| Requirements Document Reference Number | SYSTEM REQUIREMENTS | Meets Requirement | Partially Meets Requirement | Requirement Under Development | Requirement Not Met | Explanation As To Why The Proposed ASCT System Does Or Does Not Meet The Requirement |
| --- | --- | --- | --- | --- | --- | --- |
| 1 | 1 Network Characteristics |  |  |  |  |  |
| 1.0-1 | *The ASCT shall control a minimum of 150 signals concurrently* |  |  |  |  |  |
| 1.0-2 | The ASCT shall support groups of signals. |  |  |  |  |  |
| 1.0-2.0-1 | The boundaries surrounding signal controllers that operate in a coordinated fashion shall be defined by the user. |  |  |  |  |  |
| 1.0-2.0-2 | The ASCT shall control a minimum of 20 groups of signals. |  |  |  |  |  |
| 1.0-2.0-3 | The size of a group shall range from 1 to 20 signals. |  |  |  |  |  |
| 1.0-2.0-4 | Each group shall operate independently |  |  |  |  |  |
| 1.0-2.0-5 | The boundaries surrounding signal controllers that operate in a coordinated fashion shall be altered by the ASCT system according to configured parameters. |  |  |  |  |  |
| 1.0-2.0-5.0-1 | The boundaries surrounding signal controllers that operate in a coordinated fashion shall be altered by the system according to a time of day schedule. (For example: this may be achieved by assigning signals to different groups or by combining groups.) |  |  |  |  |  |
| 1.0-2.0-5.0-2 | The boundaries surrounding signal controllers that operate in a coordinated fashion shall be altered by the system according to traffic conditions. (For example: this may be achieved by assigning signals to different groups or by combining groups.) |  |  |  |  |  |
| 1.0-2.0-5.0-3 | The boundaries surrounding signal controllers that operate in a coordinated fashion shall be altered by the system when commanded by the user. |  |  |  |  |  |
| 2 | 2 Type of Operation |  |  |  |  |  |
| 2.1 | 2.1 General |  |  |  |  |  |
| 2.1.1 | 2.1.1 Mode of Operation |  |  |  |  |  |
| 2.1.1.0-1 | The ASCT shall operate non-adaptively during the presence of a defined condition. |  |  |  |  |  |
| 2.1.1.0-2 | The ASCT shall operate non-adaptively when adaptive control equipment fails. |  |  |  |  |  |
| 2.1.1.0-2.0-1 | The ASCT shall operate non-adaptively when a user-specified detector fails. |  |  |  |  |  |
| 2.1.1.0-2.0-2 | The ASCT shall operate non-adaptively when the number of failed detectors connected to a signal controller exceeds a user-defined value. |  |  |  |  |  |
| 2.1.1.0-2.0-3 | The ASCT shall operate non-adaptively when the number of failed detectors in a group exceeds a user-defined value. |  |  |  |  |  |
| 2.1.1.0-2.0-4 | The ASCT shall operate non-adaptively when a user-defined communications link fails. |  |  |  |  |  |
| 2.1.1.0-3 | The ASCT shall operate non-adaptively when a user manually commands the ASCT to cease adaptively controlling a group of signals. |  |  |  |  |  |
| 2.1.1.0-4 | The ASCT shall operate non-adaptively when a user manually commands the ASCT to cease adaptive operation. |  |  |  |  |  |
| 2.1.1.0-5 | The ASCT shall operate non-adaptively in accordance with a user-defined time-of-day schedule. |  |  |  |  |  |
| 2.1.1.0-7 | The ASCT shall alter the adaptive operation to achieve required objectives in user-specified conditions. (The required objectives are specified in Needs Statement 4.1.0-1. Responding to this requirement demonstrates how the proposed system allows the user to define the conditions at which the objectives shift and their associated requirements are fulfilled.) (The alteration may be made by adjusting parameters or by directly controlling the state of signal controllers.) |  |  |  |  |  |
| 2.1.1.0-7.0-1 | When current measured traffic conditions meet user-specified criteria, the ASCT shall alter the state of the signal controllers, maximizing the throughput of the coordinated route. |  |  |  |  |  |
| 2.1.1.0-7.0-2 | When current measured traffic conditions meet user-specified criteria, the ASCT shall alter the state of signal controllers, preventing queues from exceeding the storage capacity at user-specified locations. |  |  |  |  |  |
| 2.1.1.0-7.0-3 | When current measured traffic conditions meet user-specified criteria, the ASCT shall alter the state of signal controllers providing equitable distribution of green times. |  |  |  |  |  |
| 2.1.1.0-7.0-4 | When current measured traffic conditions meet user-defined criteria, the ASCT shall alter the state of signal controllers providing two-way progression on a coordinated route. |  |  |  |  |  |
| 2.1.1.0-8 | **T**he ASCT shall provide maximum and minimum phase times. |  |  |  |  |  |
| 2.1.1.0-8.0-1 | The ASCT shall provide a user-specified maximum value for each phase at each signal controller. |  |  |  |  |  |
| 2.1.1.0-8.0-1.0-1 | The ASCT shall not provide a phase length longer that the maximum value. |  |  |  |  |  |
| 2.1.1.0-8.0-2 | The ASCT shall provide a user-specified minimum value for each phase at each signal controller. |  |  |  |  |  |
| 2.1.1.0-8.0-2.0-1 | The ASCT shall not provide a phase length shorter than the minimum value. |  |  |  |  |  |
| 2.1.1.0-9 | The ASCT shall detect repeated phases that do not serve all waiting vehicles. (These phase failures may be inferred, such as by detecting repeated max-out.) |  |  |  |  |  |
| 2.1.1.0-9.0-1 | The ASCT shall alter operations, to minimize repeated phase failures. |  |  |  |  |  |
| 2.1.1.0-10 | The ASCT shall determine the order of phases at a user-specified intersection. (The calculation will be based on the optimization function.) |  |  |  |  |  |
| 2.1.1.0-11 | The ASCT shall provide coordination along a route. |  |  |  |  |  |
| 2.1.1.0-11.0-1 | The ASCT shall coordinate along a user-defined route. |  |  |  |  |  |
| 2.1.1.0-11.0-2 | The ASCT shall determine the coordinated route based on traffic conditions. |  |  |  |  |  |
| 2.1.1.0-11.0-3 | The ASCT shall determine the coordinated route based on a user-defined schedule. |  |  |  |  |  |
| 2.1.1.0-11.0-4 | The ASCT shall store 24 user-defined coordination routes. |  |  |  |  |  |
| 2.1.1.0-11.0-4.0-1 | The ASCT shall implement a stored coordinated route by operator command. |  |  |  |  |  |
| 2.1.1.0-11.0-4.0-2 | The ASCT shall implement a stored coordinated route based on traffic conditions. |  |  |  |  |  |
| 2.1.1.0-11.0-4.0-3 | The ASCT shall implement a stored coordinated route based on a user-defined schedule. |  |  |  |  |  |
| 2.1.1.0-12 | The ASCT shall not prevent the use of phase timings in the local controller set by agency policy. |  |  |  |  |  |
| 2.1.2 | 2.1.2 Allowable Phases |  |  |  |  |  |
| 2.1.2.0-1 | The ASCT shall not prevent protected/permissive left turn phase operation. |  |  |  |  |  |
| 2.1.2.0-2 | The ASCT shall not prevent the protected left turn phase to lead or lag the opposing through phase based upon user-specified conditions. |  |  |  |  |  |
| 2.1.2.0-3 | The ASCT shall prevent skipping a user-specified phase when the user-specified phase sequence is operating. |  |  |  |  |  |
| 2.1.2.0-4 | The ASCT shall prevent skipping a user-specified phase based on the state of a user-specified external input. |  |  |  |  |  |
| 2.1.2.0-5 | The ASCT shall prevent skipping a user-specified phase according to a time of day schedule. |  |  |  |  |  |
| 2.1.2.0-6 | The ASCT shall omit a user-specified phase when the cycle length is below a user-specified value. |  |  |  |  |  |
| 2.1.2.0-7 | The ASCT shall omit a user-specified phase based on measured traffic conditions. |  |  |  |  |  |
| 2.1.2.0-8 | The ASCT shall omit a user-specified phase based on the state of a user-specified external input. |  |  |  |  |  |
| 2.1.2.0-9 | The ASCT shall omit a user-specified phase according to a time of day schedule |  |  |  |  |  |
| 2.1.2.0-10 | The ASCT shall assign unused time from a preceding phase that terminates early to a user-specified phase as follows:   * next phase; * next coordinated phase; * user-specified phase. |  |  |  |  |  |
| 2.1.2.0-11 | The ASCT shall assign unused time from a preceding phase that is skipped to a user-specified phase as follows:   * previous phase; * next phase; * next coordinated phase; * user-specified phase. |  |  |  |  |  |
| 2.1.2.0-12 | The ASCT shall not alter the order of phases at a user-specified intersection. |  |  |  |  |  |
| 2.1.3 | 2.1.3 Oversaturation |  |  |  |  |  |
| 2.1.3.0-1 | The ASCT shall detect the presence of queues at pre-configured locations. |  |  |  |  |  |
| 2.1.3.0-2 | When queues are detected at user-specified locations, the ASCT shall execute user-specified timing plan/operational mode. |  |  |  |  |  |
| 2.1.3.0-3 | When queues are detected at user-specified locations, the ASCT shall execute user-specified adaptive operation strategy. |  |  |  |  |  |
| 2.1.3.0-4 | When queues are detected at user-specified locations, the ASCT shall omit a user-specified phase at a user-specified signal controller. |  |  |  |  |  |
| 2.1.3.0-5 | The ASCT shall meter traffic into user-specified bottlenecks by storing queues at user-specified locations. |  |  |  |  |  |
| 2.1.3.0-6 | The ASCT shall store queues at user-specified locations. |  |  |  |  |  |
| 2.1.3.0-7 | The ASCT shall maintain capacity flow through user-specified bottlenecks. |  |  |  |  |  |
| 2.1.3.0-8 | When queues are detected at user-specified locations, the ASCT shall limit the cycle length of the group to a user-specified value. |  |  |  |  |  |
| 2.2 | 2.2 Sequence-based Adaptive Coordination |  |  |  |  |  |
| 2.2.0-2 | **(Sequence-based only)** The ASCT shall select cycle length based on a time of day schedule. |  |  |  |  |  |
| 2.2.0-3 | **(Sequence-based only)** The ASCT shall calculate phase lengths for all phases at each signal controller to suit the current coordination strategy. |  |  |  |  |  |
| 2.2.0-4 | **(Sequence-based only)** The ASCT shall calculate offsets to suit the current coordination strategy for the user-specified reference point for each signal controller along a coordinated route within a group. |  |  |  |  |  |
| 2.2.0-4.0-1 | **(Sequence-based only)** The ASCT shall apply offsets for the user-specified reference point of each signal controller along a coordinated route. |  |  |  |  |  |
| 2.2.0-5 | **(Sequence-based only)** The ASCT shall calculate a cycle length for each cycle based on its optimization objectives (as required elsewhere, e.g., progression, queue management, equitable distribution of green). |  |  |  |  |  |
| 2.2.0-5.0-1 | **(Sequence-based only)** The ASCT shall limit cycle lengths to user-specified values. |  |  |  |  |  |
| 2.2.0-5.0-2 | **(Sequence-based only)** The ASCT shall limit cycle lengths to a user-specified range. |  |  |  |  |  |
| 2.2.0-5.0-3 | **(Sequence-based only)** The ASCT shall calculate optimum cycle length according to the user-specified coordination strategy. |  |  |  |  |  |
| 2.2.0-5.0-4 | **(Sequence-based only)** The ASCT shall limit changes in cycle length to not exceed a user-specified value. |  |  |  |  |  |
| 2.2.0-5.0-4.0-1.0-2 | **(Sequence-based only)** The increased limit shall be user-defined. |  |  |  |  |  |
| 2.2.0-5.0-5 | **(Sequence-based only)** The ASCT shall adjust offsets to minimize the chance of stopping vehicles approaching a signal that have been served by a user-specified phase at an upstream signal. |  |  |  |  |  |
| 2.3 | 2.3 Non-sequence-based adaptive coordination |  |  |  |  |  |
| 2.3.0-2 | **(Non-sequence-based only)** The ASCT shall calculate the appropriate state of the signal to suit the current coordination strategy at the critical signal controller. (A critical signal controller is defined by the user.) |  |  |  |  |  |
| 2.3.0-3 | **(Non-sequence-based only)** At non-critical intersections within a group, the ASCT shall calculate the time at which a user-specified phase shall be green, relative to a reference point at the critical intersection, to suit the current coordination strategy. |  |  |  |  |  |
| 2.3.0-4 | **(Non-sequence-based only)** When demand is present, the ASCT shall implement a user-specified maximum time between successive displays of each phase at each intersection. |  |  |  |  |  |
| 2.3.0-5 | **(Non-sequence-based only)** The ASCT shall adjust signal timing so that vehicles approaching a signal that have been served during a user-specified phase at an upstream signal do not stop. |  |  |  |  |  |
| 2.4 | 2.4 Single intersection adaptive operation |  |  |  |  |  |
| 2.4.0-2 | The ASCT shall calculate a cycle length of a single intersection, based on current measured traffic conditions. (The calculation is based on the optimization objectives.) |  |  |  |  |  |
| 2.4.0-3 | The ASCT shall calculate optimum phase lengths, based on current measured traffic conditions. (The calculation is based on the optimization objectives.) |  |  |  |  |  |
| 2.4.0-3.0-1 | The ASCT shall limit the difference between the length of a given phase and the length of the same phase during its next service to a user-specified value. |  |  |  |  |  |
| 2.4.0-3.0-2 | When queues are detected at user-specified locations, the ASCT shall execute user-specified timing plan/operational mode. |  |  |  |  |  |
| 2.4.0-4 | The ASCT shall calculate phase order, based on current measured traffic conditions. (The calculation is based on the optimization objectives.) |  |  |  |  |  |
| 2.5 | 2.5 Phase-based adaptive coordination |  |  |  |  |  |
| 2.5.0-2 | **(Phase-based only)** The ASCT shall alter the state of the signal controller for all phases at the user-specified intersection. |  |  |  |  |  |
| 2.5.0-3 | **(Phase-based only)** The ASCT shall calculate the time at which a user-specified phase shall be green at an intersection. |  |  |  |  |  |
| 2.5.0-4 | **(Phase-based only)** When demand is present, the ASCT shall implement a user-specified maximum time between successive displays of each phase at each intersection. |  |  |  |  |  |
| 2.5.0-5 | **(Phase-based only)** The ASCT shall alter the operation of the non-critical intersections to minimize stopping of traffic released from user-specified phases at the user-specified critical intersection. |  |  |  |  |  |
| 2.5.0-6 | **(Phase-based only)** The ASCT shall alter the operation of the non-critical intersections to minimize stopping of traffic arriving at user-specified phases at the user-specified critical intersection. |  |  |  |  |  |
| 2.5.0-7 | **(Phase-based only)** The ASCT shall adjust the state of the signal controller so that vehicles approaching a signal that have been served during a user-specified phase at an upstream signal do not stop. |  |  |  |  |  |
| 2.6 | 2.6 Responsiveness |  |  |  |  |  |
| 2.6.0-1 | The ASCT shall limit the change in consecutive cycle lengths to be less than a user-specified value. |  |  |  |  |  |
| 2.6.0-2 | The ASCT shall limit the change in phase times between consecutive cycles to be less than a user-specified value. (This does not apply to early gap-out or actuated phase skipping.) |  |  |  |  |  |
| 2.6.0-3 | The ASCT shall limit the changes in the direction of primary coordination to a user-specified frequency. |  |  |  |  |  |
| 2.6.0-4 | When a large change in traffic demand is detected, the ASCT shall respond more quickly than normal operation, subject to user-specified limits. |  |  |  |  |  |
| 2.6.0-5 | The ASCT shall select cycle length from a list of user-defined cycle lengths. |  |  |  |  |  |
| 3 | 3 External/Internal Interfaces |  |  |  |  |  |
| 3.0-1 | The ASCT shall support external interfaces to other entities. |  |  |  |  |  |
| 3.0-1.0-1 | The ASCT shall have the ability to send operational data to IDOT’s system. |  |  |  |  |  |
| 3.0-1.0-2 | The ASCT shall have the ability to send control data to the IDOT’s system. |  |  |  |  |  |
| 3.0-1.0-3 | The ASCT shall send monitoring data to IDOT’s system. |  |  |  |  |  |
| 3.0-1.0-4 | The ASCT shall send coordination data to IDOT’s system. |  |  |  |  |  |
| 3.0-1.0-5 | The ASCT shall send performance data to the KDOT AOC. |  |  |  |  |  |
| 4 | 4 Crossing Arterials and Boundaries |  |  |  |  |  |
| 4.0-1 | *The ASCT shall conform its operation to an external system's operation.* |  |  |  |  |  |
| 4.0-1.0-1 | The ASCT shall alter its operation to minimize interruption of traffic entering the system. (This may be achieved via detection, with no direct connection to the other system.) |  |  |  |  |  |
| 4.0-1.0-2 | The ASCT shall operate a fixed cycle length to match the cycle length of an adjacent system. |  |  |  |  |  |
| 4.0-1.0-3 | The ASCT shall alter its operation based on data received from another system. |  |  |  |  |  |
| 4.0-1.0-4 | The ASCT shall support adaptive coordination on crossing routes. |  |  |  |  |  |
| 5 | 5 Access and Security |  |  |  |  |  |
| 5.0-1 | *The ASCT shall be implemented with a security policy that addresses the following selected elements:* |  |  |  |  |  |
| 5.0-1.0-1 | Local access to the ASCT. |  |  |  |  |  |
| 5.0-1.0-2 | Remote access to the ASCT. |  |  |  |  |  |
| 5.0-1.0-3 | * System monitoring. |  |  |  |  |  |
| 5.0-1.0-4 | * System manual override. |  |  |  |  |  |
| 5.0-1.0-5 | * Development |  |  |  |  |  |
| 5.0-1.0-6 | * Operations |  |  |  |  |  |
| 5.0-1.0-7 | * User login |  |  |  |  |  |
| 5.0-1.0-8 | * User password |  |  |  |  |  |
| 5.0-1.0-9 | * Administration of the system |  |  |  |  |  |
| 5.0-1.0-10 | * Signal controller group access |  |  |  |  |  |
| 5.0-1.0-11 | * Access to classes of equipment |  |  |  |  |  |
| 5.0-1.0-12 | * Access to equipment by jurisdiction |  |  |  |  |  |
| 5.0-1.0-13 | * Output activation |  |  |  |  |  |
| 5.0-1.0-14 | * System parameters |  |  |  |  |  |
| 5.0-1.0-15 | * Report generation |  |  |  |  |  |
| 5.0-1.0-16 | * Configuration |  |  |  |  |  |
| 5.0-1.0-17 | * Security alerts |  |  |  |  |  |
| 5.0-1.0-18 | * Security logging |  |  |  |  |  |
| 5.0-1.0-19 | * Security reporting |  |  |  |  |  |
| 5.0-1.0-20 | * Database |  |  |  |  |  |
| 5.0-1.0-21 | * Signal controller |  |  |  |  |  |
| 5.0-2 | The ASCT shall provide monitoring and control access at the following locations: |  |  |  |  |  |
| 5.0-2.0-1 | * KDOT AOC |  |  |  |  |  |
| 5.0-2.0-4 | * IDOT TMC |  |  |  |  |  |
| 5.0-2.0-5 | * Local controller cabinets |  |  |  |  |  |
| 5.0-2.0-7 | * Remote locations via internet |  |  |  |  |  |
| 5.0-3 | The ASCT shall comply with the agency's security policy. |  |  |  |  |  |
| 5.0-4 | The ASCT shall not prevent access to the local signal controller database, monitoring or reporting functions by any installed signal management system. |  |  |  |  |  |
| 6 | 6 Data Log |  |  |  |  |  |
| 6.0-1 | The ASCT shall log the following events: |  |  |  |  |  |
| 6.0-1.0-1 | Time-stamped vehicle phase calls |  |  |  |  |  |
| 6.0-1.0-2 | Time-stamped pedestrian phase calls |  |  |  |  |  |
| 6.0-1.0-3 | Time-stamped emergency vehicle preemption calls |  |  |  |  |  |
| 6.0-1.0-4 | Time-stamped transit priority calls |  |  |  |  |  |
| 6.0-1.0-5 | Time-stamped railroad preemption calls |  |  |  |  |  |
| 6.0-1.0-6 | Time-stamped start and end of each phase |  |  |  |  |  |
| 6.0-1.0-7 | Time-stamped controller interval changes |  |  |  |  |  |
| 6.0-1.0-8 | Time-stamped start and end of each transition to a new timing plan |  |  |  |  |  |
| 6.0-2 | The ASCT shall export its systems log in the following formats:   * MS Excel * Text * CSV * Open source SQL database |  |  |  |  |  |
| 6.0-3 | The ASCT shall store the event log for a minimum of 60 days |  |  |  |  |  |
| 6.0-4 | The ASCT shall store results of all signal timing parameter calculations for a minimum of 60 days. |  |  |  |  |  |
| 6.0-5 | The ASCT shall store the following measured data in the form used as input to the adaptive algorithm for a minimum of 60 days:   * volume * occupancy * queue length * phase utilization * arrivals in green * green band efficiency |  |  |  |  |  |
| 6.0-6 | The ASCT system shall archive all data automatically after a user-specified period not less than 30 days. |  |  |  |  |  |
| 6.0-7 | The ASCT shall provide data storage for a system size of 30 signal controllers. The data to be stored shall include the following:   * Controller state data * Reports * Log data * Security data * ASCT parameters * Detector status data |  |  |  |  |  |
| 6.0-8 | The ASCT shall calculate and report relative data quality including:   * The extent data is affected by detector faults * Other applicable items |  |  |  |  |  |
| 6.0-9 | The ASCT shall report comparisons of logged data when requested by the user:  \* Day to day,  \* Hour to hour  \* Hour of day to hour of day  \* Hour of week to hour of week  \* day of week to day week  \* Day of year to day of year |  |  |  |  |  |
| 6.0-10 | The ASCT shall store data logs in a standard database. |  |  |  |  |  |
| 6.0-11 | The ASCT shall report stored data in a form suitable to provide explanations of system behavior to public and politicians and to troubleshoot the system. |  |  |  |  |  |
| 6.0-12 | The ASCT shall store the following data in 5 minute increments:   * volume * occupancy * queue length |  |  |  |  |  |
| 7 | 7 Advanced Controller Operation |  |  |  |  |  |
| 7.0-1 | When specified by the user, the ASCT shall serve a vehicle phase more than once for each time the coordinated phase is served. |  |  |  |  |  |
| 7.0-2 | The ASCT shall provide a minimum of 16 phase overlaps. |  |  |  |  |  |
| 7.0-3 | The ASCT shall accommodate a minimum of 16 phases at each signal |  |  |  |  |  |
| 7.0-4 | The ASCT shall accommodate a minimum of 4 rings at each signal. |  |  |  |  |  |
| 7.0-5 | The ASCT shall accommodate a minimum of 8 phases per ring |  |  |  |  |  |
| 7.0-6 | The ASCT shall provide a minimum of XX different user-defined phase sequences for each signal. |  |  |  |  |  |
| 7.0-6.0-1 | Each permissible phase sequence shall be user-assignable to any signal timing plan. |  |  |  |  |  |
| 7.0-6.0-2 | Each permissible phase sequence shall be executable by a time of day schedule. |  |  |  |  |  |
| 7.0-6.0-3 | Each permissible phase sequence shall be executable based on measured traffic conditions |  |  |  |  |  |
| 7.0-7 | The ASCT shall not prevent a phase/overlap output by time-of-day. |  |  |  |  |  |
| 7.0-8 | The ASCT shall not prevent a phase/overlap output based on an external input. |  |  |  |  |  |
| 7.0-9 | The ASCT shall not prevent any phases from being designated as coordinated phases. |  |  |  |  |  |
| 7.0-10 | The ASCT shall have the option for a coordinated phase to be released early based on a user-definable point in the phase or cycle. |  |  |  |  |  |
| 7.0-11 | The ASCT shall not prevent the controller from displaying flashing yellow arrow left turn or right turn. |  |  |  |  |  |
| 7.0-13 | When adaptive operation is used in conjunction with normal coordination, the ASCT shall not prevent a controller serving a cycle length different from the cycles used at adjacent intersections. |  |  |  |  |  |
| 8 | 8 Pedestrians |  |  |  |  |  |
| 8.0-2 | When a pedestrian phase is called, the ASCT shall accommodate pedestrian crossing times during adaptive operations. |  |  |  |  |  |
| 8.0-3 | When a pedestrian phase is called, the ASCT shall accommodate pedestrian crossing times then resume adaptive operation. |  |  |  |  |  |
| 8.0-6 | The ASCT shall begin a non-coordinated phase later than its normal starting point within the cycle when all of the following conditions exist:   * The user enables this feature * Sufficient time in the cycle remains to serve the minimum green times for the phase and the subsequent non-coordinated phases before the beginning of the coordinated phase * The phase is called after its normal start time * The associated pedestrian phase is not called |  |  |  |  |  |
| 8.0-9 | The ASCT shall not inhibit negative vehicle and pedestrian phase timing. |  |  |  |  |  |
| 9 | 9 Special Functions |  |  |  |  |  |
| 9.0-2 | The ASCT shall set a specific state for each special function output based on the current cycle length. |  |  |  |  |  |
| 9.0-3 | The ASCT shall set a specific state for each special function output based on a time-of-day schedule. |  |  |  |  |  |
| 10 | 10 Detection |  |  |  |  |  |
| 10.0-1 | The ASCT shall be compatible with the following detector technologies:   * Inductive loop detectors * Video detection systems |  |  |  |  |  |
| 11 | 11 Railroad and EV Preemption |  |  |  |  |  |
| 11.0-2 | *The ASCT shall maintain adaptive operation at non-preempted intersections during emergency vehicle preemption.* |  |  |  |  |  |
| 11.0-4 | *The ASCT shall resume adaptive control of signal controllers when preemptions are released.* |  |  |  |  |  |
| 11.0-5 | *The ASCT shall execute user-specified actions at non-preempted signal controllers during preemption. (E.g., inhibit a phase, activate a sign, display a message on a DMS)* |  |  |  |  |  |
| 11.0-6 | *The ASCT shall operate normally at non-preempted signal controllers when special functions are engaged by a preemption event. (Examples of such special functions are a phase omit, a phase maximum recall or a fire route.)* |  |  |  |  |  |
| 11.0-7 | *The ASCT shall release user-specified signal controllers to local control when one signal in a group is preempted.* |  |  |  |  |  |
| 11.0-8 | *The ASCT shall not prevent the local signal controller from operating in normally detected limited-service actuated mode during preemption.* |  |  |  |  |  |
| 12 | 12 Transit Priority |  |  |  |  |  |
| 12.0-1 | The ASCT shall continue adaptive operations of a group when one of its signal controllers has a transit priority call. |  |  |  |  |  |
| 12.0-2 | The ASCT shall advance the start of a user-specified green phase in response to a transit priority call. |  |  |  |  |  |
| 12.0-2.0-1 | The advance of start of green phase shall be user-defined. |  |  |  |  |  |
| 12.0-2.0-2 | Adaptive operations shall continue during the advance of the start of green phase. |  |  |  |  |  |
| 12.0-3 | The ASCT shall delay the end of a green phase, in response to a priority call. |  |  |  |  |  |
| 12.0-3.0-1 | The delay of end of green phase shall be user-defined. |  |  |  |  |  |
| 12.0-3.0-2 | Adaptive operations shall continue during the delay of the end of green phase. |  |  |  |  |  |
| 12.0-5 | The ASCT shall control vehicle phases independently of the following: |  |  |  |  |  |
| 12.0-6 | The ASCT shall interface with any external bus transit priority system. |  |  |  |  |  |
| 12.0-8 | The ASCT shall accept a transit priority call from:   * a signal controller/transit vehicle detector; * an external system. |  |  |  |  |  |
| 13 | 13 Failure Events and Fallback |  |  |  |  |  |
| 13.1 | 13.1 Detector Failure |  |  |  |  |  |
| 13.1.0-1 | The ASCT shall take user-specified action in the absence of valid detector data within a group. |  |  |  |  |  |
| 13.1.0-1.0-1 | The ASCT shall release control to central system control. |  |  |  |  |  |
| 13.1.0-1.0-2 | The ASCT shall release control to local operations to operate under its own time-of-day schedule. |  |  |  |  |  |
| 13.1.0-2 | The ASCT shall use the following alternate data sources for operations in the absence of the real-time data from a detector: |  |  |  |  |  |
| 13.1.0-2.0-1 | * Data from a user-specified alternate detector. |  |  |  |  |  |
| 13.1.0-2.0-2 | * Stored historical data from the failed detector. |  |  |  |  |  |
| 13.1.0-2.0-3 | The ASCT shall switch to the alternate source in real time without operator intervention. |  |  |  |  |  |
| 13.1.0-3 | In the event of a detector failure, the ASCT shall issue an alarm to user-specified recipients. (This requirement may be fulfilled by sending the alarm to a designated list of recipients by a designated means, or by using an external maintenance management system. |  |  |  |  |  |
| 13.1.0-4 | In the event of a failure, the ASCT shall log details of the failure in a permanent log. |  |  |  |  |  |
| 13.1.0-5 | The permanent failure log shall be searchable, archivable and exportable. |  |  |  |  |  |
| 13.2 | 13.2 Communications Failure |  |  |  |  |  |
| 13.2-1 | The ASCT shall execute user-specified actions when communications to one or more signal controllers fails within a group. |  |  |  |  |  |
| 13.2-1.0-1 | In the event of loss of communication to a user-specified signal controller, the ASCT shall release control of all signal controllers within a user-specified group to local control. |  |  |  |  |  |
| 13.2-1.0-2 | The ASCT shall switch to the alternate operation in real time without operator intervention. |  |  |  |  |  |
| 13.2-2 | In the event of communications failure, the ASCT shall issue an alarm to user-specified recipients. (This requirement may be fulfilled by sending the alarm to a designated list of recipients by a designated means, or by using an external maintenance management system. |  |  |  |  |  |
| 13.2-3 | The ASCT shall issue an alarm within 5 minutes of detection of a failure. |  |  |  |  |  |
| 13.2-4 | In the event of a communications failure, the ASCT shall log details of the failure in a permanent log. |  |  |  |  |  |
| 13.2-5 | The permanent failure log shall be searchable, archivable and exportable. |  |  |  |  |  |
| 13.3 | 13.3 Adaptive Processor Failure |  |  |  |  |  |
| 13.3-1 | The ASCT shall execute user-specified actions when adaptive control fails: |  |  |  |  |  |
| 13.3-1.0-1 | The ASCT shall release control to central system control. |  |  |  |  |  |
| 13.3-2 | In the event of adaptive processor failure, the ASCT shall issue an alarm to user-specified recipients. (This requirement may be fulfilled by sending the alarm to a designated list of recipients by a designated means, or by using an external maintenance management system. |  |  |  |  |  |
| 13.3-3 | The permanent failure log shall be searchable, archivable and exportable. |  |  |  |  |  |
| 13.3-4 | During adaptive processor failure, the ASCT shall provide all local detector inputs to the local controller. |  |  |  |  |  |
| 14 | 14 Software |  |  |  |  |  |
| 14.0-1 | * The ASCT system must run on the Microsoft Windows 7, 8, and 10 operating systems |  |  |  |  |  |
| 14.0-2 | The ASCT shall fully satisfy all requirements when connected with inductive loop detectors and video detection systems. |  |  |  |  |  |
| 14.0-3 | *The ASCT shall fully satisfy all requirements when connected with Siemens Eagle EPAC M50 and M60 Series, Econolite Cobalt, and Intelight ATC traffic signal controllers.* |  |  |  |  |  |
| 15 | 15 Training |  |  |  |  |  |
| 15.0-1 | The vendor shall provide the following training: |  |  |  |  |  |
| 15.0-1.0-1 | The vendor shall provide training on the operations of the adaptive system. |  |  |  |  |  |
| 15.0-1.0-2 | The vendor shall provide training on troubleshooting the system. |  |  |  |  |  |
| 15.0-1.0-3 | The vendor shall provide training on preventive maintenance and repair of equipment. |  |  |  |  |  |
| 15.0-1.0-4 | The vendor shall provide training on system configuration. |  |  |  |  |  |
| 15.0-1.0-5 | The vendor shall provide training on administration of the system. |  |  |  |  |  |
| 15.0-1.0-6 | The vendor shall provide training on system calibration. |  |  |  |  |  |
| 15.0-1.0-7 | The vendor's training delivery shall include: printed course materials and references, electronic copies of presentations and references. |  |  |  |  |  |
| 15.0-1.0-8 | The vendor's training shall be delivered at the KDOT AOC. |  |  |  |  |  |
| 15.0-1.0-9 | The Vendor shall provide a minimum of 40 hours training for up to ten (10) staff. This should include and eight hour course to provide an overview and cover the basic functions and additional detailed training as needed. The Vendor shall provide a minimum of 5 training sessions over a two month period.  In addition, the selected Vendor shall also provide all relevant ATP and training documents (e.g., test procedures, operations, user, and maintenance manuals, etc.) in both electronic and hard copy format. |  |  |  |  |  |
| 15.0-1.0-10 | The vendor shall provide a minimum of 5 training sessions over a two month period. |  |  |  |  |  |
| 16 | 16 Maintenance, Support and Warranty |  |  |  |  |  |
| 16.0-1 | The Maintenance Vendor shall provide maintenance according to a separate maintenance contract. That contract should identify repairs necessary to preserve requirements fulfillment, responsiveness in effecting those repairs, and all requirements on the maintenance provider while performing the repairs. |  |  |  |  |  |
| 16.0-2 | The Vendor shall provide routine updates to the software and software environment necessary to preserve the fulfillment of requirements for a period of 2 years. Preservation of requirements fulfillment especially includes all IT management requirements as previously identified. |  |  |  |  |  |
| 16.0-3 | The Vendor shall warrant the system to be free of defects in materials and workmanship for a period of 2 years. Warranty is defined as correcting defects in materials and workmanship (subject to other language included in the purchase documents). Defect is defined as any circumstance in which the material does not perform according to its specification. |  |  |  |  |  |
| 17 | 17 Schedule |  |  |  |  |  |
| 17.0-1 | The ASCT shall set the state of external input/output states according to a time-of-day schedule. |  |  |  |  |  |
| 17.0-2 | The ASCT output states shall be settable according to a time-of-day schedule |  |  |  |  |  |
| 17.0-3 | The ASCT operational parameters shall be settable according to a Time of Day schedule |  |  |  |  |  |
| 18 | 18 Performance Measurement, Monitoring and Reporting |  |  |  |  |  |
| 18.0-1 | The ASCT shall report measures of current traffic conditions on which it bases signal state alterations. |  |  |  |  |  |
| 18.0-2 | The ASCT shall report all intermediate calculated values that are affected by calibration parameters. |  |  |  |  |  |
| 18.0-3 | The ASCT shall maintain a log of all signal state alterations directed by the ASCT. |  |  |  |  |  |
| 18.0-3.0-1 | The ASCT log shall include all events directed by the external inputs. |  |  |  |  |  |
| 18.0-3.0-2 | The ASCT log shall include all external output state changes. |  |  |  |  |  |
| 18.0-3.0-3 | The ASCT log shall include all actual parameter values that are subject to user-specified values. |  |  |  |  |  |
| 18.0-3.0-4 | The ASCT shall maintain the records in this ASCT log for a weekly period. |  |  |  |  |  |
| 18.0-3.0-5 | The ASCT shall archive the ASCT log in the following manner: Weekly in Access database format. |  |  |  |  |  |

Note: Italicized text in the ‘System Requirements’ column indicates a mandatory requirement