CITY OF KIRKLAND	**PROJECT #**	**TR 0119 000**
CAPITAL IMPROVEMENT PROGRAM	**DEPARTMENT**	Public Works
2017 TO 2022	**DEPARTMENT CONTACT**	Dave Snider

PROJECT TITLE	KIRKLAND CITYWIDE ITS STUDY		
PROJECT LOCATION	City-wide	**PROJECT START**	**PROJECT STATUS**
		2017	Existing Project

DESCRIPTION/JUSTIFICATION

A study to revise the current Intelligent Transportation System (ITS) plan and to develop a direction for the ITS program based on the principles in the Transportation Master Plan.

REASON FOR MODIFICATION (WHERE APPLICABLE)

POLICY BASIS	**METHOD OF FINANCING (%)**		
Transportation Master Plan	Current Revenue		47 %
Intelligent Transportation Plan	Reserve	($40,000)	53 %
COUNCIL GOALS	Grants		0 %
Balanced Transportation	Other Sources		0 %
	Debt		0 %
Environment	Unfunded		0 %

CAPITAL COSTS	Prior Year(s)	2017	2018	2019	2020	2021	2022	**2017-2022 TOTAL**	Future Year(s)	**Total Project**
Planning/Design/ Engineering	0	45,000	0	0	0	0	0	45,000	0	45,000
In-House Professional Svcs.	0	30,000	0	0	0	0	0	30,000	0	30,000
Land Acquisition	0	0	0	0	0	0	0	0	0	0
Construction	0	0	0	0	0	0	0	0	0	0
Comp. Hardware/ Software	0	0	0	0	0	0	0	0	0	0
Equipment	0	0	0	0	0	0	0	0	0	0
Other Services	0	0	0	0	0	0	0	0	0	0
Total	0	75,000	0	0	0	0	0	75,000	0	75,000
NEW MAINT. AND OPER.	0	0	0	0	0	0	0	0	0	0
NEW FTE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

CITY OF KIRKLAND
CAPITAL IMPROVEMENT PROGRAM
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CRITERIA	PROJECT IMPACTS (RESPOND TO ALL SECTIONS WHICH APPLY)
Amount of public disruption and inconvenience caused	*None - a Study only.*
Community economic impacts	*This project will allow the City to improve the transportation level of service and reduce intersection congestion.*
Health and safety, environmental, aesthetic, or social effects	*Will encourage means of transportation which will reduce regional emissions.*
Responds to an urgent need or opportunity	*The project ranks high in the City's overall transportation needs as an encouragement for non-single occupancy vehicles in the City's transportation system.*
Feasibility, including public support and project readiness	*The project is technically feasible and is consistent with goals of the community as outlined in the transportation element of the City's Comprehensive Plan.*
Conforms to legal or contractual obligations	*N/A*
Responds to state and/or federal mandate	*The Growth Management Act requires that communities develop concurrent development of infrastructure to meet growth; this project allows that concurrency for the transportation network.*
Benefits to other capital projects	*Completing network system will allow for remote monitoring and communication of signal systems.*
Implications of deferring the project	*Delays completion of the Transportation Network.*
CONFORMANCE WITH ADOPTED COMPREHENSIVE PLAN	Name of Neighborhood(s) in which located: *City-wide* Is there a specific reference to this project or land use in the immediate vicinity? *No* How does the project conform to such references? Attachment ☐ (Specify)
LEVEL OF SERVICE IMPACT	☐ Project provides no new capacity (repair, replacement or renovation). ☐ Project provides new capacity. Amount of new capacity provided: ☑ Project assists in meeting/maintaining adopted level of service. ☐ Project required to meet concurrency standards.

# Scope of Work

Introduction and Purpose

The City of Kirkland seeks to update their existing June 2008 ITS Strategic Plan to guide the future deployment and operations of ITS in Kirkland. The plan update will address not only physical elements, but policies, procedures and operations and maintenance needs to ensure the City derives the most value out of their ITS investments.

Scope of Work Overview

The work will build upon and update the June 2008 ITS Strategic Plan for field infrastructure and communications network plan elements. Key updates will include:

- Addition of area annexed from King County to City of Kirkland
- Update of field elements due to completion of ITS Phases I and II projects, and other work.
- Update of communications network to reflect status. In addition, redundancy, reliability, and communications to all ITS devices will be addressed.
- Addition of Concept of Operations descriptions for key ITS corridors, to include multimodal needs. The Concepts of Operations will establish the basis for future technology selections.
- Addition of staffing needs, focused on operations and maintenance of ITS.
- Addition of information on areas of key interest to prepare the City for future technologies.

The proposed approach to the scope of work is provided in the Figure below, and is structured in four major steps, each with three main tasks.
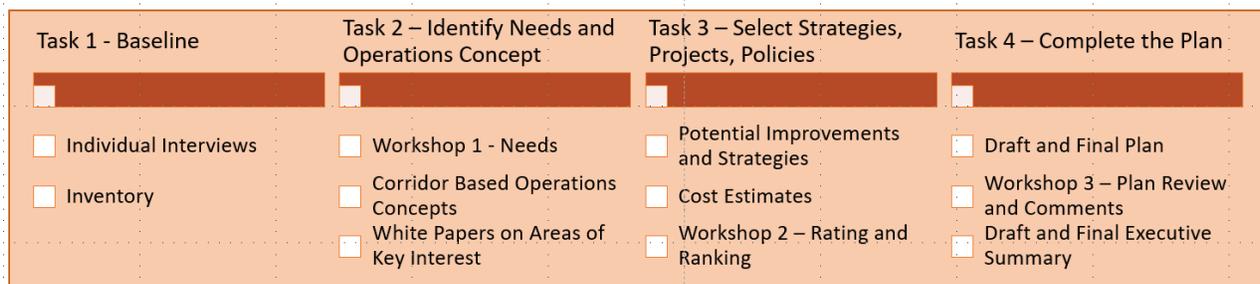
Task 1 - Baseline

The purpose of the Baseline Task is to gather information to support the overall project with a focus on needs and operations concepts. The results of the baseline step will be used to conduct the Needs Workshop in Task 2.

Task 1.1 – In-Person Interviews

The CONSULTANT will perform six (6) in-person, one-hour (or less) interviews. The interviews will be with:

- Joel Pfundt, City of Kirkland Director of Public Works
- City of Kirkland Fire Department Staff, including staff with responsibility for Emergency Vehicle Preemption systems
- City of Kirkland Traffic/ITS Operations Staff
- City of Kirkland ITS Maintenance Staff
- City of Kirkland Parking Management Staff (note that the consultant parking systems expert will join by phone)
- City of Kirkland Information Technology Department Staff

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Information gathered will focus on needs and goals of an ITS program, with more specific questions directed to the ITS staff regarding reliability, sustainability, and effectiveness of the ITS systems in place. The "key areas of interest" as presented in the project RFQ will also be discussed to better understand the information desired to be provided as part of this project. A pre-interview briefing sheet will be prepared and provided.

As part of the individual interviews, a deeper understanding of the City's information needs with respect to the "areas of key interest" outlined in the RFQ will be developed. The list in the RFQ is categorized into items that will be fully integrated into the Citywide ITS Study, and those that will be the focus of white papers that will be supplied and summarized or otherwise integrated into the Citywide ITS Plan, as provided in the table below. The specific questions the City needs answered on each topic will be clarified during the interview process.

Area of Key Interest Proposed to be Fully Incorporated Into the Citywide ITS Study	Area of Key Interest Proposed to be the Subject of a White Paper Integrated Into the Study
Expansion of ITS to corridors and intersections not included in current system	GPS-based emergency vehicle preemption
ITS enhancement on existing ITS corridors and intersections	Adaptive traffic control system engineering analysis
ITS operation and maintenance management	Advanced technologies, including potential steps to be taken in order to accommodate autonomous vehicles
Automated traffic signal performance and arterial performance measures	Data management including collection, analysis storage, and dissemination – focused on ITS applications
Evaluate ITS communication infrastructure, and identify improvements to increase reliability and provide redundant paths	ITS parking management options for areas where the City currently manages on-street and off-street parking
Evaluate system server requirements, and identify improvements to increase performance and limit down time	Explore links to GIS and Lucity (asset management software)

To clarify this proposed approach, the example of "adaptive traffic control system engineering analysis" will be used. Through the interview process, the specific aspects of adaptive control systems that the city wishes to have additional information provided will be discovered. A white paper will be prepared addressing those questions. Then, if appropriate and selected by the City, adaptive traffic signal control will be incorporated into the Citywide ITS Plan.

Task 1.1 Assumptions
- City will schedule the interviews, and provide meeting space.
- City project manager will attend all interviews.

Task 1.1 Deliverables
- Pre-interview briefing sheet.
- Areas of key interest summary topic points memo.

Task 1.2 - Inventory

An inventory to provide sufficient understanding of the current state of ITS in the City to prepare an ITS Plan will be done. The inventory will include three elements:

1. Infrastructure. Field (including field communications) and center (software systems) will be inventoried, with City support.
2. Staff. The inventory will include City-supplied information on City ITS staffing including positions, duties, and number of staff.

3. Policies and Procedures. City to provide any existing relevant policies and procedures.

The in-person interviews will support the inventory phase, which will also gather information to understand current and potential future operations (e.g. incident "hot spots", congestion indicators, citizen concerns).

Task 1.2 Assumptions

*   City will supply marked-up map showing location of ITS communications network, including media (copper, fiber, wireless), and number of pairs or strands, and communications hubs, network switch types and locations. City will also provide information on network topology and media layers in use.
*   City will supply summary inventory of existing traffic signal controllers and cabinets, CCTV cameras, detection types and locations, and other ITS field assets.
*   City will supply a list of existing ITS software systems, including relevant version information.
*   City will supply staffing inventory information.
*   City will supply relevant existing policies and procedures.

Task 1.2 Deliverables

*   Map of existing ITS field infrastructure.

Task 2 – Identify Needs and Concepts of Operations

At the completion of Task 2, the City's overall ITS needs and an understanding of how they would like to operate their arterials will be clarified. In addition, the information in the white papers will be presented, and integrated into the overall vision for ITS.

Task 2.1 - Workshop 1: Needs

A core set of stakeholders with primary responsibility for ITS will be asked to participate in a two-hour workshop intended to create a core set of needs that will drive the Citywide ITS Plan. During this workshop, input from the individual interviews, the inventory, and information that will be captured in the white papers, will be used to support identification of the ITS needs A preliminary set of Concepts of Operations will be drafted and presented at the Workshop for discussion and development This will provide input to the Concept of Operations. A briefing sheet will be developed to supply to those invited in advance.

Task 2.1 Assumptions

*   City will support scheduling the workshop and provide meeting space and overhead projector.

Task 2.2 Deliverables

*   Pre-workshop briefing sheet.
*   Workshop PowerPoint presentation and workshop materials.
*   Workshop summary notes in memo format.

Task 2.2 - Corridor-Based Concept of Operations

After the workshop, Concepts of Operations for each corridor of interest in the Citywide ITS study will be drafted. An Arterial Concept of Operations is a plain-English description of how a corridor should operate including:

–   Modal needs and priorities
–   How the corridor operates under different scenarios (peak periods, weekends, special events, incidents)
–   How cross-street traffic is managed

There are many ways to define corridor operations. On highly congested corridors with significant fluctuations in volumes, the Concept of Operations could describe a goal to maintain travel time reliability, for example.

Comments to the Concepts of Operations will be incorporated into the Draft ITS Plan.

Task 2.1 Assumptions
- None.

Task 2.2 Deliverables
- Draft Concepts of Operations for City review and input.

Task 2.3 - White Papers

After the workshop, six (6) White Papers will be prepared for City review and comment. The following are the White Paper topics:

- GPS-based emergency vehicle preemption
- Adaptive traffic control systems
- Advanced technologies, focused on City readiness for autonomous vehicles
- Data management for ITS including collection, analysis, storage, and dissemination
- ITS parking management options for areas where the City currently manages on-street and off-street parking
- Links between GIS and Lucity (asset management software), focused on ITS needs

White papers will be from 2 to 3 pages in length, and provide information to support the City in future decision-making on each topic. White papers will be supplied as an appendix to the ITS Plan.

Task 2.3 Assumptions
- None.

Task 2.3 Deliverables
- Draft White Papers (6)
- Final White Papers (6)

Task 3 – Select Strategies, Projects, Policies

Task 3.1 - Potential Improvements and Strategies

SCT will develop a list of potential improvements and strategies to meet the needs and Concepts of Operations previously developed. These will include field implementation projects, systems, communications network projects, policies, procedures, and staffing strategies.

Task 3.1 Assumptions
- None.

Task 3.1 Deliverables
- Draft List of Improvements and Strategies for City review prior to Workshop 2.

Task 3.2 - Cost Estimates

Cost estimates for the full set of potential improvements and strategies, excluding policy initiatives, will be developed. The costs will incorporate contingencies for being developed at a "zero percent" design phase.

Task 3.2 Assumptions
- None.

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Task 3.2 Deliverables
- Cost Estimates will be provided as part of Task 3.3 Workshop 2 materials.

Task 3.3 - Workshop 2: Rating and Ranking

A two-hour workshop will be held to present the full list of potential improvements and strategies and cost estimates for the stakeholders to evaluated and prioritize. Strategies will be discussed first, and will include foundational approaches such as those related to redundancy and resiliency, or complete CCTV coverage of certain types of facilities.

The approach to project prioritization will be developed and presented for potential modification at the workshop. The workshop will include a presentation of various selection criteria, and a one-step or multi-step approach to rating and ranking. One key question for discussion and resolution will be how to balance costs with meeting identified needs. For example, some projects may be ranked as high priority despite high costs – such as one that would complete a communications network link, if a top-ranked strategy is to do so.

The workshop will also cover recommendations for policies, procedures, and staffing, to gather input before developing the Draft ITS Plan.

The results of the workshop will be summarized in the Draft ITS Plan, delivered in Task 4.

Task 3.3 Assumptions
- City will support scheduling the workshop and provide meeting space and overhead projector.

Task 3.3 Deliverables
- Pre-workshop briefing sheet.
- Workshop PowerPoint presentation and workshop materials.
- The results of the workshop will be summarized in the Draft ITS Plan, delivered in Task 4.

Task 4 – Complete the Plan

Task 4.1 - Draft Citywide ITS Plan

The SCT Team will prepare a draft of the Citywide ITS Plan for stakeholder review and comment. A final document will be provided after Workshop 3.

Task 4.1 Assumptions
- City will review Draft Citywide ITS Plan within 3 weeks of receipt.

Task 4.1 Deliverables
- Draft Citywide ITS Plan

Task 4.2 - Workshop 3: Plan Review and Comments

Workshop 3 will be a one-hour meeting. A minimum of two weeks prior to Workshop 3, the stakeholder comments will be gathered. Responses and proposed revisions to the draft plan will be prepared for discussion with the stakeholder group in a workshop environment. The Workshop will also be used to get input on the Executive Summary, with an outline being readied for the Workshop.

Task 4.2 Assumptions
- City to provide comments 2 weeks in advance of Workshop 3, and 3 weeks after City receipt of the Draft ITS Plan.
- City will support scheduling the workshop and provide meeting space and overhead projector.

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Task 4.2 Deliverables

- Memo will be delivered if any comments are not incorporated, outlining reasoning behind exceptions.
- Workshop materials, including Executive Summary outline.

Task 4.3 - Final Citywide ITS Plan with Executive Summary

The SCT Team will prepare a draft of the Executive Summary for City review and comment. The Executive Summary will be designed to communicate the Citywide ITS Plan to the general public and decisionmakers, and be no more than 2 pages in length. A final Executive Summary will be prepared, incorporating the comments, and will be delivered as part of the Final Citywide ITS Plan.

Task 3.2 Assumptions

- None.

Task 3.2 Deliverables

- Final Citywide ITS Plan including Executive Summary in electronic format, and two hard copies (one ready for the copier, one bound).

Schedule

The work is planned to be completed over a nine-month period, as shown below. The schedule includes up to an additional two months of "float" to accommodate City staff schedules and availability.

City of Kirkland Citywide ITS Study - 9 Month Schedule											
	2018				2019						
Month	S	O	N	D	J	F	M	S	M	J	J
NTP/Kick off Meeting - End of July	♦										
Step 1 - Baseline											
Individual Interviews		■	■								
Inventory		■	■								
Step 2 - Identify Needs and Operations Concept											
Workshop 1 - Needs				♦							
Corridor Based Operations Concepts		■	■	■							
White Papers on Areas of Key Interest			■	■	■						
Step 3 - Select Strategies, Projects, Policies											
Potential Improvements and Strategies				■	■	■					
Cost Estimates					■	■	■				
Workshop 2 - Rating and Ranking						♦					
Step 4 - Complete the Plan											
Draft and Final Plan							■	■	■		
Workshop 3 - Plan Review and Comments								♦			
Draft and Final Executive Summary								■	■		

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January 8, 2019

Memorandum

To: Laura Drake, City of Kirkland
From: Erin Ehlinger
RE: Deliverable 1 (revised) for Citywide ITS Plan Update
        White paper content summary post-interviews

This memo provides descriptions of the proposed approach to the content of the white papers to be delivered as part of the Citywide ITS Plan Update. The white paper content suggested below was developed based on the information gathered during the interview phase of the project.

1. GPS-based Emergency Vehicle Preemption (EVPE)

   Based on the interview with Kirkland Fire Department (KFD) Deputy Chief Van Valkenberg, and confirmation with Chuck Morrison, the current Opticom system is a locally-based (intersection -based) EVPE system, with no central platform managing the Opticom. An additional interview with Kirkland Police Department (KPD) Lieutenant Rob Saloum was conducted to gather KPD's input on EVPE needs.

   DC Van Valkenberg expressed interest in the following benefits for GPS-based EVPE:

   - The ability to gather and analyze response time data including traffic signal delay.
   - The capability to use the data to improve response times. The City of Kirkland Fire Department is currently rated a 4 (on a scale of 1 to 10 with 1 being the highest rating) by the Washington Surveying and Rating Bureau (WSRB). WSRB evaluates all Washington communities for their fire protection and suppression capabilities. Using a schedule approved by the Washington State Office of the Insurance Commissioner (OIC), they assign each community a Protection Class rating. One element of the rating is response time. This rating is considered by insurance underwriters when establishing insurance cost. In other words, the better the rating, the lower the insurance cost for homeowner's insurance to the public at large. Response times have been increasing over the years in Kirkland.
     Additionally, the National Fire Protection Association (NFPA) has a voluntary fire department

certification program. Participating in this program enables fire department to improve their outcomes, and response time is one measure in the certification process. NFPA certifications help fire departments provide their highest possible service level to the communities they serve.

- Enabling corridor preemption as intersections downstream. Current EVPE operations at no more than one downstream signal (and only if enabled). This approach should further improve response times.
- GPS-based EVPE systems are not limited to a clear line-of-sight path for wireless communications between the intersection and approaching vehicles. They accommodate curved and hilly approaches and can preempt around corners. Again, this capability can improve response times.
- Specific needs at fire stations, including the upcoming new station at 100th/132nd will require approaches to ensure rigs can leave the station quickly. GPS-based EVPE can provide that capability.

Lt. Saloum noted the following:

- All KPD marked vehicles and motorcycles (but not unmarked vehicles) are equipped with Opticom emitters.
- It is used for all responses with lights and sirens, as it comes on automatically with the lights and sirens. Officers can turn it off if they wish.
- Officers follow the policy to slow at intersections no matter what.
- There are sometimes issues with officers arriving at the signal prior to the pre-empt activation.
- KPD would not want to generate any reports from a central system if one is in place.

Chuck Morrison provided the following input:

Transportation is interested in using GPS-based EVPE system to assist in:

- Gathering and analyzing preempt usage at intersections, and throughout corridors
- Evaluating the effectiveness of the preempt operation, and developing recovery strategies for improving traffic flow.
- Improve safety by eventually eliminating optical detection vulnerabilities to non-permitted users
- Until optical detection is eliminated, programming to restrict preemption to permitted vehicles should be implemented to reduce undesirable preempts.
- Developing multiple intersection and non-linear routing response strategies.

Linked preempt routing of multiple intersections is dependent on the central system communications network. Reliability of communications to the central system must be considered, and plans to improve the robustness of the communication network need to be developed as necessary.

It is also noted that transit pre-emption should also be considered in EVPE operations, as the same equipment can be (and is) used.

The white paper will discuss other GPS-based EVPE systems, and assess if the GTT system is the best choice for City of Kirkland. In addition, the white paper will discuss the potential benefits of a GPS-based system as well as central control. A path to deployment of a GPS-based EVPE system will be provided.

2. Adaptive traffic control system engineering analysis.

   Adaptive traffic control requires a highly reliable and resilient communications network. In addition, they require operator access to the central operations platform to make on-demand real-time adjustments to the signal operations parameters if, for example, detection is malfunctioning, or other system components are not responding as needed. The interviews have revealed that the City's telecommunications network used for traffic signal operations is likely not sufficiently reliable nor resilient to support adaptive control. In addition, there are organizational issues with respect to systems/server access and management that must be resolved before implementing adaptive control.

   The white paper will outline the steps and process needed to be followed to move forward with adaptive control, and will include a description of the traffic conditions that benefit from adaptive control.

3. Autonomous vehicles

   This white paper will address potential policies and investments for the City to consider in preparation for autonomous and/or connected vehicles. It will consider the current state of technologies related to autonomous and/or connected vehicles. A range of policy directions will be provided, and descriptions of the implications of each policy direction will be described. The infrastructure needs of connected vehicles, with respect to City investment, will also be addressed in the context of the policy direction.

4. Technologies to support parking management

   The interviews revealed that the City is currently managing parking in a non-dynamic manner, and the defacto policy is that the City provides parking as a service to the community at little to no cost. There are no existing significant parking demand issues, including on- and off-street. Nor are there current issue with TNCs. This white paper will address the policy decisions the City should consider. Each policy direction will indicate how that policy will establish a path for implementing technologies to support parking management. The focus will be on near-term practical implementations, with a section included

that will touch on more advanced policy and technology approaches. In addition, links to case studies will be provided.

5. Explore links to GIS and Lucity

Based on the interview with Brian Dalseg of Signals Maintenance, it is suggested that this topic not be addressed. The Lucity system is GIS-based. There are various approaches to tracking traffic signal/ITS assets. The amount of effort required to modify the current set-up to incorporate a full set of cabinet equipment details cannot be supported by staff. Brian was satisfied with the systems current configuration. If desired, investment in enhancing the current data set in Lucity or in another asset database (even an Excel spreadsheet) can be included as a project option in the plan with a cost assigned, and can be rated and ranked alongside other investments.

6. Data management for ITS including collection, analysis, storage, and dissemination

Based on the interviews, and the City's soon to be developed approach to cloud storage, it is suggested that this topic be refocused on performance measures, data needed to provide performance measures and traveler information, and how that data can be gathered, stored and managed. This work is suggested to be fully incorporated into the Strategic Plan, rather than supplied as a separate white paper. The performance measures could be aligned with the rating/ranking process we will follow for the implementation plan. Specific needs that can be addressed include:

Automated Performance Measures

The white paper will discuss the data management aspects of this function.

- Travel time/origin destination detection, as well as additional remote detection located a significant distance from our signalized intersections. These may work best using cloud/cellular based technology depending on connectivity.
- A software solution that will store, categorize, and display detector and performance measure data will need integrate with our existing equipment.

Traveler Information

- Focus on the data management aspect of this function. Assess the approach and investment to distributing still images or video of traffic cameras on the City's website, as well as other traveler information such as travel times, road closures, etc. Evaluate what to display, as well as how relevant it is when so much detailed traveler information is now available from third parties. Address approach to providing traveler information – including the City providing this information themselves, or via a third-party supplier, including camera images.