| Requirements Document Reference Number | System Requirements Sample Requirements | Need Statement (Con Ops) |
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| 1 | 1 Network Characteristics |  |
| 1.0-1 | The ASCT shall control a minimum of XX signals concurrently | 4.2.0-1  The system operator needs to eventually adaptively control up to XXX signals, up to XXX miles from the TMC (or specified location). |
| 1.0-2 | *The ASCT shall support groups of signals.* | 4.2.0-2  The system operator needs to be able to adaptively control up to XX independent groups of signals  4.2.0-3  The system operator needs to vary the number of signals in an adaptively controlled group to accommodate the prevailing traffic conditions. |
| 1.0-2.0-1 | The boundaries surrounding signal controllers that operate in a coordinated fashion shall be defined by the user. | 4.2.0-2  The system operator needs to be able to adaptively control up to XX independent groups of signals |
| 1.0-2.0-2 | The ASCT shall control a minimum of XX groups of signals. | 4.2.0-2  The system operator needs to be able to adaptively control up to XX independent groups of signals |
| 1.0-2.0-3 | The size of a group shall range from 1 to XX signals. | 4.2.0-3  The system operator needs to vary the number of signals in an adaptively controlled group to accommodate the prevailing traffic conditions. |
| 1.0-2.0-4 | Each group shall operate independently | 4.2.0-2  The system operator needs to be able to adaptively control up to XX independent groups of signals |
| 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.* | 4.2.0-3  The system operator needs to vary the number of signals in an adaptively controlled group to accommodate the prevailing traffic conditions. |
| 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.) | 4.2.0-3  The system operator needs to vary the number of signals in an adaptively controlled group to accommodate the prevailing traffic conditions. |
| 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.) | 4.2.0-3  The system operator needs to vary the number of signals in an adaptively controlled group to accommodate the prevailing traffic conditions. |
| 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. | 4.2.0-3  The system operator needs to vary the number of signals in an adaptively controlled group to accommodate the prevailing traffic conditions. |
| 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. | 4.7.0-1  The system operator needs to detect traffic conditions during which adaptive control is not the preferred operation, and implement some pre-defined operation while that condition is present. |
| 2.1.1.0-2 | *The ASCT shall operate non-adaptively when adaptive control equipment fails.* | 4.14.0-1  The system operator needs to fall back to TOD or isolated free operation, as specified by the operator, without causing disruption to traffic flow, in the event of equipment, communications and software failure. |
| 2.1.1.0-2.0-1 | The ASCT shall operate non-adaptively when a user-specified detector fails. | 4.14.0-1  The system operator needs to fall back to TOD or isolated free operation, as specified by the operator, without causing disruption to traffic flow, in the event of equipment, communications and software failure. |
| 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. | 4.14.0-1  The system operator needs to fall back to TOD or isolated free operation, as specified by the operator, without causing disruption to traffic flow, in the event of equipment, communications and software failure. |
| 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. | 4.14.0-1  The system operator needs to fall back to TOD or isolated free operation, as specified by the operator, without causing disruption to traffic flow, in the event of equipment, communications and software failure. |
| 2.1.1.0-2.0-4 | The ASCT shall operate non-adaptively when a user-defined communications link fails. | 4.14.0-1  The system operator needs to fall back to TOD or isolated free operation, as specified by the operator, without causing disruption to traffic flow, in the event of equipment, communications and software failure. |
| 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. | 4.7.0-3  The system operator needs to over-ride adaptive operation. |
| 2.1.1.0-4 | The ASCT shall operate non-adaptively when a user manually commands the ASCT to cease adaptive operation. | 4.7.0-3  The system operator needs to over-ride adaptive operation. |
| 2.1.1.0-5 | The ASCT shall operate non-adaptively in accordance with a user-defined time-of-day schedule. | 4.7.0-2  The system operator needs to schedule pre-determined operation by time of day.  4.7.0-3  The system operator needs to over-ride adaptive operation. |
| 2.1.1.0-6 | The ASCT shall operate non-adaptively when commanded by an external system process. | 4.17.0-2  The system operator needs to react to commands issued by (specify an external control or decision support system, such as an ICM system or another signal system). |
| 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.)* | 4.1.0-1.0-1   * Maximize the throughput on coordinated routes   ***Note to user when selecting these requirements:***  ***Select from requirements in the 2.2 group when sequence-based systems are allowed (sequence-based systems explicitly calculate cycle, offset, and split).***  ***Select from requirements in the 2.3 group when non-sequence-based systems are allowed (non-sequence-based systems do not explicitly calculate cycle, offset, and split).***  ***(Select requirements from both groups when the vendor is given the choice of supplying one type of adaptive operation or the other.)***  4.1.0-1.0-3   * Distribute phase times in an equitable fashion   ***Note to user when selecting these requirements:***  ***Select from requirements in the 2.2 group when sequence-based systems are allowed (sequence-based systems explicitly calculate cycle, offset, and split).***  ***Select from requirements in the 2.3 group when non-sequence-based systems are allowed (non-sequence-based systems do not explicitly calculate cycle, offset, and split).***  ***(Select requirements from both groups when the vendor is given the choice of supplying one type of adaptive operation or the other.)***  4.1.0-3  The system operator needs to change the operational strategy (for example, from smooth flow to maximizing throughput or managing queues) based on changing traffic conditions. |
| 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. | 4.1.0-1.0-1   * Maximize the throughput on coordinated routes   ***Note to user when selecting these requirements:***  ***Select from requirements in the 2.2 group when sequence-based systems are allowed (sequence-based systems explicitly calculate cycle, offset, and split).***  ***Select from requirements in the 2.3 group when non-sequence-based systems are allowed (non-sequence-based systems do not explicitly calculate cycle, offset, and split).***  ***(Select requirements from both groups when the vendor is given the choice of supplying one type of adaptive operation or the other.)***  4.1.0-3  The system operator needs to change the operational strategy (for example, from smooth flow to maximizing throughput or managing queues) based on changing traffic conditions. |
| 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. | 4.1.0-1.0-4   * Manage the lengths of queues   ***Note to user when selecting these requirements:***  ***Select from requirements in the 2.2 group when sequence-based systems are allowed (sequence-based systems explicitly calculate cycle, offset, and split).***  ***Select from requirements in the 2.3 group when non-sequence-based systems are allowed (non-sequence-based systems do not explicitly calculate cycle, offset, and split).***  ***(Select requirements from both groups when the vendor is given the choice of supplying one type of adaptive operation or the other.)***  4.1.0-3  The system operator needs to change the operational strategy (for example, from smooth flow to maximizing throughput or managing queues) based on changing traffic conditions. |
| 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. | 4.1.0-1.0-3   * Distribute phase times in an equitable fashion   ***Note to user when selecting these requirements:***  ***Select from requirements in the 2.2 group when sequence-based systems are allowed (sequence-based systems explicitly calculate cycle, offset, and split).***  ***Select from requirements in the 2.3 group when non-sequence-based systems are allowed (non-sequence-based systems do not explicitly calculate cycle, offset, and split).***  ***(Select requirements from both groups when the vendor is given the choice of supplying one type of adaptive operation or the other.)***  4.1.0-3  The system operator needs to change the operational strategy (for example, from smooth flow to maximizing throughput or managing queues) based on changing traffic conditions. |
| 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. | 4.1.0-1.0-2   * Provide smooth flow along coordinated routes   ***Note to user when selecting these requirements:***  ***Select from requirements in the 2.2 group when sequence-based systems are allowed (sequence-based systems explicitly calculate cycle, offset, and split).***  ***Select from requirements in the 2.3 group when non-sequence-based systems are allowed (non-sequence-based systems do not explicitly calculate cycle, offset, and split).***  ***(Select requirements from both groups when the vendor is given the choice of supplying one type of adaptive operation or the other.)***  4.1.0-3  The system operator needs to change the operational strategy (for example, from smooth flow to maximizing throughput or managing queues) based on changing traffic conditions. |
| 2.1.1.0-8 | ***T****he ASCT shall provide maximum and minimum phase times.* | 4.1.0-1.0-3   * Distribute phase times in an equitable fashion   ***Note to user when selecting these requirements:***  ***Select from requirements in the 2.2 group when sequence-based systems are allowed (sequence-based systems explicitly calculate cycle, offset, and split).***  ***Select from requirements in the 2.3 group when non-sequence-based systems are allowed (non-sequence-based systems do not explicitly calculate cycle, offset, and split).***  ***(Select requirements from both groups when the vendor is given the choice of supplying one type of adaptive operation or the other.)***  4.1.0-1.0-6   * At an isolated intersection, optimize operation with a minimum of phase failures (based on the optimization objectives). |
| 2.1.1.0-8.0-1 | *The ASCT shall provide a user-specified maximum value for each phase at each signal controller.* | 4.1.0-1.0-3   * Distribute phase times in an equitable fashion   ***Note to user when selecting these requirements:***  ***Select from requirements in the 2.2 group when sequence-based systems are allowed (sequence-based systems explicitly calculate cycle, offset, and split).***  ***Select from requirements in the 2.3 group when non-sequence-based systems are allowed (non-sequence-based systems do not explicitly calculate cycle, offset, and split).***  ***(Select requirements from both groups when the vendor is given the choice of supplying one type of adaptive operation or the other.)***  4.1.0-1.0-6   * At an isolated intersection, optimize operation with a minimum of phase failures (based on the optimization objectives). |
| 2.1.1.0-8.0-1.0-1 | The ASCT shall not provide a phase length longer that the maximum value. | 4.1.0-1.0-3   * Distribute phase times in an equitable fashion   ***Note to user when selecting these requirements:***  ***Select from requirements in the 2.2 group when sequence-based systems are allowed (sequence-based systems explicitly calculate cycle, offset, and split).***  ***Select from requirements in the 2.3 group when non-sequence-based systems are allowed (non-sequence-based systems do not explicitly calculate cycle, offset, and split).***  ***(Select requirements from both groups when the vendor is given the choice of supplying one type of adaptive operation or the other.)***  4.1.0-1.0-6   * At an isolated intersection, optimize operation with a minimum of phase failures (based on the optimization objectives). |
| 2.1.1.0-8.0-2 | *The ASCT shall provide a user-specified minimum value for each phase at each signal controller.* | 4.1.0-1.0-3   * Distribute phase times in an equitable fashion   ***Note to user when selecting these requirements:***  ***Select from requirements in the 2.2 group when sequence-based systems are allowed (sequence-based systems explicitly calculate cycle, offset, and split).***  ***Select from requirements in the 2.3 group when non-sequence-based systems are allowed (non-sequence-based systems do not explicitly calculate cycle, offset, and split).***  ***(Select requirements from both groups when the vendor is given the choice of supplying one type of adaptive operation or the other.)***  4.1.0-1.0-6   * At an isolated intersection, optimize operation with a minimum of phase failures (based on the optimization objectives). |
| 2.1.1.0-8.0-2.0-1 | The ASCT shall not provide a phase length shorter than the minimum value. | 4.1.0-1.0-3   * Distribute phase times in an equitable fashion   ***Note to user when selecting these requirements:***  ***Select from requirements in the 2.2 group when sequence-based systems are allowed (sequence-based systems explicitly calculate cycle, offset, and split).***  ***Select from requirements in the 2.3 group when non-sequence-based systems are allowed (non-sequence-based systems do not explicitly calculate cycle, offset, and split).***  ***(Select requirements from both groups when the vendor is given the choice of supplying one type of adaptive operation or the other.)***  4.1.0-1.0-6   * At an isolated intersection, optimize operation with a minimum of phase failures (based on the optimization objectives). |
| 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.) | 4.1.0-4  The system operator needs to detect repeated phase failures and control signal timing to prevent phase failures building up queues. The operator in this case is trying to prevent a routine queue from forming where it will block another movement in the cycle unnecessarily. For example, the operator may need to prevent a queue resulting from the trailing end of the through green from blocking the storage needed by an entering side-street left turn in the subsequent phase. An overall queue management strategy, particularly when congestion is present, is covered under 4.1.0-1.0-5. |
| 2.1.1.0-9.0-1 | The ASCT shall alter operations, to minimize repeated phase failures. | 4.1.0-4  The system operator needs to detect repeated phase failures and control signal timing to prevent phase failures building up queues. The operator in this case is trying to prevent a routine queue from forming where it will block another movement in the cycle unnecessarily. For example, the operator may need to prevent a queue resulting from the trailing end of the through green from blocking the storage needed by an entering side-street left turn in the subsequent phase. An overall queue management strategy, particularly when congestion is present, is covered under 4.1.0-1.0-5. |
| 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.) | 4.1.0-1.0-1   * Maximize the throughput on coordinated routes   ***Note to user when selecting these requirements:***  ***Select from requirements in the 2.2 group when sequence-based systems are allowed (sequence-based systems explicitly calculate cycle, offset, and split).***  ***Select from requirements in the 2.3 group when non-sequence-based systems are allowed (non-sequence-based systems do not explicitly calculate cycle, offset, and split).***  ***(Select requirements from both groups when the vendor is given the choice of supplying one type of adaptive operation or the other.)***  4.1.0-1.0-2   * Provide smooth flow along coordinated routes   ***Note to user when selecting these requirements:***  ***Select from requirements in the 2.2 group when sequence-based systems are allowed (sequence-based systems explicitly calculate cycle, offset, and split).***  ***Select from requirements in the 2.3 group when non-sequence-based systems are allowed (non-sequence-based systems do not explicitly calculate cycle, offset, and split).***  ***(Select requirements from both groups when the vendor is given the choice of supplying one type of adaptive operation or the other.)***  4.1.0-1.0-4   * Manage the lengths of queues   ***Note to user when selecting these requirements:***  ***Select from requirements in the 2.2 group when sequence-based systems are allowed (sequence-based systems explicitly calculate cycle, offset, and split).***  ***Select from requirements in the 2.3 group when non-sequence-based systems are allowed (non-sequence-based systems do not explicitly calculate cycle, offset, and split).***  ***(Select requirements from both groups when the vendor is given the choice of supplying one type of adaptive operation or the other.)*** |
| 2.1.1.0-11 | *The ASCT shall provide coordination along a route.* | 4.1.0-8  The system operator needs to designate the coordinated route based on traffic conditions and the selected operational strategy. |
| 2.1.1.0-11.0-1 | The ASCT shall coordinate along a user-defined route. | 4.1.0-8  The system operator needs to designate the coordinated route based on traffic conditions and the selected operational strategy. |
| 2.1.1.0-11.0-2 | The ASCT shall determine the coordinated route based on traffic conditions. | 4.1.0-8  The system operator needs to designate the coordinated route based on traffic conditions and the selected operational strategy. |
| 2.1.1.0-11.0-3 | The ASCT shall determine the coordinated route based on a user-defined schedule. | 4.1.0-8  The system operator needs to designate the coordinated route based on traffic conditions and the selected operational strategy. |
| 2.1.1.0-11.0-4 | *The ASCT shall store XX user-defined coordination routes.* | 4.1.0-8  The system operator needs to designate the coordinated route based on traffic conditions and the selected operational strategy. |
| 2.1.1.0-11.0-4.0-1 | The ASCT shall implement a stored coordinated route by operator command. | 4.1.0-8  The system operator needs to designate the coordinated route based on traffic conditions and the selected operational strategy. |
| 2.1.1.0-11.0-4.0-2 | The ASCT shall implement a stored coordinated route based on traffic conditions. | 4.1.0-8  The system operator needs to designate the coordinated route based on traffic conditions and the selected operational strategy. |
| 2.1.1.0-11.0-4.0-3 | The ASCT shall implement a stored coordinated route based on a user-defined schedule. | 4.1.0-8  The system operator needs to designate the coordinated route based on traffic conditions and the selected operational strategy. |
| 2.1.1.0-12 | The ASCT shall not prevent the use of phase timings in the local controller set by agency policy. | 4.1.0-9  The system operator needs to set signal timing parameters (such as minimum green, maximum green and extension time) to comply with agency policies. |
| 2.1.2 | 2.1.2 Allowable Phases |  |
| 2.1.2.0-1 | The ASCT shall not prevent protected/permissive left turn phase operation. | 4.9.0-1.0-14   * Protected/permissive phasing and alternate left turn phase sequences. |
| 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. | 4.9.0-1.0-14   * Protected/permissive phasing and alternate left turn phase sequences. |
| 2.1.2.0-3 | The ASCT shall prevent skipping a user-specified phase when the user-specified phase sequence is operating. | 4.9.0-1.0-6   * Prevent one or more phases being skipped under certain traffic conditions or signal states. |
| 2.1.2.0-4 | The ASCT shall prevent skipping a user-specified phase based on the state of a user-specified external input. | 4.9.0-1.0-6   * Prevent one or more phases being skipped under certain traffic conditions or signal states.   4.17.0-2  The system operator needs to react to commands issued by (specify an external control or decision support system, such as an ICM system or another signal system). |
| 2.1.2.0-5 | The ASCT shall prevent skipping a user-specified phase according to a time of day schedule. | 4.9.0-1.0-6   * Prevent one or more phases being skipped under certain traffic conditions or signal states. |
| 2.1.2.0-6 | The ASCT shall omit a user-specified phase when the cycle length is below a user-specified value. | 4.9.0-1.0-5   * Allow one or more phases to be omitted (disabled) under certain traffic conditions or signal states. |
| 2.1.2.0-7 | The ASCT shall omit a user-specified phase based on measured traffic conditions. | 4.9.0-1.0-5   * Allow one or more phases to be omitted (disabled) under certain traffic conditions or signal states. |
| 2.1.2.0-8 | The ASCT shall omit a user-specified phase based on the state of a user-specified external input. | 4.9.0-1.0-5   * Allow one or more phases to be omitted (disabled) under certain traffic conditions or signal states.   4.17.0-2  The system operator needs to react to commands issued by (specify an external control or decision support system, such as an ICM system or another signal system). |
| 2.1.2.0-9 | The ASCT shall omit a user-specified phase according to a time of day schedule | 4.9.0-1.0-5   * Allow one or more phases to be omitted (disabled) under certain traffic conditions or signal states. |
| 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. | 4.9.0-1.0-10   * Allow the operator to specify which phase receives unused time from a preceding 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. | 4.9.0-1.0-10   * Allow the operator to specify which phase receives unused time from a preceding phase |
| 2.1.2.0-12 | The ASCT shall not alter the order of phases at a user-specified intersection. | 4.1.0-7  The system operator needs to fix the sequence of phases at any specified location. For example, the operator may need to fix the phase order at a diamond interchange. |
| 2.1.3 | 2.1.3 Oversaturation |  |
| 2.1.3.0-1 | The ASCT shall detect the presence of queues at pre-configured locations. | 4.1.0-1.0-4   * Manage the lengths of queues   ***Note to user when selecting these requirements:***  ***Select from requirements in the 2.2 group when sequence-based systems are allowed (sequence-based systems explicitly calculate cycle, offset, and split).***  ***Select from requirements in the 2.3 group when non-sequence-based systems are allowed (non-sequence-based systems do not explicitly calculate cycle, offset, and split).***  ***(Select requirements from both groups when the vendor is given the choice of supplying one type of adaptive operation or the other.)***  4.1.0-1.0-5   * Manage the locations of queues within the network   ***Note to user when selecting these requirements:***  ***Select from requirements in the 2.2 group when sequence-based systems are allowed (sequence-based systems explicitly calculate cycle, offset, and split).***  ***Select from requirements in the 2.3 group when non-sequence-based systems are allowed (non-sequence-based systems do not explicitly calculate cycle, offset, and split).***  ***(Select requirements from both groups when the vendor is given the choice of supplying one type of adaptive operation or the other.)***  4.1.0-4  The system operator needs to detect repeated phase failures and control signal timing to prevent phase failures building up queues. The operator in this case is trying to prevent a routine queue from forming where it will block another movement in the cycle unnecessarily. For example, the operator may need to prevent a queue resulting from the trailing end of the through green from blocking the storage needed by an entering side-street left turn in the subsequent phase. An overall queue management strategy, particularly when congestion is present, is covered under 4.1.0-1.0-5.  4.5.0-1  The system operator needs to detect queues from outside the system and modify the ASCT operation to accommodate the queuing.  4.5.0-2  The system operator needs to detect queues within the system's boundaries and modify the ASCT operation to accommodate the queuing.  4.5.0-3  The system operator needs to detect queues propagating outside its boundaries from within the ASCT boundaries, and modify its operation to accommodate the queuing.  4.5.0-4  The system operator needs to store queues in locations where they can be accommodated without adversely affecting adaptive operation.  4.5.0-5  The system operator needs to prevent queues forming at user-specified locations. |
| 2.1.3.0-2 | When queues are detected at user-specified locations, the ASCT shall execute user-specified timing plan/operational mode. | 4.1.0-1.0-4   * Manage the lengths of queues   ***Note to user when selecting these requirements:***  ***Select from requirements in the 2.2 group when sequence-based systems are allowed (sequence-based systems explicitly calculate cycle, offset, and split).***  ***Select from requirements in the 2.3 group when non-sequence-based systems are allowed (non-sequence-based systems do not explicitly calculate cycle, offset, and split).***  ***(Select requirements from both groups when the vendor is given the choice of supplying one type of adaptive operation or the other.)***  4.1.0-1.0-5   * Manage the locations of queues within the network   ***Note to user when selecting these requirements:***  ***Select from requirements in the 2.2 group when sequence-based systems are allowed (sequence-based systems explicitly calculate cycle, offset, and split).***  ***Select from requirements in the 2.3 group when non-sequence-based systems are allowed (non-sequence-based systems do not explicitly calculate cycle, offset, and split).***  ***(Select requirements from both groups when the vendor is given the choice of supplying one type of adaptive operation or the other.)***  4.1.0-4  The system operator needs to detect repeated phase failures and control signal timing to prevent phase failures building up queues. The operator in this case is trying to prevent a routine queue from forming where it will block another movement in the cycle unnecessarily. For example, the operator may need to prevent a queue resulting from the trailing end of the through green from blocking the storage needed by an entering side-street left turn in the subsequent phase. An overall queue management strategy, particularly when congestion is present, is covered under 4.1.0-1.0-5.  4.5.0-1  The system operator needs to detect queues from outside the system and modify the ASCT operation to accommodate the queuing.  4.5.0-2  The system operator needs to detect queues within the system's boundaries and modify the ASCT operation to accommodate the queuing.  4.5.0-3  The system operator needs to detect queues propagating outside its boundaries from within the ASCT boundaries, and modify its operation to accommodate the queuing.  4.5.0-4  The system operator needs to store queues in locations where they can be accommodated without adversely affecting adaptive operation.  4.5.0-5  The system operator needs to prevent queues forming at user-specified locations. |
| 2.1.3.0-3 | When queues are detected at user-specified locations, the ASCT shall execute user-specified adaptive operation strategy. | 4.1.0-1.0-4   * Manage the lengths of queues   ***Note to user when selecting these requirements:***  ***Select from requirements in the 2.2 group when sequence-based systems are allowed (sequence-based systems explicitly calculate cycle, offset, and split).***  ***Select from requirements in the 2.3 group when non-sequence-based systems are allowed (non-sequence-based systems do not explicitly calculate cycle, offset, and split).***  ***(Select requirements from both groups when the vendor is given the choice of supplying one type of adaptive operation or the other.)***  4.1.0-1.0-5   * Manage the locations of queues within the network   ***Note to user when selecting these requirements:***  ***Select from requirements in the 2.2 group when sequence-based systems are allowed (sequence-based systems explicitly calculate cycle, offset, and split).***  ***Select from requirements in the 2.3 group when non-sequence-based systems are allowed (non-sequence-based systems do not explicitly calculate cycle, offset, and split).***  ***(Select requirements from both groups when the vendor is given the choice of supplying one type of adaptive operation or the other.)***  4.1.0-4  The system operator needs to detect repeated phase failures and control signal timing to prevent phase failures building up queues. The operator in this case is trying to prevent a routine queue from forming where it will block another movement in the cycle unnecessarily. For example, the operator may need to prevent a queue resulting from the trailing end of the through green from blocking the storage needed by an entering side-street left turn in the subsequent phase. An overall queue management strategy, particularly when congestion is present, is covered under 4.1.0-1.0-5.  4.5.0-1  The system operator needs to detect queues from outside the system and modify the ASCT operation to accommodate the queuing.  4.5.0-2  The system operator needs to detect queues within the system's boundaries and modify the ASCT operation to accommodate the queuing.  4.5.0-3  The system operator needs to detect queues propagating outside its boundaries from within the ASCT boundaries, and modify its operation to accommodate the queuing.  4.5.0-4  The system operator needs to store queues in locations where they can be accommodated without adversely affecting adaptive operation.  4.5.0-5  The system operator needs to prevent queues forming at user-specified locations. |
| 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. | 4.1.0-1.0-4   * Manage the lengths of queues   ***Note to user when selecting these requirements:***  ***Select from requirements in the 2.2 group when sequence-based systems are allowed (sequence-based systems explicitly calculate cycle, offset, and split).***  ***Select from requirements in the 2.3 group when non-sequence-based systems are allowed (non-sequence-based systems do not explicitly calculate cycle, offset, and split).***  ***(Select requirements from both groups when the vendor is given the choice of supplying one type of adaptive operation or the other.)***  4.1.0-1.0-5   * Manage the locations of queues within the network   ***Note to user when selecting these requirements:***  ***Select from requirements in the 2.2 group when sequence-based systems are allowed (sequence-based systems explicitly calculate cycle, offset, and split).***  ***Select from requirements in the 2.3 group when non-sequence-based systems are allowed (non-sequence-based systems do not explicitly calculate cycle, offset, and split).***  ***(Select requirements from both groups when the vendor is given the choice of supplying one type of adaptive operation or the other.)***  4.1.0-4  The system operator needs to detect repeated phase failures and control signal timing to prevent phase failures building up queues. The operator in this case is trying to prevent a routine queue from forming where it will block another movement in the cycle unnecessarily. For example, the operator may need to prevent a queue resulting from the trailing end of the through green from blocking the storage needed by an entering side-street left turn in the subsequent phase. An overall queue management strategy, particularly when congestion is present, is covered under 4.1.0-1.0-5.  4.5.0-4  The system operator needs to store queues in locations where they can be accommodated without adversely affecting adaptive operation.  4.5.0-5  The system operator needs to prevent queues forming at user-specified locations. |
| 2.1.3.0-5 | The ASCT shall meter traffic into user-specified bottlenecks by storing queues at user-specified locations. | 4.1.0-1.0-4   * Manage the lengths of queues   ***Note to user when selecting these requirements:***  ***Select from requirements in the 2.2 group when sequence-based systems are allowed (sequence-based systems explicitly calculate cycle, offset, and split).***  ***Select from requirements in the 2.3 group when non-sequence-based systems are allowed (non-sequence-based systems do not explicitly calculate cycle, offset, and split).***  ***(Select requirements from both groups when the vendor is given the choice of supplying one type of adaptive operation or the other.)***  4.1.0-1.0-5   * Manage the locations of queues within the network   ***Note to user when selecting these requirements:***  ***Select from requirements in the 2.2 group when sequence-based systems are allowed (sequence-based systems explicitly calculate cycle, offset, and split).***  ***Select from requirements in the 2.3 group when non-sequence-based systems are allowed (non-sequence-based systems do not explicitly calculate cycle, offset, and split).***  ***(Select requirements from both groups when the vendor is given the choice of supplying one type of adaptive operation or the other.)***  4.5.0-4  The system operator needs to store queues in locations where they can be accommodated without adversely affecting adaptive operation.  4.5.0-5  The system operator needs to prevent queues forming at user-specified locations. |
| 2.1.3.0-6 | The ASCT shall store queues at user-specified locations. | 4.1.0-1.0-4   * Manage the lengths of queues   ***Note to user when selecting these requirements:***  ***Select from requirements in the 2.2 group when sequence-based systems are allowed (sequence-based systems explicitly calculate cycle, offset, and split).***  ***Select from requirements in the 2.3 group when non-sequence-based systems are allowed (non-sequence-based systems do not explicitly calculate cycle, offset, and split).***  ***(Select requirements from both groups when the vendor is given the choice of supplying one type of adaptive operation or the other.)***  4.1.0-1.0-5   * Manage the locations of queues within the network   ***Note to user when selecting these requirements:***  ***Select from requirements in the 2.2 group when sequence-based systems are allowed (sequence-based systems explicitly calculate cycle, offset, and split).***  ***Select from requirements in the 2.3 group when non-sequence-based systems are allowed (non-sequence-based systems do not explicitly calculate cycle, offset, and split).***  ***(Select requirements from both groups when the vendor is given the choice of supplying one type of adaptive operation or the other.)***  4.5.0-4  The system operator needs to store queues in locations where they can be accommodated without adversely affecting adaptive operation.  4.5.0-5  The system operator needs to prevent queues forming at user-specified locations. |
| 2.1.3.0-7 | The ASCT shall maintain capacity flow through user-specified bottlenecks. | 4.5.0-4  The system operator needs to store queues in locations where they can be accommodated without adversely affecting adaptive operation.  4.5.0-5  The system operator needs to prevent queues forming at user-specified locations. |
| 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. | 4.1.0-1.0-5   * Manage the locations of queues within the network   ***Note to user when selecting these requirements:***  ***Select from requirements in the 2.2 group when sequence-based systems are allowed (sequence-based systems explicitly calculate cycle, offset, and split).***  ***Select from requirements in the 2.3 group when non-sequence-based systems are allowed (non-sequence-based systems do not explicitly calculate cycle, offset, and split).***  ***(Select requirements from both groups when the vendor is given the choice of supplying one type of adaptive operation or the other.)*** |
| 2.2 | 2.2 Sequence-based Adaptive Coordination |  |
| 2.2.0-1 | **Use this section if sequence-based adaptive coordination is likely to provide acceptable operation in your situation.** |  |
| 2.2.0-2 | **(Sequence-based only)** The ASCT shall select cycle length based on a time of day schedule. | 4.1.0-1.0-1   * Maximize the throughput on coordinated routes   ***Note to user when selecting these requirements:***  ***Select from requirements in the 2.2 group when sequence-based systems are allowed (sequence-based systems explicitly calculate cycle, offset, and split).***  ***Select from requirements in the 2.3 group when non-sequence-based systems are allowed (non-sequence-based systems do not explicitly calculate cycle, offset, and split).***  ***(Select requirements from both groups when the vendor is given the choice of supplying one type of adaptive operation or the other.)***  4.1.0-1.0-2   * Provide smooth flow along coordinated routes   ***Note to user when selecting these requirements:***  ***Select from requirements in the 2.2 group when sequence-based systems are allowed (sequence-based systems explicitly calculate cycle, offset, and split).***  ***Select from requirements in the 2.3 group when non-sequence-based systems are allowed (non-sequence-based systems do not explicitly calculate cycle, offset, and split).***  ***(Select requirements from both groups when the vendor is given the choice of supplying one type of adaptive operation or the other.)***  4.1.0-1.0-3   * Distribute phase times in an equitable fashion   ***Note to user when selecting these requirements:***  ***Select from requirements in the 2.2 group when sequence-based systems are allowed (sequence-based systems explicitly calculate cycle, offset, and split).***  ***Select from requirements in the 2.3 group when non-sequence-based systems are allowed (non-sequence-based systems do not explicitly calculate cycle, offset, and split).***  ***(Select requirements from both groups when the vendor is given the choice of supplying one type of adaptive operation or the other.)***  4.1.0-1.0-4   * Manage the lengths of queues   ***Note to user when selecting these requirements:***  ***Select from requirements in the 2.2 group when sequence-based systems are allowed (sequence-based systems explicitly calculate cycle, offset, and split).***  ***Select from requirements in the 2.3 group when non-sequence-based systems are allowed (non-sequence-based systems do not explicitly calculate cycle, offset, and split).***  ***(Select requirements from both groups when the vendor is given the choice of supplying one type of adaptive operation or the other.)*** |
| 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 . | 4.1.0-1.0-3   * Distribute phase times in an equitable fashion   ***Note to user when selecting these requirements:***  ***Select from requirements in the 2.2 group when sequence-based systems are allowed (sequence-based systems explicitly calculate cycle, offset, and split).***  ***Select from requirements in the 2.3 group when non-sequence-based systems are allowed (non-sequence-based systems do not explicitly calculate cycle, offset, and split).***  ***(Select requirements from both groups when the vendor is given the choice of supplying one type of adaptive operation or the other.)***  4.1.0-1.0-5   * Manage the locations of queues within the network   ***Note to user when selecting these requirements:***  ***Select from requirements in the 2.2 group when sequence-based systems are allowed (sequence-based systems explicitly calculate cycle, offset, and split).***  ***Select from requirements in the 2.3 group when non-sequence-based systems are allowed (non-sequence-based systems do not explicitly calculate cycle, offset, and split).***  ***(Select requirements from both groups when the vendor is given the choice of supplying one type of adaptive operation or the other.)***  4.1.0-4  The system operator needs to detect repeated phase failures and control signal timing to prevent phase failures building up queues. The operator in this case is trying to prevent a routine queue from forming where it will block another movement in the cycle unnecessarily. For example, the operator may need to prevent a queue resulting from the trailing end of the through green from blocking the storage needed by an entering side-street left turn in the subsequent phase. An overall queue management strategy, particularly when congestion is present, is covered under 4.1.0-1.0-5. |
| 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.* | 4.1.0-1.0-1   * Maximize the throughput on coordinated routes   ***Note to user when selecting these requirements:***  ***Select from requirements in the 2.2 group when sequence-based systems are allowed (sequence-based systems explicitly calculate cycle, offset, and split).***  ***Select from requirements in the 2.3 group when non-sequence-based systems are allowed (non-sequence-based systems do not explicitly calculate cycle, offset, and split).***  ***(Select requirements from both groups when the vendor is given the choice of supplying one type of adaptive operation or the other.)***  4.1.0-1.0-2   * Provide smooth flow along coordinated routes   ***Note to user when selecting these requirements:***  ***Select from requirements in the 2.2 group when sequence-based systems are allowed (sequence-based systems explicitly calculate cycle, offset, and split).***  ***Select from requirements in the 2.3 group when non-sequence-based systems are allowed (non-sequence-based systems do not explicitly calculate cycle, offset, and split).***  ***(Select requirements from both groups when the vendor is given the choice of supplying one type of adaptive operation or the other.)***  4.1.0-1.0-4   * Manage the lengths of queues   ***Note to user when selecting these requirements:***  ***Select from requirements in the 2.2 group when sequence-based systems are allowed (sequence-based systems explicitly calculate cycle, offset, and split).***  ***Select from requirements in the 2.3 group when non-sequence-based systems are allowed (non-sequence-based systems do not explicitly calculate cycle, offset, and split).***  ***(Select requirements from both groups when the vendor is given the choice of supplying one type of adaptive operation or the other.)*** |
| 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. | 4.1.0-1.0-1   * Maximize the throughput on coordinated routes   ***Note to user when selecting these requirements:***  ***Select from requirements in the 2.2 group when sequence-based systems are allowed (sequence-based systems explicitly calculate cycle, offset, and split).***  ***Select from requirements in the 2.3 group when non-sequence-based systems are allowed (non-sequence-based systems do not explicitly calculate cycle, offset, and split).***  ***(Select requirements from both groups when the vendor is given the choice of supplying one type of adaptive operation or the other.)***  4.1.0-1.0-2   * Provide smooth flow along coordinated routes   ***Note to user when selecting these requirements:***  ***Select from requirements in the 2.2 group when sequence-based systems are allowed (sequence-based systems explicitly calculate cycle, offset, and split).***  ***Select from requirements in the 2.3 group when non-sequence-based systems are allowed (non-sequence-based systems do not explicitly calculate cycle, offset, and split).***  ***(Select requirements from both groups when the vendor is given the choice of supplying one type of adaptive operation or the other.)***  4.1.0-1.0-4   * Manage the lengths of queues   ***Note to user when selecting these requirements:***  ***Select from requirements in the 2.2 group when sequence-based systems are allowed (sequence-based systems explicitly calculate cycle, offset, and split).***  ***Select from requirements in the 2.3 group when non-sequence-based systems are allowed (non-sequence-based systems do not explicitly calculate cycle, offset, and split).***  ***(Select requirements from both groups when the vendor is given the choice of supplying one type of adaptive operation or the other.)*** |
| 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).* | 4.1.0-1.0-1   * Maximize the throughput on coordinated routes   ***Note to user when selecting these requirements:***  ***Select from requirements in the 2.2 group when sequence-based systems are allowed (sequence-based systems explicitly calculate cycle, offset, and split).***  ***Select from requirements in the 2.3 group when non-sequence-based systems are allowed (non-sequence-based systems do not explicitly calculate cycle, offset, and split).***  ***(Select requirements from both groups when the vendor is given the choice of supplying one type of adaptive operation or the other.)***  4.1.0-1.0-2   * Provide smooth flow along coordinated routes   ***Note to user when selecting these requirements:***  ***Select from requirements in the 2.2 group when sequence-based systems are allowed (sequence-based systems explicitly calculate cycle, offset, and split).***  ***Select from requirements in the 2.3 group when non-sequence-based systems are allowed (non-sequence-based systems do not explicitly calculate cycle, offset, and split).***  ***(Select requirements from both groups when the vendor is given the choice of supplying one type of adaptive operation or the other.)***  4.1.0-1.0-3   * Distribute phase times in an equitable fashion   ***Note to user when selecting these requirements:***  ***Select from requirements in the 2.2 group when sequence-based systems are allowed (sequence-based systems explicitly calculate cycle, offset, and split).***  ***Select from requirements in the 2.3 group when non-sequence-based systems are allowed (non-sequence-based systems do not explicitly calculate cycle, offset, and split).***  ***(Select requirements from both groups when the vendor is given the choice of supplying one type of adaptive operation or the other.)***  4.1.0-1.0-4   * Manage the lengths of queues   ***Note to user when selecting these requirements:***  ***Select from requirements in the 2.2 group when sequence-based systems are allowed (sequence-based systems explicitly calculate cycle, offset, and split).***  ***Select from requirements in the 2.3 group when non-sequence-based systems are allowed (non-sequence-based systems do not explicitly calculate cycle, offset, and split).***  ***(Select requirements from both groups when the vendor is given the choice of supplying one type of adaptive operation or the other.)*** |
| 2.2.0-5.0-1 | **(Sequence-based only)** The ASCT shall limit cycle lengths to user-specified values. | 4.1.0-1.0-1   * Maximize the throughput on coordinated routes   ***Note to user when selecting these requirements:***  ***Select from requirements in the 2.2 group when sequence-based systems are allowed (sequence-based systems explicitly calculate cycle, offset, and split).***  ***Select from requirements in the 2.3 group when non-sequence-based systems are allowed (non-sequence-based systems do not explicitly calculate cycle, offset, and split).***  ***(Select requirements from both groups when the vendor is given the choice of supplying one type of adaptive operation or the other.)***  4.1.0-1.0-2   * Provide smooth flow along coordinated routes   ***Note to user when selecting these requirements:***  ***Select from requirements in the 2.2 group when sequence-based systems are allowed (sequence-based systems explicitly calculate cycle, offset, and split).***  ***Select from requirements in the 2.3 group when non-sequence-based systems are allowed (non-sequence-based systems do not explicitly calculate cycle, offset, and split).***  ***(Select requirements from both groups when the vendor is given the choice of supplying one type of adaptive operation or the other.)***  4.1.0-1.0-3   * Distribute phase times in an equitable fashion   ***Note to user when selecting these requirements:***  ***Select from requirements in the 2.2 group when sequence-based systems are allowed (sequence-based systems explicitly calculate cycle, offset, and split).***  ***Select from requirements in the 2.3 group when non-sequence-based systems are allowed (non-sequence-based systems do not explicitly calculate cycle, offset, and split).***  ***(Select requirements from both groups when the vendor is given the choice of supplying one type of adaptive operation or the other.)***  4.1.0-1.0-4   * Manage the lengths of queues   ***Note to user when selecting these requirements:***  ***Select from requirements in the 2.2 group when sequence-based systems are allowed (sequence-based systems explicitly calculate cycle, offset, and split).***  ***Select from requirements in the 2.3 group when non-sequence-based systems are allowed (non-sequence-based systems do not explicitly calculate cycle, offset, and split).***  ***(Select requirements from both groups when the vendor is given the choice of supplying one type of adaptive operation or the other.)*** |
| 2.2.0-5.0-2 | **(Sequence-based only)** The ASCT shall limit cycle lengths to a user-specified range. | 4.1.0-1.0-1   * Maximize the throughput on coordinated routes   ***Note to user when selecting these requirements:***  ***Select from requirements in the 2.2 group when sequence-based systems are allowed (sequence-based systems explicitly calculate cycle, offset, and split).***  ***Select from requirements in the 2.3 group when non-sequence-based systems are allowed (non-sequence-based systems do not explicitly calculate cycle, offset, and split).***  ***(Select requirements from both groups when the vendor is given the choice of supplying one type of adaptive operation or the other.)***  4.1.0-1.0-2   * Provide smooth flow along coordinated routes   ***Note to user when selecting these requirements:***  ***Select from requirements in the 2.2 group when sequence-based systems are allowed (sequence-based systems explicitly calculate cycle, offset, and split).***  ***Select from requirements in the 2.3 group when non-sequence-based systems are allowed (non-sequence-based systems do not explicitly calculate cycle, offset, and split).***  ***(Select requirements from both groups when the vendor is given the choice of supplying one type of adaptive operation or the other.)***  4.1.0-1.0-3   * Distribute phase times in an equitable fashion   ***Note to user when selecting these requirements:***  ***Select from requirements in the 2.2 group when sequence-based systems are allowed (sequence-based systems explicitly calculate cycle, offset, and split).***  ***Select from requirements in the 2.3 group when non-sequence-based systems are allowed (non-sequence-based systems do not explicitly calculate cycle, offset, and split).***  ***(Select requirements from both groups when the vendor is given the choice of supplying one type of adaptive operation or the other.)***  4.1.0-1.0-4   * Manage the lengths of queues   ***Note to user when selecting these requirements:***  ***Select from requirements in the 2.2 group when sequence-based systems are allowed (sequence-based systems explicitly calculate cycle, offset, and split).***  ***Select from requirements in the 2.3 group when non-sequence-based systems are allowed (non-sequence-based systems do not explicitly calculate cycle, offset, and split).***  ***(Select requirements from both groups when the vendor is given the choice of supplying one type of adaptive operation or the other.)*** |
| 2.2.0-5.0-3 | **(Sequence-based only)** The ASCT shall calculate optimum cycle length according to the user-specified coordination strategy. | 4.1.0-1.0-1   * Maximize the throughput on coordinated routes   ***Note to user when selecting these requirements:***  ***Select from requirements in the 2.2 group when sequence-based systems are allowed (sequence-based systems explicitly calculate cycle, offset, and split).***  ***Select from requirements in the 2.3 group when non-sequence-based systems are allowed (non-sequence-based systems do not explicitly calculate cycle, offset, and split).***  ***(Select requirements from both groups when the vendor is given the choice of supplying one type of adaptive operation or the other.)***  4.1.0-1.0-2   * Provide smooth flow along coordinated routes   ***Note to user when selecting these requirements:***  ***Select from requirements in the 2.2 group when sequence-based systems are allowed (sequence-based systems explicitly calculate cycle, offset, and split).***  ***Select from requirements in the 2.3 group when non-sequence-based systems are allowed (non-sequence-based systems do not explicitly calculate cycle, offset, and split).***  ***(Select requirements from both groups when the vendor is given the choice of supplying one type of adaptive operation or the other.)***  4.1.0-1.0-3   * Distribute phase times in an equitable fashion   ***Note to user when selecting these requirements:***  ***Select from requirements in the 2.2 group when sequence-based systems are allowed (sequence-based systems explicitly calculate cycle, offset, and split).***  ***Select from requirements in the 2.3 group when non-sequence-based systems are allowed (non-sequence-based systems do not explicitly calculate cycle, offset, and split).***  ***(Select requirements from both groups when the vendor is given the choice of supplying one type of adaptive operation or the other.)***  4.1.0-1.0-4   * Manage the lengths of queues   ***Note to user when selecting these requirements:***  ***Select from requirements in the 2.2 group when sequence-based systems are allowed (sequence-based systems explicitly calculate cycle, offset, and split).***  ***Select from requirements in the 2.3 group when non-sequence-based systems are allowed (non-sequence-based systems do not explicitly calculate cycle, offset, and split).***  ***(Select requirements from both groups when the vendor is given the choice of supplying one type of adaptive operation or the other.)*** |
| 2.2.0-5.0-4 | ***(Sequence-based only)*** *The ASCT shall limit changes in cycle length to not exceed a user-specified value.* | 4.1.0-1.0-1   * Maximize the throughput on coordinated routes   ***Note to user when selecting these requirements:***  ***Select from requirements in the 2.2 group when sequence-based systems are allowed (sequence-based systems explicitly calculate cycle, offset, and split).***  ***Select from requirements in the 2.3 group when non-sequence-based systems are allowed (non-sequence-based systems do not explicitly calculate cycle, offset, and split).***  ***(Select requirements from both groups when the vendor is given the choice of supplying one type of adaptive operation or the other.)***  4.1.0-1.0-2   * Provide smooth flow along coordinated routes   ***Note to user when selecting these requirements:***  ***Select from requirements in the 2.2 group when sequence-based systems are allowed (sequence-based systems explicitly calculate cycle, offset, and split).***  ***Select from requirements in the 2.3 group when non-sequence-based systems are allowed (non-sequence-based systems do not explicitly calculate cycle, offset, and split).***  ***(Select requirements from both groups when the vendor is given the choice of supplying one type of adaptive operation or the other.)***  4.1.0-1.0-3   * Distribute phase times in an equitable fashion   ***Note to user when selecting these requirements:***  ***Select from requirements in the 2.2 group when sequence-based systems are allowed (sequence-based systems explicitly calculate cycle, offset, and split).***  ***Select from requirements in the 2.3 group when non-sequence-based systems are allowed (non-sequence-based systems do not explicitly calculate cycle, offset, and split).***  ***(Select requirements from both groups when the vendor is given the choice of supplying one type of adaptive operation or the other.)***  4.1.0-1.0-4   * Manage the lengths of queues   ***Note to user when selecting these requirements:***  ***Select from requirements in the 2.2 group when sequence-based systems are allowed (sequence-based systems explicitly calculate cycle, offset, and split).***  ***Select from requirements in the 2.3 group when non-sequence-based systems are allowed (non-sequence-based systems do not explicitly calculate cycle, offset, and split).***  ***(Select requirements from both groups when the vendor is given the choice of supplying one type of adaptive operation or the other.)*** |
| 2.2.0-5.0-4.0-1 | ***(Sequence-based only)*** *The ASCT shall increase the limit for the following XX cycles based on a change in conditions*. | 4.1.0-1.0-1   * Maximize the throughput on coordinated routes   ***Note to user when selecting these requirements:***  ***Select from requirements in the 2.2 group when sequence-based systems are allowed (sequence-based systems explicitly calculate cycle, offset, and split).***  ***Select from requirements in the 2.3 group when non-sequence-based systems are allowed (non-sequence-based systems do not explicitly calculate cycle, offset, and split).***  ***(Select requirements from both groups when the vendor is given the choice of supplying one type of adaptive operation or the other.)***  4.1.0-1.0-2   * Provide smooth flow along coordinated routes   ***Note to user when selecting these requirements:***  ***Select from requirements in the 2.2 group when sequence-based systems are allowed (sequence-based systems explicitly calculate cycle, offset, and split).***  ***Select from requirements in the 2.3 group when non-sequence-based systems are allowed (non-sequence-based systems do not explicitly calculate cycle, offset, and split).***  ***(Select requirements from both groups when the vendor is given the choice of supplying one type of adaptive operation or the other.)***  4.1.0-1.0-3   * Distribute phase times in an equitable fashion   ***Note to user when selecting these requirements:***  ***Select from requirements in the 2.2 group when sequence-based systems are allowed (sequence-based systems explicitly calculate cycle, offset, and split).***  ***Select from requirements in the 2.3 group when non-sequence-based systems are allowed (non-sequence-based systems do not explicitly calculate cycle, offset, and split).***  ***(Select requirements from both groups when the vendor is given the choice of supplying one type of adaptive operation or the other.)***  4.1.0-1.0-4   * Manage the lengths of queues   ***Note to user when selecting these requirements:***  ***Select from requirements in the 2.2 group when sequence-based systems are allowed (sequence-based systems explicitly calculate cycle, offset, and split).***  ***Select from requirements in the 2.3 group when non-sequence-based systems are allowed (non-sequence-based systems do not explicitly calculate cycle, offset, and split).***  ***(Select requirements from both groups when the vendor is given the choice of supplying one type of adaptive operation or the other.)*** |
| 2.2.0-5.0-4.0-1.0-1 | **(Sequence-based only)** The change in conditions shall be defined by XX successive adaptive increases in cycle length at the maximum rate. | 4.1.0-1.0-1   * Maximize the throughput on coordinated routes   ***Note to user when selecting these requirements:***  ***Select from requirements in the 2.2 group when sequence-based systems are allowed (sequence-based systems explicitly calculate cycle, offset, and split).***  ***Select from requirements in the 2.3 group when non-sequence-based systems are allowed (non-sequence-based systems do not explicitly calculate cycle, offset, and split).***  ***(Select requirements from both groups when the vendor is given the choice of supplying one type of adaptive operation or the other.)***  4.1.0-1.0-2   * Provide smooth flow along coordinated routes   ***Note to user when selecting these requirements:***  ***Select from requirements in the 2.2 group when sequence-based systems are allowed (sequence-based systems explicitly calculate cycle, offset, and split).***  ***Select from requirements in the 2.3 group when non-sequence-based systems are allowed (non-sequence-based systems do not explicitly calculate cycle, offset, and split).***  ***(Select requirements from both groups when the vendor is given the choice of supplying one type of adaptive operation or the other.)***  4.1.0-1.0-3   * Distribute phase times in an equitable fashion   ***Note to user when selecting these requirements:***  ***Select from requirements in the 2.2 group when sequence-based systems are allowed (sequence-based systems explicitly calculate cycle, offset, and split).***  ***Select from requirements in the 2.3 group when non-sequence-based systems are allowed (non-sequence-based systems do not explicitly calculate cycle, offset, and split).***  ***(Select requirements from both groups when the vendor is given the choice of supplying one type of adaptive operation or the other.)***  4.1.0-1.0-4   * Manage the lengths of queues   ***Note to user when selecting these requirements:***  ***Select from requirements in the 2.2 group when sequence-based systems are allowed (sequence-based systems explicitly calculate cycle, offset, and split).***  ***Select from requirements in the 2.3 group when non-sequence-based systems are allowed (non-sequence-based systems do not explicitly calculate cycle, offset, and split).***  ***(Select requirements from both groups when the vendor is given the choice of supplying one type of adaptive operation or the other.)*** |
| 2.2.0-5.0-4.0-1.0-2 | **(Sequence-based only)** The increased limit shall be user-defined. | 4.1.0-1.0-1   * Maximize the throughput on coordinated routes   ***Note to user when selecting these requirements:***  ***Select from requirements in the 2.2 group when sequence-based systems are allowed (sequence-based systems explicitly calculate cycle, offset, and split).***  ***Select from requirements in the 2.3 group when non-sequence-based systems are allowed (non-sequence-based systems do not explicitly calculate cycle, offset, and split).***  ***(Select requirements from both groups when the vendor is given the choice of supplying one type of adaptive operation or the other.)***  4.1.0-1.0-2   * Provide smooth flow along coordinated routes   ***Note to user when selecting these requirements:***  ***Select from requirements in the 2.2 group when sequence-based systems are allowed (sequence-based systems explicitly calculate cycle, offset, and split).***  ***Select from requirements in the 2.3 group when non-sequence-based systems are allowed (non-sequence-based systems do not explicitly calculate cycle, offset, and split).***  ***(Select requirements from both groups when the vendor is given the choice of supplying one type of adaptive operation or the other.)***  4.1.0-1.0-3   * Distribute phase times in an equitable fashion   ***Note to user when selecting these requirements:***  ***Select from requirements in the 2.2 group when sequence-based systems are allowed (sequence-based systems explicitly calculate cycle, offset, and split).***  ***Select from requirements in the 2.3 group when non-sequence-based systems are allowed (non-sequence-based systems do not explicitly calculate cycle, offset, and split).***  ***(Select requirements from both groups when the vendor is given the choice of supplying one type of adaptive operation or the other.)***  4.1.0-1.0-4   * Manage the lengths of queues   ***Note to user when selecting these requirements:***  ***Select from requirements in the 2.2 group when sequence-based systems are allowed (sequence-based systems explicitly calculate cycle, offset, and split).***  ***Select from requirements in the 2.3 group when non-sequence-based systems are allowed (non-sequence-based systems do not explicitly calculate cycle, offset, and split).***  ***(Select requirements from both groups when the vendor is given the choice of supplying one type of adaptive operation or the other.)*** |
| 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. | 4.1.0-5  The system operator needs to minimize the chance that a queue forms at a specified location.  ***Note to user when selecting these requirements:***  ***Select from requirements in the 2.2 group when sequence-based systems are allowed (sequence-based systems explicitly calculate cycle, offset, and split).***  ***Select from requirements in the 2.3 group when non-sequence-based systems are allowed (non-sequence-based systems do not explicitly calculate cycle, offset, and split).***  ***Select from requirements in the 2.5 group when phase-based systems are allowed (phase-based systems do not explicitly calculate cycle, offset and split at all intersections).***  ***(Select requirements from two or all three groups when the vendor is given the choice of supplying the type of adaptive operation.)*** |
| 2.3 | 2.3 Non-sequence-based adaptive coordination |  |
| 2.3.0-1 | **Use this section if non-sequence-based adaptive coordination is likely to provide acceptable operation in your situation.** |  |
| 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.) | 4.1.0-1.0-1   * Maximize the throughput on coordinated routes   ***Note to user when selecting these requirements:***  ***Select from requirements in the 2.2 group when sequence-based systems are allowed (sequence-based systems explicitly calculate cycle, offset, and split).***  ***Select from requirements in the 2.3 group when non-sequence-based systems are allowed (non-sequence-based systems do not explicitly calculate cycle, offset, and split).***  ***(Select requirements from both groups when the vendor is given the choice of supplying one type of adaptive operation or the other.)***  4.1.0-1.0-2   * Provide smooth flow along coordinated routes   ***Note to user when selecting these requirements:***  ***Select from requirements in the 2.2 group when sequence-based systems are allowed (sequence-based systems explicitly calculate cycle, offset, and split).***  ***Select from requirements in the 2.3 group when non-sequence-based systems are allowed (non-sequence-based systems do not explicitly calculate cycle, offset, and split).***  ***(Select requirements from both groups when the vendor is given the choice of supplying one type of adaptive operation or the other.)***  4.1.0-1.0-3   * Distribute phase times in an equitable fashion   ***Note to user when selecting these requirements:***  ***Select from requirements in the 2.2 group when sequence-based systems are allowed (sequence-based systems explicitly calculate cycle, offset, and split).***  ***Select from requirements in the 2.3 group when non-sequence-based systems are allowed (non-sequence-based systems do not explicitly calculate cycle, offset, and split).***  ***(Select requirements from both groups when the vendor is given the choice of supplying one type of adaptive operation or the other.)***  4.1.0-1.0-4   * Manage the lengths of queues   ***Note to user when selecting these requirements:***  ***Select from requirements in the 2.2 group when sequence-based systems are allowed (sequence-based systems explicitly calculate cycle, offset, and split).***  ***Select from requirements in the 2.3 group when non-sequence-based systems are allowed (non-sequence-based systems do not explicitly calculate cycle, offset, and split).***  ***(Select requirements from both groups when the vendor is given the choice of supplying one type of adaptive operation or the other.)*** |
| 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. | 4.1.0-1.0-1   * Maximize the throughput on coordinated routes   ***Note to user when selecting these requirements:***  ***Select from requirements in the 2.2 group when sequence-based systems are allowed (sequence-based systems explicitly calculate cycle, offset, and split).***  ***Select from requirements in the 2.3 group when non-sequence-based systems are allowed (non-sequence-based systems do not explicitly calculate cycle, offset, and split).***  ***(Select requirements from both groups when the vendor is given the choice of supplying one type of adaptive operation or the other.)***  4.1.0-1.0-2   * Provide smooth flow along coordinated routes   ***Note to user when selecting these requirements:***  ***Select from requirements in the 2.2 group when sequence-based systems are allowed (sequence-based systems explicitly calculate cycle, offset, and split).***  ***Select from requirements in the 2.3 group when non-sequence-based systems are allowed (non-sequence-based systems do not explicitly calculate cycle, offset, and split).***  ***(Select requirements from both groups when the vendor is given the choice of supplying one type of adaptive operation or the other.)***  4.1.0-1.0-3   * Distribute phase times in an equitable fashion   ***Note to user when selecting these requirements:***  ***Select from requirements in the 2.2 group when sequence-based systems are allowed (sequence-based systems explicitly calculate cycle, offset, and split).***  ***Select from requirements in the 2.3 group when non-sequence-based systems are allowed (non-sequence-based systems do not explicitly calculate cycle, offset, and split).***  ***(Select requirements from both groups when the vendor is given the choice of supplying one type of adaptive operation or the other.)***  4.1.0-1.0-4   * Manage the lengths of queues   ***Note to user when selecting these requirements:***  ***Select from requirements in the 2.2 group when sequence-based systems are allowed (sequence-based systems explicitly calculate cycle, offset, and split).***  ***Select from requirements in the 2.3 group when non-sequence-based systems are allowed (non-sequence-based systems do not explicitly calculate cycle, offset, and split).***  ***(Select requirements from both groups when the vendor is given the choice of supplying one type of adaptive operation or the other.)*** |
| 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. | 4.1.0-1.0-1   * Maximize the throughput on coordinated routes   ***Note to user when selecting these requirements:***  ***Select from requirements in the 2.2 group when sequence-based systems are allowed (sequence-based systems explicitly calculate cycle, offset, and split).***  ***Select from requirements in the 2.3 group when non-sequence-based systems are allowed (non-sequence-based systems do not explicitly calculate cycle, offset, and split).***  ***(Select requirements from both groups when the vendor is given the choice of supplying one type of adaptive operation or the other.)***  4.1.0-1.0-2   * Provide smooth flow along coordinated routes   ***Note to user when selecting these requirements:***  ***Select from requirements in the 2.2 group when sequence-based systems are allowed (sequence-based systems explicitly calculate cycle, offset, and split).***  ***Select from requirements in the 2.3 group when non-sequence-based systems are allowed (non-sequence-based systems do not explicitly calculate cycle, offset, and split).***  ***(Select requirements from both groups when the vendor is given the choice of supplying one type of adaptive operation or the other.)***  4.1.0-1.0-3   * Distribute phase times in an equitable fashion   ***Note to user when selecting these requirements:***  ***Select from requirements in the 2.2 group when sequence-based systems are allowed (sequence-based systems explicitly calculate cycle, offset, and split).***  ***Select from requirements in the 2.3 group when non-sequence-based systems are allowed (non-sequence-based systems do not explicitly calculate cycle, offset, and split).***  ***(Select requirements from both groups when the vendor is given the choice of supplying one type of adaptive operation or the other.)***  4.1.0-1.0-4   * Manage the lengths of queues   ***Note to user when selecting these requirements:***  ***Select from requirements in the 2.2 group when sequence-based systems are allowed (sequence-based systems explicitly calculate cycle, offset, and split).***  ***Select from requirements in the 2.3 group when non-sequence-based systems are allowed (non-sequence-based systems do not explicitly calculate cycle, offset, and split).***  ***(Select requirements from both groups when the vendor is given the choice of supplying one type of adaptive operation or the other.)*** |
| 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. | 4.1.0-5  The system operator needs to minimize the chance that a queue forms at a specified location.  ***Note to user when selecting these requirements:***  ***Select from requirements in the 2.2 group when sequence-based systems are allowed (sequence-based systems explicitly calculate cycle, offset, and split).***  ***Select from requirements in the 2.3 group when non-sequence-based systems are allowed (non-sequence-based systems do not explicitly calculate cycle, offset, and split).***  ***Select from requirements in the 2.5 group when phase-based systems are allowed (phase-based systems do not explicitly calculate cycle, offset and split at all intersections).***  ***(Select requirements from two or all three groups when the vendor is given the choice of supplying the type of adaptive operation.)*** |
| 2.4 | 2.4 Single intersection adaptive operation |  |
| 2.4.0-1 | **Use this section if non-coordinated adaptive coordination is likely to provide acceptable operation in your situation.** |  |
| 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.) | 4.1.0-1.0-6   * At an isolated intersection, optimize operation with a minimum of phase failures (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.)* | 4.1.0-1.0-3   * Distribute phase times in an equitable fashion   ***Note to user when selecting these requirements:***  ***Select from requirements in the 2.2 group when sequence-based systems are allowed (sequence-based systems explicitly calculate cycle, offset, and split).***  ***Select from requirements in the 2.3 group when non-sequence-based systems are allowed (non-sequence-based systems do not explicitly calculate cycle, offset, and split).***  ***(Select requirements from both groups when the vendor is given the choice of supplying one type of adaptive operation or the other.)***  4.1.0-1.0-6   * At an isolated intersection, optimize operation with a minimum of phase failures (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. | 4.1.0-1.0-3   * Distribute phase times in an equitable fashion   ***Note to user when selecting these requirements:***  ***Select from requirements in the 2.2 group when sequence-based systems are allowed (sequence-based systems explicitly calculate cycle, offset, and split).***  ***Select from requirements in the 2.3 group when non-sequence-based systems are allowed (non-sequence-based systems do not explicitly calculate cycle, offset, and split).***  ***(Select requirements from both groups when the vendor is given the choice of supplying one type of adaptive operation or the other.)***  4.1.0-1.0-6   * At an isolated intersection, optimize operation with a minimum of phase failures (based on the optimization objectives). |
| 2.4.0-3.0-2 | When queues are detected at user-specified locations, the ASCT shall execute user-specified timing plan/operational mode. | 4.1.0-1.0-3   * Distribute phase times in an equitable fashion   ***Note to user when selecting these requirements:***  ***Select from requirements in the 2.2 group when sequence-based systems are allowed (sequence-based systems explicitly calculate cycle, offset, and split).***  ***Select from requirements in the 2.3 group when non-sequence-based systems are allowed (non-sequence-based systems do not explicitly calculate cycle, offset, and split).***  ***(Select requirements from both groups when the vendor is given the choice of supplying one type of adaptive operation or the other.)***  4.1.0-1.0-6   * At an isolated intersection, optimize operation with a minimum of phase failures (based on the optimization objectives). |
| 2.4.0-4 | The ASCT shall calculate phase order, based on current measured traffic conditions. (The calculation is based on the optimization objectives.) | 4.1.0-1.0-6   * At an isolated intersection, optimize operation with a minimum of phase failures (based on the optimization objectives). |
| 2.5 | 2.5 Phase-based adaptive coordination |  |
| 2.5.0-1 | **Use this section if phase-based adaptive coordination is likely to provide acceptable operation in your situation.** |  |
| 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. | 4.1.0-2  The system operator needs to manage the coordination in small groups of signals to link phase service at some intersections with phase service at adjacent intersections.  ***Note that phase-based systems do not explicitly calculate cycle, offset and split at all intersections.*** |
| 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. | 4.1.0-2  The system operator needs to manage the coordination in small groups of signals to link phase service at some intersections with phase service at adjacent intersections.  ***Note that phase-based systems do not explicitly calculate cycle, offset and split at all intersections.*** |
| 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. | 4.1.0-2  The system operator needs to manage the coordination in small groups of signals to link phase service at some intersections with phase service at adjacent intersections.  ***Note that phase-based systems do not explicitly calculate cycle, offset and split at all intersections.*** |
| 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. | 4.1.0-2  The system operator needs to manage the coordination in small groups of signals to link phase service at some intersections with phase service at adjacent intersections.  ***Note that phase-based systems do not explicitly calculate cycle, offset and split at all intersections.*** |
| 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. | 4.1.0-2  The system operator needs to manage the coordination in small groups of signals to link phase service at some intersections with phase service at adjacent intersections.  ***Note that phase-based systems do not explicitly calculate cycle, offset and split at all intersections.*** |
| 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. | 4.1.0-5  The system operator needs to minimize the chance that a queue forms at a specified location.  ***Note to user when selecting these requirements:***  ***Select from requirements in the 2.2 group when sequence-based systems are allowed (sequence-based systems explicitly calculate cycle, offset, and split).***  ***Select from requirements in the 2.3 group when non-sequence-based systems are allowed (non-sequence-based systems do not explicitly calculate cycle, offset, and split).***  ***Select from requirements in the 2.5 group when phase-based systems are allowed (phase-based systems do not explicitly calculate cycle, offset and split at all intersections).***  ***(Select requirements from two or all three groups when the vendor is given the choice of supplying the type of adaptive operation.)***  4.1.0-2  The system operator needs to manage the coordination in small groups of signals to link phase service at some intersections with phase service at adjacent intersections.  ***Note that phase-based systems do not explicitly calculate cycle, offset and split at all intersections.*** |
| 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. | 4.8.0-1  The system operator needs to modify the ASCT operation to closely follow changes in traffic conditions. |
| 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.) | 4.8.0-1  The system operator needs to modify the ASCT operation to closely follow changes in traffic conditions. |
| 2.6.0-3 | The ASCT shall limit the changes in the direction of primary coordination to a user-specified frequency. | 4.8.0-1  The system operator needs to modify the ASCT operation to closely follow changes in traffic conditions.  4.8.0-2  The system operator needs to constrain the selection of cycle lengths to those that provide acceptable operations, such as when resonant progression solutions are desired. |
| 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. (DEFINE "MORE QUICKLY") | 4.8.0-3  The system operator needs to respond quickly to sudden large shifts in traffic conditions. |
| 2.6.0-5 | The ASCT shall select cycle length from a list of user-defined cycle lengths. | 4.8.0-2  The system operator needs to constrain the selection of cycle lengths to those that provide acceptable operations, such as when resonant progression solutions are desired. |
| 3 | 3 External/Internal Interfaces |  |
| 3.0-1 | *The ASCT shall support external interfaces according to the* ***referenced interface control documents*** *and the following detailed requirements. (Insert appropriate requirements that suit your needs. Interface data flows should be documented in your ITS architecture. Interface requirements include:*   * *Information layer protocol* * *Application layer protocol* * *Lower layer protocol* * *Data aggregation* * *Frequency of storage* * *Frequency of reporting* * *Duration of storage)* | 4.3.0-1  The system operator needs to adaptively control signals operated by (specify jurisdictions).  4.3.0-2  The system operator needs to send data to another system that would allow the other system to coordinate with the ASCT system.  4.3.0-4  The system operator needs to receive data from another system that will allow the ASCT system to coordinate its operation with the adjacent system.  4.11.0-5  The system operator needs to report performance data in real time to (specify external system).  4.17.0-2  The system operator needs to react to commands issued by (specify an external control or decision support system, such as an ICM system or another signal system). |
| 3.0-1.0-1 | The ASCT shall send operational data to XX external system. (Insert appropriate requirements that suit your needs.) | 4.3.0-2  The system operator needs to send data to another system that would allow the other system to coordinate with the ASCT system.  4.11.0-5  The system operator needs to report performance data in real time to (specify external system). |
| 3.0-1.0-2 | The ASCT shall send control data to the XX external system. (Insert appropriate requirements that suit your needs.) | 4.3.0-2  The system operator needs to send data to another system that would allow the other system to coordinate with the ASCT system. |
| 3.0-1.0-3 | The ASCT shall send monitoring data to the XX external system. (Insert appropriate requirements that suit your needs.) | 4.11.0-1  The agency needs the (specify external decision support system) to be able to monitor the ASCT system automatically. |
| 3.0-1.0-4 | The ASCT shall send coordination data to the XX external system. (Insert appropriate requirements that suit your needs.) | 4.3.0-2  The system operator needs to send data to another system that would allow the other system to coordinate with the ASCT system. |
| 3.0-1.0-5 | The ASCT shall send performance data to the XX external system. (Insert appropriate requirements that suit your needs.) | 4.11.0-5  The system operator needs to report performance data in real time to (specify external system). |
| 3.0-1.0-6 | The ASCT shall receive commands from the XX external system. | 4.17.0-2  The system operator needs to react to commands issued by (specify an external control or decision support system, such as an ICM system or another signal system). |
| 3.0-1.0-7 | The ASCT shall implement the following commands from the XX external system when commanded: (Edit as appropriate for your situation)   * Specified cycle length * Specified direction of progression * Specified adaptive strategy | 4.17.0-2  The system operator needs to react to commands issued by (specify an external control or decision support system, such as an ICM system or another signal system). |
| 4 | 4 Crossing Arterials and Boundaries |  |
| 4.0-1 | *The ASCT shall conform its operation to an external system's operation.* | 4.3.0-4  The system operator needs to receive data from another system that will allow the ASCT system to coordinate its operation with the adjacent system.  4.3.0-6  The system operator needs to detect traffic approaching from a neighboring system and coordinate the ASCT operation with the adjacent system.  4.17.0-2  The system operator needs to react to commands issued by (specify an external control or decision support system, such as an ICM system or another signal system). |
| 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.) | 4.3.0-4  The system operator needs to receive data from another system that will allow the ASCT system to coordinate its operation with the adjacent system.  4.3.0-6  The system operator needs to detect traffic approaching from a neighboring system and coordinate the ASCT operation with the adjacent system. |
| 4.0-1.0-2 | The ASCT shall operate a fixed cycle length to match the cycle length of an adjacent system. | 4.3.0-5  The system operator needs to constrain the adaptive system to operate a cycle length compatible with the crossing arterial. |
| 4.0-1.0-3 | The ASCT shall alter its operation based on data received from another system. | 4.3.0-4  The system operator needs to receive data from another system that will allow the ASCT system to coordinate its operation with the adjacent system. |
| 4.0-1.0-4 | The ASCT shall support adaptive coordination on crossing routes. | 4.3.0-3  The system operator needs to adaptively coordinate signals on two crossing routes simultaneously. (Include signals on crossing arterials within the boundaries of the adaptive systems mapped in Chapter 3.) |
| 5 | 5 Access and Security |  |
| 5.0-1 | The ASCT shall be implemented with a security policy that addresses the following selected elements: | 4.4.0-1  The system operator needs to have a security management and administrative system that allows access and operational privileges to be assigned, monitored and controlled by an administrator, and conform to the agency's access and network infrastructure security policies. |
| 5.0-1.0-1 | * Local access to the ASCT. | 4.4.0-1  The system operator needs to have a security management and administrative system that allows access and operational privileges to be assigned, monitored and controlled by an administrator, and conform to the agency's access and network infrastructure security policies. |
| 5.0-1.0-2 | * Remote access to the ASCT. | 4.4.0-1  The system operator needs to have a security management and administrative system that allows access and operational privileges to be assigned, monitored and controlled by an administrator, and conform to the agency's access and network infrastructure security policies. |
| 5.0-1.0-3 | * System monitoring. | 4.4.0-1  The system operator needs to have a security management and administrative system that allows access and operational privileges to be assigned, monitored and controlled by an administrator, and conform to the agency's access and network infrastructure security policies. |
| 5.0-1.0-4 | * System manual override. | 4.4.0-1  The system operator needs to have a security management and administrative system that allows access and operational privileges to be assigned, monitored and controlled by an administrator, and conform to the agency's access and network infrastructure security policies. |
| 5.0-1.0-5 | * Development | 4.4.0-1  The system operator needs to have a security management and administrative system that allows access and operational privileges to be assigned, monitored and controlled by an administrator, and conform to the agency's access and network infrastructure security policies. |
| 5.0-1.0-6 | * Operations | 4.4.0-1  The system operator needs to have a security management and administrative system that allows access and operational privileges to be assigned, monitored and controlled by an administrator, and conform to the agency's access and network infrastructure security policies. |
| 5.0-1.0-7 | * User login | 4.4.0-1  The system operator needs to have a security management and administrative system that allows access and operational privileges to be assigned, monitored and controlled by an administrator, and conform to the agency's access and network infrastructure security policies. |
| 5.0-1.0-8 | * User password | 4.4.0-1  The system operator needs to have a security management and administrative system that allows access and operational privileges to be assigned, monitored and controlled by an administrator, and conform to the agency's access and network infrastructure security policies. |
| 5.0-1.0-9 | * Administration of the system | 4.4.0-1  The system operator needs to have a security management and administrative system that allows access and operational privileges to be assigned, monitored and controlled by an administrator, and conform to the agency's access and network infrastructure security policies. |
| 5.0-1.0-10 | * Signal controller group access | 4.4.0-1  The system operator needs to have a security management and administrative system that allows access and operational privileges to be assigned, monitored and controlled by an administrator, and conform to the agency's access and network infrastructure security policies. |
| 5.0-1.0-11 | * Access to classes of equipment | 4.4.0-1  The system operator needs to have a security management and administrative system that allows access and operational privileges to be assigned, monitored and controlled by an administrator, and conform to the agency's access and network infrastructure security policies. |
| 5.0-1.0-12 | * Access to equipment by jurisdiction | 4.4.0-1  The system operator needs to have a security management and administrative system that allows access and operational privileges to be assigned, monitored and controlled by an administrator, and conform to the agency's access and network infrastructure security policies. |
| 5.0-1.0-13 | * Output activation | 4.4.0-1  The system operator needs to have a security management and administrative system that allows access and operational privileges to be assigned, monitored and controlled by an administrator, and conform to the agency's access and network infrastructure security policies. |
| 5.0-1.0-14 | * System parameters | 4.4.0-1  The system operator needs to have a security management and administrative system that allows access and operational privileges to be assigned, monitored and controlled by an administrator, and conform to the agency's access and network infrastructure security policies. |
| 5.0-1.0-15 | * Report generation | 4.4.0-1  The system operator needs to have a security management and administrative system that allows access and operational privileges to be assigned, monitored and controlled by an administrator, and conform to the agency's access and network infrastructure security policies. |
| 5.0-1.0-16 | * Configuration | 4.4.0-1  The system operator needs to have a security management and administrative system that allows access and operational privileges to be assigned, monitored and controlled by an administrator, and conform to the agency's access and network infrastructure security policies. |
| 5.0-1.0-17 | * Security alerts | 4.4.0-1  The system operator needs to have a security management and administrative system that allows access and operational privileges to be assigned, monitored and controlled by an administrator, and conform to the agency's access and network infrastructure security policies. |
| 5.0-1.0-18 | * Security logging | 4.4.0-1  The system operator needs to have a security management and administrative system that allows access and operational privileges to be assigned, monitored and controlled by an administrator, and conform to the agency's access and network infrastructure security policies. |
| 5.0-1.0-19 | * Security reporting | 4.4.0-1  The system operator needs to have a security management and administrative system that allows access and operational privileges to be assigned, monitored and controlled by an administrator, and conform to the agency's access and network infrastructure security policies. |
| 5.0-1.0-20 | * Database | 4.4.0-1  The system operator needs to have a security management and administrative system that allows access and operational privileges to be assigned, monitored and controlled by an administrator, and conform to the agency's access and network infrastructure security policies. |
| 5.0-1.0-21 | * Signal controller | 4.4.0-1  The system operator needs to have a security management and administrative system that allows access and operational privileges to be assigned, monitored and controlled by an administrator, and conform to the agency's access and network infrastructure security policies. |
| 5.0-2 | *The ASCT shall provide monitoring and control access at the following locations:* | 4.10.0-1  The system operator needs to monitor and control all required features of adaptive operation from the following locations: (Edit and select as appropriate to suit your situation.) |
| 5.0-2.0-1 | * Agency TMC | 4.10.0-1.0-1   * Agency TMC |
| 5.0-2.0-2 | * Maintenance facility | 4.10.0-1.0-2   * Maintenance facility |
| 5.0-2.0-3 | * Agency LAN or WAN | 4.10.0-1.0-3   * Workstations on agency LAN or WAN located at (specify) |
| 5.0-2.0-4 | * Other agency TMC | 4.10.0-1.0-4   * Other agency's TMC (specify) |
| 5.0-2.0-5 | * Local controller cabinets | 4.10.0-1.0-5   * Local controller cabinets |
| 5.0-2.0-6 | * Maintenance vehicles | 4.10.0-1.0-6   * Maintenance vehicles |
| 5.0-2.0-7 | * Remote locations via internet | 4.10.0-1.0-7   * Remote locations (specify) |
| 5.0-3 | The ASCT shall comply with the agency's security policy as described in (specify appropriate policy document). | 4.4.0-1  The system operator needs to have a security management and administrative system that allows access and operational privileges to be assigned, monitored and controlled by an administrator, and conform to the agency's access and network infrastructure security policies. |
| 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. | 4.10.0-2  The operator needs to access to the database management, monitoring and reporting features and functions of the signal controllers and any related signal management system from the access points defined for those system components. |
| 6 | 6 Data Log |  |
| 6.0-1 | *The ASCT shall log the following events: (edit as appropriate)* | 4.11.0-6  The system operator needs to be able to report the exact state of signal timing and input data for a specified period, to allow historical analysis of the system operation. |
| 6.0-1.0-1 | Time-stamped vehicle phase calls | 4.11.0-6  The system operator needs to be able to report the exact state of signal timing and input data for a specified period, to allow historical analysis of the system operation. |
| 6.0-1.0-2 | Time-stamped pedestrian phase calls | 4.11.0-6  The system operator needs to be able to report the exact state of signal timing and input data for a specified period, to allow historical analysis of the system operation. |
| 6.0-1.0-3 | Time-stamped emergency vehicle preemption calls | 4.11.0-6  The system operator needs to be able to report the exact state of signal timing and input data for a specified period, to allow historical analysis of the system operation. |
| 6.0-1.0-4 | Time-stamped transit priority calls | 4.11.0-6  The system operator needs to be able to report the exact state of signal timing and input data for a specified period, to allow historical analysis of the system operation. |
| 6.0-1.0-5 | Time-stamped railroad preemption calls | 4.11.0-6  The system operator needs to be able to report the exact state of signal timing and input data for a specified period, to allow historical analysis of the system operation. |
| 6.0-1.0-6 | Time-stamped start and end of each phase | 4.11.0-6  The system operator needs to be able to report the exact state of signal timing and input data for a specified period, to allow historical analysis of the system operation. |
| 6.0-1.0-7 | Time-stamped controller interval changes | 4.11.0-6  The system operator needs to be able to report the exact state of signal timing and input data for a specified period, to allow historical analysis of the system operation. |
| 6.0-1.0-8 | Time-stamped start and end of each transition to a new timing plan | 4.11.0-6  The system operator needs to be able to report the exact state of signal timing and input data for a specified period, to allow historical analysis of the system operation. |
| 6.0-2 | The ASCT shall export its systems log in the following formats: (edit as appropriate)   * MS Excel * Text * CSV * Open source SQL database | 4.11.0-4  The system operator needs to store all operational data and signal timing parameters calculated by the adaptive system, and export selected data to (specify appropriate external system). |
| 6.0-3 | The ASCT shall store the event log for a minimum of XX days | 4.11.0-4  The system operator needs to store all operational data and signal timing parameters calculated by the adaptive system, and export selected data to (specify appropriate external system). |
| 6.0-4 | The ASCT shall store results of all signal timing parameter calculations for a minimum of XX days. | 4.11.0-2  The system operator needs to store and report data used to calculate signal timing and have the data available for subsequent analysis.  4.11.0-3  The system operator needs to store and report data that can be used to measure traffic performance under adaptive control. |
| 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 XX days: (edit as appropriate)   * volume * occupancy * queue length * phase utilization * arrivals in green * green band efficiency | 4.11.0-7  Have the ability to generate historic and real-time reports that effectively support operation, maintenance and reporting of system performance and traffic conditions.  4.11.0-2  The system operator needs to store and report data used to calculate signal timing and have the data available for subsequent analysis.  4.11.0-3  The system operator needs to store and report data that can be used to measure traffic performance under adaptive control. |
| 6.0-6 | The ASCT system shall archive all data automatically after a user-specified period not less than XX days. | 4.11.0-4  The system operator needs to store all operational data and signal timing parameters calculated by the adaptive system, and export selected data to (specify appropriate external system). |
| 6.0-7 | The ASCT shall provide data storage for a system size of XX signal controllers. The data to be stored shall include the following: (edit as appropriate)   * Controller state data * Reports * Log data * Security data * ASCT parameters * Detector status data | 4.11.0-4  The system operator needs to store all operational data and signal timing parameters calculated by the adaptive system, and export selected data to (specify appropriate external system). |
| 6.0-8 | The ASCT shall calculate and report relative data quality including:   * The extent data is affected by detector faults * Other applicable items | 4.11.0-7  Have the ability to generate historic and real-time reports that effectively support operation, maintenance and reporting of system performance and traffic conditions. |
| 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 | 4.11.0-7  Have the ability to generate historic and real-time reports that effectively support operation, maintenance and reporting of system performance and traffic conditions. |
| 6.0-10 | The ASCT shall store data logs in a standard database (specify as appropriate). | 4.11.0-4  The system operator needs to store all operational data and signal timing parameters calculated by the adaptive system, and export selected data to (specify appropriate external system). |
| 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. | 4.11.0-7  Have the ability to generate historic and real-time reports that effectively support operation, maintenance and reporting of system performance and traffic conditions. |
| 6.0-12 | The ASCT shall store the following data in XX minute increments: (edit as approrpriate)   * volume * occupancy * queue length | 4.11.0-2  The system operator needs to store and report data used to calculate signal timing and have the data available for subsequent analysis.  4.11.0-3  The system operator needs to store and report data that can be used to measure traffic performance under adaptive control. |
| 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. | 4.9.0-1.0-1   * Service a phase more than once per cycle |
| 7.0-2 | The ASCT shall provide a minimum of XX phase overlaps. | 4.9.0-1.0-2   * Operate at least XX overlap phases |
| 7.0-3 | The ASCT shall accommodate a minimum of XX phases at each signal | 4.9.0-1.0-3   * Operate four rings, 16 phases and up to three phases per ring (Edit to suit your needs). |
| 7.0-4 | The ASCT shall accommodate a minimum of XX rings at each signal. | 4.9.0-1.0-3   * Operate four rings, 16 phases and up to three phases per ring (Edit to suit your needs). |
| 7.0-5 | The ASCT shall accommodate a minimum of XX phases per ring | 4.9.0-1.0-3   * Operate four rings, 16 phases and up to three phases per ring (Edit to suit your needs). |
| 7.0-6 | *The ASCT shall provide a minimum of XX different user-defined phase sequences for each signal.* | 4.1.0-6  The system operator needs to modify the sequence of phases to support the various operational strategies.  4.9.0-1.0-4   * Permit different phase sequences under different traffic conditions |
| 7.0-6.0-1 | Each permissible phase sequence shall be user-assignable to any signal timing plan. | 4.1.0-6  The system operator needs to modify the sequence of phases to support the various operational strategies.  4.9.0-1.0-4   * Permit different phase sequences under different traffic conditions |
| 7.0-6.0-2 | Each permissible phase sequence shall be executable by a time of day schedule. | 4.1.0-6  The system operator needs to modify the sequence of phases to support the various operational strategies.  4.9.0-1.0-4   * Permit different phase sequences under different traffic conditions |
| 7.0-6.0-3 | Each permissible phase sequence shall be executable based on measured traffic conditions | 4.1.0-6  The system operator needs to modify the sequence of phases to support the various operational strategies.  4.9.0-1.0-4   * Permit different phase sequences under different traffic conditions |
| 7.0-7 | The ASCT shall not prevent a phase/overlap output by time-of-day. | 4.1.0-6  The system operator needs to modify the sequence of phases to support the various operational strategies. |
| 7.0-8 | The ASCT shall not prevent a phase/overlap output based on an external input. | 4.1.0-6  The system operator needs to modify the sequence of phases to support the various operational strategies.  4.17.0-2  The system operator needs to react to commands issued by (specify an external control or decision support system, such as an ICM system or another signal system). |
| 7.0-9 | The ASCT shall not prevent the following phases to be designated as coordinated phases. (User to list all required phases.) | 4.1.0-6  The system operator needs to modify the sequence of phases to support the various operational strategies.  4.9.0-1.0-9   * Allow any phase to be designated as the coordinated phase |
| 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. (User select phase or cycle.) | 4.9.0-1.0-12   * Allow the coordinated phase to terminate early under prescribed traffic conditions |
| 7.0-11 | The ASCT shall not prevent the controller from displaying flashing yellow arrow left turn or right turn. (SELECT AS APPLICABLE) | 4.9.0-1.0-15   * Use flashing yellow arrow to control permissive left turns and right turns. |
| 7.0-12 | *The ASCT shall not prevent the local signal controller from performing actuated phase control using XX extension/passage timers as assigned to user-specified vehicle detector input channels in the local controller.* | 4.9.0-1.0-11   * Allow the controller to respond independently to individual lanes of an approach. This may be implemented in the signal controller using XX extension/passage timers, which may be assignable to each vehicle detector input channel. This may allow the adaptive operation to be based on data from a specific detector, or by excluding specific detectors. |
| 7.0-12.0-1 | The ASCT shall operate adaptively using user-specified detector channels. | 4.9.0-1.0-11   * Allow the controller to respond independently to individual lanes of an approach. This may be implemented in the signal controller using XX extension/passage timers, which may be assignable to each vehicle detector input channel. This may allow the adaptive operation to be based on data from a specific detector, or by excluding specific detectors. |
| 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. | 4.9.0-1.0-16   * Service side streets and pedestrian phases at minor locations more often than at adjacent signals when this can be done without compromising the quality of the coordination. (E.g., double-cycle mid-block pedestrian crossing signals.) |
| 7.0-14 | (Describe requirements to suit other custom controller features that must be accommodated.) | 4.9.0-1.0-8   * Accommodate the following custom features used by this agency (describe the features) |
| 7.0-15 | The ASCT shall operate adaptively with the following detector logic. (DESCRIBE THE CUSTOM LOGIC) | 4.9.0-1.0-7   * Allow detector logic at an intersection to be varied depending on local signal states |
| 8 | 8 Pedestrians |  |
| 8.0-1 | When a pedestrian phase is called, the ASCT shall execute pedestrian phases up to XX seconds before the vehicle green of the related vehicle phase. | 4.6.0-5  The system operator needs to accommodate early start of walk and exclusive pedestrian phases. |
| 8.0-2 | When a pedestrian phase is called, the ASCT shall accommodate pedestrian crossing times during adaptive operations. | 4.6.0-2  The system operator needs to accommodate infrequent pedestrian operation while maintaining adaptive operation. (This is appropriate for pedestrian calls that are common but not so frequent that they drive the operational needs.)  4.6.0-3  The system operator needs to incorporate frequent pedestrian operation into routine adaptive operation. (This is appropriate when pedestrians are frequent enough that they must be assumed to be present every cycle or nearly every cycle.) |
| 8.0-3 | When a pedestrian phase is called, the ASCT shall accommodate pedestrian crossing times then resume adaptive operation. | 4.6.0-1  The system operator needs to accommodate infrequent pedestrian operation and then adaptively recover. (This is appropriate for rare pedestrian calls.) |
| 8.0-4 | The ASCT shall execute user-specified exclusive pedestrian phases during adaptive operation. | 4.6.0-5  The system operator needs to accommodate early start of walk and exclusive pedestrian phases. |
| 8.0-5 | The ASCT shall execute pedestrian recall on user-defined phases in accordance with a time of day schedule. | 4.6.0-3  The system operator needs to incorporate frequent pedestrian operation into routine adaptive operation. (This is appropriate when pedestrians are frequent enough that they must be assumed to be present every cycle or nearly every cycle.) |
| 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 | 4.9.0-1.0-13   * Allow flexible timing of non-coordinated phases (such as late start of a phase) while maintaining coordination |
| 8.0-7 | When specified by the user, the ASCT shall execute pedestrian recall on pedestrian phase adjacent to coordinated phases. | 4.6.0-3  The system operator needs to incorporate frequent pedestrian operation into routine adaptive operation. (This is appropriate when pedestrians are frequent enough that they must be assumed to be present every cycle or nearly every cycle.) |
| 8.0-8 | When the pedestrian phases are on recall, the ASCT shall accommodate pedestrian timing during adaptive operation. | 4.6.0-3  The system operator needs to incorporate frequent pedestrian operation into routine adaptive operation. (This is appropriate when pedestrians are frequent enough that they must be assumed to be present every cycle or nearly every cycle.) |
| 8.0-9 | The ASCT shall not inhibit negative vehicle and pedestrian phase timing. | 4.9.0-1.0-17   * Use negative pedestrian phasing to prevent an overlap conflicting with a pedestrian walk/don't walk |
| 9 | 9 Special Functions |  |
| 9.0-1 | The ASCT shall set a specific state for each special function output based on the occupancy on a user-specified detector. | 4.9.0-1.0-11   * Allow the controller to respond independently to individual lanes of an approach. This may be implemented in the signal controller using XX extension/passage timers, which may be assignable to each vehicle detector input channel. This may allow the adaptive operation to be based on data from a specific detector, or by excluding specific detectors.   4.17.0-1  The system operator needs to be able to turn on signs that control traffic or provide driver information when specific traffic conditions occur, when needed to support the adaptive operation, when congestion is detected at critical locations or according to a time-of-day schedule |
| 9.0-2 | The ASCT shall set a specific state for each special function output based on the current cycle length. | 4.17.0-1  The system operator needs to be able to turn on signs that control traffic or provide driver information when specific traffic conditions occur, when needed to support the adaptive operation, when congestion is detected at critical locations or according to a time-of-day schedule |
| 9.0-3 | The ASCT shall set a specific state for each special function output based on a time-of-day schedule. | 4.17.0-1  The system operator needs to be able to turn on signs that control traffic or provide driver information when specific traffic conditions occur, when needed to support the adaptive operation, when congestion is detected at critical locations or according to a time-of-day schedule |
| 10 | 10 Detection |  |
| 10.0-1 | The ASCT shall be compatible with the following detector technologies (agency to specify):   * Detector type A * Detector type B * Detector type C |  |
| 11 | 11 Railroad and EV Preemption |  |
| 11.0-1 | The ASCT shall maintain adaptive operation at non-preempted intersections during railroad preemption. | 4.13.0-1  The system operator needs to accommodate railroad and light rail preemption (explain further) |
| 11.0-2 | The ASCT shall maintain adaptive operation at non-preempted intersections during emergency vehicle preemption. | 4.13.0-2  The system operator needs to accommodate emergency vehicle preemption (explain further) |
| 11.0-3 | The ASCT shall maintain adaptive operation at non-preempted intersections during Light Rail Transit preemption. | 4.13.0-1  The system operator needs to accommodate railroad and light rail preemption (explain further) |
| 11.0-4 | The ASCT shall resume adaptive control of signal controllers when preemptions are released. | 4.13.0-1  The system operator needs to accommodate railroad and light rail preemption (explain further)  4.13.0-2  The system operator needs to accommodate emergency vehicle preemption (explain further) |
| 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) | 4.13.0-1  The system operator needs to accommodate railroad and light rail preemption (explain further)  4.13.0-2  The system operator needs to accommodate emergency vehicle preemption (explain further) |
| 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.) | 4.13.0-1  The system operator needs to accommodate railroad and light rail preemption (explain further)  4.13.0-2  The system operator needs to accommodate emergency vehicle preemption (explain further) |
| 11.0-7 | The ASCT shall release user-specified signal controllers to local control when one signal in a group is preempted. | 4.13.0-1  The system operator needs to accommodate railroad and light rail preemption (explain further)  4.13.0-2  The system operator needs to accommodate emergency vehicle preemption (explain further) |
| 11.0-8 | The ASCT shall not prevent the local signal controller from operating in normally detected limited-service actuated mode during preemption. | 4.13.0-1  The system operator needs to accommodate railroad and light rail preemption (explain further)  4.13.0-2  The system operator needs to accommodate emergency vehicle preemption (explain further) |
| 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. | 4.13.0-3  The system operator needs to accommodate bus and light rail transit signal priority (explain further) |
| 12.0-2 | *The ASCT shall advance the start of a user-specified green phase in response to a transit priority call.* | 4.13.0-3  The system operator needs to accommodate bus and light rail transit signal priority (explain further) |
| 12.0-2.0-1 | The advance of start of green phase shall be user-defined. | 4.13.0-3  The system operator needs to accommodate bus and light rail transit signal priority (explain further) |
| 12.0-2.0-2 | Adaptive operations shall continue during the advance of the start of green phase. | 4.13.0-3  The system operator needs to accommodate bus and light rail transit signal priority (explain further) |
| 12.0-3 | *The ASCT shall delay the end of a green phase, in response to a priority call.* | 4.13.0-3  The system operator needs to accommodate bus and light rail transit signal priority (explain further) |
| 12.0-3.0-1 | The delay of end of green phase shall be user-defined. | 4.13.0-3  The system operator needs to accommodate bus and light rail transit signal priority (explain further) |
| 12.0-3.0-2 | Adaptive operations shall continue during the delay of the end of green phase. | 4.13.0-3  The system operator needs to accommodate bus and light rail transit signal priority (explain further) |
| 12.0-4 | *The ASCT shall permit at least XX exclusive transit phases.* | 4.13.0-3  The system operator needs to accommodate bus and light rail transit signal priority (explain further) |
| 12.0-4.0-1 | Adaptive operations shall continue when there is an exclusive transit phase call. | 4.13.0-3  The system operator needs to accommodate bus and light rail transit signal priority (explain further) |
| 12.0-5 | *The ASCT shall control vehicle phases independently of the following:* | 4.13.0-3  The system operator needs to accommodate bus and light rail transit signal priority (explain further) |
| 12.0-5.0-1 | * LRT only phases | 4.13.0-3  The system operator needs to accommodate bus and light rail transit signal priority (explain further) |
| 12.0-5.0-2 | * Bus only phases | 4.13.0-3  The system operator needs to accommodate bus and light rail transit signal priority (explain further) |
| 12.0-6 | The ASCT shall interface with external bus transit priority system in the following fashion….. (explain the external system and refer to other interfaces as appropriate) | 4.13.0-3  The system operator needs to accommodate bus and light rail transit signal priority (explain further) |
| 12.0-7 | The ASCT shall interface with external light rail transit priority system in the following fashion….. (explain the external system and refer to other interfaces as appropriate) | 4.13.0-3  The system operator needs to accommodate bus and light rail transit signal priority (explain further) |
| 12.0-8 | The ASCT shall accept a transit priority call from:   * a signal controller/transit vehicle detector; * an external system. | 4.13.0-3  The system operator needs to accommodate bus and light rail transit signal priority (explain further) |
| 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 from XX vehicle detectors within a group. (SELECT THE APPROPRIATE ACTION.)* | 4.14.0-1  The system operator needs to fall back to TOD or isolated free operation, as specified by the operator, without causing disruption to traffic flow, in the event of equipment, communications and software failure. |
| 13.1.0-1.0-1 | The ASCT shall release control to central system control. | 4.14.0-1  The system operator needs to fall back to TOD or isolated free operation, as specified by the operator, without causing disruption to traffic flow, in the event of equipment, communications and software failure. |
| 13.1.0-1.0-2 | The ASCT shall release control to local operations to operate under its own time-of-day schedule. | 4.14.0-1  The system operator needs to fall back to TOD or isolated free operation, as specified by the operator, without causing disruption to traffic flow, in the event of equipment, communications and software failure. |
| 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:* | 4.14.0-1  The system operator needs to fall back to TOD or isolated free operation, as specified by the operator, without causing disruption to traffic flow, in the event of equipment, communications and software failure. |
| 13.1.0-2.0-1 | * Data from a user-specified alternate detector. | 4.14.0-1  The system operator needs to fall back to TOD or isolated free operation, as specified by the operator, without causing disruption to traffic flow, in the event of equipment, communications and software failure. |
| 13.1.0-2.0-2 | * Stored historical data from the failed detector. | 4.14.0-1  The system operator needs to fall back to TOD or isolated free operation, as specified by the operator, without causing disruption to traffic flow, in the event of equipment, communications and software failure. |
| 13.1.0-2.0-3 | The ASCT shall switch to the alternate source in real time without operator intervention. | 4.14.0-1  The system operator needs to fall back to TOD or isolated free operation, as specified by the operator, without causing disruption to traffic flow, in the event of equipment, communications and software failure. |
| 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. | 4.12.0-1  The system operator needs to immediately notify maintenance and operations staff of alarms and alerts.  4.12.0-2  The system operator needs to immediately and automatically pass alarms and alerts to the (specify external system). |
| 13.1.0-4 | In the event of a failure, the ASCT shall log details of the failure in a permanent log. | 4.12.0-3  The system operator needs to maintain a complete log of alarms and failure events. |
| 13.1.0-5 | The permanent failure log shall be searchable, archivable and exportable. | 4.12.0-3  The system operator needs to maintain a complete log of alarms and failure events. |
| 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. (SELECT THE APPROPRIATE ACTION)* | 4.14.0-1  The system operator needs to fall back to TOD or isolated free operation, as specified by the operator, without causing disruption to traffic flow, in the event of equipment, communications and software failure. |
| 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. | 4.14.0-1  The system operator needs to fall back to TOD or isolated free operation, as specified by the operator, without causing disruption to traffic flow, in the event of equipment, communications and software failure. |
| 13.2-1.0-2 | The ASCT shall switch to the alternate operation in real time without operator intervention. | 4.14.0-1  The system operator needs to fall back to TOD or isolated free operation, as specified by the operator, without causing disruption to traffic flow, in the event of equipment, communications and software failure. |
| 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. | 4.12.0-1  The system operator needs to immediately notify maintenance and operations staff of alarms and alerts.  4.12.0-2  The system operator needs to immediately and automatically pass alarms and alerts to the (specify external system). |
| 13.2-3 | The ASCT shall issue an alarm within XX minutes of detection of a failure. | 4.12.0-1  The system operator needs to immediately notify maintenance and operations staff of alarms and alerts.  4.12.0-2  The system operator needs to immediately and automatically pass alarms and alerts to the (specify external system). |
| 13.2-4 | In the event of a communications failure, the ASCT shall log details of the failure in a permanent log. | 4.12.0-3  The system operator needs to maintain a complete log of alarms and failure events. |
| 13.2-5 | The permanent failure log shall be searchable, archivable and exportable. | 4.12.0-3  The system operator needs to maintain a complete log of alarms and failure events. |
| 13.3 | 13.3 Adaptive Processor Failure |  |
| 13.3-1 | *The ASCT shall execute user-specified actions when adaptive control fails:* | 4.14.0-1  The system operator needs to fall back to TOD or isolated free operation, as specified by the operator, without causing disruption to traffic flow, in the event of equipment, communications and software failure. |
| 13.3-1.0-1 | The ASCT shall release control to central system control. | 4.14.0-1  The system operator needs to fall back to TOD or isolated free operation, as specified by the operator, without causing disruption to traffic flow, in the event of equipment, communications and software failure. |
| 13.3-1.0-2 | The ASCT shall release control to local operations to operate under its own time-of-day schedule. | 4.14.0-1  The system operator needs to fall back to TOD or isolated free operation, as specified by the operator, without causing disruption to traffic flow, in the event of equipment, communications and software failure. |
| 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. | 4.12.0-1  The system operator needs to immediately notify maintenance and operations staff of alarms and alerts.  4.12.0-2  The system operator needs to immediately and automatically pass alarms and alerts to the (specify external 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. | 4.14.0-1  The system operator needs to fall back to TOD or isolated free operation, as specified by the operator, without causing disruption to traffic flow, in the event of equipment, communications and software failure. |
| 14 | 14 Software |  |
| 14.0-1 | The vendor's adaptive software shall be fully operational within the following platform: (edit as appropriate)   * Windows-PC, * Linux, * Mac-OS, * Unix. | 4.15.0-2  The system operator needs to use equipment and software acceptable under current agency IT policies and procedures. |
| 14.0-2 | The ASCT shall fully satisfy all requirements when connected with detectors from manufacturer XX (specify required detector types). | 4.15.0-1.0-2   * Detector type (list acceptable equipment) |
| 14.0-3 | The ASCT shall fully satisfy all requirements when connected with XX controllers (specify controller types). | 4.15.0-1.0-1   * Controller type (list acceptable equipment) |
| 15 | 15 Training |  |
| 15.0-1 | *The vendor shall provide the following training. (Edit as appropriate.)* | 4.16.0-1  The agency needs all staff involved in operation and maintenance to receive appropriate training. |
| 15.0-1.0-1 | The vendor shall provide training on the operations of the adaptive system. | 4.16.0-1  The agency needs all staff involved in operation and maintenance to receive appropriate training. |
| 15.0-1.0-2 | The vendor shall provide training on troubleshooting the system. | 4.16.0-1  The agency needs all staff involved in operation and maintenance to receive appropriate training. |
| 15.0-1.0-3 | The vendor shall provide training on preventive maintenance and repair of equipment. | 4.16.0-1  The agency needs all staff involved in operation and maintenance to receive appropriate training. |
| 15.0-1.0-4 | The vendor shall provide training on system configuration. | 4.16.0-1  The agency needs all staff involved in operation and maintenance to receive appropriate training. |
| 15.0-1.0-5 | The vendor shall provide training on administration of the system. | 4.16.0-1  The agency needs all staff involved in operation and maintenance to receive appropriate training. |
| 15.0-1.0-6 | The vendor shall provide training on system calibration. | 4.16.0-1  The agency needs all staff involved in operation and maintenance to receive appropriate training. |
| 15.0-1.0-7 | The vendor's training delivery shall include: printed course materials and references, electronic copies of presentations and references. | 4.16.0-1  The agency needs all staff involved in operation and maintenance to receive appropriate training. |
| 15.0-1.0-8 | The vendor's training shall be delivered at (specify locations for training). | 4.16.0-1  The agency needs all staff involved in operation and maintenance to receive appropriate training. |
| 15.0-1.0-9 | The vendor shall provide a minimum of XX hours training to a minimum of XX staff. (specify how much training will be required) | 4.16.0-1  The agency needs all staff involved in operation and maintenance to receive appropriate training. |
| 15.0-1.0-10 | The vendor shall provide a minimum of XX training sessions (specify how many sessions over what period). | 4.16.0-1  The agency needs all staff involved in operation and maintenance to receive appropriate training. |
| 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. | 4.16.0-2  The agency needs the system to fulfill all requirements for the life of the system. The agency therefore needs the system to be maintained to repair faults that are not defects in materials and workmanship. |
| 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 XX years. Preservation of requirements fulfillment especially includes all IT management requirements as previously identified. | 4.16.0-4  The agency needs the system to fulfill all requirements for the life of the system. The agency therefore needs support to keep software and software environment updated as necessary to prevent requirements no longer being fulfilled. |
| 16.0-3 | The Vendor shall warrant the system to be free of defects in materials and workmanship for a period of XX 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. | 4.16.0-3  The agency needs the system to fulfill all requirements for the life of the system. The agency therefore needs the system to remain free of defects in materials and workmanship that result in requirements no longer being fulfilled. |
| 17 | 17 Schedule |  |
| 17.0-1 | The ASCT shall set the state of external input/output states according to a time-of-day schedule. | 4.17.0-1  The system operator needs to be able to turn on signs that control traffic or provide driver information when specific traffic conditions occur, when needed to support the adaptive operation, when congestion is detected at critical locations or according to a time-of-day schedule |
| 17.0-2 | The ASCT output states shall be settable according to a time-of-day schedule | 4.17.0-1  The system operator needs to be able to turn on signs that control traffic or provide driver information when specific traffic conditions occur, when needed to support the adaptive operation, when congestion is detected at critical locations or 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. | 4.11.0-2  The system operator needs to store and report data used to calculate signal timing and have the data available for subsequent analysis. |
| 18.0-2 | The ASCT shall report all intermediate calculated values that are affected by calibration parameters. | 4.11.0-2  The system operator needs to store and report data used to calculate signal timing and have the data available for subsequent analysis. |
| 18.0-3 | *The ASCT shall maintain a log of all signal state alterations directed by the ASCT.* | 4.11.0-7  Have the ability to generate historic and real-time reports that effectively support operation, maintenance and reporting of system performance and traffic conditions.  4.11.0-2  The system operator needs to store and report data used to calculate signal timing and have the data available for subsequent analysis. |
| 18.0-3.0-1 | The ASCT log shall include all events directed by the external inputs. | 4.11.0-7  Have the ability to generate historic and real-time reports that effectively support operation, maintenance and reporting of system performance and traffic conditions. |
| 18.0-3.0-2 | The ASCT log shall include all external output state changes. | 4.11.0-7  Have the ability to generate historic and real-time reports that effectively support operation, maintenance and reporting of system performance and traffic conditions. |
| 18.0-3.0-3 | The ASCT log shall include all actual parameter values that are subject to user-specified values. | 4.11.0-7  Have the ability to generate historic and real-time reports that effectively support operation, maintenance and reporting of system performance and traffic conditions. |
| 18.0-3.0-4 | The ASCT shall maintain the records in this ASCT log for XX period. | 4.11.0-7  Have the ability to generate historic and real-time reports that effectively support operation, maintenance and reporting of system performance and traffic conditions. |
| 18.0-3.0-5 | The ASCT shall archive the ASCT log in the following manner: (Specify format, frequency, etc., to suit your needs.) | 4.11.0-7  Have the ability to generate historic and real-time reports that effectively support operation, maintenance and reporting of system performance and traffic conditions. |