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Evaluation of Adaptive Signal Control Technology—Systems Engineering (SE) Document and ASCT Selection Method

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Safety and Efficiency Benefits of Implementing Adaptive Signal-Control Technology in Illinois

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16. Abstract

Adaptive signal control technology (ASCT) systems are to respond (adapt) to real-time traffic demand and patterns to provide more efficient and safer operation at signalized intersections. The Illinois Department of Transportation (IDOT) wanted to conduct a field evaluation of an ASCT system by deploying one on a corridor and assessing its performance. One of the tasks of this study was to use the procedure suggested by the Federal Highway Administration (FHWA) to develop a systems engineering (SE) document for purchasing an adaptive system. This report presents the process of preparing the SE document, developing selection criteria, and preparing a bid document for procurement of the system that was deployed on the Neil Street corridor in Champaign, Illinois. The procurement of the ASCT system was a learning experience. Preparing the SE document takes time and has to be done carefully to get the right system with appropriate features. The approval process took 14 months instead of the 3 months that was allocated to it. An objective process for evaluation and ranking of the competing proposals should be used. This study developed such a procedure and utilized it in the vendor selection for this study. It is important to have people with a traffic-engineering background involved in preparing the SE document so the system's features and functionalities are appropriately specified. The system features as advertised by vendors may not function very well in every real-world traffic condition. The expected performance from an ASCT system should be constrained to those that can be achieved in a given condition.

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This publication is based on the results of **ICT-R27-127, Safety and Efficiency Benefits of Implementing Adaptive Signal Control Technology in Illinois.** ICT-R27-127 was conducted in cooperation with the Illinois Center for Transportation; the Illinois Department of Transportation (IDOT); and the U.S. Department of Transportation, Federal Highway Administration (FHWA).

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The contents of this report reflect the view of the authors, who are responsible for the facts and the accuracy of the data presented herein. The contents do not necessarily reflect the official views or policies of the Illinois Center for Transportation, the Illinois Department of Transportation, or the Federal Highway Administration. This report does not constitute a standard, specification, or regulation.

We acknowledge the contribution of graduate students: Jane Lee and Micheal Lodes in preparing the systems engineering documents, and Jesus Osorio for reviewing and formatting this document.

Trademark or manufacturers' names appear in this report only because they are considered essential to the object of this document and do not constitute an endorsement of a product by the Federal Highway Administration, the Illinois Department of Transportation, or the Illinois Center for Transportation.

EXECUTIVE SUMMARY

Adaptive signal control technology (ASCT) systems are designed to respond (adapt) to real-time traffic demand and patterns to provide more efficient and safer operation at signalized intersections. The adaptive systems are relatively new in the United States and sporadically are deployed in various parts of the country. The Illinois Department of Transportation (IDOT) wanted to conduct a field evaluation of an ASCT system by deploying one on a corridor and assessing its performance.

One of the tasks of this study was to use the FHWA's *Model Systems Engineering Documents for Adaptive Signal-Control Technology (ASCT) Systems—Guidance Document, August 2012* (Fehon et al. 2012) for purchasing an adaptive system. The systems engineering (SE) document prepared for this project was a part of the bidding documents for procurement of the ASCT system. This report presents the process of preparing the SE document, developing selection criteria, and preparing a bid document for procurement of the system.

The project was located on Neil Street in Champaign, Illinois. In addition to six intersections along Neil Street, the traffic signal at Kirby Avenue and State Street was linked to the signal at Kirby and Neil to work in a synchronized manner.

The procurement of the ASCT system was a learning experience for the research team and the Technical Review Panel (TRP). This report was prepared to provide an overview of the process and give an example of the SE document needed for such purchases. Preparing the SE document takes time and must be carefully done to get the right system and features.

The approval process may take significantly longer than expected when other state agencies participate in the process. The team had allocated 3 months for purchasing this system, but it took 14 months to procure it.

An objective process for evaluation and ranking of the competing proposals should be used. This study developed such a procedure and utilized it in selection of a vendor for this study.

It is important to have people with a traffic engineering background involved in preparing the SE document so the system's features and functionalities are appropriately specified.

The system features as advertised by vendors may not function very well in every real-world traffic condition. The expected performance from an ASCT system should be constrained to those that can be achieved in a given condition.

CONTENTS

CHAPTER 1: INTRODUCTION

Adaptive signal-control technologies (ASCT) are to respond (adapt) to real-time traffic demand and potentially provide a more efficient and safer operation at signalized intersections. The adaptive systems are relatively new in the United States and sporadically are deployed in various parts of the country. The Illinois Department of Transportation (IDOT) wanted to conduct a field evaluation of an ASCT system by deploying one on a corridor and assessing its performance.

One of the tasks of this study was to use the FHWA's *Model Systems Engineering Documents for Adaptive Signal Control Technology (ASCT) Systems—Guidance Document, August 2012* (Fehon et al. 2012) for purchasing an adaptive system. The systems-engineering (SE) document prepared for this project was a part of the bidding documents for procurement of the ASCT system. This report presents the process of preparing the SE document, developing selection criteria, and preparing a bid document for procurement of the system.

The project is located on Neil Street in Champaign, Illinois. In addition to six intersections along Neil Street, the traffic signal at Kirby Avenue and State Street was linked to the signal at Kirby and Neil to work in a synchronized manner, as shown in Figure 1.

Figure 1. Deployment location on Neil Street in Champaign, Illinois.

The major steps in the process of procurement of an ASCT system are listed below.

1) SE-document preparation

2) Approval of SE document

3) Preparation of the technical part of the bidding document

4) Ranking and selection of the winning bid

5) Deployment and evaluation of the system performance

This report is organized as follows: Chapter 2 discusses SE document preperation. Chapter 3 presents a timeline of activies from SE document preparation until system acceptance. Chapter 4 discusses the selection of the winning bid and the ranking procedure. Chapter 5 contains the conclusion and recommendations.

CHAPTER 2: SYSTEMS ENGINEERING DOCUMENT

The FHWA publication *Model Systems Engineering Documents for Adaptive Signal Control Technology (ASCT) Systems—Guidance Document, August 2012* (Fehon et al. 2012) is a comprehensive document that explains how to use systems engineering analysis in delivering intelligent transportation systems projects. This publication is often referred as the systems engineering (SE) document. The research team followed the guidance and information from two other similar references (USDOT 2007; FHWA and Caltrans 2009) in developing a SE document for this project. The SE document defines the customer's needs and the required functionality early in the development cycle, specifies the requirements, and proceeds to design synthesis and system validation. This process is summarized by the "V" process diagram shown in Figure 2. It shows how the project-delivery approach begins at the left with the "Regional Architecture" section that ensures the ASCT project will interface well with existing infrastructure and future plans for the region. The approach moves from the nontechnical "Concept of Operations" to the very technical "Component Level Design (Detailed)." Each system component is validated and verified according to the requirements of the design phase. Each black arrow on the interior of the "V" connects one set of requirements to the corresponding validation/verification stage. The "V" diagram continues through "Operation and Maintenance" to the end of the useful life of the ASCT system. The document is available from the FHWA website at http://www.fhwa.dot.gov/cadiv/segb/index.htm. The steps outlined in the "V" diagram also include those needed for successful implementation of the ASCT.

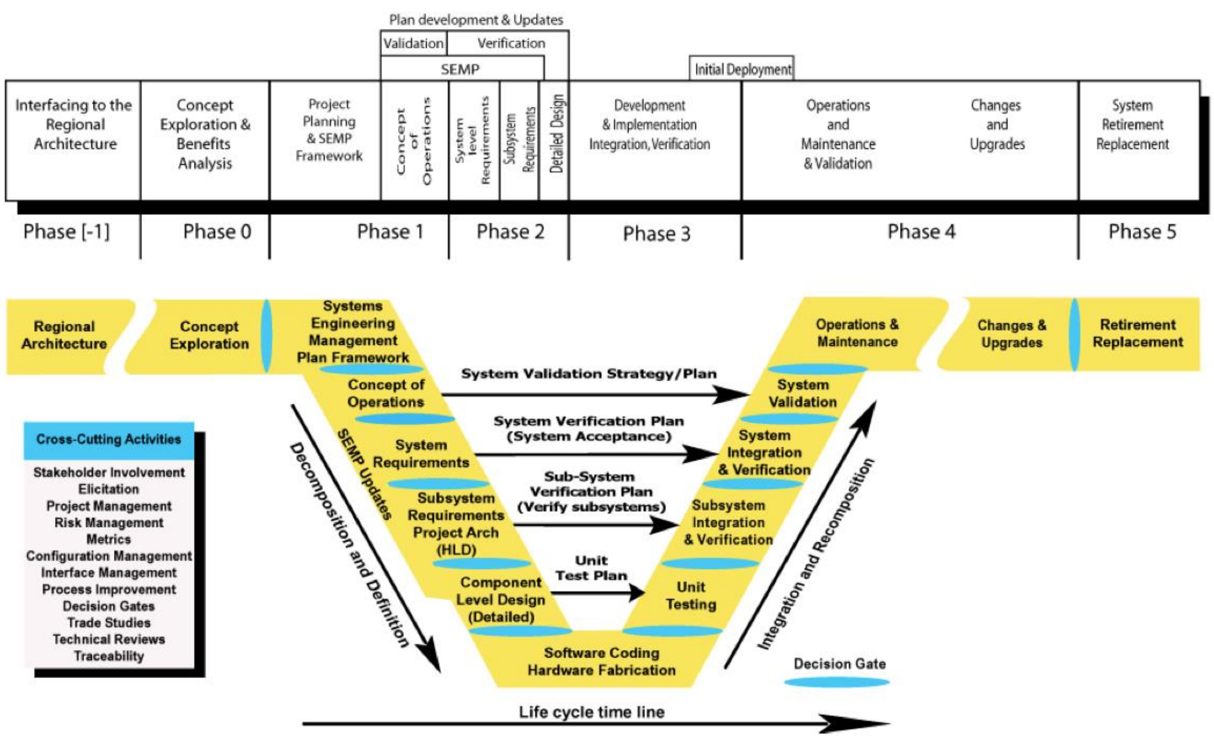


Figure 2. The "V" diagram (from: Fehon et al. 2012).

The SE document developed for ASCT consisted of eight chapters:

Chapter 1: Scope

Chapter 2: Referenced Documents

Chapter 3: User-Oriented Operational Description

Chapter 4: Operational Needs

Chapter 5: Envisioned Adaptive System Overview

Chapter 6: Adaptive Operational Environment

Chapter 7: Adaptive Support Environment

Chapter 8: Operational Scenarios

The first draft of the SE document was prepared in early August 2013. The Technical Review Panel's (TRP's) feedback was obtained, and the document was revised. The second version was prepared in early September 2013, and TRP feedback was obtained and incorporated into the document. The TRP for this project had individuals with deep knowledge of traffic-signal design and operation. Such expertise is essential in preparation of SE documents, to properly specify the required system functionalities and components. Otherwise, the SE document may conclude by specifying a system that does not satisfy the customer's needs.

Then, the SE document was sent to the University of Illinois (UI) procurement office so it could be used for purchasing the system. The office was required to go through a competitive bidding process and to prepare bidding documents that included the SE document. The university procurement office asked the State of Illinois procurement office and Illinois ethics office for approval of the SE document. The approval process moved forward very slowly. The state procurement office had many questions and comments about the SE document. After several meetings to address their questions and comments, the SE document was finally approved—virtually in the original format as presented. The final version of the SE document that was included in the bidding documents is given in Appendix A: SE Document Used in Request for Proposal for the ASCT System.

The bidding was announced in the last week of June 2014. An optional vendor conference was scheduled for June 30, 2014, to discuss state registration requirements. The deadline for submitting proposals was set for July 17, 2014. The following chapter gives the timeline from the SE document preparation to the acceptance of the ASCT system.

CHAPTER 3: TIMELINE FROM SE DOCUMENT PREPARATION TO SYSTEM ACCEPTANCE

Important dates from SE document preparation to system acceptance are chronologically listed below.

1.	Draft SE document presented to TRP	Sept. 2013
2.	Finalized SE document (received feedback from TRP, twice)	Oct. 2013
3.	SE document sent to UI Purchasing Department (procurement office)	Oct .2013
4.	Finalized the selection procedure and ranking method for bids	Nov. 2013
5.	RFP prepared after several meetings with UI procurement,	April 2014
6.	state procurement, and Illinois ethics office staff	
7.	RFP posted on UI website and announcements went out	June 2014
8.	Bid opening	July 17, 2014
9.	TRP met and selected TrafficWare's product SynchroGreen	Sept. 29, 2014
10.	Technical ranking scores for the bids sent to UI purchasing	Oct. 6, 2014
11.	UI purchasing office opened pricing envelopes	Oct. 9, 2014
12.	Evaluation scores completed and finalized	Oct. 9, 2014
13.	UI requested best and final offer from TrafficWare	Oct. 9, 2014
14.	TrafficWare did not extend best and final offer	Oct. 14, 2014
15.	UI recommended state procurement office to declare TrafficWare the winner	Oct. 16, 2014
16.	State approved posting the winner on higher ed. bulletin board	Oct. 20, 2014
17.	TrafficWare requested language changes on contract	Nov. 6, 2014
18.	Revised contract submitted to TrafficWare	Nov. 11, 2014
19.	UI received the revised contract from TrafficWare	Nov. 21, 2014
20.	Teleconferenced with TrafficWare on how evaluation would be done	Nov. 24, 2014
21.	UI sent a signed contract to TrafficWare	Dec. 16, 2014
22.	UI issued the purchase order	Dec. 17, 2014
23.	Purchase order with corrected name and address was issued	Jan. 6, 2015
24.	Kickoff meeting—UI, Champaign, IDOT District 5 and Central	Jan. 23, 2015
25.	System installation started	April 27, 2015
26.	System fine-tuning/software update continued	May 4–8, 2015

27. Further improvement at Knollwood and Neil intersection	May 16–18, 2015
28. SynchroGreen training at UI campus	June 11–14, 2015
29. List of action items for TrafficWare finalized	June 16, 2015
30. Detector locations, volume thresholds/triggers provided to TrafficWare	June 26, 2015
31. TrafficWare updated controller software and investigated camera issues	July 1, 2015
32. TrafficWare still working on improving system response to the volume thresholds/triggers	July 17, 2015
33. UI sent feedback to TrafficWare requesting completion of fine-tuning and adjustments by August 30, 2015	Aug. 11, 2015
34. TrafficWare made on-site adjustment in response to UI feedback	Aug. 18, 2015
35. UI provided another feedback, requested system improvements	Oct. 21, 2015
36. UI sent additional feedback to vendor	Nov. 6, 2015
37. Final adjustments completed by vendor	Nov. 10, 2015
38. SynchroGreen system was accepted	Nov. 10, 2015

CHAPTER 4: DEVELOPMENT OF PROPOSAL EVALUATION PROCEDURE

One requirement of the UI and state procurement offices was to develop a procedure that would be used for selecting the winning proposal. The research team developed a proposal-evaluation procedure and presented it to the TRP. In early November 2013, the selection procedure and a ranking method for evaluation of the submitted proposals were finalized.

The research team, TRP, and procurement offices agreed to use a combination of best-value procurement for software and system integration services, as well as for equipment and construction services. Field equipment (parts and labor) was procured using detailed plans and technical specifications given in the request for proposal (RFP), which included the SE document for this ASCT.

Responses to the RFP were evaluated by a team composed of the university researchers and the TRP members for this study. The TRP members were mostly from IDOT, but some were from the Federal Highway Administration (FHWA) and Illinois County Engineers. The top two or three candidate companies would be selected, based on the criteria listed below. If the evaluation team deemed it necessary and helpful, the top two candidates would be invited to make oral presentations and to respond to questions from the evaluation team.

For a bid to be considered, the respondent must be qualified and meet the vendor requirements for bidding on State of Illinois public contracts. All vendors who wish to bid on State of Illinois public university contracts must

- Be a legal entity authorized to do business in Illinois in conformance with the Illinois Secretary of State requirements.
- Register with the Illinois State Board of Elections
- Hold a current bidder eligibility number from the Illinois Department of Human Rights (IDHR)

The evaluation process ranked the vendors based on how responsive they were to the requirements of the RFP, without consideration of price, using a point ranking system (to be discussed later). Vendors who failed to meet the minimum requirements were not considered for price evaluation and award of contract.

The maximum possible number of points was 1,000 (responsiveness, 800 + price, 200).

The categories of the scored elements for responsiveness and the maximum number of points available for each element are listed in Table 1 below. The total number of points available for the responsiveness elements was 800. Mandatory requirements are designated with language such as “must” or “shall,” shall also be evaluated as part of the responsiveness determination. Although they are not scored, failure to meet any mandatory requirement will disqualify a solution from consideration for award.

Table 1. Maximum Number of Points Available for Each Responsiveness Element

Responsiveness Elements	**Total Points for Each Chapter**	**Percentage of Technical Points**
Requirements in Chapter 5 of SE document	180	22.5%
Requirements in Chapter 6 of SE document	100	12.5%
Requirements in Chapter 7 of SE document	70	8.75%
Requirements in Chapter 8 of SE document	110	13.75%
Proposer's experience and qualifications	170	21.25%
Milestones and deliverables	170	21.25%

For the qualified proposal, the evaluation spreadsheet given in Appendix B was used by each member of the evaluation team. The individual evaluations were tallied to compute a score for each vendor. A guideline was provided to maintain consistency in scoring the proposals. (The guideline is given at the end of Appendix B.)

After the scoring was completed, the price from each vendor was given to the TRP members. The total number of points for price was 200. The points for price were determined using the following formula:

$$(Maximum\ Price\ Points) * (\frac{Lowest\ Price}{Vendor's\ Price}) = Total\ Price\ Points$$

For this ASCT, three proposals were submitted. One vendor was not qualified because the proposal was incomplete. The other two proposals were evaluated based on responsiveness to the requirements of the RFP. The ranking method developed in this study was used to assign scores for each of the two vendors. Meeting the mandatory requirements of the SE document was critical in determining the winning proposal. One of the proposals did not meet the mandatory requirements. It was a mandatory requirement that the vendor must satisfactorily address the issues related to synchronization of the traffic signal at Kirby Avenue and State Street with the signal at Kirby Avenue and Neil Street.

Therefore, TrafficWare was selected as the winner and a contract was signed to install its product SynchroGreen at six intersections along Neil Street. In addition, the controller at Kirby Avenue and State Street was upgraded to be more compatible with the controller at the Kirby Avenue and Neil Street intersection. The State Street controller was not a part of the signal coordination on the Neil Street arterial. A radio communication antenna was installed at the Kirby Avenue and Neil Street intersection to synchronize the starting of eastbound (EB) and westbound (WB) green time at Kirby Avenue and State Street. The distance along Kirby Avenue between Neil Street and State Street was a short block, and a time lag between the signals at these two intersections was needed to avoid queue spillback or having long, unused green times.

CHAPTER 5: CONCLUSIONS AND RECOMMENDATIONS

The procurement of the ASCT system was a learning experience for the research team and the TRP. This report was prepared to provide an overview of the process and give an example of the SE document needed for such purchases. Preparing the SE document takes time and must be done carefully to get the right system and features to meet the client's needs.

The approval process may take significantly longer than expected when other state agencies participate in the process. The team had allocated 3 months for purchasing this system, but it took 14 months to procure it.

An objective process for evaluation and ranking of the competing proposals should be used. This study developed such a procedure and utilized it in the vendor's selection.

It is important to have people with traffic-engineering backgrounds involved in preparing the SE document so the system's features and functionalities are appropriately specified.

The system features as advertised by vendors may not function very well in every real-world traffic condition. The expected performance from an ASCT system should be constrained to those that can be achieved in a given condition.

REFERENCES

Fehon, Kevin, Mike Krueger, Jim Peters, Richard Denney, Paul Olson, and Eddie Curtis. 2012 (Aug.). *Model Systems Engineering Documents for Adaptive Signal Control Technology (ASCT) Systems*, Federal Highway Administration, FHWA-HOP-11-027, http://ops.fhwa.dot.gov/publications/fhwahop11027/

FHWA and Caltrans (Federal Highway Administration and California Department of Transportation) 2009 (Nov.). *Systems Engineering Guidebook for ITS, Version 3.0,* www.fhwa.dot.gov/cadiv/segb/

USDOT (United States Department of Transportation). 2007 (Jan.). *Systems Engineering for ITS—An Introduction for Transportation Professionals*, http://ops.fhwa.dot.gov/publications/seitsguide/seguide.pdf

APPENDIX A: SE DOCUMENT USED IN REQUEST FOR PROPOSAL FOR THE ASCT SYSTEM

ADAPTIVE SIGNAL CONTROL TECHNOLOGY PROJECT
MODEL SYSTEM ENGINEERING DOCUMENTS

CHAPTERS 1-3: PROJECT SCOPE, OVERVIEWS, DESCRIPTIONS AND GOALS

INFORMATION IN CHAPTERS 1-3 PROVIDES GENERAL INFORMATION, INCLUDING, BACKGROUND, LOCATION, SCOPE AND GOALS. THIS INFORMATION SHOULD PROVIDE VENDORS WITH AN UNDERSTANDING OF THE PROJECT. THE INFORMATION WILL NOT BE EVALUATED AS PART OF THE TECHNICAL EVALUATION PROCESS.

Con Ops Reference Number	Concept of Operations Sample Statements
1	1 Chapter 1: Scope
1.1	1.1 Document Purpose and Scope
1.1-1	The scope of this document covers the consideration of adaptive signal control technology (ASCT) for use along Neil street from Hessel Blvd. to Windsor Rd. within city of Champaign, IL. There is also one adjacent intersection (State and Kirby) that must be coordinated in the E-W direction (along Kirby) with the E-W direction of the signal at Neil St. and Kirby.
1.1-2	This document describes and provides a rationale for the expected operations of the proposed adaptive system.
1.1-3	It documents the outcome of stakeholder discussions and consensus building that has been undertaken to ensure that the system that is implemented is operationally feasible and has the support of stakeholders.
1.1-4	The intended audience of this document includes: system operators, administrators, decision-makers, elected officials, other nontechnical readers and other stakeholders who will share the operation of the system or be directly affected by it.
1.2	1.2 Project Purpose and Scope
1.2-1	An adaptive traffic signal system is one in which some or all the signal timing parameters are modified in response to changes in the traffic conditions, in real time.
1.2-2	The purpose of providing adaptive control in this area is to improve safety by selecting appropriate traffic signal operation under normal traffic demand (vehicular and pedestrian) as well as when the demand fluctuates due to sport or recreational events at the adjacent University of Illinois campus. The system should provide green time that is consistent with the real time demand, minimizes number of stops, decreases delay, increases throughput. These decisions would create demand responsive and smooth operation that result in improving traffic safety. The system should accommodate pedestrian crossing times at Kirby Ave., St. Mary’s Rd. and Hessel Blvd. and emergency preemption should be maintained at intersections along the corridor.

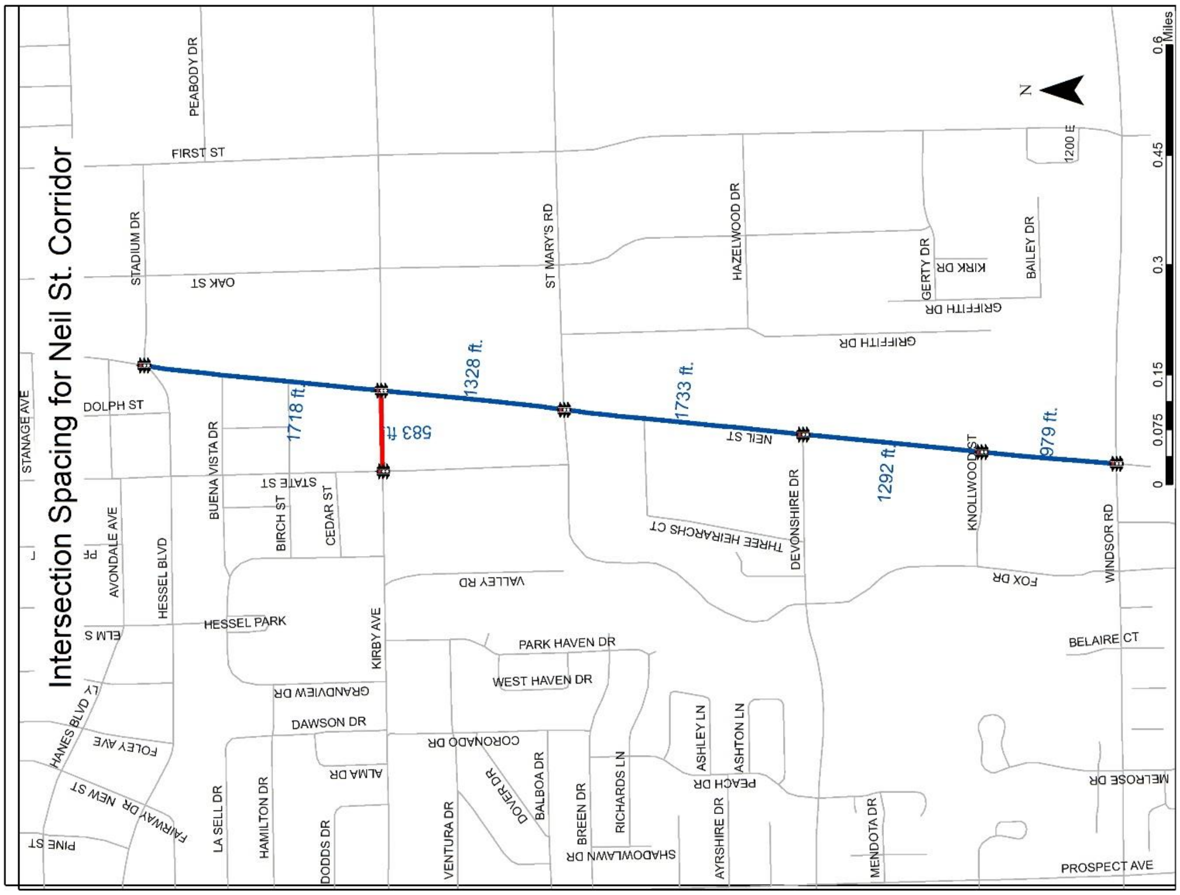
1.2-3	This project will add adaptive capabilities to the existing coordinated signal system.
1.2	1.2 Project Purpose and Scope
1.2-1	An adaptive traffic signal system is one in which some or all the signal timing parameters are modified in response to changes in the traffic conditions, in real time.
1.2-2	The purpose of providing adaptive control in this area is to improve safety by selecting appropriate traffic signal operation under normal traffic demand (vehicular and pedestrian) as well as when the demand fluctuates due to sport or recreational events at the adjacent University of Illinois campus. The system should provide green time that is consistent with the real time demand, minimizes number of stops, decreases delay, increases throughput. These decisions would create demand responsive and smooth operation that result in improving traffic safety. The system should accommodate pedestrian crossing times at Kirby Ave., St. Mary's Rd. and Hessel Blvd. and emergency preemption should be maintained at intersections along the corridor.
1.2-3	This project will add adaptive capabilities to the existing coordinated signal system.
1.2-5	All the capabilities of the existing coordinated system will be maintained.
1.2-7	Adaptive capability will be provided for all coordinated signals within Neil St. from Hessel Blvd. to Windsor Rd.
1.2-8	The adaptive capability will be provided for signals owned by IDOT and maintained by City of Champaign.
1.2-9	Interfaces will be provided to the signal system operated by City of Champaign.

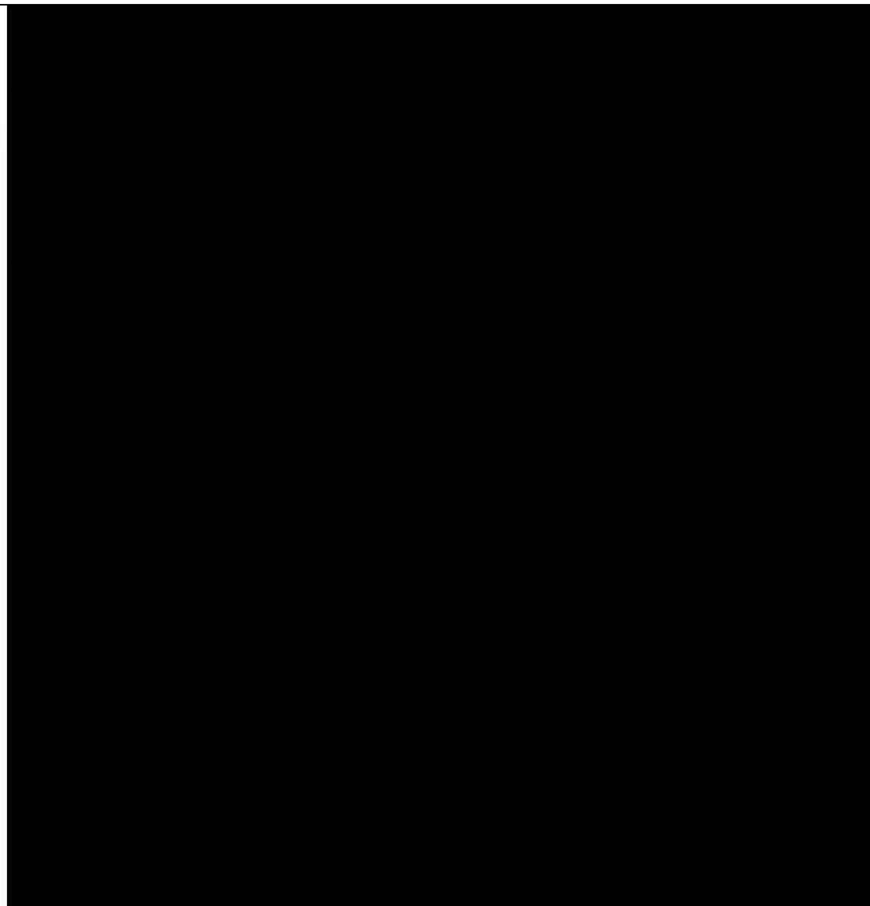
Con Ops Reference Number	**Concept of Operations Sample Statements**
2	2 Chapter 2: Referenced Documents
2.0-1	The following documents have been used in the preparation of this Concept of Operations and stakeholder discussions. Some of these documents provide policy guidance for traffic signal operation in this area, some are standards with which the system must comply, while others report the conclusions of discussions, workshops and other research used to define the needs of the project and subsequently identify project requirements.
2.0-1.0-1	References Specific to the Adaptive Locations • Studies identifying operational needs

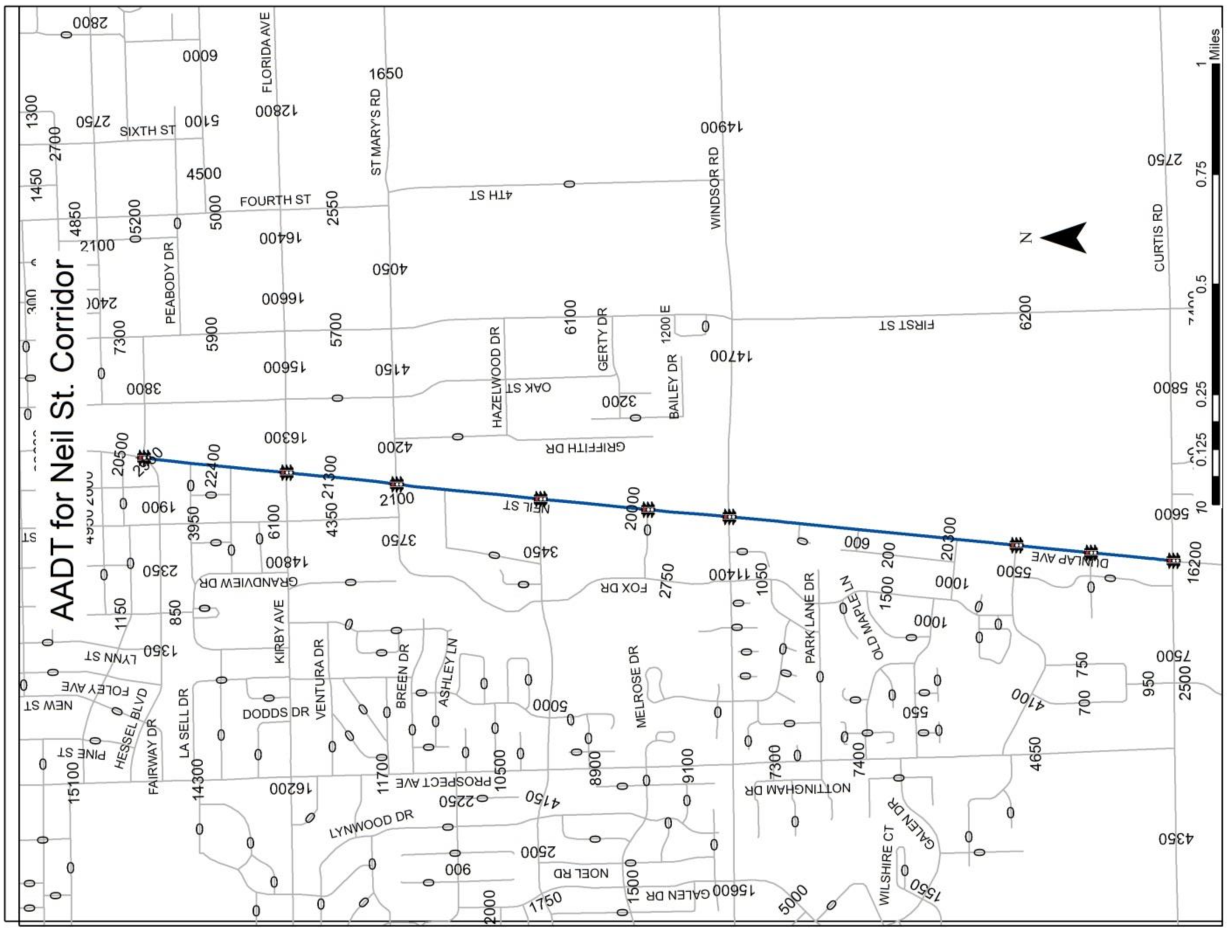
	• Regional ITS Architecture documents • Planning studies and Master Plans • Transportation Improvement Programs (TIP)
2.0-1.0-2	Systems Engineering • “Systems Engineering Guidebook for ITS”, California Department of Transportation, Division of Research & Innovation, Version 3.0, <http://www.fhwa.dot.gov/cadiv/segb/> • "Systems Engineering for Intelligent Transportation Systems, An Introduction for Transportation Professionals", <http://ops.fhwa.dot.gov/publications/seitsguide/index.htm> • “Model Systems Engineering Documents for Adaptive Signal Control Technology (ASCT) Systems”, <http://ops.fhwa.dot.gov/publications/fhwahop11027/index.htm> • “Developing Functional Requirements for ITS Projects”, Mitretek Systems, April 2002 • "Developing and Using a Concept of Operations in Transportation Management System, FHWA TMC Pooled-Fund Study <http://tmcpfs.ops.fhwa.dot.gov/cfprojects/new_detail.cfm?id=38&new=0 > • NCHRP Synthesis 307: Systems Engineering Processes for Developing Traffic Signal Systems
2.0-1.0-3	Adaptive Signals • NCHRP Synthesis 403: "Adaptive Traffic Control Systems: Domestic and Foreign State of Practice" <http://onlinepubs.trb.org/onlinepubs/nchrp/nchrp_syn_403.pdf>
2.0-1.0-4	ITS, Operations, Architecture, Other • FHWA Rule 940, Federal Register / Vol. 66, No. 5 / Monday, January 8, 2001 / Rules and Regulations, DEPARTMENT OF TRANSPORTATION, Federal Highway Administration 23 CFR Parts 655 and 940, (FHWA Docket No. FHWA-99-5899] RIN 2125-AE65 Intelligent Transportation System Architecture and Standards • Regional ITS Architecture Guidance Document; “Developing, Using, and Maintaining an ITS Architecture for your Region; National ITS Architecture Team; October, 2001
2.0-1.0-6	NEMA • Traffic signal cabinets in this corridor are NEMA TS-1 and TS-2.
2.0-1.0-3	Adaptive Signals

	• NCHRP Synthesis 403: "Adaptive Traffic Control Systems: Domestic and Foreign State of Practice" <http://onlinepubs.trb.org/onlinepubs/nchrp/nchrp_syn_403.pdf>
2.0-1.0-4	ITS, Operations, Architecture, Other • FHWA Rule 940, Federal Register / Vol. 66, No. 5 / Monday, January 8, 2001 / Rules and Regulations, DEPARTMENT OF TRANSPORTATION, Federal Highway Administration 23 CFR Parts 655 and 940, (FHWA Docket No. FHWA-99-5899] RIN 2125-AE65 Intelligent Transportation System Architecture and Standards • Regional ITS Architecture Guidance Document; “Developing, Using, and Maintaining an ITS Architecture for your Region; National ITS Architecture Team; October, 2001
2.0-1.0-6	NEMA • Traffic signal cabinets in this corridor are NEMA TS-1 and TS-2.
2.0-1.0-7	PROCUREMENT • NCHRP 560: <http://onlinepubs.trb.org/onlinepubs/nchrp/nchrp_rpt_560.pdf> • Special Experimental Project 14 (SEP 14): <http://www.fhwa.dot.gov/programadmin/contracts/sep_a.cfm> • The Road to Successful ITS Software Acquisition:<http://www.fhwa.dot.gov/publications/research/operations/its/98036/rdsuccessvol2.pdf>

Con Ops Reference Number	Concept of Operations Sample Statements
3	3 Chapter 3: User-Oriented Operational Description
3.1	3.1 The Existing Situation
3.1.1	3.1.1 Network Characteristics
	3.1.1.1 Arterial
3	3 Chapter 3: User-Oriented Operational Description
3.1.1.1	The urban arterial segment where ASCT will be installed is approximately 1.3 miles in length and consists of 6 signalized intersections. The average spacing is 1420 ft. with a minimum of 979 ft. and a maximum of 1733 ft. and. The 6 intersections on the Neil St. arterial are coordinated with timing plans for AM Peak, Midday Peak, and PM Peak. Neil St. crosses two major arterials (Kirby Ave. and Windsor Rd.) but Neil St. is not explicitly coordinated with the crossing arterials. However, there is one intersection on State and Kirby Ave. that is coordinated with Neil St. because of the short spacing (583 ft.) and concerns about queues blocking an upstream intersection. The figure below shows the project area. The roadway has five lanes with two through lanes in each direction and one center lane for left turns. There is a railroad line that runs parallel to Neil St. but all crossings are grade-separated within the project area. The estimated free-flow travel time between major intersections ranges from 19 seconds to 34 seconds, based on posted speed limit. The arterial has irregularly spaced signalized intersections, and there is no “natural” cycle length that allows ideal two-way progression. The coordination plans favor one direction (northbound or southbound) and provide adequate coordination in the opposite direction. These plans are consistent with the directional nature of the traffic demand in the AM and PM peak hours.

Con Ops Reference Number	Concept of Operations Sample Statements
	
3.1.1.1.0-4	The arterial has irregularly spaced signalized intersections, and there is no “natural” cycle length that allows two-way progression.
3.1.1.1.0-5	During the peak periods, the cycle length is generally determined by the needs of one or more critical intersections. The Kirby Ave. and Neil St. intersection is the critical intersection. The cycle length used for coordination during peak periods may be constrained by pedestrian crossing time.
3.1.1.1.0-4	The arterial has irregularly spaced signalized intersections, and there is no “natural” cycle length that allows two-way progression.
3.1.1.5.0-1	The signals are owned and operated by IDOT District 5. IDOT District 5 has an ongoing maintenance agreement with City of Champaign for the signals.

Con Ops Reference Number	Concept of Operations Sample Statements
	3.1.2 Traffic Characteristics
	

Con Ops Reference Number	Concept of Operations Sample Statements
	
3.1.2.1	3.1.2.1 Overview
3.1.2.1.0-1	The traffic characteristics are illustrated in the figure above. The figure shows AADT for the roads on and near the proposed ASCT corridor. The AADT on the main road (Neil St.) is about 20,000 veh/day (in 2011). Two of the crossing streets have AADT greater than 10,000 veh/day. The AADT for Kirby Ave is about 15,000 veh/day and Windsor Rd. is about 12,000 veh/day. Three intersections (Hessel Blvd., St. Mary's Rd., and Devonshire Dr.) have minor street AADT between 2,000 to 5,000 veh/day. The remaining intersection at Knollwood St. has much lower daily volume.

Con Ops Reference Number	Concept of Operations Sample Statements
3.1.2.2	3.1.2.2 Peak Periods
3.1.2.2.0-1	During the AM peak, traffic is heavily directional in the northbound direction. During the PM peak, traffic is heavily directional in the southbound direction. During Midday Peak, the traffic is nearly balanced in the northbound and southbound directions. The peak hour volumes in the northbound and southbound directions are both about 10% of the directional AADT. At all peak hours, the Kirby Ave./Neil St. intersection is more balanced than the intersections in the southern part of the project area. During AM Peak, traffic on Kirby Ave. and Windsor Rd. is heavily directional in the eastbound direction. During PM pea, traffic on Kirby Ave. and Windsor Rd. is heavily directional in the westbound direction. Midday peak traffic on Kirby Ave. and Windsor Rd. is relatively balanced during Midday peak.
3.1.2.4	3.1.2.4 Evenings
3.1.2.4.0-1	During the evenings after the PM peak, the flows on Neil St. are light and relatively balanced.
3.1.2.5.0-1	During the weekends, the flows are changing based upon major events at the University of Illinois. Division I athletic events such as football and basketball as well as musical events at the Assembly Hall are major attractions. On the streets crossing Neil Ave, vehicles arrive to events in the eastbound direction and depart in the westbound direction. The intersections that are mostly heavily impacted are Hessel Blvd., Kirby Ave, St. Mary's Rd., and Windsor Rd. During special events traffic patterns may change and that may increase traffic volume on other arterials. There may be road closures on surrounding streets that may affect the volume on Neil St. corridor.
3.1.2.6	3.1.2.6 Events and Incidents
3.1.2.6.0-1	Heavily directional event traffic is experienced in this area.
3.1.2.6.0-2	Heavily directional incident-related traffic is experienced in this area. • Evenings and weekends between November and April - University of Illinois basketball games • Some Saturdays (all day) between August and December – University of Illinois football games • Evenings, weekends, and some weekdays – Special events at the Assembly Hall (e.g., concerts, commencement, homecoming, trade shows) Vehicles arriving to special events create heavily traffic on Neil St. On the streets crossing Neil St., heavy directional volumes is in the eastbound direction. Vehicles departing from special events create heavily directional volumes in the westbound direction until they reach Neil St. Long queues may form on Neil St. during special events as motorists wait to go through or turn onto University of Illinois campus.
3.1.2.7	3.1.2.7 General

Con Ops Reference Number	Concept of Operations Sample Statements
3.1.2.7.0-1	There is a high proportion of turning traffic along the arterial or within the network. Left-turn volume onto Neil St. can be at least as high as 25% of the total approach volume. Left-turn volume from Neil St. onto minor road can be at least as high as 15%.
3.1.2.7.0-3	Queues sometimes overflow from turn bays into through traffic on Kirby Ave. There is limited left-turn storage on the westbound side because of a railroad bridge that is very close to the intersection.
3.1.2.7.0-5	The origin or destination of most traffic lies outside the corridor.
3.1.2.8	3.1.2.8 Future Traffic Conditions
3.1.2.8.0-1	There are no major changes expected in the expected life of the proposed ASCT.
3.1.3	3.1.3 Signal Grouping
3.1.2.7.0-1	There is a high proportion of turning traffic along the arterial or within the network. Left-turn volume onto Neil St. can be at least as high as 25% of the total approach volume. Left-turn volume from Neil St. onto minor road can be at least as high as 15%.
3.1.2.7.0-3	Queues sometimes overflow from turn bays into through traffic on Kirby Ave. There is limited left-turn storage on the westbound side because of a railroad bridge that is very close to the intersection.
3.1.2.7.0-5	The origin or destination of most traffic lies outside the corridor.
3.1.2.8	3.1.2.8 Future Traffic Conditions
3.1.2.8.0-1	There are no major changes expected in the expected life of the proposed ASCT.
3.1.3	3.1.3 Signal Grouping
3.1.3.0-1	The locations of signals to be operated under adaptive control are illustrated in figure in section 3.1.2. The adaptive control is an experimental treatment and there are no plans to expand to nearby intersections.
3.1.3.0-2	All the signals are between 900 ft. and 1800 ft. and are expected to be coordinated as one group.
3.1.4	3.1.4 Land Use Characteristics
3.1.4.1	3.1.4.1 Existing Land Uses

Con Ops Reference Number	Concept of Operations Sample Statements
3.1.4.1.0-1.0-7	The arterial segment where ASCT will be installed serves a mixture of land uses, including office, commercial, retail, and restaurant.
3.1.4.1.0-1.0-8	Is nearby two major event centers. (Memorial Stadium, Assembly Hall)
	Is directly east of the University of Illinois and Research Park which contribute to significant daily commuting trips
3.1.4.2	3.1.4.2 Future Land Use Changes
3.1.4.2.0-1	There are no changes in land use that are expected to occur within the likely expected life of the proposed ASCT.
3.1.4.3	3.1.4.3 Pedestrians and Public Transit
	This section describes the influence of pedestrians on the signal operation. • Pedestrians' phases are often called at Neil St./Kirby Ave. • Pedestrian phases are sometimes called at Hessel Blvd./Neil St. and St. Mary's Rd./Neil St. • Pedestrian phases are rarely called at all other intersections.

Con Ops Reference Number	Concept of Operations Sample Statements
	
3.1.4.3.0-1	This section describes the influence of pedestrians on the signal operation.
3.1.4.3.0-1.0-1	Pedestrian delays are a factor in choosing phasing and timing parameters. The pedestrian crossing time at Kirby Ave./Neil St. may contribute to a larger common cycle length on the Neil St. corridor.
3.1.4.3.0-1.0-2	Pedestrians impede turning movements at Kirby Ave. Vehicles turning right at any approach of Kirby Ave./Neil St. may have to wait for pedestrians before continuing. ... (Describe the locations.)

Con Ops Reference Number	Concept of Operations Sample Statements
3.1.4.3.0-1.0-4	Pedestrians are present most cycles at Kirby Ave. and Neil St.
3.1.4.3.0-2	This section describes the influence of transit on the signal operation.

3.1.4.3.0-2.0-1	• There are 5 bus lines operating along the route
	• 10 Gold (crossing at Hessel)
	  ○ 10 min headway from 7:50am-6:30pm on weekdays
	• 4 Blue (crossing at Hessel)
	  ○ ~40 min headway from 7:40am -7:15pm
	• 9A Brown (crossing at Hessel)
	  ○ 30 min headway from 6:45am-7:20pm
	• 1 Yellow (crossing at Hessel)
	  ○ 30 min headway from 6:50am-6:25pm
	• 27 Airbus (on Neil from Windsor to Curtis)
	  ○ 1 hr headway from 5:55am-7:03pm

3.1.4.3.0-2.0-2	Buses cross the coordinated route at Hessel Blvd. Buses enter the intersection at Windsor Rd. but do not travel along Neil St. in the project area.
3.1.4.4	3.1.4.4 Agencies
3.1.4.4.0-1	The existing signal system is operated by IDOT. The Kirby Ave./State St. intersections is controlled by a signal owned and operated by City of Champaign.
3.1.4.4.0-2	The effectiveness of emergency vehicles can be affected by the operation of the signal system. The existing system has emergency vehicle preemption that must be maintained in any ASCT system.
3.1.4.5	3.1.4.5 Existing Architecture
3.1.4.5.0-1	The existing system architecture has following elements:
3.1.4.5.0-1.0-2	on-street masters
3.1.4.5.0-1.0-3	Communications infrastructure (fiber optic cable, twisted wire pair cable)
3.1.4.5.0-1.0-4	Detection locations and technology (loops: stop line, mid-block detection zones)

Con Ops Reference Number	Concept of Operations Sample Statements
3.2	3.2 Limitations of the Existing system
3.2.0-1	The following statements summarize the limitations of the existing system that prevent it from satisfactorily accommodating the traffic situations described above.
3.2.0-2	The existing system cannot recognize the onset of peak periods, so the peak period coordination plan introduction times may be set conservatively to ensure they cover the normal variation in duration and intensity of the peak. This means that the timing could be less efficient during the early and late parts of the peak periods.
3.2.0-6	The existing system cannot detect the changes in traffic conditions before and after atypical traffic generating events (such as games, concerts) at Memorial stadium and Assembly Hall. As a result, the coordination plans that are set to cover "typical" traffic conditions are not efficient for traffic conditions that may start and end in different time for each event. An adaptive system could be expected to reduce this inefficiency and match the signal timing more closely to the actual traffic patterns.
3.3	3.3 Proposed Improvements to the System
3.3.0-1	This section describes in broad terms the improvements that are desirable in order to address the limitations described above. The main improvements that are desired are: (Select from the samples below and create new descriptions that suit your situation.)
3.3.0-2	Recognize changes in traffic conditions and react quickly and automatically to accommodate those changes.
3.3.0-5	Improve the management of queues within the network.
3.4	3.4 Vision, Goals and Objectives for the Proposed System
3.4.1	3.4.1 Vision
3.4.1-1	The vision of the ASCT system is to provide an advanced traffic control system that responds to changing traffic conditions, and reduces delays and corridor travel times; thus improves traffic safety.
	3.4.2 Goals
3.4.2	The goals of the ASCT system are: • Smooth the traffic flow along the corridor (i.e. reduce number of stops) • Reduce travel time and delay • Increase safety

Con Ops Reference Number	Concept of Operations Sample Statements
3.4.3	3.4.3 User Objectives
3.4.3	The objectives of the adaptive system that support the stated goals are: To smooth traffic flow along the corridor: Provide green band in the coordinated directions To maximize the throughput in coordinated directions
3.4.3.0-1.0-2	To support measurable improvements in personal mobility: • Adjust operations to changing conditions • Reduce delays • Reduce travel times • Provide the same level of safety provided by the existing system to vehicles, pedestrians and transit.
3.4.4	3.4.4 Operational Objectives
3.4.4.0-1	The operational objectives of the ASCT system will be to:
3.4.4.0-1.0-1	Smooth the flow of traffic along coordinated routes
3.4.4.0-1.0-2	Maximize the throughput in coordinated directions
3.4.4.0-1.0-5	Control operation using a combination of these objectives
3.4.4.0-1.0-6	Control operation by changing the objectives under various circumstances
3.5	3.5 Strategies to be applied by the Improved System
3.5.0-1	The adaptive coordination and control strategies that may be employed to achieve the operational objectives are: • Provide a green band along a coordinated route to smooth the flow of traffic in one or both directions; • Maximize the throughput in coordinated directions;

CHAPTER FOUR

Mandatory requirements are indicated with the use of the terms **mandatory, shall or must.**

Con Ops Reference Number	Concept of Operations Sample Statements
4	4 Chapter 4: Operational Needs
4.0-1	This chapter describes the operational needs of the users that shall be satisfied by the proposed ASCT system. Each of these statements describes something that the system operators need to be able to achieve. Each of these needs will be satisfied by compliance with one or more system requirements. In the attached list of requirements, each one is linked to one or more of these needs statements.

Con Ops Reference Number	Concept of Operations Sample Statement	System Requirements (see Guidance)	Guidance Section	Meets system requirements.	Does not meet system requirements.
4.1	4.1 Adaptive Strategies				
4.1.0-1	The system operator must have the ability to implement different strategies individually or in combination to suit different prevailing traffic conditions. These strategies include:		3.4 3.5		
4.1.0-1.0-2	• Provide smooth flow along coordinated routes	2.2.0-4 (Sequence-based only) The ASCT shall calculate offsets to suit the current coordination strategy for the user-specified reference point for each signal controller along a coordinated route within a group. 2.2.0-4.0-1	4.1.0-1.0-2		

		(Sequence-based only) The ASCT shall apply offsets for the user-specified reference point of each signal controller along a coordinated route. 2.1.1.0-7.0-4 When current measured traffic conditions meet user-defined criteria, the ASCT shall alter the state of signal controllers providing two-way progression on a coordinated route. 2.2.0-5.0-3 (Sequence-based only) The ASCT shall calculate optimum cycle length according to the user-specified coordination strategy. 2.2.0-5 (Sequence-based only) The ASCT shall calculate a cycle length based on its optimization objectives at least once every cycle. 2.3.0-3 (Non-sequence-based only) At non-critical intersections within a group, the ASCT shall calculate the time at which a user-specified phase shall be green, relative to a reference point at the critical intersection, to suit the current coordination strategy. 2.3.0-2 (Non-sequence-based only) The ASCT shall calculate the appropriate state of the signal to suit the current coordination strategy at the critical signal controller. (A critical signal controller is defined by the user.) 2.3.0-4 (Non-sequence-based only) When demand is present, the ASCT shall implement a user-specified maximum time between successive displays of each phase at each intersection. 2.2.0-2 (Sequence-based only) The ASCT shall select an initial cycle length based on a time of day schedule. 2.2.0-5.0-2 (Sequence-based only) The ASCT shall limit cycle lengths to a user-specified range.			

		2.2.0-5.0-4 (Sequence-based only) The ASCT shall limit changes in cycle length to not exceed a user-specified value. 2.1.1.0-10 The ASCT shall determine the order of phases at a user-specified intersection.			
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. 2.1.1.0-7.0-2 When current measured traffic conditions meet user-specified criteria, the ASCT shall alter the state of signal controllers, preventing queues from exceeding the storage capacity at user-specified locations. 2.1.1.0-7.0-4 When current measured traffic conditions meet user-defined criteria, the ASCT shall alter the state of signal controllers providing two-way progression on a coordinated route. 2.1.1.0-7 The ASCT shall alter the adaptive operation to achieve required objectives in user-specified conditions.	3.4 3.5		

Con Ops Reference Number	Concept of Operations Sample Statement	System Requirements (see Guidance)	Guidance Section	Meets system requirements.	Does not meet system requirements.
4.1.0-4	The system operator needs to detect	2.1.3.0-2	4.1.0-4		

	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.	When queues are detected at user-specified locations, the ASCT shall execute user-specified timing plan/operational mode. 2.2.0-3 (Sequence-based only) The ASCT shall calculate phase lengths for all phases at each signal controller to suit the current coordination strategy. 2.1.3.0-1 The ASCT shall detect the presence of queues at pre-configured locations. 2.1.1.0-9 The ASCT shall detect repeated phases that do not serve all waiting vehicles. (These phase failures may be inferred, such as by detecting repeated max-out.) 2.1.1.0-9.0-1 The ASCT shall alter operations, to minimize repeated phase failures. 2.1.3.0-3 When queues are detected at user-specified locations, the ASCT shall execute user-specified adaptive operation strategy. 2.1.3.0-4 When queues are detected at user-specified locations, the ASCT shall omit a user-specified phase at a user-specified signal controller.			
4.1.0-5	The system operator needs to minimize the chance that a queue forms at a specified location. (i.e. reduce number of stops)	2.3.0-5 (Non-sequence-based only) The ASCT shall adjust signal timing so that vehicles approaching a signal that have been served during a user-specified phase at an upstream signal do not stop. 2.5.0-7 (Sequence-based only) The ASCT shall adjust the state of the signal controller so that vehicles approaching a signal that have been served during a user-specified phase at an upstream signal do not stop. 2.2.0-5.0-5	3.4 3.5		

		(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.			
4.1.0-6	The system operator needs to modify the sequence of phases to support the various operational strategies.	7.0-6 The ASCT shall provide a minimum of 4 different user-defined phase sequences for each signal. 7.0-6.0-1 Each permissible phase sequence shall be user-assignable to any signal timing plan. 7.0-6.0-2 Each permissible phase sequence shall be executable by a time of day schedule. 7.0-6.0-3 Each permissible phase sequence shall be executable based on measured traffic conditions 7.0-7 The ASCT shall not prevent a phase/overlap output by time-of-day. 7.0-8 The ASCT shall not prevent a phase/overlap output based on an external input. 7.0-9 The ASCT shall not prevent the following phases to be designated as coordinated phases. • NB through (all intersections) • SB through (all intersections) • EB through (Kirby and Windsor) • WB through (Kirby and Windsor)	3.4 3.5		

Con Ops Reference Number	**Concept of Operations Sample Statement**	**System Requirements (see Guidance)**	**Guidance Section**	**Meets system requirements.**	**Does not meet system requirements.**
4.1.0-7	The system operator needs to fix the sequence of phases at	2.1.2.0-12	3.4		

	any specified location. For example, the operator may need to fix the phase order at a diamond interchange.	The ASCT shall not alter the order of phases at a user-specified intersection.	3.5		
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 The ASCT shall provide coordination along a route. 2.1.1.0-11.0-1 The ASCT shall coordinate along a user-defined route. 2.1.1.0-11.0-2 The ASCT shall determine the coordinated route based on traffic conditions. 2.1.1.0-11.0-3 The ASCT shall determine the coordinated route based on a user-defined schedule. 2.1.1.0-11.0-4 The ASCT shall store 2 user-defined coordination routes (NB and SB) 2.1.1.0-11.0-4.0-1 The ASCT shall implement a stored coordinated route by operator command. 2.1.1.0-11.0-4.0-2 The ASCT shall implement a stored coordinated route based on traffic conditions. 2.1.1.0-11.0-4.0-3 The ASCT shall implement a stored coordinated route based on a user-defined schedule.	3.4 3.5		
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.	2.1.1.0-12 The ASCT shall not prevent the use of phase timings in the local controller set by agency policy.	3.4 3.5		

4.2	4.2 Network characteristics		4.1		
4.2.0-1	The system operator needs to eventually adaptively control up to 6 signals, up to 5 miles from Newmark Laboratory.	1.0-1 The ASCT shall control a minimum of 6 signals concurrently	4.1		
4.2.0-2	The system operator needs to be able to adaptively control up to 1 independent groups of signals	1.0-2 The ASCT shall support groups of signals. 1.0-2.0-2 The ASCT shall control a minimum of 1 group of signals. 1.0-2.0-1 The boundaries surrounding signal controllers that operate in a coordinated fashion shall be defined by the user.	4.1		
4.3	4.3 Coordination across boundaries		4.2 4.3		

Con Ops Reference Number	Concept of Operations Sample Statement	System Requirements (see Guidance)	Guidance Section	Meets system requirements.	Does not meet system requirements.
4.3.0-1	The system operator needs to adaptively control signals operated by IDOT and coordinate those signals with one non-adaptive signals operated by City of Champaign	3.0-1 The ASCT system shall have the capability to communicate adaptive timings from one intersection in the coordinated group (Neil and Kirby) to a non-adaptive signal outside of the coordinated group. (State and Kirby)	4.2 4.3		
4.3.0-2	The system operator needs to send data (e.g., signal timings) to another system that would allow the other system to coordinate with the ASCT system.	3.0-1.0-1 The ASCT shall send signal timing data that is sufficient to coordinate one intersection outside of the adaptive group to the Kirby Ave. and State St. external intersection.	4.2 4.3		
4.4	4.4 Security		4.3.4		
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 The ASCT shall be implemented with a security policy that addresses the following selected elements: 5.0-1.0-1 • Local access to the ASCT. 5.0-1.0-2 • Remote access to the ASCT. 5.0-1.0-3 • System monitoring. 5.0-1.0-4 • System manual override. 5.0-1.0-7	4.3.4		

		• User login 5.0-1.0-8 • User password 5.0-1.0-17 • Security alerts 5.0-1.0-18 • Security logging 5.0-1.0-19 • Security reporting 5.0-3 The ASCT shall comply with the agency's security policy.			
4.6	4.6 Pedestrians		4.5		
4.6.0-1	The system operator needs to accommodate infrequent pedestrian operation and then adaptively recover. (This is appropriate for rare pedestrian calls.)	8.0-3 When a pedestrian phase is called, the ASCT shall accommodate pedestrian crossing times then resume adaptive operation.	4.5		
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.)	8.0-2 When a pedestrian phase is called, the ASCT shall accommodate pedestrian crossing times during adaptive operations. 8.0-5 The ASCT shall execute pedestrian recall on user-defined phases in accordance with a time of day schedule. 8.0-8 When the pedestrian phases are on recall, the ASCT shall accommodate pedestrian timing during adaptive operation.	4.5		

4.7	4.7 Non-adaptive situations		4.6		
4.7.0-2	The system operator needs to schedule pre-determined operation by time of day.	2.1.1.0-5 The ASCT shall operate non-adaptively in accordance with a user-defined time-of-day schedule.	4.6		
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.	4.6		
4.8	4.8 System responsiveness		4.7		
4.8.0-1	The system operator needs to modify the ASCT operation to closely follow changes in traffic conditions.	2.6.0-1 The ASCT shall limit the change in consecutive cycle lengths to be less than a user-specified value. 2.6.0-2 The ASCT shall limit the change in phase times between consecutive cycles to be less than a user-specified value. (This does not apply to early gap-out or actuated phase skipping.) 2.6.0-3 The ASCT shall limit the changes in the direction of primary coordination to a user-specified frequency.	4.7		
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.	2.6.0-5 The ASCT shall select cycle length from a list of user-defined cycle lengths.	4.7		

Con Ops Reference Number	Concept of Operations Sample Statement	System Requirements (see Guidance)	Guidance Section	Meets system requirements.	Does not meet system requirements.
4.8.0-3	The system operator needs to respond quickly to sudden large shifts in traffic conditions.	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. More quickly means that the limits on cycle length and green splits are increased.	4.7		
4.9	4.9 Complex coordination and controller features		4.8		
4.9.0-1	The system operator needs to implement the following advanced controller features while maintaining adaptive operation:		4.8		
4.9.0-1.0-2	• Operate at least 4 overlap phases	7.0-2 The ASCT shall provide a minimum of 4 phase overlaps.	4.8		
4.9.0-1.0-3	• Operate 2 rings up to 4 phases per ring.	7.0-3 The ASCT shall accommodate a minimum of 8 phases at each signal 7.0-4 The ASCT shall accommodate a minimum of 2 rings at each signal. 7.0-5 The ASCT shall accommodate a minimum of 4 phases per ring	4.8		

Con Ops Reference Number	Concept of Operations Sample Statement	System Requirements (see Guidance)	Guidance Section	Meets system requirements.	Does not meet system requirements.
4.9.0-1.0-4	• Permit different phase sequences under different traffic conditions	7.0-6 The ASCT shall provide a minimum of 4 different user-defined phase sequences for each signal. Each permissible phase sequence shall be executable by a time of day schedule.	4.8		
4.9.0-1.0-5	• Allow one or more phases to be omitted (disabled) under certain traffic conditions or signal states.	2.1.2.0-9 The ASCT shall omit a user-specified phase according to a time of day schedule.	4.8		
4.9.0-1.0-6	• Prevent one or more phases being skipped under certain traffic conditions or signal states.	2.1.2.0-5 The ASCT shall prevent skipping a user-specified phase according to a time of day schedule.	4.8		

Con Ops Reference Number	Concept of Operations Sample Statement	System Requirements (see Guidance)	Guidance Section	Meets system requirements.	Does not meet system requirements.
4.9.0-1.0-10	▪ Allow the operator to specify which phase receives unused time from a preceding phase	2.1.2.0-10 The ASCT shall assign unused time from a preceding phase that terminates early to a user-specified phase as follows: • next phase; • next coordinated phase; • user-specified phase. 2.1.2.0-11 The ASCT shall assign unused time from a preceding phase that is skipped to a user-specified phase as follows: • previous phase; • next phase; • next coordinated phase; • user-specified phase.	4.9.0-1.0-10		
4.9.0-1.0-12	• Allow the coordinated phase to terminate early under prescribed traffic conditions	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.)	4.8		

Con Ops Reference Number	Concept of Operations Sample Statement	System Requirements (see Guidance)	Guidance Section	Meets system requirements.	Does not meet system requirements.
4.9.0-1.0-13	• Allow flexible timing of non-coordinated phases (such as late start of a phase) while maintaining coordination	8.0-6 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.	4.8		
4.9.0-1.0-14	• Protected/permissive phasing and alternate left turn phase sequences.	2.1.2.0-1 The ASCT shall not prevent protected/permissive left turn phase operation. 2.1.2.0-2 The ASCT shall not prevent the protected left turn phase to lead or lag the opposing through phase based upon user-specified conditions.	4.8		

Con Ops Reference Number	Concept of Operations Sample Statement	System Requirements (see Guidance)	Guidance Section	Meets system requirements.	Does not meet system requirements.
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.)	7.0-13 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.	4.8		
4.10	4.10 Monitoring and control		4.9		
4.10.0-1	The system operator needs to monitor and control all required features of adaptive operation from the following locations:	5.0-2 The ASCT shall provide monitoring and control access at the following locations:	4.9		
4.10.0-1.0-3	Workstations on agency LAN or WAN	5.0-2.0-3 Agency LAN or WAN located at City of Champaign server	4.9		
4.10.0-1.0-5	Local controller cabinets	5.0-2.0-5 Local controller cabinets	4.9		
4.10.0-1.0-7	Remote locations	5.0-2.0-7 Remote locations via internet (Newmark Civil Engineering Laboratory, IDOT District 5 Office)	4.9		

Con Ops Reference Number	Concept of Operations Sample Statement	System Requirements (see Guidance)	Guidance Section	Meets system requirements.	Does not meet system requirements.
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.	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.	4.9		
4.11	4.11 Performance reporting		4.10		
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 The ASCT shall log the following events: 6.0-1.0-1 Time-stamped vehicle phase calls 6.0-1.0-2 Time-stamped pedestrian phase calls 6.0-1.0-3 Time-stamped emergency vehicle preemption calls 6.0-1.0-6 Time-stamped start and end of each phase 6.0-1.0-7 Time-stamped controller interval changes 6.0-1.0-8 Time-stamped start and end of each transition to a new timing plan	4.10		

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.	6.0-5 The ASCT shall store the following measured data in the form used as input to the adaptive algorithm for a minimum of 30 days: • volume • occupancy • queue length • phase utilization • arrivals in green • green band efficiency 6.0-8 The ASCT shall calculate and report relative data quality including: • The extent data is affected by detector faults • Other applicable items 6.0-9 The ASCT shall report comparisons of logged data when requested by the user: ▪ Day to day, ▪ Hour to hour ▪ Hour of day to hour of day ▪ Hour of week to hour of week ▪ day of week to day week ▪ day of year to day of year 6.0-11 The ASCT shall report stored data in a form suitable to provide explanations of system behavior	4.11.0-7		

		to public and politicians and to troubleshoot the system. 18.0-3 The ASCT shall maintain a log of all signal state alterations directed by the ASCT. 18.0-3.0-4 The ASCT shall maintain the records in this ASCT log for weekly period. 18.0-3.0-5 The ASCT shall archive the ASCT log in the following manner: weekly MS Access format. 18.0-3.0-1 The ASCT log shall include all events directed by the external inputs.18.0-3.0-2 The ASCT log shall include all external output state changes. 18.0-3.0-3 The ASCT log shall include all actual parameter values that are subject to user-specified values.			

Con Ops Reference Number	Concept of Operations Sample Statement	System Requirements (see Guidance)	Guidance Section	Meets system requirements.	Does not meet system requirements.
4.12	4.12 Failure notification		4.10		
4.12.0-1	The system operator needs to immediately notify maintenance and operations staff of alarms and alerts.	13.1.0-3 In the event of a detector failure, the ASCT shall issue an alarm to user-specified recipients. (This requirement may be fulfilled by sending the alarm to a designated list of recipients by a designated means, or by using an external maintenance management system. 13.2-2 In the event of communications failure, the ASCT shall issue an alarm to user-specified recipients. 13.3-2 In the event of adaptive processor failure, the ASCT shall issue an alarm to user-specified recipients. 13.2-3 The ASCT shall issue an alarm within 2 minutes of detection of a failure.	4.10		
4.12.0-3	The system operator needs to maintain a complete log of alarms and failure events.	13.1.0-4 In the event of a failure, the ASCT shall log details of the failure in a permanent log. 13.1.0-5 The permanent failure log shall be searchable, archivable and exportable. 13.2-4	4.11		

		In the event of a communications failure, the ASCT shall log details of the failure in a permanent log.			
4.13	4.13 Preemption and priority				
4.13.0-2	The system operator needs to accommodate emergency vehicle preemption in the same manner that it has been accommodated with the current traffic control system.	11.0-4 The ASCT shall resume adaptive control of signal controllers when preemptions are released. 11.0-5 The ASCT shall execute user-specified actions at non-preempted signal controllers during preemption. (E.g., inhibit a phase, activate a sign, display a message on a DMS) 11.0-6 The ASCT shall operate normally at non-preempted signal controllers when special functions are engaged by a preemption event. (Examples of such special functions are a phase omit, a phase maximum recall or a fire route.) 11.0-7 The ASCT shall release user-specified signal controllers to local control when one signal in a group is preempted. 11.0-8 The ASCT shall not prevent the local signal controller from operating in normally detected limited-service actuated mode during preemption. 11.0-2 The ASCT shall maintain adaptive operation at non-preempted intersections during emergency vehicle preemption.	4.12		

4.14	4.14 Failure and fallback				
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. 13.1.0-1 The ASCT shall take user-specified action in the absence of valid detector data from 2 vehicle detectors within a group. 13.1.0-1.0-1 The ASCT shall release control to central system control. 13.2-1 The ASCT shall execute user-specified actions when communications to one or more signal controllers fails within a group 13.2-1.0-1 In the event of loss of communication to a user-specified signal controller, the ASCT shall release control of all signal controllers within a user-specified group to local control. 13.3-1 The ASCT shall execute user-specified actions when adaptive control fails: 13.3-1.0-1 The ASCT shall release control to central system control. 2.1.1.0-2 The ASCT shall operate non-adaptively when adaptive control equipment fails. 2.1.1.0-2.0-1			

		The ASCT shall operate non-adaptively when a user-specified detector fails. 2.1.1.0-2.0-3 The ASCT shall operate non-adaptively when the number of failed detectors in a group exceeds a user-defined value. 2.1.1.0-2.0-4 The ASCT shall operate non-adaptively when a user-defined communications link fails. 13.3-1.0-2 The ASCT shall release control to local operations to operate under its own time-of-day schedule. 13.3-4 During adaptive processor failure, the ASCT shall provide all local detector inputs to the local controller.			

Con Ops Reference Number	Concept of Operations Sample Statement	System Requirements (see Guidance)	Guidance Section	Meets system requirements.	Does not meet system requirements.
4.15	4.15 Constraints		4.13		
4.15.0-1	The system operator is constrained to use the following equipment:		4.13		
4.15.0-1.0-1	Controller type (The current controller type is Siemens M50 series. The vendor may supply other NEMA TS-2 controller system as desired.)	14.0-3 The ASCT shall fully satisfy all requirements when connected with NEMA TS-2 type 1 and type 2.	4.14		
4.15.0-1.0-2	Detector type (The current detector system is inductive loop. The vendor may supply an additional detection system as desired for their operations but the existing detection must remain operational.)	14.0-2 The ASCT shall fully satisfy all requirements when connected with detectors from manufacturer.(inductive loop detectors)	4.14		
4.15.0-1.0-3	• Communication system	ASCT shall fully satisfy all requirements when connected with fiber optic communication.	4.14		
4.15.0-1.0-4	• Cabinet type and size (NEMA cabinet type TS-1, TS-2)	The ASCT shall fully satisfy all requirements when any external hardware is installed in NEMA TS-1 and TS-2 cabinets.	4.14		
4.15.0-2	• The system operator needs to use equipment and software acceptable under current agency IT policies and procedures.	14.0-1 The vendor's adaptive software shall be fully operational within the following platform: • Windows-PC	4.14		

Con Ops Reference Number	Concept of Operations Sample Statement	System Requirements (see Guidance)	Guidance Section	Meets system requirements.	Does not meet system requirements.
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.	16.0-3 The Vendor shall warrant the system to be free of defects in materials and workmanship for a period of 3 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		
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.	16.0-2 The Vendor shall provide routine updates to the software and software environment necessary to preserve the fulfillment of requirements for a period of 3 years. Preservation of requirements fulfillment especially includes all IT management requirements as previously identified.	4.16.0-4		

CHAPTERS 5-8 ARE DESIRABLE FEATURES WHICH THE UNIVERISTY WOULD LIKE THE ASCT SYSTEM TO POSSESS. THESE FACTORS WILL BE EVALUATED AND SCORED.

IMPORTANT: IF THE VENDOR IS PROPOSING A SYSTEM THAT WOULD NOT MEET THE DESIRED FEATURE, VENDOR MUST PROVIDE AN EXPLANATION OF WHY THE SYSTEM CANNOT MEET THE DESIRABLE FACTOR.

Con Ops Reference Number	Concept of Operations Sample Statement	Meets system requirements.	Does not meet system requirements.
5	5 Chapter 5: Envisioned Adaptive System Overview		
5.1	5.1 Size and grouping		
5.1.0-1	The agency has plans to adaptively control a total of 6 intersections organized in one group of intersections that are sufficiently close to warrant coordination under the prevailing traffic conditions.		
5.2	5.2 Operational objectives		
5.2.0-1	The objective of the coordination will be to provide for smooth flow along the arterial road, minimizing the number of stops experienced by vehicles traveling along the road. Where "natural" cycle lengths exist that permit two-way progression, the system will generally operate at one of those cycle lengths unless longer phase lengths are required to accommodate the demand.		
5.2.0-3	The objective of the coordination will be to control traffic in a manner that maximize the throughput in coordinated directions. The delays experienced by the traffic entering and leaving the coordinated route will be balanced with the delays and stops experienced by other traffic traveling along the route.		
5.2.0-5	The system, or the operator, will select the appropriate coordination objective, depending on the current traffic conditions. For example, during commuter peaks the primary objective may be to maximize the throughput along the road in the peak direction. Then during the business hours the objective may be to balance delays between traffic associated with the adjacent activity and traffic simply traveling through the system.		
5.2.0-7	During moderate to light traffic conditions, one or more phases may be omitted (e.g., a protected phase if protected/permissive left turns are operated), in order to more efficiently serve other movements, provided it is safe to do so. This may be accomplished through a time of day schedule or based on the measured traffic conditions.		

Con Ops Reference Number	Concept of Operations Sample Statement	Meets system requirements.	Does not meet system requirements.
5.2.0-8	Within these operational objectives, the ASCT system will change its operation to accommodate the rise and fall of volumes through the peaks and the changing patterns of flow throughout the day and week. However, there is also a stochastic element to traffic in the short term, with the number of arrivals for a phase varying from cycle to cycle, and pedestrians not being present on all phases in all cycles. It is therefore desirable for the system to have some local tactical control. While vehicle-actuated coordination typically allows phases to run longer or shorter from cycle to cycle to match the actual number of vehicles using the phase, the system will also allow the operator to decide where the unused time will be used. If a phase is to be skipped, the operator can specify that the spare time will be added to the existing phase, the following phase or the next coordinated phase.		
5.3	5.3 Fallback operation		
5.3.0-1	The system will have a fallback state that allows coordination using a common cycle length for all signals within a coordinated group. This common cycle length will be taken from the TOD plan.		
5.3.0-2	The system will have a fallback state that allows individual intersections to operate in a vehicle-actuated, isolated mode in the event of failures of the adaptive processor software or hardware, detectors or communication.		
5.4	5.4 Crossing routes and adjacent systems		
5.4.0.4	The system will send data to a neighboring intersection to stay in coordination with the adjacent intersection while still operating in adaptive mode.		
5.5	5.5 Operator access		
5.5.0-1	Operators, traffic engineering and maintenance staff will be assigned different levels of authority, and access to equipment for which they are authorized, based on their roles and responsibilities. This will allow them to control, view, and monitor and analyze the operation of the system as appropriate.		
5.5.0-3	The system will be connected to the agency's LAN, allowing access to all authorized users.		

Con Ops Reference Number	Concept of Operations Sample Statement	Meets system requirements.	Does not meet system requirements.
5.5.0-4	The system will allow access by authorized users outside the agency		
5.6	5.6 Complex coordination and controller operation		
5.6.0-1	The agency will use the following complex coordination and controller features:		
5.6.0-1.0-2	provision for the required number of rings, phases, phases per ring, and overlap phases;		
5.6.0-1.0-3	the ability to operate different phase sequences based on different traffic conditions or by time-of-day;		
5.6.0-1.0-4	the ability to omit a phase under some traffic conditions or based on external input to allow a shorter cycle length to operate, or to provide additional time to other phases;		
5.6.0-1.0-6	The agency will permit phases or overlaps by time-of-day schedule or external input.		
5.6.0-2	the ability to designate the following phases as coordinated phases (NB,SB);		
5.6.0-4	the ability to allow the coordinated phase to terminate early if the coordinated platoon is short;		
5.6.0-5	the ability to introduce a non-coordinated phase later than its normal starting point within a cycle, if it can be served with minimum green within the remaining time available;		
5.6.0-6	Protected only, protected/permissive and permissive only phasing		

Con Ops Reference Number	Concept of Operations Sample Statement	Meets system requirements.	Does not meet system requirements.
6	6 Chapter 6: Adaptive Operational Environment		
6.0-3	The system will be operated and monitored from workstations located at IDOT District 5 and Newmark Civil Engineering Laboratory		
6.0-4	An operator will be able to have full access to the system from each local controller or on-street master.		
6.0-5	The central server equipment will be housed at City of Champaign server facility in an air-conditioned.		
6.0-6	Equipment compatibility constraints		
6.0-6.0-1	The central server will be a standard platform (maintained by the agency IT Department) and able to be replaced independently from the software.		
6.0-6.0-3	The agency prefers specific detector technology. (Existing loops).		
6.0-6.0-4	The agency prefers to use the following controller types. • TS-2 type 1, type 2 (The existing controller is Siemens M50 series)		
6.0-7	The operators will already be experienced in setting up and fine tuning traditional coordinated signal systems. They will require training specific to the adaptive system, sufficient to allow them to set up, adjust and fine tune all aspects of the system. **(Note: this is a desired element that will be evaluated and scored).**		
6.0-15	Replacement or repair of defective or failed equipment must be covered for 3 years by the manufacturers' warranties. The labor cost of replacement during this period must be included in the purchase price. **(Note: this is a mandatory element that is required)**		
6.0-16	The maintenance of parts and equipment for a period of 3 years must be included in the purchase price. **(Note: this is a mandatory element that is required)**		
6.0-17	The maintenance of all adaptive system software for a period of 3 years must be included in the purchase price. **(Note: this is a mandatory element that is required)**		

Con Ops Reference Number	Concept of Operations Sample Statement	Meets system requirements.	Does not meet system requirements.
6.0-18	The agency expects to operate this system using the latest software for a period of at least 3 years.		
6.0-19	Vendor must provide agency with technical support and assistance in using the adaptive software for 3 years.		
6.0-20	Operations and maintenance staff will have the ability to log in to the system from remote locations via the internet, and have full functionality consistent with their access level.		
6.0-21	The ASCT's operation will be able to be customized to suit the different situations that will be experienced in the different areas where it will operate.		

Con Ops Reference Number	Concept of Operations Sample Statement	Meets system requirements.	Does not meet system requirements.
7	7 Chapter 7: Adaptive Support Environment		
7.1	7.1 Institutions and Stakeholders		
7.1.0-1	Existing stakeholders of the traffic signal system include: • University of Illinois • Illinois Department of Transportation • City of Champaign		
7.1.0-2	The stakeholders who will be affected by or have a direct interest in the adaptive system are: • Illinois Department of Transportation, University of Illinois, and City of Champaign		
7.1.0-3	The activities that will be undertaken by the adaptive system stakeholders include: preparation of timing parameters, implementation and fine tuning, system monitoring and adjustment, system performance monitoring and evaluation.		

Con Ops Reference Number	Concept of Operations Sample Statement	Meets system requirements.	Does not meet system requirements.
7.2	7.2 Facilities		
7.2.0-1	The server will be located at a facility owned by the City of Champaign. IDOT and University of Illinois will access the server via remote internet/VPN.		
7.3	7.3 System Architecture Constraints		
7.3.0-1	The adaptive processor/server will be protected within the agency's firewalls. The IT Department will provide resources, equipment and system management so that operators will have appropriate access to the system locally, from within the agency's LAN and from remote locations.		
7.3.0-2	The communications media available for use by the system will be: Fiber optic cable (12 multi-mode, 12 single mode) is pulled throughout the length of the corridor. It is expected that the fiber optic cable will be connected to the City of Champaign CU2B project. This will provide access at the City of Champaign server room as well as the University of Illinois.		
7.4	7.4 Utilities		
7.4.0-1	City of Champaign is responsible for the utilities with maintenance agreement with IDOT.		
7.6	7.6 Computing hardware		
7.6.0-1	No additional computing equipment will be necessary except any upgrades to the server or in local controller cabinets.		
7.7	7.7 Software		
7.7.0-1	IDOT is responsible for keeping software up to date.		
7.7.0-2	IDOT is responsible for keeping software licenses current.		
7.8	7.8 Personnel		

Con Ops Reference Number	Concept of Operations Sample Statement	Meets system requirements.	Does not meet system requirements.
7.8.0-1	No additional staff is necessary.		
7.8.0-3	The operators of the ASTC will need to be trained on the configuration, operation, maintenance, and troubleshooting of the ASCT software.		
7.9	7.9 Operating procedures		
7.9.0-1	IDOT personnel will be responsible for backing up databases.		
7.10	7.10 Maintenance		
7.10.0-1	IDOT and the City of Champaign have an ongoing maintenance agreement.		
7.11	7.11 Disposal		
7.11.0-1	Describe what material and/or equipment will need to be disposed of during the life of the project, and how it will be disposed.		
7.11.0-2	All material will be disposed of in accordance with the applicable laws at the end of service life.		

Con Ops Reference Number	Concept of Operations Sample Statement	Meets system requirements.	Does not meet system requirements.
8	8 Chapter 8: Operational Scenarios		
8.1	8.1 Overview		
8.1.0-1	The following operational scenarios describe how the system is expected to operate under various conditions. The proposed ASCT system is expected to be able to manage the following operational scenarios and issues envisioned for both the current and future project locations. Scenarios are described for the following operational conditions: • Typical peak period conditions • Typical non-peak period conditions • Memorial Stadium/Assembly Hall special event conditions • Fault conditions (communications, detection, adaptive processor) • Emergency vehicle preemption conditions • Installation		
8.2	8.2 Typical Peak Period Traffic		
8.2.3	8.2.3 Neil St. – Windsor Rd. to Hessel Blvd.		
8.2.3.1	8.2.3.1 Road network		

Con Ops Reference Number	Concept of Operations Sample Statement	Meets system requirements.	Does not meet system requirements.
8.2.3.1.0-1	The section of Neil St. to be coordinated using ASCT has six signalized intersections. It is a five lane arterial road with two lanes in the northbound and southbound directions and one center lane for turning storage. There are exclusive left-turn lanes at all of the major approaches and all minor. Kirby Ave. and Windsor Rd. are arterial roads that accommodate regional traffic rather than providing local access. There is one nearby signal at Kirby Ave. and State St. that requires coordination with the critical intersection at Kirby Ave. and Neil St. The Kirby Ave./State St. intersection will not be equipped with ASCT control but must be coordinated with the Neil St./Kirby Ave. intersection. There are protected left-turns at all major approaches. About half of the minor approaches have protected left-turn phases. There are no exclusive right-turn phases at any major or minor approaches. There are no major shopping centers or residential areas directly adjacent to the corridor. The land use directly adjacent to the corridor is mostly local businesses and restaurants.		
8.2.3.2	8.2.3.2 Traffic conditions		
8.2.3.2.0-1	During the AM peak, traffic demand is much heavier in the northbound direction. During PM peak, traffic demand is much heavier in the southbound direction. There is a midday peak that is relatively balanced compared to AM peak and PM peak. The traffic volume along Neil St. is higher than the volume on any of the crossing streets.		
8.2.3.3	8.2.3.3 Operational objectives		
8.2.3.3.0-1	The operational objectives for this arterial under these conditions are to: • Provide smooth flow along the arterial through other intersections. • Maximize the throughput in coordinated direction.		
8.2.3.4	8.2.3.4 Coordination and signal timing strategies		

Con Ops Reference Number	Concept of Operations Sample Statement	Meets system requirements.	Does not meet system requirements.
8.2.3.4.0-1	The signal timing strategies used by the system to accommodate this situation are: • During AM peak and PM peak, the system will select signal timing parameters to provide coordination in the direction of heavier flow. During midday peak, the coordination will be balanced between northbound and southbound. The phase times will be selected to minimize phase failures while satisfying the constraint that demand on a minor approach must be served within a specified amount of time.		
8.2.3.5	8.2.3.5 Summary of operation		
8.2.3.5.0-1	Under these conditions, the ASCT system will determine the critical intersection and select a phase arrangement and calculate phase times that accommodate traffic at that intersection. It will then set the timing at the other intersections to provide a green band in the direction of heaviest traffic along the arterial, to minimize the number of stops in that direction. The green time for the non-arterial phases at those intersections will be set to accommodate the traffic using those phases, while allocating the remaining time to the arterial road. The system will determine the sequence of phases on the arterial (lead-lead or lag-lag) that minimizes the stops in the non-coordinated direction under these conditions.		
8.3	8.3 Typical non-peak period traffic		
8.3.3	8.3.3 Neil St. – Windsor Rd. to Hessel Blvd.		
8.3.3.1	8.3.3.1 Road network		
8.3.3.1.0-1	The corridor has been described previously in this document in 8.2.3.1.0-1.		
8.3.3.2	8.3.3.2 Traffic conditions		
8.3.3.2.0-1	During the non-peak, traffic demand is relatively balanced between the northbound and southbound directions		
8.3.3.3	8.3.3.3 Operational objectives		
8.3.3.3.0-1	The operational objectives for this arterial under these conditions are to: • Provide smooth flow along the arterial through other intersections.		

Con Ops Reference Number	Concept of Operations Sample Statement	Meets system requirements.	Does not meet system requirements.
8.3.3.2	8.3.3.2 Traffic conditions		
8.3.3.2.0-1	During the non-peak, traffic demand is relatively balanced between the northbound and southbound directions		
8.3.3.3	8.3.3.3 Operational objectives		
8.3.3.3.0-1	The operational objectives for this arterial under these conditions are to: • Provide smooth flow along the arterial through other intersections.		
8.3.3.4	8.3.3.4 Coordination and signal timing strategies		
8.3.3.4.0-1	The signal timing strategies used by the system to accommodate this situation are: • During non-peak, the system will select signal timing parameters to provide coordination that will be balanced between northbound and southbound. The phase times will be selected to minimize phase failures while satisfying the constraint that demand on a minor approach must be served within a specified amount of time.		
8.3.3.5	8.3.3.5 Summary of operation		
8.3.3.5.0-1	Under these conditions, the ASCT system will determine the critical intersection and select a phase arrangement and calculate phase times that accommodate traffic at that intersection. It will then set the timing at the other intersections to provide a coordination that is balanced between northbound and southbound, to minimize the number of stops in both directions. The green time for the non-arterial phases at those intersections will be set to accommodate the traffic using those phases, while allocating the remaining time to the arterial road. The system will determine the sequence of phases on the arterial (lead-lead or lag-lag) that minimizes the stops in the non-coordinated direction under these conditions.		

Con Ops Reference Number	Concept of Operations Sample Statement	Meets system requirements.	Does not meet system requirements.
8.6	8.6 Memorial Stadium/Assembly Hall event		
8.6.1	8.6.1 High travel day		
8.6.1.0-1	During periods of major activity within or close to the ASCT's area of operation, the traffic characteristics are often similar to the peak periods, either oversaturated or unsaturated. The system will behave in a similar fashion to those periods, and the detection system will determine whether unsaturated or oversaturated conditions prevail. If there is heavily directional traffic before or after the activity, the system will determine the predominant direction and coordinate accordingly, with an appropriate cycle length and offset. If the event traffic is not as heavy as peak hours, but the traffic on the corridor is still highly directional, then the system will recognize this and provide coordination predominantly in the heaviest direction, even though the cycle length may be similar to business hours (with balanced flows) cycle lengths.		
8.8	8.8 Fault Conditions		
8.8.1	8.8.1 Communications Fault Condition		
8.8.1-1	If a communication failure prevents the adaptive system from continuing to control one or more intersections within a defined group, all signals within the group will revert to an appropriate, user-specified fallback mode of operation, either time-of-day operation or free operation. The fallback mode will be specified by the user based on location and time of day. All communication failure alarms will be automatically transmitted to maintenance and operations staff for appropriate attention.		
8.8.2	8.8.2 Detection Fault Condition		
8.8.2.0-1	The system will recognize a detector failure and take appropriate action to accommodate the missing data. For a local detector failure, the local controller will place a soft recall or maximum recall (to be user-specified) on the appropriate phase, and issue an alarm. For a detector that influences the adaptive operation (e.g., a system detector), the system will use data from an alternate (user-specified) detector, such as in an adjacent lane or at an appropriate upstream or downstream location. If the number of detector failures within a specified group exceeds a user-specified threshold, the system will cease adaptive operation and go to a fallback operation specified by the user (such as time-of-day operation or free operation). The fallback operation will be specified by the user based on location and time of day. All detector failure alarms will be automatically transmitted to maintenance and operations staff for appropriate attention.		

8.9	8.9 Emergency Vehicle Preemption		
8.9.4	8.9.4 Emergency Vehicle Preemption		
8.9.4.0-1	When an intersection responds to an EV preemption, other signals within the coordinated group continue to operate adaptively. The preempted signal returns to adaptive control once the preemption is released.		
8.12	8.12 Installation		
8.12.0-1	During installation and fine tuning, the operator or vendor will calibrate all the user-defined values in the system. In order to understand the response of the system to changes in traffic conditions, it is necessary to examine the results of intermediate calculations, in addition to the overall outputs and changes of state commanded by the system. For example, if a cycle length is calculated based on a calculated parameter, such as level of saturation of detectors in critical lanes on critical movements, then the state of that calculated parameter must be available for inspection for each detector. This will allow the operator to properly calibrate each detector, and then separately calibrate the parameters in the cycle length calculation or look-up table. This would also allow an operator to identify a faulty detector that is causing an incorrect measure to be calculated, even though the detector has failed; or identify a detector on which traffic behavior is different from other detectors on that phase, such as a left turn lane that has a heavy U-turn volume.		

APPENDIX B: EVALUATION SPREADSHEET (COMPLETED)

Evaluation Spreadsheet					
Criteria	Total number of points possible	Mandatory requirement type X	Score for Vendor 1	Comments	Vendor met mandatory requirement Yes or No
Chapter 4					
The system operator must have the ability to implement different strategies individually or in combination to suit different prevailing traffic conditions. These strategies include:					
Provide smooth flow along coordinated routes (4.1.0-1.0-2)		X			
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. (4.1.0-3).		X			
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. (4.1.0-4).		X			
The system operator needs to minimize the chance that a queue forms at a specified location. (i.e., reduce number of stops). (4.1.0-5).		X			
The system operator needs to modify the sequence of phases to support the various operational strategies (4.1.0-6)		X			
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 (4.1.0-7).		X			
The system operator needs to designate the coordinated route based on traffic conditions and the selected operational strategy (4.1.0-8).		X			
The system operator needs to set signal timing parameters (such as minimum green, maximum green and extension time) to comply with agency policies. (4.1.0-9).		X			

The system operator needs to eventually adaptively control up to 6 signals, up to 5 miles from Newmark Laboratory. (4.2.0-2).		X			
The system operator needs to adaptively control signals operated by IDOT and coordinate those signals with one non-adaptive signals operated by City of Champaign. (4.3.0-1)		X			
The system operator needs to send data (e.g., signal timings) to another system that would allow the other system to coordinate with the ASCT system. (4.3.0-2).		X			
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.(4.4.0-1).		X			
The system operator needs to accommodate infrequent pedestrian operation and then adaptively recover. (This is appropriate for rare pedestrian calls.) (4.6.0-1)		X			
The system operator needs to schedule pre-determined operation by time of day (4.7.0-2.)		X			
The system operator needs to over-ride adaptive operation.(4.7.0-3)		X			
The system operator needs to modify the ASCT operation to closely follow changes in traffic conditions. (4.8.0-1).		X			
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. (4.8.0-2).		X			
The system operator needs to respond quickly to sudden large shifts in traffic conditions. (4.8.0-3)		X			
The system operator needs to implement the following advanced controller features while maintaining adaptive operation:		X			
Operate at least 4 overlap phases. (4.9.0-1.0-2)		X			
Operate 2 rings up to 4 phases per ring. (4.9.0-1.0-3)		X			
Permit different phase sequences under different traffic conditions. (4.9.0-1.0-4).		X			
Allow one or more phases to be omitted (disabled) under certain traffic conditions or signal states. (4.9.0-1.0-5).		X			
Prevent one or more phases being skipped under certain traffic conditions or signal states. (4.9.0-1.0-6).		X			
Allow the operator to specify which phase receives unused time from a preceding phase. (4.9.0-1.0-10).		X			
Allow the coordinated phase to terminate early under prescribed traffic conditions. (4.9.0-1.0-12).		X			

Allow flexible timing of non-coordinated phases (such as late start of a phase) while maintaining coordination. (4.9.0-1.0-13).		X			
Protected/permissive phasing and alternate left turn phase sequences. (4.9.0-1.0-14).		X			
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.) (4.9.0-1.0-16).		X			
The system operator needs to monitor and control all required features of adaptive operation from the following locations:					
Workstations on agency LAN or WAN (4.10.0-1.0-3).		X			
Local controller cabinets (4.10.0-1.0-5).		X			
Remote locations (4.10.0-1.0-7).		X			
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. (4.10.0-2).		X			
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. (4.11.0-6).		X			
Have the ability to generate historic and real-time reports that effectively support operation, maintenance and reporting of system performance and traffic conditions (4.11.0-7).		X			
The system operator needs to immediately notify maintenance and operations staff of alarms and alerts. (4.12.0-1).		X			
The system operator needs to maintain a complete log of alarms and failure events. (4.12.0-3).		X			
The system operator needs to accommodate emergency vehicle preemption in the same manner that it has been accommodated with the current traffic control system. (4.13.0-2).		X			
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.(4.14.0-1).		X			
The system operator is constrained to use the following equipment:					
Controller type (The current controller type is Siemens M50 series. The vendor may supply other NEMA TS-2 controller system as desired.). (4.15.0-1.0-1).		X			

Detector type (The current detector system is inductive loop. The vendor may supply an additional detection system as desired for their operations but the existing detection must remain operational.). (4.15.0-1.0-2).		X			
Communication system (4.15.0-1.0-3).		X			
Cabinet type and size (NEMA cabinet type TS-1, TS-2). (4.15.0-1.0-4).		X			
The system operator needs to use equipment and software acceptable under current agency IT policies and procedures. (4.15.0-2).		X			
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. (4.16.0-3).		X			
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. (4.16.0-4).		X			
Chapter 5	**18 scored questions, max 180 points (22.5%)**				
The objective of the coordination will be to provide for smooth flow along the arterial road, minimizing the number of stops experienced by vehicles traveling along the road. Where "natural" cycle lengths exist that permit two-way progression, the system will generally operate at one of those cycle lengths unless longer phase lengths are required to accommodate the demand. (5.2.0-1)	10				
The objective of the coordination will be to control traffic in a manner that maximize the throughput in coordinated directions. The delays experienced by the traffic entering and leaving the coordinated route will be balanced with the delays and stops experienced by other traffic traveling along the route. (5.2.0-3)	10				
The system, or the operator, will select the appropriate coordination objective, depending on the current traffic conditions. For example, during commuter peaks the primary objective may be to maximize the throughput along the road in the peak direction. Then during the business hours the objective may be to balance delays between traffic associated with the adjacent activity and traffic simply traveling through the system. (5.2.0-5)	10				
During moderate to light traffic conditions, one or more phases may be omitted (e.g., a protected phase if protected/permissive left turns are operated), in order to more efficiently serve other movements, provided it is safe	10				

to do so. This may be accomplished through a time of day schedule or based on the measured traffic conditions. (5.2.0-7).					
Within these operational objectives, the ASCT system will change its operation to accommodate the rise and fall of volumes through the peaks and the changing patterns of flow throughout the day and week. However, there is also a stochastic element to traffic in the short term, with the number of arrivals for a phase varying from cycle to cycle, and pedestrians not being present on all phases in all cycles. It is therefore desirable for the system to have some local tactical control. While vehicle-actuated coordination typically allows phases to run longer or shorter from cycle to cycle to match the actual number of vehicles using the phase, the system will also allow the operator to decide where the unused time will be used. If a phase is to be skipped, the operator can specify that the spare time will be added to the existing phase, the following phase or the next coordinated phase (5.2.0-8).	10				
The system will have a fallback state that allows coordination using a common cycle length for all signals within a coordinated group. This common cycle length will be taken from the TOD plan (5.3.0-2).	10				
The system will send data to a neighboring intersection to stay in coordination with the adjacent intersection while still operating in adaptive mode. (5.4.0.4).	10				
Operators, traffic engineering and maintenance staff will be assigned different levels of authority, and access to equipment for which they are authorized, based on their roles and responsibilities. This will allow them to control, view, and monitor and analyze the operation of the system as appropriate. (5.5.0-1).	10				
The system will be connected to the agency's LAN, allowing access to all authorized users. (5.5.0-3).	10				
The system will allow access by authorized users outside the agency (5.5.0-4).	10				
The agency will use the following complex coordination and controller features:					
Provision for the required number of rings, phases, phases per ring, and overlap phases; (5.6.0-1). 5.6.0-1.0-2	10				
The ability to operate different phase sequences based on different traffic conditions or by time-of-day; (5.6.0-1.0-3).	10				
The ability to omit a phase under some traffic conditions or based on external input to allow a shorter cycle length to operate, or to provide additional time to other phases; (5.6.0-1.0-4).	10				

The agency will permit phases or overlaps by time-of-day schedule or external input. (5.6.0-1.0-6).	10				
The ability to designate the following phases as coordinated phases (NB, SB); (5.6.0-2).	10				
The ability to allow the coordinated phase to terminate early if the coordinated platoon is short; (5.6.0-4).	10				
the ability to introduce a non-coordinated phase later than its normal starting point within a cycle, if it can be served with minimum green within the remaining time available; (5.6.0-5).	10				
Protected only, protected/permissive and permissive only phasing (5.6.0-6).	10				
Chapter 6	**10 scored questions, Max 100 points (12.5%)**				
The system will be operated and monitored from workstations located at IDOT District 5 and Newmark Civil Engineering Laboratory. (6.0-3).	10				
An operator will be able to have full access to the system from each local controller or on-street master. (6.0-4).	10				
The central server will be a standard platform (maintained by the agency IT Department) and able to be replaced independently from the software. (6.0-6.0-1). Note: The central server equipment will be housed at the City of Champaign server facility in an air-conditioned environment.	10				
The agency prefers specific detector technology. (Existing loops). (6.0-6.0-3).	10				
The agency prefers to use the following controller types. TS-2 type 1, type 2. (The existing controller is Siemens M50 series). (6.0-6.0-4).	10				
The operators will already be experienced in setting up and fine tuning traditional coordinated signal systems. They will require training specific to the adaptive system, sufficient to allow them to set up, adjust and fine tune all aspects of the system. (6.0-7).	10				
Replacement or repair of defective or failed equipment must be covered for 3 years by the manufacturers' warranties. The labor cost of replacement during this period must be included in the purchase price. (6.0-15).		X			
The maintenance of parts and equipment for a period of 3 years must be included in the purchase price (6.0-16).		X			
The maintenance of all adaptive system software for a period of 3 years must be included in the purchase price. (6.0-17).		X			
The agency expects to operate this system using the latest software for a period of at least 3 years. (6.0-18).	10				

Vendor should provide agency with technical support and assistance in using the adaptive software for 3 years. (6.0-19).	10				
Operations and maintenance staff will have the ability to log in to the system from remote locations via the internet, and have full functionality consistent with their access level (6.0-20).	10				
The ASCT's operation will be able to be customized to suit the different situations that will be experienced in the different areas where it will operate. (6.0-21)	10				
Chapter 7	**7 scored questions, Max 70 points (8.75%)**				
The adaptive processor/server will be protected within the agency's firewalls. The IT Department will provide resources, equipment and system management so that operators will have appropriate access to the system locally, from within the agency's LAN and from remote locations. (7.3.0-1).	10				
The communications media available for use by the system will be: Fiber optic cable (12 multi-mode, 12 single mode) is pulled throughout the length of the corridor. It is expected that the fiber optic cable will be connected to the City of Champaign CU2B project. This will provide access at the City of Champaign server room as well as the University of Illinois.	10				
No additional computing equipment will be necessary except any upgrades to the server or in local controller cabinets. (7.6.0-1).	10				
The operators of the ASTC will need to be trained on the configuration, operation, maintenance, and troubleshooting of the ASCT software. (7.8.0-3).	10				
IDOT personnel will be responsible for backing up databases. (7.10.0-1). 7.9.0-1	10				
Describe what material and/or equipment will need to be disposed of during the life of the project, and how it will be disposed. (7.11.0-1).	10				
All material will be disposed of in accordance with the applicable laws at the end of service life. (7.11.0-2).	10				
Chapter 8	**11 scored questions, Max 110 points (13.75%)**				

The section of Neil St. to be coordinated using ASCT has six signalized intersections. It is a five lane arterial road with two lanes in the northbound and southbound directions and one center lane for turning storage. There are exclusive left-turn lanes at all of the major approaches and all minor. Kirby Ave. and Windsor Rd. are arterial roads that accommodate regional traffic rather than providing local access. There is one nearby signal at Kirby Ave. and State St. that requires coordination with the critical intersection at Kirby Ave. and Neil St. The Kirby Ave./State St. intersection will not be equipped with ASCT control but must be coordinated with the Neil St./Kirby Ave. intersection. There are protected left-turns at all major approaches. About half of the minor approaches have protected left-turn phases. There are no exclusive right-turn phases at any major or minor approaches. There are no major shopping centers or residential areas directly adjacent to the corridor. The land use directly adjacent to the corridor is mostly local businesses and restaurants.		X			
The operational objectives for this arterial under these conditions are to: Provide smooth flow along the arterial through other intersections. Maximize the throughput in coordinated direction. (8.2.3.3.0-1).	10				
The signal timing strategies used by the system to accommodate this situation are: During AM peak and PM peak, the system will select signal timing parameters to provide coordination in the direction of heavier flow. During midday peak, the coordination will be balanced between northbound and southbound. The phase times will be selected to minimize phase failures while satisfying the constraint that demand on a minor approach must be served within a specified amount of time. (8.2.3.4.0-1).	10				
Under these conditions, the ASCT system will determine the critical intersection and select a phase arrangement and calculate phase times that accommodate traffic at that intersection. It will then set the timing at the other intersections to provide a coordination that is balanced between northbound and southbound, to minimize the number of stops in both directions. The green time for the non-arterial phases at those intersections will be set to accommodate the traffic using those phases, while allocating the remaining time to the arterial road. The system will determine the sequence of phases on the arterial (lead-lead or lag-lag) that minimizes the stops in the non-coordinated direction under these conditions (8.3.3.5.0-1).	10				

During periods of major activity within or close to the ASCT's area of operation, the traffic characteristics are often similar to the peak periods, either oversaturated or unsaturated. The system will behave in a similar fashion to those periods, and the detection system will determine whether unsaturated or oversaturated conditions prevail. If there is heavily directional traffic before or after the activity, the system will determine the predominant direction and coordinate accordingly, with an appropriate cycle length and offset. If the event traffic is not as heavy as peak hours, but the traffic on the corridor is still highly directional, then the system will recognize this and provide coordination predominantly in the heaviest direction, even though the cycle length may be similar to business hours (with balanced flows) cycle lengths. (8.6.1.0-1).	10				
If a communication failure prevents the adaptive system from continuing to control one or more intersections within a defined group, all signals within the group will revert to an appropriate, user-specified fallback mode of operation, either time-of-day operation or free operation. The fallback mode will be specified by the user based on location and time of day. All communication failure alarms will be automatically transmitted to maintenance and operations staff for appropriate attention. (8.8.1-1).	10				
The system will recognize a detector failure and take appropriate action to accommodate the missing data. For a local detector failure, the local controller will place a soft recall or maximum recall (to be user-specified) on the appropriate phase, and issue an alarm. For a detector that influences the adaptive operation (e.g., a system detector), the system will use data from an alternate (user-specified) detector, such as in an adjacent lane or at an appropriate upstream or downstream location. If the number of detector failures within a specified group exceeds a user-specified threshold, the system will cease adaptive operation and go to a fallback operation specified by the user (such as time-of-day operation or free operation). The fallback operation will be specified by the user based on location and time of day. All detector failure alarms will be automatically transmitted to maintenance and operations staff for appropriate attention. (8.8.2.0-1).	10				
When an intersection responds to an EV preemption, other signals within the coordinated group continue to operate adaptively. The preempted signal returns to adaptive control once the preemption is released. (8.9.4.0-1).	10				

During installation and fine tuning, the operator or vendor will calibrate all the user-defined values in the system. In order to understand the response of the system to changes in traffic conditions, it is necessary to examine the results of intermediate calculations, in addition to the overall outputs and changes of state commanded by the system. For example, if a cycle length is calculated based on a calculated parameter, such as level of saturation of detectors in critical lanes on critical movements, then the state of that calculated parameter must be available for inspection for each detector. This will allow the operator to properly calibrate each detector, and then separately calibrate the parameters in the cycle length calculation or look-up table. This would also allow an operator to identify a faulty detector that is causing an incorrect measure to be calculated, even though the detector has failed; or identify a detector on which traffic behavior is different from other detectors on that phase, such as a left turn lane that has a heavy U-turn volume. (8.12.0-1).					
Proposer's Experience and Qualifications (Section 1.3 below)	**4 questions, max 170 points (21.25%)**				
Vendor and Staffing Specifications: The information below will be used to determine Vendor's responsibility (see B.1.2 of the Instructions above) and relationship management practices and to meet mandatory requirements as described in Section B.2. Responsiveness Elements. (1.3.3.)	40				
Track Record/Current System Customers: The successful Vendor should demonstrate a track record of satisfactory performance from a minimum of two customers using the same or similar ASCT system for at least two years. For the current version of the system being proposed in response to this RFP, provide the names and contacts for two Customers currently using Vendor's PMCS system and indicate how long each Customer has used this system version, and provide contact information for these Customer's. Include all components of your system each Customer is using. (1.3.3.1).	40				
Vendor's Qualifications. Vendor must provide resumes and/or background information and experience of the key management and operational staff who will be assigned to provide the services outlined in this RFP. (1.3.3.2).	40				
Vendor's Experience. Vendor's personnel working on the ASCT Project must have documentable project experience on similar sized project with similar scope. Vendor should provide a description of the skillsets each person working on the ASCT Project possesses (1.3.3.3).	50				
Milestones and Deliverables (See Section 1.4 below)	**4 questions, max 170 points (21.25%)**				

Schedule. Vendor will provide a project schedule within the RFP response that includes dates for delivery and installation for all project locations described in Section 1.2., within the ASCT Model System Engineering Document. The Schedule shall include all portions of the delivery and installation through final system testing and acceptance. (1.4.1).	45				
Implementation Plan. Vendor must provide an Implementation Plan Describing how Vendor will implement the Adaptive Signal Control Technology System. The Implementation Plan should in include a schedule with the completion date. Vendor must provide details on the number of times traffic will need to be interrupted at the project locations. (1.4.2).	45				
System Testing and Acceptance. Before final acceptance, the system must be demonstrated to meet all of the performance, installation, operation, and training, to the satisfaction of purchaser's representatives. (1.4.3.).	45				
Warranty. All hardware and software shall be warranted for thirty-six (36) months from the date of commissioning. (1.4.4).	35				
Total Points					

Evaluation Key
Factors worth 10 points
0 points - does not meet requirement
1-3 barely meets requirement
4-6 meets requirement
7-9- slightly above requirement
10 Outstanding. Exceeds requirement in many, if not most areas
Factors worth 35 points
0 points - does not meet requirement
1-10- barely meets requirement
11-21 - meets requirement
22-32 slightly above requirement
33- 35 Outstanding. Exceeds requirement in many, if not most areas
Factors worth 40 points
0 -points does not meet requirement
1-12 barely meets requirement
13-24 meets requirement

25-36 slightly above requirement	
37-40 Outstanding. Exceeds requirement in many, if not most areas	
Factors worth 45 points	
0 points - does not meet requirement	
1-14- barely meets requirement	
15-27 meets requirement	
28-40 slightly above requirement	
41-45 Outstanding. Exceeds requirements in many, if not most areas.	
Factors worth 50 points	
0-points does not meet requirement	
1-15 barely meets requirement	
16-30 meets requirement	
31-45 slightly above requirement	
46-50 Outstanding. Exceeds requirements in many, if not most areas.	

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