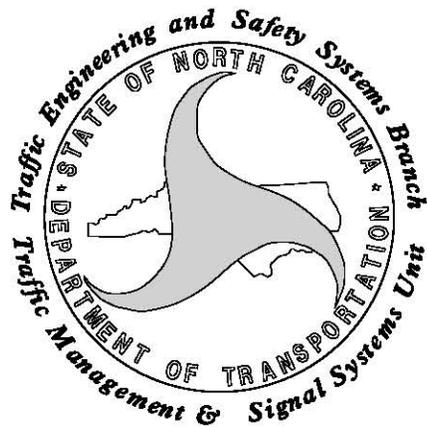


# Design Manual

## Definitions



Part 4

**-A-**

**AASHTO** - American Association of State Highway and Transportation Officials.

**Actuated Operation** - A traffic signal operation that responds to information from vehicle or pedestrian detectors and provides signal operation and phase timing accordingly.

**Actuation** - A registration of demand for right-of-way by traffic to the controller unit.

**ANSI** - American National Standards Institute

**Average Daily Traffic (ADT)** - The average two-way volume of traffic at a given location during a 24-hour day, measured over some period of time less than a year.

**AWG** - American Wire Gauge. Standard measurement of wire based upon the circular mil system. One mil equals 0.001 inch (or approximately 0.0254mm).

**-B-**

**Back Panel** - A panel that is mounted on the back of the inside of a cabinet and on which terminals are mounted. The back panel may also include the sidewalls of the cabinet.

**Back Plate** - A black metal plate attached to a signal head used to increase the target value of the signal face (used when signal face is not readily visible to motorist due to competing background lighting such as commercial signs and lights, sunlight, etc).

**Barrier** - A reference point in the designated sequence of a dual ring controller. The barrier interlocks the two rings, and assures that conflicting phases will not be selected and/or timed concurrently. Both rings cross the barrier simultaneously to select and time phases on the other side.

**Blank-out Sign** - A sign that is typically used to control turning movements by time-of-day operation or in a preemption sequence. Sign is blank until message is needed.

**Bore & Jack** - An installation method for underground conduit.

**Buffer Tubes** - Extruded cylindrical tubes used for protection and isolation encasing optical fibers.

**-C-**

**Call** - see Actuation

**Call Delay** - For a detector unit, the ability to delay its output to the controller for a predetermined length of time after a vehicle enters the detection zone. For a controller, the ability to disregard a call from a detector unit for a predetermined length of time.

**Card-Rack Mounted Detectors** - see Rack Mounted Detectors

**Channel** - A specified band for the transmission and reception of fiber optic data and/or images.

**CIM** - Cable Identification Marker

**Cladding** - The material surrounding the core of an optic fiber. The cladding keeps the light in the fiber core.

**Clearance Interval** - The time from the end of the right of way of one phase to the beginning of the right of way of a conflicting phase. See also Yellow Change Interval and Red Clearance Interval.

**Closed Circuit Camera (CCTV)** – A television transmission circuit with a limited number of reception stations and no broadcast facilities.

**Closed Loop System (CLS)** - A signal system in which signals are connected to a master controller. The master controller selects timing patterns for the system that may be traffic-responsive or time-of-day. The master is connected to a computer in a central office. The computer

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can be used to monitor the system, make timing changes, and receive reports of signal malfunctions.

**Communication Cable** - Also called interconnect cable. The cable that is used to transmit and receive data between field devices and/or a central facility.

**Communications Hub** - Enclosure used to house a central computer network. It can be controlled from a remote location.

**Conditional Re-service** - A feature that allows reservice of an even phase (through phase) after an odd phase is conditionally serviced. Once the odd phase is allowed conditional service, the even phase (same ring) may begin timing again but times only minimum green.

**Conditional Service** - A feature that allows an odd phase to time again after normal service to that phase. Requirements for conditional service are: 1) A call is placed on odd phase while even phases are timing, 2) an even phase (same ring as odd phase) gaps or maxes out, and 3) vehicle clearance time of gapped/maxed out phase, plus conditional service minimum green time is less than or equal to the time remaining on the max timer of the even phase still timing.

**Conduit** - A polyethylene, PVC, or metal pipe used to protect wires or cables.

**Conflict Monitor** - A device located inside the cabinet (usually separate from controller) that continually checks for the presence of conflicting signal indications. Upon detection of conflicting indications, the conflict monitor will cause the signal to go into flash.

**Controller (Signal Controller)** - A device that determines the sequence and duration of indications displayed by traffic signals. See also Type 2070L Controller, NEMA Controller, and Type 170 Controller.

**Controller Asset Number** - A controller communication address number used in interconnected traffic signal systems. It is usually designated as the signal inventory number.

**Coordination** - A timing relationship between adjacent signals that allows traffic to progress smoothly along a corridor.

**Cycle Length** - The time period required for one complete sequence of signal indications. In an actuated traffic signal controller, a complete cycle is dependent on the presence of calls on all phases. In a pre-timed traffic signal, it is the complete sequence of signal indications.

### **-D-**

**Delineator Marker** - A vertically anchored plastic dome post used to mark the path of underground conduit.

**Design Hour Volume (DHV or K Factor)** - The percentage of the 24-hour volume that occurs during the peak hour (usually on the Roadway Design Cover Sheet; if not, 10% is a good assumption).

**Design Speed** - The speed used for the design of the detection zone placement/controller timing.

**Design Year** - Usually five years after the project letting date.

**Detection Zone** - The area of the roadway where a vehicle will cause actuation.

**Dielectric** - A dielectric cable contains no metallic components and is, therefore, non-conductive. Glass fibers are dielectric.

**Directional Drill** - A method of installing underground conduit.

**Digital Detector Unit (Detector)** - A digital device used in a vehicle detection system which produces a signal when a vehicle passes through or remains within the detection zone of a sensing element.

**Directional Split (D)** - The highest percentage of the two-way traffic going in one direction at any time (usually on the Roadway Design Cover Sheet; if not, 60% is a good assumption).

**Direction Design Hour Volumes (DDHV)** - Estimated design year counts derived from ADT counts.

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**Drop Cable** - A communications cable that is spliced into a trunk cable to service a traffic signal, CCTV, or DMS.

**Dual Entry** - An operating mode programmed on the controller that causes compatible phases on different rings to be served together even when only one of the phases has a call. Ex: For a location with phase 4 + 7 and 4 + 8 for side street phases, select dual entry for phase 4 so phase 4 comes on with phase 7 and phase 8.

**Dual-Quad Phasing** - Standard NEMA phasing sequence using two interlocking rings separated by a barrier.

**Dual-Ring Controller** - A controller unit containing two interlocking rings which are arranged to time in a preferred sequence and to allow concurrent timing of compatible phases in both rings, subject to the restraint of the barrier. Each of the compatible phase groups must cross the barrier simultaneously to select and time phases in the phase group on the other side.

**Dummy Phase** - A phase that times as a normal phase but for which there are no directly connected on-street signal indications. This is typically used as an all-red phase.

**Dynamic Maximum Function** - A 2070L feature that causes the maximum timing interval to be adjusted based on demand. Appropriate where demand is occasionally higher than normal max times (such as at a school).

**Dynamic Message Sign (DMS)** – A message board located over or near a road to alert travelers to possible traffic related problems. The message can be updated from a remote location. Formerly known as Changeable Message Sign and Variable Message Sign.

### **-E-**

**EIA** - Electronic Industries Association

**EIA-232** - A common interface standard for data communications equipment. It specifies signal voltages, signal timing, signal function, a protocol for information exchange, and mechanical connectors. Formerly known as RS-232.

**Electrical Disconnect** - Refers to the box where electrical connections are made. The box also houses the breaker controlling service to the cabinet.

**Electrical Service** - Includes the conduit, power meter, disconnect box, and triplex cable that provides power for any cabinet.

**Emergency Vehicle Preemption** - A type of preemption in which the normal signal sequence is interrupted, giving right of way to emergency vehicles.

**Exclusive Mode** – see Protected Mode

**Exclusive Pedestrian Phase** - A phase that serves only pedestrians. No vehicles are served.

**Exclusive/ Permissive Mode** – see Protected/Permissive Mode

**Extend** - For a detector unit, the ability of a detector to continue its output for a predetermined length of time following an actuation; i.e., after the vehicle leaves the detection zone. For a controller, the ability to hold a vehicle call for a predetermined length of time following an actuation (see also Stretch Detection).

### **-F-**

**Fiber** - A thin filament of glass. An optical waveguide consisting of a core and a cladding that is capable of carrying information in the form of light.

**Fiber Optic Jumper** - Optical fiber cable that has connectors installed on both ends. Note: Industry standard utilizes a yellow jacket for SMFO jumper and an orange jacket for MMFO jumper.

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**Fiber Optic Pigtail** - Optical fiber cable that has a connector installed on one end. Note: Industry standard utilizes a yellow jacket for SMFO pigtail and an orange jacket for MMFO pigtail.

**Fiber Optic Receiver** - An electronic device that converts optical signals to electrical signals.

**Fiber Optic Splice** - An interconnection method for joining the end of one bare fiber to another fiber.

**Fiber Optic Splice Enclosure** - An enclosure used to house a cable run splice point, and organize and protect splice trays.

**Fiber Optic Splice Tray** - A container used to secure, organize, and protect spliced fibers.

**Fiber Optic Transceiver** - An electronic device that converts optical signals to electrical signals and converts an electrical information-carrying signal to a corresponding optical signal for transmission by fiber. A transceiver is one device consisting of a transmitter and a receiver.

**Fiber Optic Transmitter** - An electronic device used to convert an electrical information-carrying signal to a corresponding optical signal for transmission by fiber. The transmitter is usually a Light Emitting Diode (LED).

**Flashing Operation** - A mode of operation in which traffic signal indications are turned on and off at a repetitive rate.

**Free-Run Operation** - A mode of operation for a traffic signal where the signal is not currently coordinated with adjacent traffic signals in the system.

**Fully-Actuated Coordination** - A traffic signal coordination feature in which at some point in the cycle, the coordinated phase loops become activated. This allows the coordinated phases the opportunity to gap out

so that the traffic signal can service the minor phases without sacrificing system progression

**Fully-Actuated Operation** - A type of traffic signal operation in which all traffic movements are detected (actuated) and timing intervals vary with demand.

**Fusion Splice** - A permanent joint produced by the application of localized heat sufficient to fuse the ends of the optical fiber, forming a continuous light signal path.

### **-G-**

**Gap** - Elapsed time between the end of one vehicle actuation and the beginning of the next actuation.

**Gap-Out** - Termination of a green interval due to an excessive time interval between the actuations of vehicles arriving on the green phase.

**Gap Time** - The time interval that extends the right of way portion of a phase. This interval is reset with each vehicle actuation. The phase is subject to the limit of the maximum green interval.

### **-H-**

**Heat Shrink Tubing** - Used to seal the opening of a conduit or riser where fiber optic cable exits.

### **-I-**

**Inductive Loop** - A loop of electrical wire placed in the roadway for vehicle detection.

**Interconnect Cable** - See Communications Cable

**Interconnect Center** - Refers to the housing compartment of the splice tray and patch panel.

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**Interval** - Any of several divisions of the signal cycle during which signal indications do not change.

**Isolated Signal** - A signal which operates independently of any other signal.

**-J-**

**Jumpers** - See Fiber Optic Jumpers

**Junction Box (Pull Box)** - An enclosure usually placed underground with a removable top flush with ground level. It is used for splicing and storing cable. There are three types used for traffic purposes. 1) Regular sized junction boxes are used for loop lead-in or signal cable. 2) Oversized junction boxes are used primarily for communications cable. 3) Oversized heavy-duty junction boxes are used when the box may come in contact with vehicular traffic.

**-L-**

**Lagging Left** - A green arrow indication for a left turn that follows the green indication for the opposing through movement.

**Lamp** - The light bulb of a traffic signal section or an illuminated sign.

**Lead-In Cable** - The electrical cable that serves to connect the loop wire to the detector unit in the controller cabinet.

**Leading Left** - A green arrow indication for a left turn that precedes the green indication for the opposing through movement.

**Lead/Lag Operation** - A type of operation where a leading protected left is provided in one direction, followed by the through movements, and ending with a protected left in the opposite direction. Typically, the non-conflicting through movement is being served with the protected lefts.

**Link** - A telecommunications circuit between any two telecommunications devices.

**Load Bay** - The section of the back panel where load switches are installed.

**Load Switch** - An electrical device activated by the controller that turns power on or off for the traffic signal indications.

**Locking Memory** - A vehicle call for demand is remembered or held by the controller until the call has been satisfied by the appropriate green indication, even if the vehicle has left the detection zone.

**Loop** - see Inductive Loop

**Loop Emulator Detection System** - The system detects vehicles by processing images obtained through video cameras located at an intersection and providing outputs to the signal controller. The loop emulator detection system may be used when lead-in cable is difficult to maintain during lengthy time frames or when flexibility to move detection areas is needed such as for temporary signal configurations during numerous construction phases.

**Loop Setback** - The distance between the stop line and the loop.

**Loop Wire** - The electrical wire running from the lead-in cable to the inductive loop, forming the loop, and continuing back to the lead-in cable.

**Louvers** - A series of slats that are installed in a signal visor to limit a signal's visibility from an undesired direction.

**-M-**

**Mast Arm** - A structural support extending over the roadway from a pole, for the purpose of supporting traffic control devices.

**Master Asset Number** - A controller communication address number for the master controller that is used to communicate with the central computer.

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**Master Controller** - A controller that supervises interconnected local controllers.

**Maximum Green Interval** - The maximum green time for a phase after an actuation by a conflicting phase.

**Maximum Recall** - An operating mode in which the right of way reverts to a particular phase. The controller serves this phase each cycle, regardless of vehicle demand.

**Max-Out** - Termination of a green phase resulting from the expiration of the maximum green interval.

**Messenger Cable** - see Span Wire

**Microwave Vehicle Detector** - A detector that uses a microwave beam to detect the motion of a vehicle. Microwave vehicle detectors are used where it may be impractical or cost prohibitive to use an inductive loop, such as on a bridge deck.

**Minimum Green Interval (Initial Interval)** - Minimum green indication time for a phase.

**Minimum Recall** - An operating mode in which the right of way reverts to a particular phase in the absence of conflicting vehicle calls. The controller serves this phase each time through the cycle for at least the minimum green interval, regardless of vehicle demand.

**Modem** - A device located in the master controller cabinet for transmitting digital data over telephone wires by modulating the data into an audio signal to send it and demodulating an audio signal into data to receive it.

**Multi-Channel Detector** - A detector unit that is capable of monitoring two or more detection zones.

**MUTCD** - Manual on Uniform Traffic Control Devices

## -N-

**National Electrical Safety Code (NESC)** - Governs utility separations and clearances.

**NEMA** - National Electrical Manufacturer's Association

**NEMA Controller** - A type of controller in widespread use. The specifications for these controllers were developed by NEMA to provide compatibility and interchangeability. NEMA controllers are distinguished by standardized functions and input/output formats, and internal programming.

**Nonlocking Memory** - A controller feature in which a waiting call is dropped or forgotten by the controller after the vehicle leaves the detection zone.

## -O-

**OASIS** - A traffic signal controller software developed by Econolite for implementation in an Advanced Transportation Controller (ATC) Type 2070 controller.

**Occupancy** - The proportion of time that a detection zone is occupied.

**Offset** - A time relationship, expressed in seconds or percent of cycle length, determined by the difference between the coordinated green phase and a system reference point.

**Optically Programmed Head** - A signal head containing optical units projecting an indication which is selectively masked so as to be visible only within desired viewing boundaries.

**Option Zone** - As a driver approaches a signal this is the area where, after seeing the signal head turn yellow, the driver is uncertain whether to decelerate and stop the vehicle, or continue and pass through the intersection.

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**Overlap** - A green indication that allows traffic to move while a different phase is being timed.

**-P-**

**Passage Time** - see Gap Time

**Patch Panel** - A collection of connector panels in a common housing.

**Peak Hour Factor (PHF)** - The ratio of the total hourly flow to the maximum 15-minute rate of flow within the hour. A high PHF indicates uniform traffic throughout the hour and a low PHF indicates "spikes" of traffic within the hour.

**Pedestrian Change Interval** - The time that the flashing "Don't Walk" indication is displayed following the "Walk" interval.

**Pedestrian Clearance Interval** - The time interval that includes the pedestrian change interval, the yellow interval, and the all-red interval.

**Pedestrian Push-button** - A pedestrian detector that uses a pedestrian-operated button to place actuations.

**Pedestrian Recall** - An operating mode in which the controller serves a particular pedestrian phase for the walk time each time through the cycle, regardless of actuation.

**Pedestrian Signal Head** - Signal assembly advising pedestrians by word or symbols to "Walk" or "Don't Walk."

**Pedestrian Soft Recall** - An operating mode in which the controller serves a particular pedestrian phase for the walk time each time that the corresponding vehicle phase is served.

**Permanent Call** - A continuous call usually resulting from loop or detector unit malfunction.

**Permissive Mode** - A mode in which turning traffic is allowed to move but must yield to other traffic.

**Phase** - The right-of-way assignment of one or more traffic or pedestrian movements within the signal cycle.

**Phase Omit** - A feature that prohibits the controller from allowing a particular phase. Logic circuitry or controller programming may sometimes initiate the operation of this feature.

**Phase Rotation** - A programming option on some controllers that temporarily rearranges (rotates) the sequential order of phases to be served, depending on time-of-day or vehicle demand input. For example, a three-phase signal in which the left turn normally operates as a leading left, but operates as a lagging left during peak hours.

**Phase Sequencing** - A feature in which the traffic signal phases are sequenced differently than the NEMA standard dual ring configuration.

**Pig Tail** - See Fiber Optic Pigtail

**Preemption** - Transfer of the normal control of a signal to a special signal control due to a special situation such as passage of a train or granting of right of way to an emergency vehicle.

**Presence Detection** - The operating mode of a detector unit that sends a call to the controller as long as the vehicle remains within the detection zone.

**Pretimed Operation** - Traffic signal operation with predetermined fixed cycle length(s), fixed interval durations and interval sequence(s).

**Protected Mode** - A mode in which turning traffic is given right of way without having to yield to other traffic.

**Protected/Permissive Mode** - A mode in which turning traffic is given right of way during one portion of the cycle, but has to yield to other traffic during other portions of the cycle.

**Pull Box** - see Junction Box

**Push-button** - see Pedestrian Push-button

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**-Q-**

**Quadrupole Loop** - An inductive loop design with a longitudinal saw slot along the center of a rectangular loop so that the loop wire can be installed in a figure-eight pattern. These loops are especially useful in the detection of small vehicles.

**Queue Detector** - A detector set back from the stop line so as not to place a call until a certain number of vehicles line up in the lane.

**-R-**

**Rack-Mounted Detectors** - Detector units that are not enclosed in a case and, therefore, must be inserted into a wired receptacle or "rack" in the cabinet.

**Railroad Preemption** - A type of preemption in which the normal signal sequence is interrupted when a train is approaching. Railroad tracks are cleared of vehicles and right of way is granted to vehicle movements that do not conflict with the train movement.

**Recall, Maximum** - see Maximum Recall

**Recall, Minimum** - see Minimum Recall

**Recall, Pedestrian** - see Pedestrian Recall

**Recall, Soft** - see Soft Recall

**Red Clearance Interval** - A clearance interval following the yellow change interval in which both the terminating phase and the next right of way phase display a red indication.

**Red Detector Lock** - A detector call is locked on a phase when that phase is in its red interval. The lock ensures service to the phase even if the detector input terminates prior to serving the phase.

**Red Rest** - An operating mode in which the signal will "rest" in red for all approaches, and will give a green indication to the first approach that is actuated.

**Red Revert** - Minimum red time before immediate phase reservice. Red revert times concurrently with the red clearance interval. This feature is typically used in lieu of a dummy phase.

**Riser** - A galvanized steel conduit that is used to protect wires and cables transitioning from underground to aerial.

**RS-232** - See EIA-232

**-S-**

**Sawcut** - The groove cut into pavement to install inductive loops.

**Sealant** - The material used in the saw slot of an inductive loop to encapsulate the wire and environmentally seal the slot.

**Self Healing Transceiver** - A fiber optic transceiver that has the ability to transmit and receive a signal in a reverse direction should one of its two channels become disabled or damaged.

**Semi-Actuated Operation** - A type of traffic signal operation in which some, but not all traffic movements are detected.

**Sequential Phasing** - Standard NEMA phasing sequence in which the cycle progresses through the individual phases in a predetermined order with no concurrent phases.

**Shelf-Mounted Detectors** - Detector units that are enclosed in a case and are placed on a shelf inside the cabinet.

**Signal Face** - That part of a signal head that controls one or more traffic movements in a single direction and contains one or more signal sections.

**Signal Head** - An assembly of one or more signal faces together with the associated signal housings.

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**Signal Section** - The assembly of a housing, lens, and light source with necessary components and supporting hardware to be used for providing one signal indication.

**Signal System** - Two or more signal installations operating in coordination.

**Simultaneous Gap-Out** - An operating mode programmed on the controller in which two phases must concurrently satisfy their respective gap times in order to cross the barrier.

**Single-Mode Fiber (SMFO)** - A type of optical fiber in which the signal travels in one mode. The fiber has a small core diameter of approximately 8 microns. Used primarily for communications in transportation applications that may cover longer distances.

**Snow Shoe** - A cable storage rack used for storing extra cable on an aerial run.

**Soft Recall** - An operating mode in which the right of way reverts to a particular phase in the absence of conflicting vehicle calls. The controller is able to skip this phase in the cycle if there are no calls for it.

**Span Wire (Messenger Cable)** - A cable used to support traffic signal heads, signal cable, communications cable and/or signs.

**Splice Cabinet** - A cabinet used to provide a housing for cable splices.

**Splice Enclosure** - See Fiber Optic Splice Enclosure

**Splice Tray** - See Fiber Optic Splice Tray

**Split** - The portion of cycle length, in seconds or percent, allocated to green, yellow and all red for a particular signal phase.

**Split Phasing** - An operating mode in which two facing approaches are serviced with separate phases.

**Standard Signal Face Clearances** - A standard chart that shows how each signal clears from each phase.

**Stop Line (Stopbar)** - A pavement marking line indicating where vehicles should stop when directed by a traffic control device.

**Strain Pole** - Typically a metal pole that has sufficient strength to support a span wire without the use of guys.

**Stretch Detection** - A detection scheme which uses the extend feature of the detector unit and passage time on the controller to extend the green interval of a phase (see also Extend).

**System Detectors** - Detectors used to provide information to a master controller (or a central control computer). This information is used to select appropriate coordination patterns to meet the traffic demands.

**-T-**

**Time Based System (TBS)** - A system that changes timing plans on an internal time basis. This type of system does not require interconnection of the traffic signals.

**Time-of-Day Patterns** - Signal timing plans that are implemented according to the time of day.

**Time-Space Diagram** - A pictorial representation of the operation of a signal system.

**Tracer Wire** - A number 14 copper wire in a jacket that is pulled through non-metallic conduit along with fiber optic cable to provide a means for locating the conduit after it is installed.

**Traffic-Actuated Controller** - see Actuated Controller

**Traffic-Adaptive System (TAS)** - A system in which a master controller (or a central control computer) can adapt cycle length, splits and offsets based on vehicle demand.

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**Traffic-Responsive System (TRS)** - A system in which a master controller (or a central control computer) specifies cycle, splits and offsets based on the real-time demands of traffic as sensed by vehicle detectors.

**Traffic Signal** - Any power-operated traffic control device that alternately assigns right of way.

**Transceiver** - See Fiber Optic Transceiver

**Trenching** - An excavation method to install a conduit system underground.

**Triplex** - An electrical service cable consisting of three twisted cables, two current carrying conductors, and one neutral. All three are housed in an outer jacket.

**Trunk** - A transmission link joining two points which is distinguished by its large information carrying capacity and that all signals go from point to point without branching off to any separate drops except at the end points.

**Type 170 Controller** - A type of controller in widespread use. In a Type 170 controller, processor hardware is standardized with the actual control being provided by specialized, externally-loaded software.

**Type 2070L Controller** - One of the three primary types of controllers in widespread use. In a Type 2070L controller, hardware is standardized at the module level to aid in compatibility between manufacturers' equipment. Currently, manufacturer specific drivers are embedded in the firmware to allow customer-supplied application programs, such as OASIS, to run in an OS-9 operating system.

**-V-**

**Vehicle Call Memory** – See Red Detector Lock and Yellow Detector Lock

**Volume-Density** - A type of signal control with a variable passage time and a variable minimum green time. It reduces the probability of vehicles being caught in the option zone.

**-W-**

**Weatherhead** - The entrance into the top of a riser used for electrical cables.

**-Y-**

**Yellow Change Interval** - The display of a yellow indication following the right of way interval which warns drivers of the termination of right of way.

**Yellow Detector Lock** - A detector call is locked on a phase whenever the phase is not in its green interval. The lock ensures service to the phase even if the detector input terminates prior to serving the phase.

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