.4	1.5	
65	72	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.1	1.1	1.2	1.2	1.3	1.3	

Movement	Speed Limit	V (MPH) (based on TE 306.1)	w (ft)																				
			230	235	240	245	250	255	260	265	270	275	280	285	290	295	300	305	310	315	320	325	330
Thru	n/a	20	7.5	7.7	7.8	8.0	8.2	8.4	8.5	8.7	8.9	9.0	9.2	9.4	9.5	9.7	9.9	10.1	10.2	10.4	10.6	10.7	10.9
	10	17	9.0	9.2	9.4	9.6	9.8	10.0	10.2	10.4	10.6	10.8	11.0	11.2	11.4	11.6	11.8	12.0	12.2	12.4	12.6	12.8	13.0
	15	22	6.7	6.9	7.0	7.2	7.3	7.5	7.7	7.8	8.0	8.1	8.3	8.4	8.6	8.7	8.9	9.0	9.2	9.4	9.5	9.7	9.8
	20	27	5.3	5.4	5.6	5.7	5.8	5.9	6.1	6.2	6.3	6.4	6.6	6.7	6.8	6.9	7.1	7.2	7.3	7.4	7.6	7.7	7.8
	25	32	4.3	4.4	4.5	4.6	4.7	4.8	5.0	5.1	5.2	5.3	5.4	5.5	5.6	5.7	5.8	5.9	6.0	6.1	6.2	6.3	6.4
	30	37	3.6	3.7	3.8	3.9	4.0	4.1	4.1	4.2	4.3	4.4	4.5	4.6	4.7	4.8	4.9	5.0	5.1	5.2	5.3	5.3	5.4
	35	42	3.0	3.1	3.2	3.3	3.4	3.5	3.5	3.6	3.7	3.8	3.9	3.9	4.0	4.1	4.2	4.3	4.3	4.4	4.5	4.6	4.7
	40	47	2.6	2.7	2.8	2.8	2.9	3.0	3.1	3.1	3.2	3.3	3.3	3.4	3.5	3.6	3.6	3.7	3.8	3.8	3.9	4.0	4.1
	45	52	2.3	2.3	2.4	2.5	2.5	2.6	2.7	2.7	2.8	2.9	2.9	3.0	3.1	3.1	3.2	3.3	3.3	3.4	3.4	3.5	3.6
	50	57	2.0	2.0	2.1	2.2	2.2	2.3	2.3	2.4	2.5	2.5	2.6	2.6	2.7	2.8	2.8	2.9	2.9	3.0	3.1	3.1	3.2
	55	62	1.7	1.8	1.9	1.9	2.0	2.0	2.1	2.1	2.2	2.2	2.3	2.3	2.4	2.5	2.5	2.6	2.6	2.7	2.7	2.8	2.8
60	67	1.5	1.6	1.6	1.7	1.7	1.8	1.8	1.9	1.9	2.0	2.0	2.1	2.1	2.2	2.2	2.3	2.4	2.4	2.5	2.5	2.6	
65	72	1.4	1.4	1.5	1.5	1.6	1.6	1.6	1.7	1.7	1.8	1.8	1.9	1.9	2.0	2.0	2.1	2.1	2.2	2.2	2.3	2.3	

Legend:

Values lesser than 1s for red clearance interval are increased to 1s (minimum value for red clearance interval based on TE 306.1 memorandum)

Values greater than the 'maximum' threshold for red clearance interval (threshold based on NRO Best Practices Guidelines)

Type-170 Controller																							
Yellow Change Interval																							
(based on TE 306.1 and NRO Traffic Engineering Practice 406.2)																							
Movement	Speed Limit	V (MPH) (based on TE 306.1)	G (%)																				
			-10	-9	-8	-7	-6	-5	-4	-3	-2	-1	0	1	2	3	4	5	6	7	8	9	10
Left	10	5	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
	15	10	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
	20	15	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
	25	20	3.5	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
	30	25	4.0	3.5	3.5	3.5	3.5	3.5	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
	35	30	4.5	4.0	4.0	4.0	4.0	3.5	3.5	3.5	3.5	3.5	3.5	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
	40	35	5.0	4.5	4.5	4.5	4.5	4.0	4.0	4.0	4.0	4.0	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.0	3.0	3.0	3.0
	45	40	5.5	5.0	5.0	5.0	4.5	4.5	4.5	4.5	4.0	4.0	4.0	4.0	4.0	4.0	3.5	3.5	3.5	3.5	3.5	3.5	3.5
	50	45	6.0	6.0	5.5	5.5	5.0	5.0	5.0	5.0	4.5	4.5	4.5	4.5	4.0	4.0	4.0	4.0	4.0	4.0	3.5	3.5	3.5
	55	50	6.5	6.5	6.0	6.0	5.5	5.5	5.5	5.0	5.0	5.0	5.0	4.5	4.5	4.5	4.5	4.5	4.0	4.0	4.0	4.0	4.0
60	55	7.0	7.0	6.5	6.5	6.0	6.0	5.5	5.5	5.5	5.5	5.0	5.0	5.0	5.0	4.5	4.5	4.5	4.5	4.5	4.0	4.0	
65	60	7.5	7.5	7.0	7.0	6.5	6.5	6.0	6.0	6.0	5.5	5.5	5.5	5.0	5.0	5.0	5.0	5.0	4.5	4.5	4.5	4.5	
Thru	10	17	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
	15	22	3.5	3.5	3.5	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
	20	27	4.0	4.0	4.0	3.5	3.5	3.5	3.5	3.5	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
	25	32	4.5	4.5	4.5	4.0	4.0	4.0	4.0	3.5	3.5	3.5	3.5	3.5	3.5	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
	30	37	5.0	5.0	5.0	4.5	4.5	4.5	4.0	4.0	4.0	4.0	4.0	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.0	3.0
	35	42	5.5	5.5	5.5	5.0	5.0	5.0	4.5	4.5	4.5	4.5	4.0	4.0	4.0	4.0	4.0	4.0	3.5	3.5	3.5	3.5	3.5
	40	47	6.0	6.0	6.0	5.5	5.5	5.0	5.0	5.0	5.0	4.5	4.5	4.5	4.5	4.5	4.0	4.0	4.0	4.0	4.0	4.0	3.5
	45	52	6.5	6.5	6.0	6.0	6.0	5.5	5.5	5.5	5.0	5.0	5.0	5.0	4.5	4.5	4.5	4.5	4.5	4.0	4.0	4.0	4.0
	50	57	7.5	7.0	6.5	6.5	6.5	6.0	6.0	5.5	5.5	5.5	5.5	5.0	5.0	5.0	5.0	4.5	4.5	4.5	4.5	4.5	4.5
	55	62	8.0	7.5	7.0	7.0	6.5	6.5	6.5	6.0	6.0	6.0	5.5	5.5	5.5	5.5	5.0	5.0	5.0	5.0	4.5	4.5	4.5
60	67	8.5	8.0	7.5	7.5	7.0	7.0	7.0	6.5	6.5	6.0	6.0	6.0	5.5	5.5	5.5	5.5	5.0	5.0	5.0	5.0	5.0	
65	72	9.0	8.5	8.0	8.0	7.5	7.5	7.0	7.0	7.0	6.5	6.5	6.0	6.0	6.0	6.0	5.5	5.5	5.5	5.5	5.0	5.0	

Legend:

Values lesser than 3s for yellow change interval are increased to 3s (minimum value for yellow change interval based on TE 306.1 memorandum)

Values greater than the 'maximum' threshold for yellow change interval (thresholds based on NRO Best Practices Guidelines)

Type-170 Controller

Red Clearance Interval

(based on TE 306.1 and NRO Traffic Engineering Practice 406.2)

Left Movement	Speed Limit	V (MPH) (based on TE 306.1)	w (ft)																					
			20	25	30	35	40	45	50	55	60	65	70	75	80	85	90	95	100	105	110	115	120	
Left	n/a	20	1.0	1.0	1.0	1.0	1.0	1.5	1.5	1.5	2.0	2.0	2.0	2.5	2.5	2.5	3.0	3.0	3.0	3.5	3.5	3.5	4.0	
Thru	10	17	1.0	1.0	1.0	1.5	1.5	1.5	2.0	2.0	2.5	2.5	2.5	3.0	3.0	3.5	3.5	3.5	4.0	4.0	4.5	4.5	4.5	
	15	22	1.0	1.0	1.0	1.0	1.0	1.0	1.5	1.5	1.5	1.5	2.0	2.0	2.0	2.5	2.5	2.5	3.0	3.0	3.0	3.5	3.5	
	20	27	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.5	1.5	1.5	1.5	2.0	2.0	2.0	2.0	2.5	2.5	2.5	
	25	32	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.5	1.5	1.5	1.5	2.0	2.0	2.0	2.0	
	30	37	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.5	1.5	1.5	1.5	1.5	
	35	42	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.5	1.5
	40	47	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
	45	52	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
	50	57	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
	55	62	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
	60	67	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
65	72	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	

Left Movement	Speed Limit	V (MPH) (based on TE 306.1)	w (ft)																					
			125	130	135	140	145	150	155	160	165	170	175	180	185	190	195	200	205	210	215	220	225	
Left	n/a	20	4.0	4.0	4.5	4.5	4.5	5.0	5.0	5.0	5.5	5.5	5.5	6.0	6.0	6.0	6.5	6.5	7.0	7.0	7.0	7.5	7.5	
Thru	10	17	5.0	5.0	5.5	5.5	5.5	6.0	6.0	6.5	6.5	6.5	7.0	7.0	7.5	7.5	7.5	8.0	8.0	8.5	8.5	8.5	9.0	
	15	22	3.5	3.5	4.0	4.0	4.0	4.5	4.5	4.5	5.0	5.0	5.0	5.5	5.5	5.5	5.5	6.0	6.0	6.0	6.5	6.5	6.5	
	20	27	3.0	3.0	3.0	3.0	3.5	3.5	3.5	3.5	4.0	4.0	4.0	4.0	4.5	4.5	4.5	4.5	5.0	5.0	5.0	5.0	5.5	
	25	32	2.0	2.5	2.5	2.5	2.5	2.5	3.0	3.0	3.0	3.0	3.0	3.5	3.5	3.5	3.5	4.0	4.0	4.0	4.0	4.0	4.5	
	30	37	2.0	2.0	2.0	2.0	2.0	2.0	2.5	2.5	2.5	2.5	2.5	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.5	3.5	3.5	3.5
	35	42	1.5	1.5	1.5	1.5	2.0	2.0	2.0	2.0	2.0	2.0	2.5	2.5	2.5	2.5	2.5	2.5	2.5	3.0	3.0	3.0	3.0	3.0
	40	47	1.0	1.5	1.5	1.5	1.5	1.5	1.5	1.5	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.5	2.5	2.5	2.5	2.5	2.5
	45	52	1.0	1.0	1.0	1.0	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.5
	50	57	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	2.0	2.0	2.0	2.0	2.0
	55	62	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	2.0
	60	67	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.5	1.5	1.5	1.5	1.5	1.5	1.5
65	72	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.5	1.5	1.5	1.5	

Left Movement	Speed Limit	V (MPH) (based on TE 306.1)	w (ft)																					
			230	235	240	245	250	255	260	265	270	275	280	285	290	295	300	305	310	315	320	325	330	
Left	n/a	20	7.5	8.0	8.0	8.0	8.5	8.5	8.5	9.0	9.0	9.0	9.5	9.5	9.5	10.0	10.0	10.0	10.5	10.5	10.5	11.0	11.0	
Thru	10	17	9.0	9.5	9.5	9.5	10.0	10.0	10.5	10.5	10.5	11.0	11.0	11.5	11.5	11.5	12.0	12.0	12.5	12.5	12.5	13.0	13.0	
	15	22	7.0	7.0	7.0	7.5	7.5	7.5	8.0	8.0	8.0	8.0	8.5	8.5	8.5	9.0	9.0	9.0	9.5	9.5	9.5	10.0	10.0	
	20	27	5.5	5.5	5.5	6.0	6.0	6.0	6.0	6.5	6.5	6.5	6.5	7.0	7.0	7.0	7.0	7.5	7.5	7.5	7.5	8.0	8.0	
	25	32	4.5	4.5	4.5	4.5	5.0	5.0	5.0	5.0	5.5	5.5	5.5	5.5	5.5	6.0	6.0	6.0	6.0	6.0	6.5	6.5	6.5	
	30	37	3.5	4.0	4.0	4.0	4.0	4.0	4.0	4.5	4.5	4.5	4.5	4.5	4.5	5.0	5.0	5.0	5.0	5.5	5.5	5.5	5.5	
	35	42	3.0	3.0	3.5	3.5	3.5	3.5	3.5	3.5	4.0	4.0	4.0	4.0	4.0	4.0	4.5	4.5	4.5	4.5	4.5	4.5	4.5	5.0
	40	47	2.5	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.5	3.5	3.5	3.5	3.5	3.5	3.5	4.0	4.0	4.0	4.0	4.0	4.0	4.0
	45	52	2.5	2.5	2.5	2.5	2.5	2.5	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.5	3.5	3.5	3.5	3.5	3.5	3.5
	50	57	2.0	2.0	2.0	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.5
	55	62	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	3.0	3.0	3.0	3.0
	60	67	1.5	1.5	1.5	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5
65	72	1.5	1.5	1.5	1.5	1.5	1.5	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.5	2.5	2.5	2.5	

Legend:

Values lesser than 1s for red clearance interval are increased to 1s (minimum value for red clearance interval based on TE 306.1 memorandum)

Values greater than the 'maximum' threshold for red clearance interval (threshold based on NRO Best Practices Guidelines)