CITY OF CHATTANOOGA REGIONAL ITS SYSTEM ASCT SYSTEMS ENGINEERING ANALYSIS

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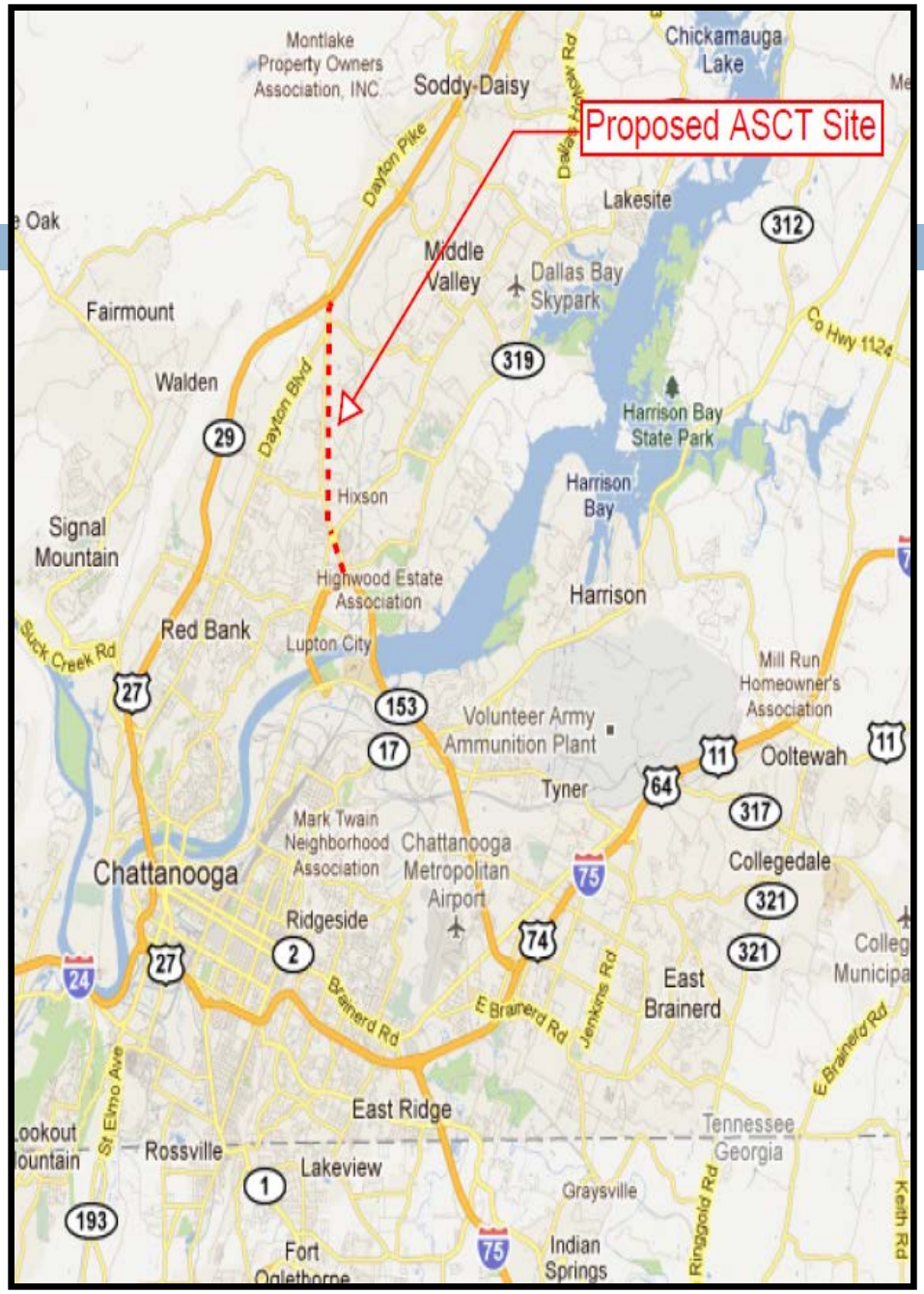
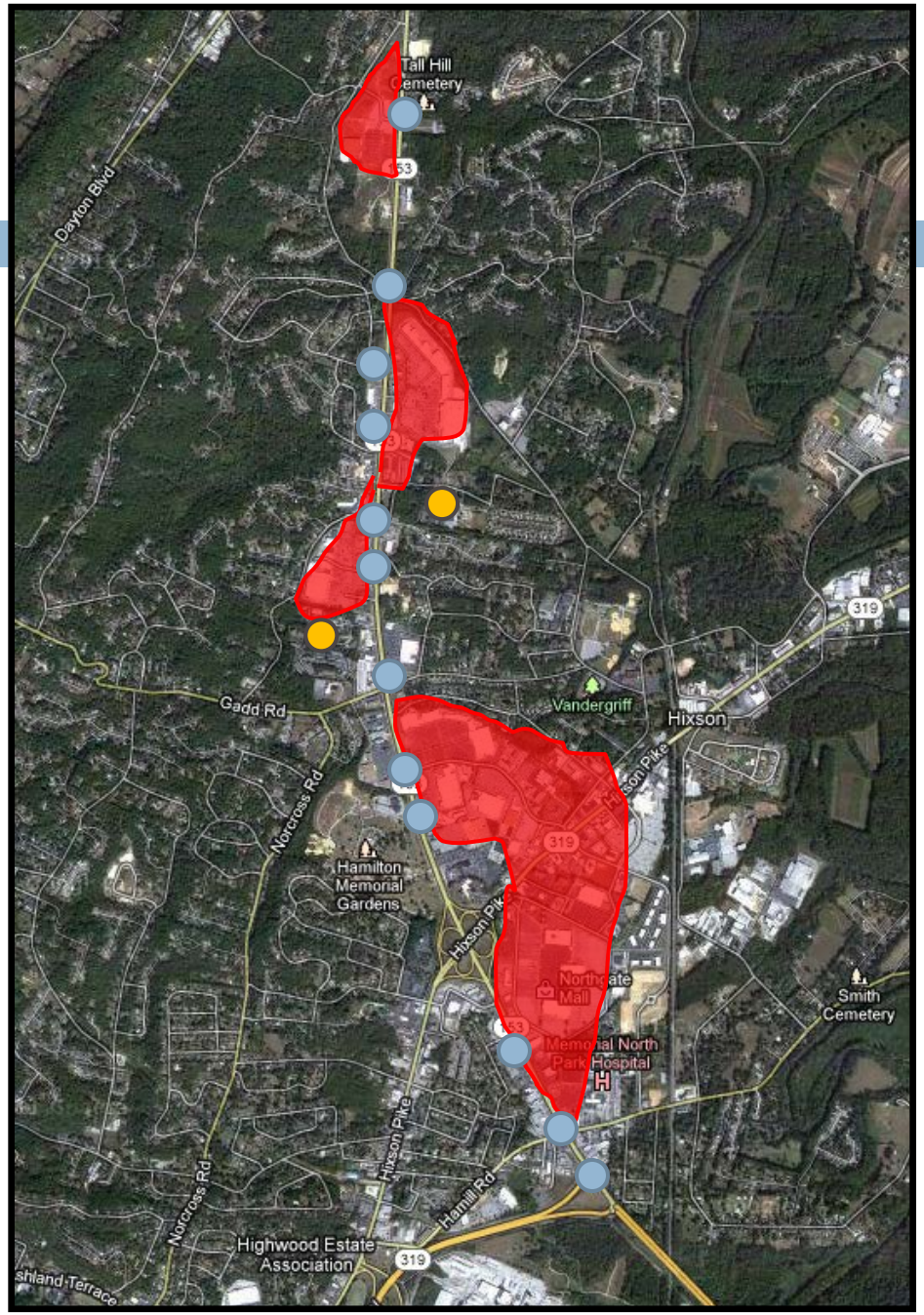
Project Description

- Volkert, Inc. is designing a 118 traffic signal upgrade for the City of Chattanooga.
- Within this project, the City of Chattanooga desired to implement a ASCT system along Tennessee SR-153.



Project Description

- Project Length: 5 Miles
- 13 Signals – Existing fiber interconnect
- 1 Route Interchange
- Several large shopping/retail centers
- 2 Schools
- Signals were unevenly spaced
- Traffic volumes showed considerable variability



Initial Attempt –ASCT SEA

- Review of existing SEA documents containing evaluations of ASCT's.
- Approaches varied by agency and consultant.
- The City of Chattanooga originally wanted to pursue a sole-source procurement.
- Initial analysis utilized a quasi set of system requirements.
- The ASCT products were evaluated in a pro and con format against the system requirements
- In the end, the evaluation became mired in sales pitches/jargon and non-objective evaluation criteria.
- Decided to move away from a sole-source procurement.

Second Attempt – ASCT SEA

- Our second attempt utilized:
- The model document provided an objective road map to evaluate various ASCT products.
- The workflow and templates made the process much simpler and created an objective and informative decision process for our client and ourselves.

Model Document Resources

CONCEPT OF OPERATIONS TEMPLATE

Relevant standards are the ANSI/AIAA G-043-1992 standard and IEEE Standard P1362 V3.2.

SECTION	CONTENTS
Title Page	The title page should follow the Agency's procedures or style guide. At a minimum, it should contain the following information: ▪ CONCEPT OF OPERATIONS FOR THE [insert name of project] - [insert name of sponsoring agency] ▪ Date that the document was formally approved ▪ The organization responsible for preparing the document ▪ Internal document control number, if available ▪ Revision version and date issued
1.0 Purpose of Document	This section is a brief statement of the purpose of this document. It is a description and rationale of the expected operations of the system under development. It is a vehicle for stakeholder discussion and consensus to ensure that the system that is built is operationally feasible. This will briefly describe contents, intention, and audience. One or two paragraphs will normally suffice.
2.0 Scope of Project	This short section gives a brief overview of the system to be built. It includes its purpose and a high-level description. It describes what area will be covered and which agencies will be involved, either directly or through interfaces. One or two paragraphs will usually suffice.
3.0 Referenced Documents	This optional section is a place to list any supporting documentation used and other resources that are useful in understanding the operations of the system. This could include any documentation of current operations and any strategic plans that drive the goals of the system under development.
4.0 Background	Here is a brief description of the current system or situation, how the existing system is used currently, and its drawbacks and limitations. This leads into the reasons for the proposed development and the general approach to improving the system. This is followed by a discussion of the nature of the planned changes and a justification for them.

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Model Document Resources

Rele

SECTION

Title Page

1.0 Purpose Document

2.0 Scope of Project

3.0 Referenced Documents

4.0 Background

Select	Con Ops Reference Number	Concept of Operations Sample Statements	Guidance Section	Satisfied by System Requirement
		within the group, and select the next highest "natural" cycle length. Small changes in volume from cycle to cycle will not affect the desirable cycle length. Volume changes will only affect the cycle length when the change is sufficiently large that it warrants changing to another "natural" cycle length.		
	11.2.1.0-4	FOR A FIXED, PRE-SPECIFIED, CYCLE LENGTH SYSTEM. The cycle length will be selected according to a time of day schedule. The system will determine the appropriate offsets, phase times and phase sequence based on the current traffic conditions.		2.2.0-4 2.2.0-4.0-1 2.2.0-3 2.2.0-2
	11.2.1.0-5	FOR SYSTEM-SELECTED VARIABLE GROUPING. At the shoulders of the peaks, not all the intersections reach their peak demand at the same time. It is likely that some groups of intersections could operate with different characteristics (e.g., cycle length, direction of offset) for some of the peak period. The system will determine when to operate all intersections with the same coordination, and when to operate them as several different groups based on measured conditions. The user will configure the thresholds the system will use to determine intersection groups and the direction of offsets.		1.0-2 1.0-2.0-1
	11.2.1.0-6	FOR SCHEDULED VARIABLE GROUPING. At the shoulders of the peaks, not all the intersections reach their peak demand at the same time. It is likely that some groups of intersections could operate with different characteristics (e.g., cycle length, direction of offset) for some of the peak period. The system will allow the operator to specify when all intersections		1.0-2 1.0-2.0-1

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Model Document Resources

Concept of Operations Template

Rele

SECTION

Title Page

1.0 Purpose
Document

2.0 Scope of
Project

3.0
Referenced
Documents

4.0
Background

Select	Con Ops Reference Number	
		within the group, changes in volum Volume changes large that it warr
	11.2.1.0-4	FOR A FIXED, PRE The cycle length will determine th the current traffi
	11.2.1.0-5	FOR SYSTEM-SEL At the shoulders at the same time different charact peak period. The the same coordin based on measur will use to deter
	11.2.1.0-6	FOR SCHEDULED At the shoulders at the same time different charact peak period. The

Concept of Operations
Sample Statements

Select	Requirements Document Reference Number	System Requirements Sample Requirements	Satisfies Con Ops statement
			11.2.2.0-1 11.2.1.0-2 11.3.0-1 11.4.0-1
	2.2.0-4	The ASCT shall calculate offsets for the user-specified reference point for each signal controller along a coordinated route within a group.	11.2.1.0-1 11.2.1.0-4 11.2.2.0-1 11.2.1.0-2 11.3.0-1 11.4.0-1
	2.2.0-4.0-1	The ASCT shall apply offsets for the user-specified reference point of each signal controller along a coordinated route.	11.2.1.0-1 11.2.1.0-4 11.2.2.0-1 11.2.1.0-2 11.3.0-1

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System Requirements
Sample Requirements

City of Chattanooga ASCT SEA Documents

period. 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.	13.1.0-2.0-2 13.1.0-1.0-2
11.8.5 Failure State Alarms Detector Failure When a detector fails or communications fail, an alarm will be issued to user-specified recipients. To issue an alarm, the ASCT will send an email, page, etc. to recipients authorized to receive each alarm.	13.1.0-3 13.2-2
11.8.6 Adaptive Processor Failure There are two types of adaptive system failures: failure of the server or equipment that operates the adaptive algorithms; and inability of the adaptive algorithms to accommodate current traffic conditions. If the equipment that operates the adaptive algorithms fails, the system will recognize the failure and place the operation in an appropriate, user-specified fallback mode, either time-of-day operation or actuated free operation. The fallback mode will be specified by the user based on location and time of day. The presence of the adaptive processor will not inhibit the normal operation of the signal controller when it is in fallback operation. The adaptive system makes its decisions based largely on detector information. Occasionally, as the result of an incident or other event outside the control of the system and outside the area covered by the system, congestion will propagate back into the adaptive control area and the measured traffic conditions will be outside the range of data that can be processed by the system. In locations where this is likely to occur, the intersection detectors, or queue detectors installed specifically for this purpose, will measure increased occupancy. In such cases, when user-specified signal timing and detector occupancy conditions are met, the system will recognize that its response to the input data may not be appropriate, and it will revert to an appropriate, user-specified fallback mode, 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 adaptive system failure alarms will be automatically and immediately transmitted to maintenance and operations staff for appropriate attention.	2.1.3.0-2 13.3-1 13.3-1.0-1 2.1.3.0-1 2.1.1.0-1.0-1 2.1.1.0-1.0-2 13.3-1.0-2 13.3-2

City of Chattanooga ASCT SEA Documents

Concept of Operations Reference	High-Level System Requirements		InSync	Scoot	ACSLite
11.8.3 11.8.4	2.1.1.0-2.0-2	The ASCT shall operate non-adaptively when the number of failed detectors connected to a signal controller exceeds a user-defined value.	YES	YES	YES
11.8.4	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.	YES	YES	NO
11.8.1 11.8.2	2.1.1.0-2.0-4	The ASCT shall operate non-adaptively when a user-defined communications link fails.	*	*	NO
11.5 11.6	2.1.1.0-5	The ASCT shall alter the state of the signal controllers based on current measured traffic conditions. (The alteration may be made by adjusting parameters or by directly controlling the state of signal controllers.)	YES	YES	YES
8.2.1 8.2.2 11.5 11.6	2.1.1.0-5.0-1	When current measured traffic conditions exceed user-specified thresholds, the ASCT shall alter the state of the signal controllers, maximizing the throughput of the coordinated route.	*	YES	NO
8.2.1 8.2.2 11.5 11.6	2.1.1.0-5.0-2	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.	*	YES	NO
8.2.1 8.2.2 11.5 11.6	2.1.1.0-5.0-3	When current measured traffic conditions meet user-specified criteria, the ASCT shall alter the state of signal controllers providing equitable distribution of green times.	YES	YES	YES
8.2.1 8.2.2 11.5 11.6	2.1.1.0-5.0-4	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.	YES	YES	YES
11.1 11.2	2.1.1.0-8	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.)	YES	YES	YES