

Manual of Traffic Control Signal Design

Connecticut Department of Transportation
Bureau of Engineering and Highway Operations
Division of Traffic Engineering
2001

This manual presumes that a traffic engineering study has determined that traffic signal control is needed. This document is intended to provide guidelines for certain considerations involved in the design of such devices.

Some of the information contained in this manual reflects current departmental policy and current State Traffic Commission Regulations as of August, 2000. In the event that policy or regulations are changed such that they conflict with information in this manual, the revised policy / regulations will supersede.

MANUAL REVIEW COMMITTEE

Gerry M. Fascione
Jennifer M. Gillis, P.E.

Carl R. Marino
Robin M. Waterman
Richard H. Nicol, Chairman

TABLE OF CONTENTS

References.....	5-6
Preliminary Considerations.....	7
Design Volumes.....	7
Dual Turn Lanes.....	8-10
Phasing.....	11-24
Left Turn	
Advance Green	11-12
Protected Left	13
Lag Green	14-17
Lead - Lag	18
Dual Advance	19
Directional Separation	19
Quad	19-23
Turn Overlap	24
Capacity Analysis & Signal Timing.....	25
Lost Time	25
Cycle Length - Webster's Equation	25
Signal Timing.....	25-27A
Gap Reduction	26
Variable Initial	26
Clearance Intervals	27-27A
Vehicle Detection.....	28-33
Controller Operation	28
Detector Types	28-30
Loop Installation Guidelines	30-33
Microwave Installation Guidelines	33
Dilemma Zone.....	34-35
Flashing Operation.....	36
Programmed Flash	36
Traffic Signal Maintenance	36

Pre-emption.....		37-44
Emergency Vehicle	37-38	
Pre-emption Definitions	38-39	
Pre-emption Design Guidelines	40-42	
Railroad Pre-emption	43-44	
Traffic Signal Equipment		45-50
Signal Heads - location & size	45-49	
Span Poles	49-50	
Signing and Pavement Markings.....		51-52
Auxiliary Signs and Signals		52
Merritt Parkway Guidelines		53
Flashing Stop-Ahead Signs.....		53-53A
Electrical Considerations		54-67
Field Survey & Utility Meetings	54-55	
General	55-56	
Conduit	56	
Cable	57-58	
Span Pole Structural Design	59-60	
Mast Arm Structural Design	61-62	
Mast Arm Profile Design Guidelines	63-64	
Loop Detector Design	65	
Service Types	66	
Energy Information	66	
Overlaps	67	
Signal Plan Layout		68-73
Pedestrian & Bicycle Considerations.....		74-76
Side-Street Green	75	
Audible Pedestrian Indications	76	
Signal Systems.....		77-91
Traffic Engineering Analysis	77	
System Analysis	77-78	
Selection of Alternative Systems	78	
Signal System Work Sheet	79	
Signal System Concurrence Sheet	80-81	
Signal System Coordination Types	81	
Signal System Design	82-83	

Time Space Diagrams	83-84	
Closed Loop Design	85-86	
Signal System Information	87-91	
Non - Closed Loop	87	
Closed Loop	88-89	
Closed Loop Terminology	90-91	
Signal Ownership & Maintenance.....		92-94
Ownership	92	
Installation Costs	93-94	
Electrical Energy Costs	94	
Pre-emption Systems	94	
Signal Design Check List		95-96
Guidelines for Reviewing Traffic Signal Designs by Consultant		97-100
Clear Zone Chart.....		101
Drafting Guidelines for Consultants.....		102-134
Preliminary Design Requirements	102-103	
Semifinal Design Requirements	103	
Final Design Requirements	103-104	
Electronic Requirements	105	
Manual Drafting Guidelines	106-119	
CADD Drafting Guidelines	120-133	
Metric Dimensional Guide	134	
Glossary.....		135-138
Signal Manual Update Sheet		139

References

1. "Traffic Signals: Capacity and Timing Analysis" by R. Akcelik, March 1981 Australian Road Research Board - Research Report ARR No. 123.
2. Connecticut Department of Transportation Highway Design Manual, latest edition.
3. Highway Capacity Manual, Transportation Research Board, latest edition.
4. Highway Capacity Software, McTrans Center, University of Florida, Gainesville, Florida.
5. Manual of Traffic Signal Design - second edition, Institute of Transportation Engineers, 1990.
6. Manual on Uniform Traffic Control Devices For Streets And Highways, US Department of Transportation Federal Highway Administration - latest edition.
7. NCHRP Synthesis 225 - "Left Turn Treatments at Intersections" Transportation Research Board National Research Council, Washington, D.C. 1996.
8. National Electric Code - latest edition.
9. National Electric Safety Code - latest edition.
10. NEMA Standards Publication No. TS-2 1992, Traffic Controller Assemblies.
11. Public Roads Capacity Analysis Techniques for Design of Signalized Intersections, Reprinted from Public roads Vol. 34 No. 9 & 10 , August 1967 & October 1967, US Department of Transportation Federal Highway Administration.
12. Regulations of the Connecticut State Agencies Vol. II Section 16-243 -Construction and Maintenance Standards Governing Traffic Signals Attached to Public Service Company Poles.
13. Standard Specifications for Roads, Bridges and Incidental Construction - latest edition, Connecticut Department of Transportation, and supplement.
14. State Traffic Commission Administrative Regulations - section 14-298-700 to 14-298-741.
15. Traffic Control Systems Handbook FHWA – SA-95-302, US Department of Transportation Federal Highway Administration, February 1996.
16. Transportation and Traffic Engineering Handbook - fifth edition, Institute of Transportation Engineers.
17. Catalog of Signs (Metric) – Connecticut Department of Transportation, September 2000.

18. CADD/Graphics/GIS Manual.
19. State of Connecticut, Department of Transportation, Bureau of Engineering and Highway Operations – 1999-2001 – Functional Specifications for Traffic Control Equipment.
20. Transportation Quarterly – Signal Change Intervals and Intersection Geometry – January 1984, Volume XXXVIII, No. 1.
21. Consulting Engineer's Manual – latest edition.