Manual of Traffic Control Signal Design

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

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References


17. Catalog of Signs (Metric) – Connecticut Department of Transportation, September 2000.

