City of San Antonio
INSPECTOR ROUTE OPTIMIZATION

RFCSP NO. 6100002909

Version 1.2 – 2014-03-17

Statement of Work

Document Control Log

Date	Contributor	Description	Ver
2/6	APEX	1st Draft	0.1
2/6	Barrera	Distributed to team for review	0.1
2/10	Barrera	Redlined document w/track changes / distributed to team **Requests**: 1. Pelkmann – Architecture Diagram Template for APEX 2. Ostlund – Review & update Hansen Integration Specifications Document	0.2
2/10	Moore	Feedback based on Requirements Traceability matrix embedded as comments	0.3
2/10	Hettrick, Harris	Reference SOW Review Sec 2.1.1 – Updated COSA Resources	0.3
2/10	Ostlund	2.3.1: Flat File as opposed to API Comments embedded in document below	0.4
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2/19	APEX	Reviewed SOW comments embedded as track changes	0.4
2/19	Barrera, APEX	Discussion – SOW comments embedded as track changes Distributed to SOW Review Team via link in SOW Development meetings	0.5
2/24	Business & Tech Review	Comments and updates embedded in document	0.6
2/25	Barrera	Redlined SOW sent to APEX and distributed to Review Team	0.6
2/25	Moore	Business Requirements Traceability matrix	
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3/3	Apex	Reviewed SOW comments embedded as track changes	0.8.1
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3/10	Barrera	Applied some formatting changes to SDLC section and distributed to Review Team for feedback	0.9
3/12	COSA Meeting	SOW & Supportive Documents Review (Reference Meeting Minutes)	0.9
3/13	Barrera	SOW Updates with Track Changes Distributed to Review Team for final review Pending Hansen Integration meeting Friday, March 15 – results to update Hansen Integration	1.0
3/14	Barrera / Estrada	Changed UAD's to UAP's (Prototype vs Demo) Added Appendix B & E, Glossary	1.1
3/17	Barrera	Accepted all tracked changes "DRAFT" Watermark removed	1.2
3/17	Ostlund, APEX, Barrera, Bustos	Updated Appendix D – Hansen Integration Specifications	1.2
3/17	Barrera	FINAL SOW distributed to Review Team & Legal for Contract inclusion	1.2

Review Team

COSA: Gilbert Barrera, Caesar Bustos, Michael Constantino, Jim Flood, Kevin Goodwin, Marshall Harris, James Hettrick, Kevin Holmes, Terry Kannawin, Jonathan Kaplan, Caryn Moore, Bart Mulcahy, Dee Ostlund, Klaus Pelkmann, Patrick Poloskey, Michael Shannon

APEX: Sam Fayez, Ahmed El-Nashar, Brittany Villalard

2/24 Business Review – Gilbert Barrera, Caryn Moore, James Flood, Patrick Poloskey, Michael Constantino

2/24 Technical Review – Kevin Holmes, Kevin Goodwin, Caryn Moore, Gilbert Barrera

Contents

1 Definitions

Productivity Apex, Inc. (PAI) is uniquely positioned to undertake and successfully complete this project. PAI's core team possesses a large base of experience and knowledge in the theory and practice of the products and services requested, and has improved our clients operations and performance. Also, we contributed to the body of knowledge through publications and conference presentations. In particular, PAI team has extensive experience in all the areas required:

- Project Management
- Industrial Engineering
- Transportation
- Simulation Modeling and Analysis
- Operations Research
- Process and Operations Optimization
- Business Process Reengineering
- Data Mining and Artificial Intelligence
- Software Development
    - Desktop Applications
    - Web-based Applications
    - Mobile device Application

Founded in 2001, PAI is a United States technical research, development, and consulting firm dedicated to increasing productivity and efficiency. Our team offers a wide range of technical and consulting services in systems simulation modeling, analysis, optimization, and data mining. PAI's core team possesses a large base of knowledge in the theory and practice of each of our services, and has collectively contributed to the body of knowledge through publications and conference presentations. We use a disciplined and documented methodology that creates superior products, sound analysis, and customized solutions. We emphasize collaboration with our clients, placing a high premium on superior solutions, services, and deliverables. We are able to deliver a consistently high level of performance because our dedicated team of scientists, engineers, and business professionals adhere to a rigorous process of scientific discipline in our applied research and development efforts in addition to our high levels of service and customer satisfaction.

PAI has successfully completed numerous projects in modeling, optimization, simulation, and analysis for both public and private sector clients over a wide range of domains. Whether it is modeling space vehicle hardware processing flows, policies and procedures, optimizing freight flow, passenger flow through an airport terminal, patient flow through a hospital, a food processing line, product flow within a manufacturing plant, or guest experience through a theme park, our clients use our simulation modeling, analysis, and optimization expertise to improve their performance and level of service. Reference clients in this domain include NASA, Department of Defense, Department of Transportation, U.S. Federal Highway Administration, U.S. Federal Motor Carrier Safety Administration, Lockheed Martin Corporation, Greater Orlando Aviation Authority, The Boeing Company, Walt Disney Company, Universal Studios, and Marriott Vacation Club International.

We use a structured approach and project management best practices in all of our efforts to achieve project objectives. Our initial focus is to quickly gain a thorough understanding of our clients' domain, processes, organizational structure, and policies and procedures. During this phase, the team captures the current system processes, i.e. the "As-Is", through customer interviews, meetings, observation, document reviews, databases queries, etc. The result of this initial step is documented in a process and workflow map. We also capture comments and concerns from the customer's team regarding their processes and tasks. Our team then collects pertinent data and performs analysis of the current state using a suite of analysis techniques that is tailored to fit the system under study and the objectives of the project. Examples of these techniques include, but are not limited to, process modeling and simulation, lean principles, best practices comparisons and gap analysis, mathematical modeling, data mining, and statistical data analysis. These analysis methodologies enable our team to identify inefficiencies and their root causes and to propose opportunities for optimization through workflow modifications and reengineered processes that will lead to improved performance.

2 Project Management:

2.1 Software Development Life Cycle (SDLC) - Requirements and Responsibilities

The following identifies the platforms and responsibilities for the software development life cycle. This SDLC must be applied to each User Acceptance Prototype (UAP) and User Acceptance Test (UAT) defined in Section 2.2.2 Milestones.

Project Team Roles:

ADL: COSA IT GIS Application Lead; this includes Application Development as it applies to Hansen Integration
BA: COSA IT PMO Business Analyst
PM: COSA IT PMO Project Manager
SME: COSA DSD Business Subject Matter expert

1. Requirements Analysis

1.1. Vendor responsible to create, review and finalize requirements documentation with SME's
1.1.1. Deliverables:
1.1.1.1. Detail Business Requirements Document

1.2. BA responsible to review requirements and secure approvals
1.2.1. Deliverables:
1.2.1.1. Signed Detail Business Requirements Document in Project Library

2. Application Design Documentation

2.1. Vendor Responsible to create application design specifications
2.1.1. Application Development Specifications Documents
- User Interface – Visual & Content Design
- Functions
- Security/Access Controls
- Navigation

- Help Aides
- Data entry integrity controls (required, optional, dependencies, values control, look up validation, conditional entries, etc)

2.1.2. Application Architecture Diagram including systems requirements

2.1.3. Infrastructure Architecture Diagram in collaboration with IT Architect.
- As needed to account for any firewall rules and/or additional systems architecture components

2.1.4. System Security Plan (as applicable)
2.1.5. User Roles & Responsibilities

2.2. ADL responsible to review and secure IT approvals. Deliverable: Signed Detail Application Development Specifications Document in Project Library

3. Development (Development Environment)

3.1. Vendor responsible to develop software code.
3.1.1. Vendor responsible to include documentation of functions embedded in software code as agreed upon between vendor and ADL.
3.1.2. Deliverables - Signed Detail Application Development Specifications Document

3.2. Vendor responsible to document release deliverables and script for porting release to the QA environment.

3.3. Vendor responsible to develop systems/integration test scripts according to agreed upon standards between vendor and ADL.
3.3.1. Vendor responsible to incorporate previous release test scripts to assure quality regression testing.

3.4. ADL to review and secure IT approval for deliverables in items 3.1, 3.2 & 3.3

3.5. Vendor responsible to develop the following deliverables:
3.5.1. User Guide
3.5.2. Admin Guide

3.6. SME & ADL responsible for 3.5 deliverables review & Approval

4. Systems/Integration Testing (QA Environment)

4.1. ADL responsible to execute the script to port release deliverables into the QA environment.

4.2. Vendor responsible to execute systems/integration test and report results to ADL/PM/BA.
4.2.1. Test results report must include list of defects discovered during testing. Agreed upon Excel table.
4.2.2. Vendor is responsible to maintain defects list, status updates

4.3. **MILESTONE** - ADL responsible for Go/No-Go Decision - QA readiness for UAT
4.3.1. **GO Decision** – Proceed with Step 5 “QA-UAT”

4.3.2. **NO-GO** – Repeat Steps 3 – 4

5. User Acceptance Prototype / Testing (QA Environment)

5.1. Vendor responsible to create UAP Affidavit / UAT scripts in collaboration with business SME's & BA
- 5.1.1. Requirements Traceability Matrix (RTM)
- 5.1.2. Regression Testing
- 5.1.3. UAP Affidavit
- 5.1.4. UAT Script (reference Appendix B for example of test script)

5.2. Vendor responsible to develop new release training material and conduct training for business SME's.
- 5.2.1. SME responsible to review/approve training content and schedule

5.3. BA responsible to review UAP affidavit /UAT scripts, RTM and secure approvals

5.4. BA responsible to schedule and conduct UAT, record results and publish defects to Project Team.
- 5.4.1. SME's responsible to execute UAP Affidavit / UAT scripts

5.5. Vendor responsible to review defects reported from UAT and produce resolution report.

5.6. Milestone – SME's responsible for Go/No-Go Decision – PROD readiness
- 5.6.1. BA conducts team review meeting immediately after UAT.
  - 5.6.1.1. Review recorded Defects
    - 5.6.1.1.1. Categorize & Prioritize
    - 5.6.1.1.2. Determine if any defects can be pushed to next release
  - 5.6.1.2. Secure Formal Business Acceptance
    - 5.6.1.2.1. **GO Decision** – Proceed with Step 5.7 "Training" & 6 "Production Deployment"
    - 5.6.1.2.2. **NO-GO** – Repeat Steps 3 – 5

5.7. Vendor responsible to conduct training for SME's & Systems Admin
- 5.7.1. BA responsible to reserve training facility, required equipment and schedule training
- 5.7.2. SME responsible for providing mobile equipment necessary for training

6. Production Deployment (PROD Environment)

6.1. Vendor responsible to develop production deployment plan.

6.2. Vendor responsible to document deliverables and script for porting release to the production environment.

6.3. Vendor responsible to document back out plan.

6.4. Vendor responsible to create Production Validation Scenarios
- 6.4.1. To include end-to-end application testing

6.5. ADL responsible to review and secure approval for deliverables 6.1 thru 6.3

6.6. BA responsible to review and secure approval for deliverable 6.4

6.7. ADL responsible to port release to Production environment using release deliverables/script documentation

6.7.1. ADL validates with SME that training (Step 5.7) has been completed and that no issues were discovered prior to executing the Production deployment.
6.7.2. ADL responsible to track gaps on Production deployment scripts and update documentation.

6.8. BA responsible to schedule and conduct Production Validation Scenarios, record results and publish defects to Project Team.
6.8.1. SME's responsible to execute Production Validation Script

6.9. Vendor responsible to review defects reported from Production Validation Scenarios and produce resolution report.

6.10. Milestone – SME's responsible for Go/No-Go Decision
6.10.1. BA conducts team review meeting immediately after Production Validation Scenarios.
6.10.1.1. Review recorded Defects
6.10.1.1.1. Categorize & Prioritize
6.10.1.1.2. Determine if any defects can be pushed to next release

6.10.1.2. Secure Formal Business Acceptance
6.10.1.2.1. **GO Decision** – Proceed with Step 7 "Warranty Period"
6.10.1.2.2. **NO-GO** – Repeat Steps 3 – 6

7. Warranty Period
7.1. Project team responsible to comply with approved Post-Production SLA

8. Maintenance & Support
8.1. Project Team responsible to comply with approved Maintenance & Support SLA

2.2 Project Management Plan

The project management plan presented herein by PAI provides a broad view of the tasks that will be performed during the execution of the project. However, once the project starts, our team will conduct a detailed review and update of the plan, in order to execute, monitor, control, and close the project. The objective of the project management plan is to document the steps necessary to integrate and coordinate all subsidiary plans in one comprehensive document, serving as the primary source of data and information about the project.

The Work Breakdown Structure (WBS) presented in this proposal overviews the project effort and deliverables in smaller, more manageable, tasks and activities. Prior to starting the project APEX and COSA will collaborate on WBS and schedule to assure resource allocations are solidified to execute the plan. Once the project starts, the proposed WBS will be updated and reviewed together with the project schedule, although dates and period of performance are not expected to change drastically.

Please see Appendix A for detailed project schedule. Upon contract execution, project schedule will be revisited to fine tune sub-deliverables and named resource assignments.

2.2.1 Project Required Resources

The following table presents the team members for this project. References to "TBD by Resource Manager" will be solidified by Council approved contract date.

APEX

Name	Role
Mansooreh Mollaghasemi	Program Manager
Sam Fayez	Project Manager/Senior Industrial Engineer
Ahmed El-Nashar	Operations Research Scientist
Fabio Zavagnini	Operations Research Analyst
Alex Hijab	Lead Software Developer
Bryan Rosander	Software Developer
Brittany Villalard	Technical Outreach & Quality Control

COSA

Name	Role
Kevin Goodwin	Technology Strategy
Gilbert Barrera	Project Manager
Caryn Moore	Business Analyst
Kevin Holmes	GIS Sr. Manager
TBD by Resource Manager	GIS Analyst
Dee Ostlund	Sr. IT Manager, Enterprise Applications
Kelly Hargis	Hansen Technical Specialist
Caesar Bustos	Applications Solutions Supervisor
TBD by Resource Manager	Applications Development Specialist
TBD by Resource Manager	Systems Architect
TBD by Resource Manager	Computing Systems Analyst
TBD by Resource Manager	Network Analyst
TBD by Resource Manager	Database Analyst
TBD by Resource Manager	Customer Service

BUSINESS

Name	Role
Patrick Poloskey	Field Services Manager
Michael Constantino	Field Services Manager
Kathy Quinones	Communications
James Flood	Business Technology Oversight
Michael Shannon	Product Acceptance Sign-Off
TBD by Resource Manager	UAP/UAT Field Inspector
TBD by Resource Manager	UAP/UAT Field Inspector
TBD by Resource Manager	UAP/UAT Field Inspector
TBD by Resource Manager	UAP/UAT Field Inspector
TBD by Resource Manager	UAP/UAT Field Inspector
TBD by Resource Manager	UAP/UAT Supervisor
TBD by Resource Manager	UAP/UAT Supervisor

2.2.2 Project Milestones

The following table presents the expected milestones for this project, their required resources and the project's percentage of planned completion dates based on Contract Signed Date (CSD).

WBS	Task Name	CSD + weeks	Resource Role -APEX	Resource Role - COSA
2.3	Submit Updated Project Management Plan	2	Project Manager/Senior Industrial Engineer, Operations Research Analyst	Project manager
3.7.3	Deliver Final business process diagram to stakeholders	6	Operations Research Analyst	DSD SME
4.1.5	Deliver approved Analysis Requirements Document to stakeholders	9	Lead Software Developer, Operations Research Analyst	DSD SME; ITSD ADL; ITSD BA
4.2.4	Deliver Final Updated System Architecture to stakeholders	11	Lead Software Developer, Operations Research Analyst	ITSD Architect
5.1.6	Conduct UAP for system Interface Prototype	23	Project Manager/Senior Industrial Engineer, Operations Research Analyst	DSD SME's; ITSD ADL; ITSD BA
5.2.4	Conduct UAP for integrating system interface with the optimization algorithm	31	Project Manager/Senior Industrial Engineer, Operations Research Analyst	DSD SME's; ITSD ADL; ITSD BA
5.3.6	Conduct UAP for Mobile Application Prototype	27	Project Manager/Senior Industrial Engineer, Operations Research Analyst	DSD SME's; ITSD ADL; ITSD BA
6.3.3	Conduct UAT for Final System Application to stakeholders	36	Operations Research Analyst, Lead Software Developer	DSD SME's; ITSD ADL; ITSD BA
6.3.4.1	Train Supervisors and Managers on System capabilities	37	Operations Research Analyst	DSD SME's; ITSD ADL; ITSD BA
6.3.4.2	Train Inspectors on System capabilities	37	Operations Research Analyst	DSD SME's
6.3.4.3	Train System Administrators	37	Lead Software Developer	DSD SME; ITSD ADL
6.4	Deliver Executable for Final Application (integrated with current system) to stakeholders	37	Lead Software Developer	ITSD ADL
6.5	Deliver Source Code of Final Application to stakeholders	37	Lead Software Developer, Software Developer	ITSD ADL
7.2	System Roll-Out	38	Lead Software Developer	DSD SME's; ITSD ADL; ITSD BA

COSA resources to be assigned by contract date
ITSD SME, ITSD ADL resource roles may include 1 to many resources

2.2.3 Project Deliverables

The following table presents the list of deliverables for this project.

WBS	Task Name	CSD + weeks
2.3	Submit Updated Project Management Plan	2
3.7.3	Deliver Final business process diagram to stakeholders	6
4.1.5	Deliver approved Analysis Requirements Document to stakeholders	9
4.2.4	Deliver Final Updated System Architecture to stakeholders	11
5.1.6	Conduct UAP for system Interface Prototype	23
5.2.4	Conduct UAP for integrating system interface with the optimization algorithm	31
5.3.6	Conduct UAP for Mobile Application Prototype	27
6.3.3	Conduct UAT for Final System Application to stakeholders	36
6.3.4.1	Train Supervisors and Managers on System capabilities	37
6.3.4.2	Train Inspectors on System capabilities	37
6.3.4.3	Train System Administrators	37
6.4	Deliver Executable for Final Application (integrated with current system) to stakeholders	37
6.5	Deliver Source Code of Final Application to stakeholders	37
6.6	Deliver Installation Documentation and User Guide to Stakeholders	38

2.2.4 Travel Requirements

Travel will be scheduled according to the client's availability and project requirements. All trips are intended to be scheduled according to the project plan; however, confirmation will be provided no later than two weeks prior to travel. Any travel arrangements or preparations will be conveyed accordingly, if deemed required. All travel expenses are inclusive in proposed project cost submitted in response to RFCSP solicitation.

2.2.4.1 Training

The team will travel to the client's location to provide training and support. The team anticipates providing training to all personnel involved in the use of the proposed system, including managers, supervisors, inspectors, and on-site system and application administrators. Training will be scheduled at times most convenient to the client in order to minimize disruption of regular operational activities. Please refer to Proposed Project Management Plan section for schedule of training events. In order for Apex to complete training sessions successfully, the following requirements are needed.

- Presentation room with large screen with ability to present from HDMI output
- (16) mobile devices (14 for trainees + 2 for instructors)
    - 10 training sessions, each has 7 inspectors + 1 instructors (8 mobile devices)
    - Running 2 parallel sessions at a time
- (5) terminals with internet connection and internet web browser
    - 3 training sessions, each session has 5 supervisors
    - Running one session at a time

2.2.4.2 Client Roll-Out (70 field devices)

The team will travel to the client's location for the installation, deployment and final demonstration of the developed solution. To successfully roll-out the system the Apex team will make sure to:

- Plan with COSA for integrating and deploying the optimization system
- Communicate the deployment plan and changes to the current process to the stakeholders
- Provide appropriate training to inspectors, supervisors, and system administrators.
- Monitor how inspectors, supervisors, and system administrators use the system

The team will deploy the system during the off-hours and will ensure that all installations have been completed properly and all systems are up and running. Once all personnel are trained and prepared to operate the system, the team will coordinate and schedule with DSD supervisors the appropriate date for Roll-Out or Go Live.

The optimization system runs completely independent and it will not require any configuration changes on the City's servers or legacy systems, aside from Hansen integration output. In case of failure to deploy the system, Apex team will remove all installed components required to run the optimization system and any file system partitions that have been allocated for the optimization system.

2.3 Visits & Meetings

The PAI team will conduct a series of meetings and visits with the stakeholders to capture the current processes in regards to the handling of daily inspections. PAI will systematically analyze the full-lifecycle of the inspection process, from the moment of receiving inspection requests, to the assignment of these requests and the planning inspectors' routes, and ending by completing the inspection. A list of visits and meetings that are expected to be held during the course of the project are listed below. In addition to these meetings the project will have bi-weekly re-occurring meetings to review status and track progress.

1. Kick-Off Meeting (Teleconference)
    a. Update project tasks
2. Meeting with city's Key Stakeholders (On-site – 4 days)
    a. Identify key business processes
    b. Review existing technologies
    c. Identify current system(s) integration requirements
3. Review System Requirements (Teleconference)
    a. Review updated system requirements with stakeholders
4. Review System Architecture (Teleconference)
    a. Review updated system architecture with stakeholders
5. UAP for system Interface Design (Teleconference) (WBS 5.1.6)
    a. Demo system interface design wireframe & mockups
    b. Get feedback from stakeholders
6. UAP for Hansen/Route optimization Interface Prototype (Teleconference) (WBS 5.2.4)
    a. Demo of System Interface Prototype to stakeholders
    b. Get feedback from stakeholders
7. UAT for System Interface & Optimization Algorithm Integration (On-site – 3 days) (WBS 5.2.x)
    a. Perform integration testing between system interface and the optimization algorithm to stakeholders
    b. Get feedback from stakeholders
8. UAP for Mobile Application design (Teleconference) (WBS 5.3.x)
    a. Demo the mobile app wireframe & mockups
    b. Get feedback from stakeholders
9. UAP for Mobile Application Prototype (Teleconference) (WBS 5.3.6)
    a. Live demo of Prototype System to stakeholders
    b. Get feedback from stakeholders
10. UAT for Final Application & Users Training (On-site – 5-10 days) (WBS 6.3.3)
    a. Install Developed Application in City of San Antonio Infrastructure (2-3 days)
    b. Perform End-to-End UAT (2-3 days)
    c. Train Supervisors and Managers on System capabilities(2-4 days)
    d. Train Inspectors on System capabilities(2-4 days)
    e. Train System Administrators(2-3 days)

2.4 Assumptions and Requirements

In order to effectively develop and deploy the proposed solution to the city of San Antonio, it is requested by PAI that the following assumptions and requirements be satisfied:

1. The City of San Antonio will provide PAI with Flat File or comparable method to gain access to the daily inspection details in an appropriate format (including all inspection information required to run the proposed tool). Reference Appendix D for Hansen Integration specifications. These specifications provide initial details in integration parameters which will require revisions upon collaboration between APEX and COSA to generate a final technology specification that meets the business needs.
2. Virtualized and physical server environments are both supported by our software solution. Virtualized server environments, running Windows Server operating systems, are recommended due to their ability to easily be scaled both horizontally and vertically, as well as the inherent backup and disaster-recovery protections offered by this technology.
3. All server instances should have at least 8 GB of RAM (16 GB recommended), support multiple CPU cores, and have RAID protected storage.
4. It is recommended that multiple hosts be configured to offer fault-tolerant failover protection in the event of an outage due to hardware / software failure (with each host having both a database server and web server instance).
5. A firewall and load balancer, such as Citrix NetScaler, should be present within the environment.
6. Offsite backups should be utilized for server snapshots / disk images, database backups / transaction logs and /file system backups.
7. Users have to re-run the proposed tool to re-build the solution whenever information is updated in the City's system
8. A customized mobile application will be developed to provide the capabilities of:
    a. Communicating with the inspector
    b. Sending inspection assignments to the inspector
    c. Real-time tracking of inspectors
    d. Facilitating inspector status updates
9. Clarification for the level of integration with the LDAP application protocol is needed.
    a. Will LDAP authentication only be used for managers/administrators to access the tool / web dashboard?
    b. Is Microsoft Active Directory present within the environment, and is it intended to be utilized for authentication?
    c. Are inspectors required to uses LDAP for authentication via their mobile device?
10. Appendix E is an architecture diagram which presents the minimum architecture requirements required for production use of the route optimization application/system deployment.

2.5 Risk Management Plan

PAI will be responsible to update and maintain the project Risk & Issues Registry.

The approach for managing risks for the project will include a methodical process by which the project team identifies, scores, and ranks the various risks. Every effort will be made to proactively identify risks in order to implement a mitigation strategy from the project's onset. The most likely and highest impact risks will be added to the project schedule to ensure that the assigned risk managers take the necessary steps to implement the mitigation response at the appropriate time during the schedule.

Potential risks will be listed and registered, with each risk item being carefully analyzed. The analysis of risk items will result in identifying the impact on projects tasks, schedules, and deliverables. The project team will prioritize each risk item based on anticipated impact on deliverables and/or schedule. A mitigation and response plan will be developed for each potential risk item identified with the objective of minimizing the impact of the risk (if encountered) on the project objectives and outcome. For each risk item the following will be defined in the risk registry:

- Risk Identification
    - Risk ID
    - Risk Category
    - Trigger Point
    - Potential Outcome
    - Raised By
    - Date Raised
    - Source
- Risk Analysis
    - WBS Impacted
    - Impact
    - Probability
    - Matrix Score
- Mitigation Planning
    - Handling Strategy
    - Report to
    - Mitigation Plan
    - Expected Mitigation Outcome
- Risk Monitoring and Control
    - Status
    - Trigger Date
    - Notes

A sample of the risks that were experienced and logged in previous similar projects is presented in the following table:

Risk Identification					Risk Analysis			Response/Mitigation Planning	
Risk ID	Risk Category	Trigger Point	Potential Outcome	Source	Impact	Probability	Matrix Score (Priority)	Handling Strategy	Mitigation Plan
25	User - Input/Commitment	Delay in customer feedback	* Increase in development time * Rework	Formal Risk Review	0.2	0.3	0.06	Transfer	* Contact customer with anticipation and address this concern to avoid it from happening
31	Ext - Subcontractors & Suppliers	Delay in equipment acquisition and installation	* Delay in the schedule	Formal Risk Review	0.1	0.1	0.01	Mitigate	* Schedule installation date with vendor/customer and confirm appointment
36	Tech - Complexity	Incompatibility between math model and data formats	* Affect scope of project * Non-compliance with project objectives	Formal Risk Review	0.2	0.7	0.14	Mitigate	* Find ways to transform available data into compatible data. * Develop algorithm based on available data formats
40	Tech - Complexity	Debugging time takes longer than expected	* Delay in the schedule	Formal Risk Review	0.4	0.3	0.12	Mitigate	* Review project plan and reschedule accordingly.
44	User - Skills	Truck Drivers do not know how to properly operate Navigation Device	* Delay in the Schedule * Innacurate Data	Status Meeting	0.2	0.7	0.14	Mitigate	* Provide further trainning and technical support to Truck Drivers and users of the system
46	User - Input/Commitment	High Turnover on company drivers/owner operators	* Delay in the schedule * Innacurate Data * Potential Reinstallation Issues	Status Meeting	0.4	0.3	0.12	Accept	* Based the results of the test on the number of total drivers available for that particular phase

2.6 Change Management

Any party introducing a variance to contract/SOW constraints must follow the Change Control Process described in the following seven (7) steps and illustrated in Figure 1:

#	Process	Definition	Role
1	Record/Classify	The client initiates change by making a formal request for something to be changed, to which the project team then records and categorizes (e.g., importance, impact, complexity) that request.	COSA
2	Assess	Impact assessment (cost, resource, schedule) and risk analysis is completed, focusing on the risk to both the offeror and to the process, in order to judge who should carry out the change. Everyone with a stake in the change must then meet to determine whether there is a business or technical justification for the change prior to the planning step.	COSA & APEX

3	Approval	Change Order form must be submitted for review/approval by the Project Sponsor	COSA
4	Plan	Program/Project Management will assign the change to the team member(s) with the specific role of carrying out this particular type of change. The team member(s) will then plan the change in detail, in addition to developing a contingency plan in case the change needs to be backed out.	APEX
5	Build/Test	If all stakeholders agree with the plan, the team member(s) will construct the solution, which will then be tested. Team member(s) will then seek approval from management and request a time and date for implementation.	COSA & APEX
6	Implement	All stakeholders must agree to a time, date and cost of implementation. A post-implementation review, which would take place during a separate stakeholder meeting, will typically follow the implementation of the change.	COSA & APEX
7	Close/Gain Acceptance	When the client agrees that the change was implemented correctly, the change can be closed.	COSA

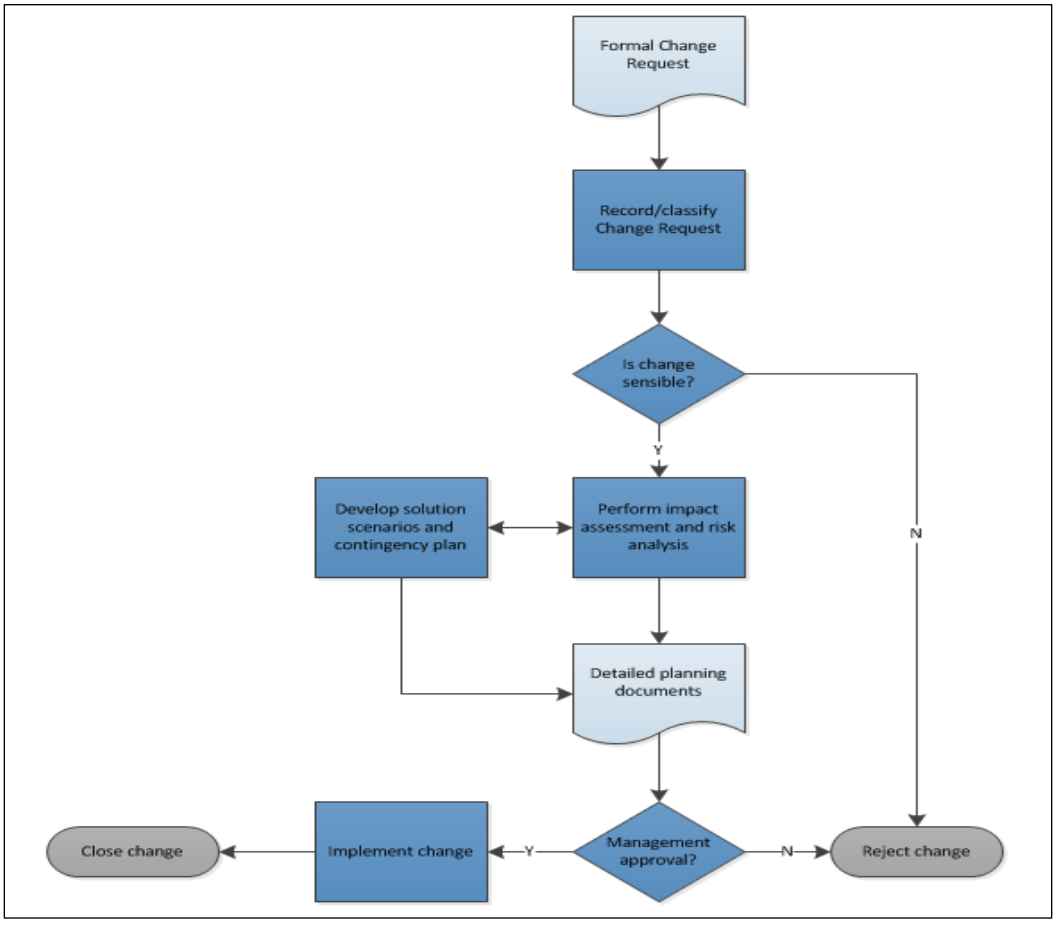

Figure 1. Change Control Process

Please see Appendix C for change request form.

2.7 Communication Plan

Team communications will be managed by categorizing and tracking the different types of team communications that can occur during the life cycle of the project in a Project Communication Plan (Table 1). The Communication Plan details the communication messages and content to be disseminated to team members and project stakeholders prior to initiating the project, and incorporates key details that will be relayed to entire project team to foster cooperation and understanding of the initiatives.

Table 1. Communication Plan

	CoSA Inspector Route Optimization Project Team Communication Plan					
	Deliverable	**Description**	**Delivery Method**	**Frequency**	**APEX Owner**	**COSA Audience**
Reports	Project status report	Regular update on critical project issues	E-mail	Weekly	Project Manager	Project Manager
	Quality assurance report	Regular update on software development process / performance	Meeting	Weekly	Lead Software Developer	Project Manager Project Team
Presentations	Project review	Project status update	Meeting / Telecon	Monthly	Project Manager	Project Sponsor Project Team Program Manager
	UAP's & UAT's	System prototypes, System Modules Validation, User Acceptance Testing	Meeting	As defined in Section 2 – Project Management Plan	Project Manager	As defined in Section 2 - Project Management Plan
Project Announcements	Task reminders	Task owner schedule reminders	E-mail	Daily	Project Coordinator	Project Manager Project Team member's as assigned
	Critical developments	Update on high priority project developments	Meeting	Weekly	Project Manager	Project Manager
Reviews and Meetings	Team meeting	Meeting to review project status	Meeting	Weekly	Project Coordinator	Project Manager Project Team
	End user training	Training meetings for all personnel required for system use	Meeting	Once	OR Analyst	As defined in Section 2 - Project Management Plan
	Pre-Roll-Out meeting	Preparation for System Go Live date	Meeting	Once	Project Manager	Project Sponsor Project Team Program Manager
	Go / No-Go Milestones	Product Readiness Meetings	UAP / UAT Results Reports; Meeting	As Defined in Section 2 - Project management Plan & SDLC	Project Manager	Project Sponsor Project Team Program Manager

2.8 Invoicing

Invoices for all presented deliverables shall be submitted at the same time, after which the City must review and notify Team of acceptance/rejection no later than 10 business days after having received the product, service, and/or cost item. Payment terms are net 30 days after submission, including City review period. Table 1 on the following page highlights the base year anticipated invoice periods, associated deliverables, and percentage of project award.

Table 2. Project Invoice Schedule

Invoice #	Date *CSD + Weeks*	Deliverables Submitted	Amount (%) Invoiced	Amount of each invoice
001	2	Updated Project Management Plan	10%	$30,500
002	4-5	Final Bus Process Diagram	10%	$30,500
003	2	Final Updated System Arch.	10%	$30,500
004	3	Final Analysis Requirement Document	10%	$30,500
005	9	System Interface Prototype	20%	$61,000
006	6	GUI & Optimization Prototype	20%	$61,000
007	4	Mobile Application Prototype	10%	$30,500
008	4	Executable for Final App	5%	$15,250
009	4	Installation Doc & User Guide	5%	$15,250
Total	**7 months**	**9 deliverables**	**100%**	**$305,000**[1]
		OPTIONAL EXPENDITURES		
Solution Maintenance & Support (Option Years 1-4)				$52,200/year
Additional device OS				$15,000/platform
Additional Maintenance & Support (licenses, hardware, and/or optional features)				$2,700/year

* Concurrent tasks

The amount invoiced shall include labor charges for actual hours worked and other actual expenses based upon contract rates and conditions, not to exceed the limits specified in the award and that have been accepted by the City. These charges shall not exceed limits specified in the award.

In addition to the above information, the invoice shall include the following minimum identifiers:

- City Project Number and Title
- Period of Performance (months deliverable(s) completed for fixed price task orders)
- Invoice Number
- Client name and address

[1] Award amount includes Base Year solution development and custom mobile application development for Android platform

Invoices for final payment will be so identified and submitted when tasks have been completed and no further charges are to be incurred. These close-out invoices, or a written notification that final invoicing has been completed, will be submitted within 30 days of final deliverable completion. A copy of the City's written acceptance of project completion will be attached to the final invoice.

3 Proposed Tool

Leveraging the latest standards in software and web infrastructure development, our solution has been built from the ground-up to be flexible, dynamic and scalable. PAI proudly offers advanced deployment, maintenance, health-check and fault tolerance solutions that can seamlessly and transparently be implemented, ensuring maximum service reliability and uptime.

3.1 System Description

Figure 3 schematically illustrates the proposed inspection process. The shaded parts in this figure represent the required new components to deploy the proposed inspection process, the rest of the process remain the same as in the current one.

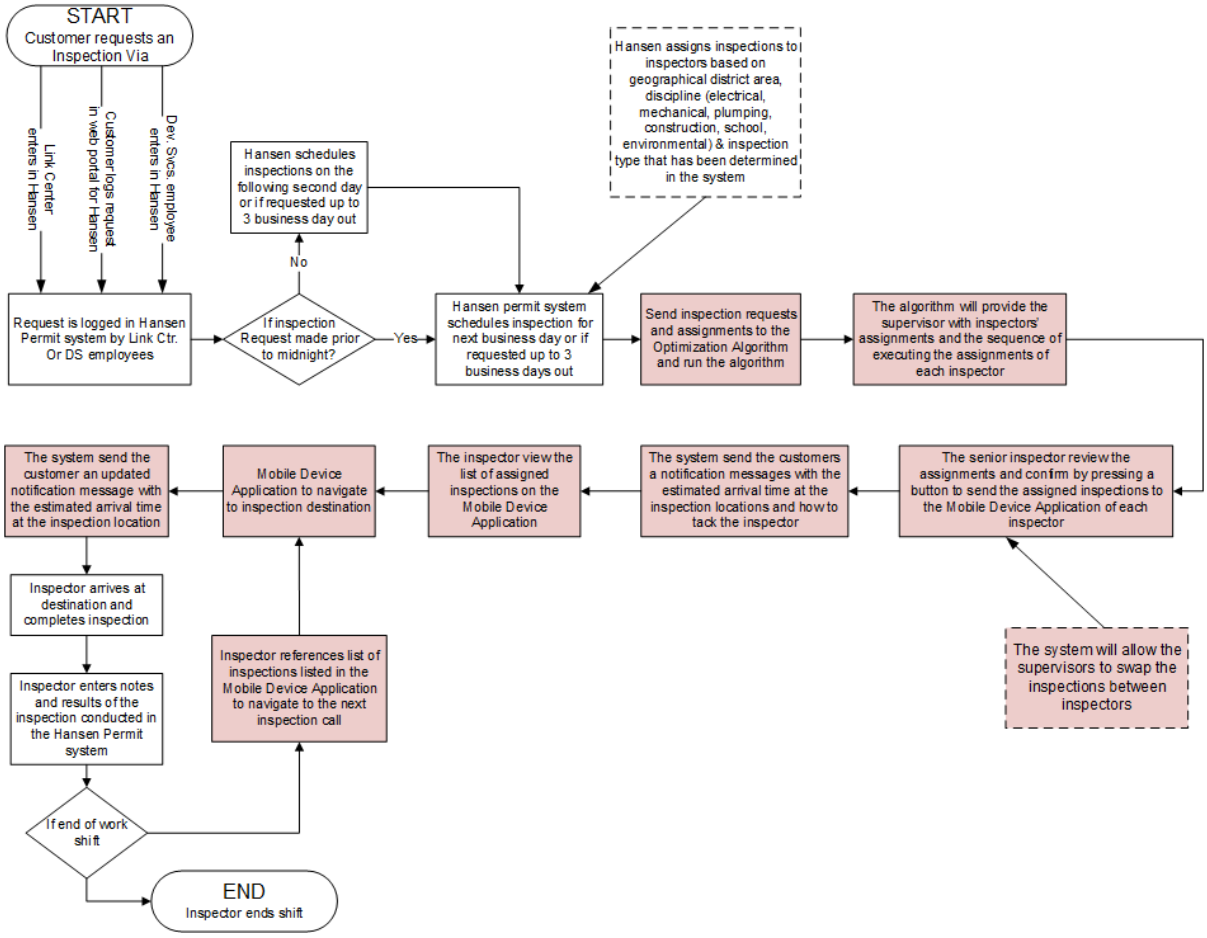

Figure 2. Proposed Inspection Process Description

The proposed tool will retrieve the daily inspection requests assigned to each inspector from the Hansen system before starting the optimization process. The optimization algorithm will process the inspections queues retrieved from Hansen, process route optimization and send inspections with optimized route to inspector's mobile device(s). DSD supervisors will also be able to view all or selected inspectors routes from the online graphical dashboard with ability to drill into inspection information passed from Hansen.

The tool will allow DSD Supervisors to do the following:

1. Review the inspections execution plan to each inspector
2. Swap or move inspections between inspectors are to be performed in Hansen and then process via On-Demand Hansen/ Route Optimization Interface.
3. Once the supervisor sends assignments to the inspectors, a notification with the estimated inspection time will be sent to customers along with their order in inspectors' assignments.
    a. The tool will be able to notify the customers of the estimated arrival time or place in queue (based on system defined parameter) either by e-mail or text message (based on system defined parameter).

Inspectors will receive inspection assignments and execution order on the mobile device application.

1. Inspectors will select inspections by order and navigate to inspection locations using a mobile device application
2. Once the inspectors start navigating to the inspection location, the system will notify the customer that the inspector is en-route and/or estimated arrival time, depending on notification switch set by the user configured system parameter.
3. When the inspector completes his/her current inspection, he/she can refer to the remaining assigned inspections on the mobile device application to navigate to the next assignment

3.2 Technical Specifications

3.2.1 Route Planning and Routing Parameters

The proposed tool utilizes an optimization algorithm that is based on one of the most advanced and sophisticated evolutionary heuristics in which a probabilistic guided search technique is used to determine the most efficient solution. The algorithm inputs information about customers' inspection requests, available inspectors, and operational constraints and provides the user with an optimal solution while considering all defined operational constraints. The algorithm inputs information from the City's Permitting and Inspection System on:

1. Customer inspection request
    a. Location of the inspection request
2. Latitude/longitude or
3. Complete address
4. Available inspectors
    a. Inspectors Starting Point
    b. Inspectors Start & Stop Work Times

c.

5. Operational constraints
    a. Priority level
        i. routing constraint to be toggled on/off by supervisor
            1. Toggle Off used only as display
            2. Toggle On used to plan route and display
    b. Inspection date
    c. Inspection expected time

The algorithm will use the above information as inputs to produce the execution sequence of assigned inspection requests / service calls for each inspector while satisfying all defined operational constraints. The tool will allow the DSD supervisor to predefine the optimization criteria in system preferences either by using shortest distance or least traveling time in order to generate vehicle routing plans that maximize resource utilization and efficiency. The tool will allow supervisors to turn on/off the expected inspection time reporting as well as the notifications for (1) expected arrival time and/or (2) sequence in the queue.

3.2.1.1 Location address information and validation

The proposed tool can use either address information or X/Y coordinates. The algorithm favors using the X/Y coordinates of inspection locations to find the optimal solution. Alternatively, the algorithm can use address information to determine the equivalent X/Y coordinates for that location if they are not available.

If any of the locations does not have a valid address or X/Y coordinates information, the tool will exclude it from the route planning process and continue running the optimization process, generating a customizable invalid location online report

3.2.1.2 Inspection priority

The proposed tool will allow the user to prioritize inspection requests. The system will also allow the user to send emergency inspections to inspectors. In case of an emergency request, the system will display the current location and the status of each inspector and will recommend the best inspector to execute this emergency inspection according to the inspection specialty, inspectors' location, and their status. However, the system will give the supervisor the flexibility to select a particular inspector to whom this priority job will be assigned.

3.2.1.3 Inspection status/information change

Navigation plans will be rebuilt as frequently as inspection information is updated in the City's Permitting and Inspection System, revising the sequence of inspections in near real-time.

In case of cancelled route points, the algorithm will rerun the assignments of the affected inspector, reevaluating the sequence of stops based upon their present location. An updated notification containing an updated schedule will be sent to the customer(s).

In the case of priority change to a job, the algorithm will rerun the assignments of the affected inspector, reevaluating the sequence of stops based upon their present location and availability (remaining hours of duty), and giving urgency to the higher priority job. An updated notification containing a current schedule will be sent to the customer(s).

In case of changes to the route starting point of the inspectors, the algorithm will use the new starting point to deduce the best sequence for executing these requests for each inspector.

3.2.1.4 Inspection assignment modification

Supervisors will be allowed to manually modify the route planes generated by the optimization algorithm to handle factors such as cancellations, emergencies, resource outages or critical inspections. In such cases, the route sequence is re-optimized for all impacted inspectors and new schedules are resent to their mobile devices. This provides a mechanism for inspectors to receive updates from the City's Permitting and Inspection Management system.

3.2.1.5 Solution display

The proposed tool will display the generated optimal routes on a map, graphically showing the sequence of executing the assigned inspections for each inspector, priority inspection requests will be visually identified by highlighting them with colors according to their priority level. Also, the tool will show detailed information for each route and inspection locations associated with the expected time to arrive to each location. Route construction process will consider real travel time from one location to another, expected inspection time at each location (i.e., service time), and expected delays due to traffic (e.g., factors such as street closures, traffic patterns, etc.).

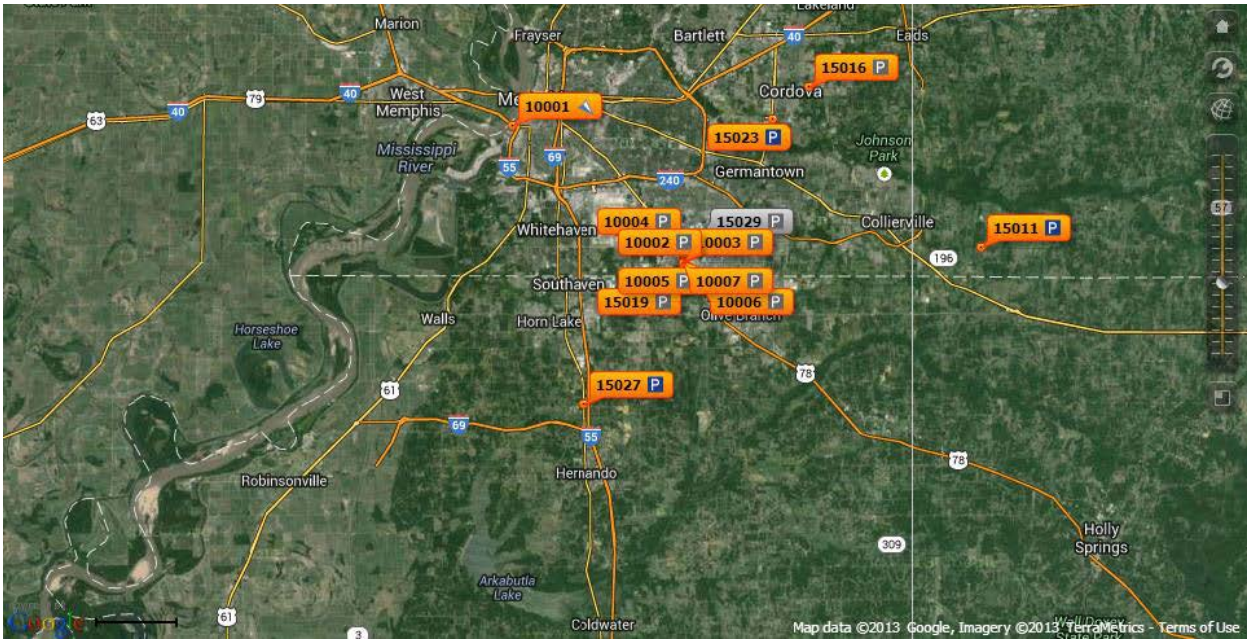

Figure 3. Example of Field Inspectors' AVL tracking maps

3.2.2 Real-Time Tracking

Figure 5 shows the architecture of the proposed tool illustrating the connectivity between client mobile devices and the hosting infrastructure. APEX will work with COSA architects to complete and maintain architecture diagrams for all platforms.

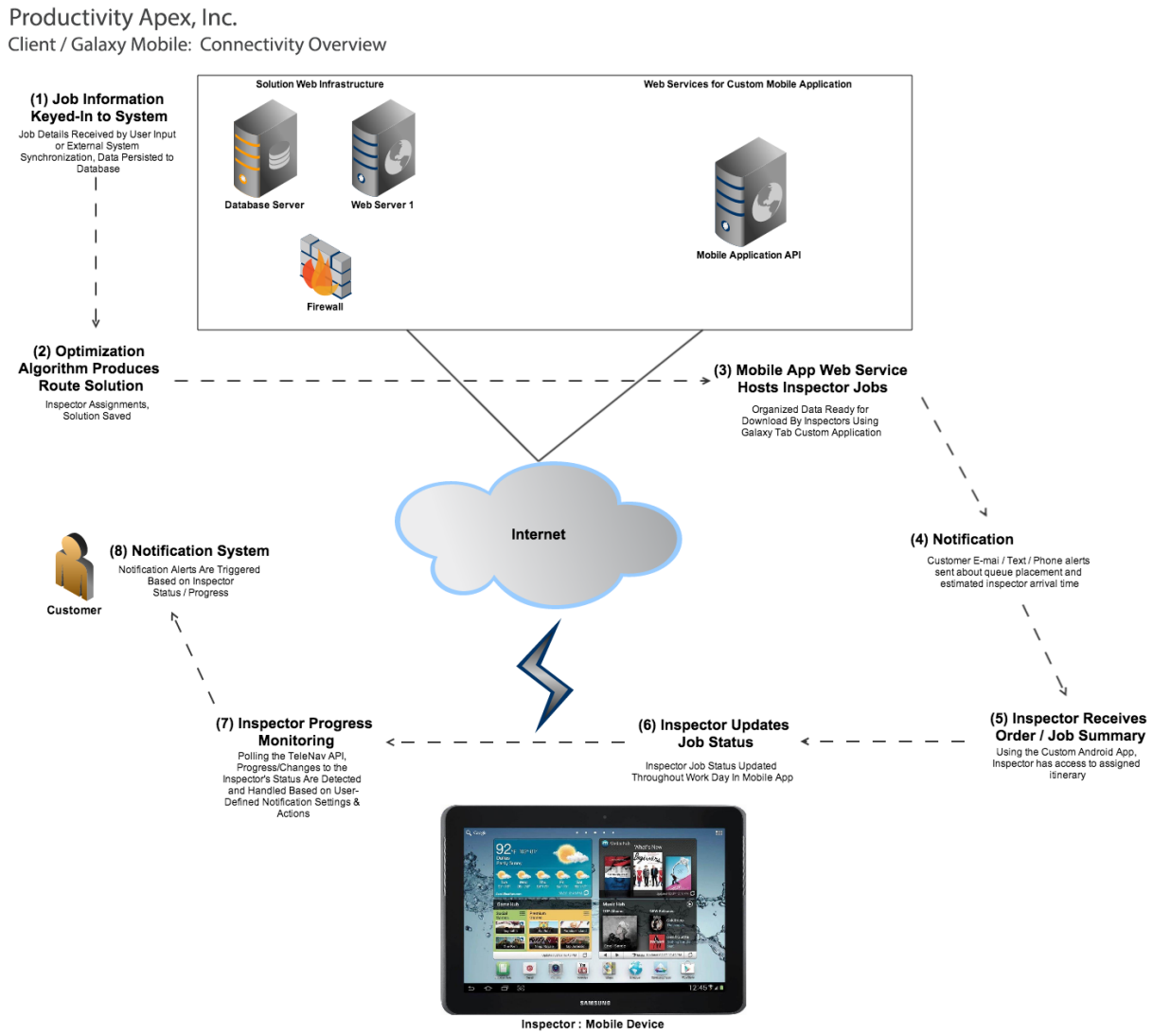

Figure 4: Proposed System Architecture

A custom mobile application will be developed and installed on the mobile devices used by the inspectors as a communication channel between the inspector and the supervisors in the back office. This application will be completely integrated with the optimization tool. Using this application, the supervisors will be able to:

- Send inspection assignments directly to the inspectors
- Send special instructions to the inspectors through the application
- Track inspector location (GPS) in real time

- Monitor inspector progression
- Provide the supervisors with event trigger alert capability if feasible

The tool will be supported by a real-time tracking module that will provide the users with the capability to track the inspectors using their mobile devices. Real-time inspector positioning can be plotted on a map so the users will be able to locate the position of each inspector. AVL data will be used in the event that we have to consume assets in the field for real-time assignment.

3.2.3 Operations Analysis and Reports

The proposed tool will offer users the capability to choose and customize reports on demand. Users will be able to generate reports for a specific date or a period of time, as well as per inspector or group of inspectors. Some of these include:

Name	Category	Frequency
Trip Reports	Trip report	On demand
Inspections/Job Overview Reports	Job status report	On demand
Working Time Report by Inspector or Crew	Working time report	On demand
Daily Summary Reports	Trip report	Daily
Notifications Reports	Administrative	On demand
Current Position Reports	Location report	On demand
Inspection Status Reports	Job status report	On demand

In addition, utilizing the capabilities of Microsoft SQL Management Studio will provide the user / system administrator with an advanced mechanism to extract data in a format suitable to the City's reporting needs.

3.2.4 Data Archiving / Extraction

The process of extracting data from the solution for consumption by the City of San Antonio is direct integration with the city's existing navigational / mobile devices utilized. There will be no cost for import/export operations that do not impact overall system reliability or performance.

3.2.5 Security

Secure / encrypted communication will be supported for all access, integration, and data transfer requirements. The solution will support identity and access management integration with the City's LDAP-compliant directory as well as City-defined account management parameters, including invalid logon attempts, user idle timeout, password complexity, and password change frequency. It will support self-service password resets and the principle of least privilege for access management. User access will be managed through role-based access controls – inspector, inspection team, manager, and executive – and will include the ability to control management user groups from being able to view versus edit inspector routes.

3.2.6 Customer Notification Parameters & Management Reporting

A background service will be implemented that monitors recently completed work, and performs analysis and operations based on the results. Notifications can be sent to the customer by virtually any

means desired, including telephone, SMS, and e-mail. The criteria to trigger the alert can be a customizable, user-defined value. This notification can be triggered by inspector progress, location, or other user-defined parameters. Based on inspection status update, a background service will be created that monitors all desired factors and metrics in order to determine if / when notifications should be sent. The planned notification systems have the capabilities of being bi-directional, allowing customers to respond to the notification service and to have that information be leveraged by the system.

3.2.7 Mapping

The PAI system supports integration with all of the leading mapping providers, including Google, Bing and Apple. While Bing is the mapping service that we use by default, this can be changed based upon project requirements. Inspection routes as well as inspection points and their attributes will be displayed on a map.

3.2.8 Environments

PAI will support multiple environments to include the following:

1. Development – Vendor controlled environment where vendor will develop code for product creation
2. Quality Assurance – COSA controlled environment for UAP & UAT as well as application porting validation
3. Production – COSA controlled environment for production use

COSA will provide access to PAI authorized staff for debugging, testing and COSA monitored technical assistance with issues which may arise on deployment of product to QA & Production environments.

4 Mobile Application

The delivered tool will be supported by a special application that will be developed and installed on the mobile devices used by the inspectors to allow supervisors to communicate efficiently with them. The device will interact with the server using an encrypted, secure connection using HTML/JSON/XML/REST/SOAP communications. The application will allow the supervisors to send the route plan details to the inspectors with complete information for each inspection, including:

- Permit #
- Permit Name
- Customer Name
- Customer Phone #
- Address
- Location Description
- Permit Type
- Inspection Type
- Type of Work
- Department of Commerce
- Email

- Schedule date

Inspectors will also be notified of route changes through mobile alerts triggered by the application. The mobile application will simultaneously serve as a tracking device, capturing events such as arrivals, departures, and delays. This will provide the supervisors with real-time information regarding the current location of the inspectors, providing the user with information about inspector progression in executing the assigned orders.

5 Glossary

Term	Description
ADL	Application Development Liaison. This is a representative of the core technology development group within COSA who is accountable for assigned deliverables within the specified technology development group.
BA	Business Analyst
COSA	City of San Antonio
CSD	Contract Start Date
DEV	Development. Used as acronym to identify Development Technology Environment
DSD	Development Services Department
GIS	Graphical Information System
GPS	Global Positioning System
Hansen	Permitting & Inspections Management System used by Development Services to service customers.
ITSD	Information Technology Services Department
OS	Operating System
PAI	Productivity Apex, Inc
PM	Project Manager
PROD	Production. Used to identify Production Technology Environment
Proposed Tool	Route Optimization system
QA	Quality Assurance. Used to identify Quality Assurance Technology Environment
RTM	Requirements Traceability Matrix
SDLC	Software Development Life Cycle
SLA	Service Level Agreement
SME	Subject Matter Expert
SOW	Statement of Work
UAP	User Acceptance Prototype. Process which vendor demonstrates various stages of application development providing the customer the opportunity to provide feedback and acceptance of modular components.
UAT	User Acceptance Testing. Process which customer is engaged by hands-on testing of the application. This exercise includes detailed testing scripts.
WBS	Work Breakdown Structure. Within SOW is used to represent project Milestones tied directly to the Project schedule/Timeline.

Appendix A – Project Schedule

(Page 1 of 2)

ID	WBS	Task Name	Duration	Predecessors	Start	Finish
1	1	Kick-Off Meeting	1 day		Tue 4/1/14	Tue 4/1/14
2	**2**	**Review and Update Project Management Plan**	**9 days**	**1**	**Wed 4/2/14**	**Mon 4/14/14**
3	**2.1**	**Review Project Schedule**	**3 days**	**1**	**Wed 4/2/14**	**Fri 4/4/14**
4	2.1.1	Update start dates on project schedule based on contract award date	3 days	1	Wed 4/2/14	Fri 4/4/14
5	2.1.2	Update project tasks based on Kick-Off Meeting	3 days	1	Wed 4/2/14	Fri 4/4/14
6	**2.2**	**Review and Submit Project Risk Registry**	**5 days**	**5,4**	**Mon 4/7/14**	**Fri 4/11/14**
7	2.2.1	Build Detailed Risk Registry	5 days	5,4	Mon 4/7/14	Fri 4/11/14
8	2.3	Submit Updated Project Management Plan	1 day?	7	Mon 4/14/14	Mon 4/14/14
9	**3**	**Study and Review current Business Processes**	**19 days**	**8**	**Tue 4/15/14**	**Fri 5/9/14**
10	3.1	Identify Key Stakeholders	1 day	1,8	Tue 4/15/14	Tue 4/15/14
11	3.2	Develop and Send Pre-Visit list of Questions	5 days	1,8	Tue 4/15/14	Mon 4/21/14
12	3.3	Receive Pre-Visit List of Questions	5 days	11	Tue 4/22/14	Mon 4/28/14
13	3.4	Schedule Meetings with Key Stakeholders from City of San Antonio	5 days	10	Wed 4/16/14	Tue 4/22/14
14	**3.5**	**Conduct Live Meetings with stakeholders from City of San Antonio including inspectiors, supervisors, Managers, etc**	**5 days**	**13**	**Wed 4/23/14**	**Tue 4/29/14**
15	3.5.1	Travel to San Antonio, Texas	1 day	13	Wed 4/23/14	Wed 4/23/14
16	3.5.2	Identify Key Business Processes	4 days	15	Thu 4/24/14	Tue 4/29/14
17	**3.5.3**	**Review Existing Technology**	**4 days**	**15**	**Thu 4/24/14**	**Tue 4/29/14**
18	3.5.3.1	Identify current system(s) integration requirements	4 days	15	Thu 4/24/14	Tue 4/29/14
19	**3.6**	**Review integration requirements**	**8 days**	**18**	**Wed 4/30/14**	**Fri 5/9/14**
20	3.6.1	Review with stakeholders current system(s) integration requirements	5 days	18	Wed 4/30/14	Tue 5/6/14
21	3.6.2	Define current system(s) integration requirements	8 days	18	Wed 4/30/14	Fri 5/9/14
22	**3.7**	**Capture detailed As-Is business process and workflow**	**7 days**	**16**	**Wed 4/30/14**	**Thu 5/8/14**
23	3.7.1	Update business process diagram (if necessary)	5 days	16	Wed 4/30/14	Tue 5/6/14
24	3.7.2	Review updated business process diagram with stakeholders	1 day	23	Wed 5/7/14	Wed 5/7/14
25	3.7.3	Deliver Final business process diagram to stakeholders	1 day	24	Thu 5/8/14	Thu 5/8/14
26	**4**	**Review and UpdateSystem Architecture and Requirements**	**28 days?**	**25**	**Fri 5/9/14**	**Tue 6/17/14**
27	**4.1**	**System Requirements**	**18 days?**	**25**	**Fri 5/9/14**	**Tue 6/3/14**
28	4.1.1	Compile System Requirements in an Analysis Requirements Document	8 days	25	Fri 5/9/14	Tue 5/20/14
29	4.1.2	Review Updated System Requirements with stakeholders	1 day	28	Wed 5/21/14	Wed 5/21/14
30	4.1.3	Update System Requirements (if necessary)	5 days	29	Thu 5/22/14	Wed 5/28/14
31	4.1.4	Approve Final Analysis Requirements Document by stakeholders	3 days	30	Thu 5/29/14	Mon 6/2/14
32	4.1.5	Deliver approved Analysis Requirements Document to stakeholders	1 day?	31	Tue 6/3/14	Tue 6/3/14
33	**4.2**	**System Architecture**	**10 days**		**Wed 6/4/14**	**Tue 6/17/14**
34	4.2.1	Update existing System Architecture (if necessary)	5 days	32	Wed 6/4/14	Tue 6/10/14
35	4.2.2	Review Updated System Architecture with stakeholders	1 day	34	Wed 6/11/14	Wed 6/11/14
36	4.2.3	Incorporate Changes to System Architecture (if required)	3 days	35	Thu 6/12/14	Mon 6/16/14
37	4.2.4	Deliver Final Updated System Architecture to stakeholders	1 day	36	Tue 6/17/14	Tue 6/17/14
38	**5**	**Develop a Prototype (Beta Version) of the System**	**101 days**	**37**	**Wed 6/18/14**	**Wed 11/5/14**
39	**5.1**	**Develop System Interface Prototype**	**62 days**	**37**	**Wed 6/18/14**	**Thu 9/11/14**
40	5.1.1	Design System Interface wireframe & mockups	10 days	37	Wed 6/18/14	Tue 7/1/14
41	5.1.2	Conduct UAT for system Interface Design	1 day	40	Wed 7/2/14	Wed 7/2/14

Appendix A

ID	WBS	Task Name	Duration	Predecessors	Start	Finish
42	5.1.3	Compile stakeholders feedback and changes	5 days	41	Thu 7/3/14	Wed 7/9/14
43	5.1.4	Build System Interface Prototype	30 days	42	Thu 7/10/14	Wed 8/20/14
44	5.1.5	Evaluate and Test System Interface Prototype	10 days	43	Thu 8/21/14	Wed 9/3/14
45	5.1.6	Conduct UAT for system Interface Prototype	1 day	44	Thu 9/4/14	Thu 9/4/14
46	5.1.7	Compile stakeholders feedback and changes	5 days	45	Fri 9/5/14	Thu 9/11/14
47	**5.2**	**Prototype System Interface & Optimization Algorithm Integration**	**39 days**	**46**	**Fri 9/12/14**	**Wed 11/5/14**
48	5.2.1	Integrate System Interface with Optimization Algorithm	20 days		Fri 9/12/14	Thu 10/9/14
49	5.2.2	Evaluate & Test the integration between the system interface & the optimization algorithm	10 days	48	Fri 10/10/14	Thu 10/23/14
50	5.2.3	Travel To city of San Antonio, Texas	1 day	49	Fri 10/24/14	Fri 10/24/14
51	5.2.4	Conduct UAT for integrating system interface with the optimization algorithm	3 days	50	Mon 10/27/14	Wed 10/29/14
52	5.2.5	Compile stakeholders feedback and changes	5 days	51	Thu 10/30/14	Wed 11/5/14
53	**5.3**	**Develop Mobile Application Prototype**	**84 days**	**37**	**Wed 6/18/14**	**Mon 10/13/14**
54	5.3.1	Design Mobile Application wireframe & mockups	5 days	32	Wed 6/18/14	Tue 6/24/14
55	5.3.2	Conduct UAT for Mobile Application Design	1 day	54	Wed 6/25/14	Wed 6/25/14
56	5.3.3	Compile stakeholders feedback and changes	2 days	55	Thu 6/26/14	Fri 6/27/14
57	5.3.4	Build Mobile Application Prototype	60 days	56	Mon 6/30/14	Fri 9/19/14
58	5.3.5	Evaluate and Test Mobile Application Prototype	10 days	57	Mon 9/22/14	Fri 10/3/14
59	5.3.6	Conduct UAT for Mobile Application Prototype	1 day	58	Mon 10/6/14	Mon 10/6/14
60	5.3.7	Compile stakeholders feedback and changes	5 days	59	Tue 10/7/14	Mon 10/13/14
61	**6**	**Develop and Install Final Application**	**27 days**	**52,60**	**Thu 11/6/14**	**Fri 12/12/14**
62	6.1	Incorporate changes and Develop Final System Application	10 days	52,60	Thu 11/6/14	Wed 11/19/14
63	6.2	Integrate Final Application with existing System(s)	10 days	62	Thu 11/20/14	Wed 12/3/14
64	**6.3**	**Conduct Live Demo and Trainning of Final Application to stakeholders**	**6 days**	**63**	**Thu 12/4/14**	**Thu 12/11/14**
65	6.3.1	Travel to San Antonio, Texas	1 day	63	Thu 12/4/14	Thu 12/4/14
66	6.3.2	Install Developed Application in City of San Antonio Infrastructure	1 day	65	Fri 12/5/14	Fri 12/5/14
67	6.3.3	Conduct UAT for Final System Application to stakeholders	1 day	65	Fri 12/5/14	Fri 12/5/14
68	**6.3.4**	**Trainning**	**4 days**	**67**	**Mon 12/8/14**	**Thu 12/11/14**
69	6.3.4.1	Train Supervisors and Managers on System capabilities	4 days	67	Mon 12/8/14	Thu 12/11/14
70	6.3.4.2	Train Inspectors on System capabilities	4 days	67	Mon 12/8/14	Thu 12/11/14
71	6.3.4.3	Train System Administrators	4 days	67	Mon 12/8/14	Thu 12/11/14
72	6.4	Deliver Executable for Final Application to stakeholders	1 day	67,71	Fri 12/12/14	Fri 12/12/14
73	6.5	Deliver Source Code of Final Application to stakeholders	1 day	67,71	Fri 12/12/14	Fri 12/12/14
74	6.6	Deliver Instalation Documentation and User Guide to Stakeholders	1 day	67,71	Fri 12/12/14	Fri 12/12/14
75	**7**	**System Roll-Out**	**3 days**	**70**	**Mon 12/15/14**	**Wed 12/17/14**
76	7.1	Preparation meeting with all stakeholders for system Roll-Out	2 days	67,68,72,73,74	Mon 12/15/14	Tue 12/16/14
77	7.2	System Roll-Out	1 day	76	Wed 12/17/14	Wed 12/17/14

Appendix B – Sample UAT Test Script

UAT Sample Template is provided in electronic format.

DSD UAT Test Scripts Template.doc

Appendix C – Change Request Form

Change Request Form

SUBMITTER - GENERAL INFORMATION

CR# *[CR001]*

Type of CR ☐ Enhancement ☐ Defect

Project/Program/Initiative

Submitter Name *[John Doe]*

Brief Description of Request *[Enter a detailed description of the change being requested]*

Date Submitted *[mm/dd/yyyy]*

Date Required *[mm/dd/yyyy]*

Priority ☐ Low ☐ Medium ☐ High ☐ Mandatory

Reason for Change *[Enter a detailed description of why the change is being requested]*

Other Artifacts Impacted *[List other artifacts affected by this change]*

Assumptions and Notes *[Document assumptions or comments regarding the requested change]*

Comments *[Enter additional comments]*

Attachments or References ☐ Yes ☐ No **Link:**

Approval Signature *[Approval Signature]* **Date Signed** *[mm/dd/yyyy]*

PROJECT MANAGER - INITIAL ANALYSIS

Hour Impact *[#hrs] [Enter the hour impact of the requested change]*

Duration Impact *[#dys] [Enter the duration impact of the requested change]*

Schedule Impact *[WBS] [Detail the impact this change may have on schedules]*

Cost Impact *[Cost] [Detail the impact this change may have on cost]*

Comments *[Enter additional comments]*

Recommendations *[Enter recommendations regarding the requested change]*

Approval Signature *[Approval Signature]* **Date Signed** *[mm/dd/yyyy]*

CHANGE CONTROL BOARD – DECISION

Decision ☐ Approved ☐ Approved with Conditions ☐ Rejected ☐ More Info

Decision Date *[mm/dd/yyyy]*

Decision Explanation *[Document the CCB's decision]*

Conditions *[Document and conditions imposed by the CCB]*

Approval Signature *[Approval Signature]* **Date Signed** *[mm/dd/yyyy]*

Appendix D – Hansen Integration Specifications

The following Hansen Integration specifications is initial due diligence between APEX and COSA. This represents a baseline for the interface necessary between Hansen system and Route Optimization tool. These specifications will require revisions to address more detail and clarification of requirements for the development of the Hansen and routing tool integration. Vendor will be responsible to deliver final technical specifications document and process diagram(s).

A. Standard Daily Process:

1. Scheduled Hansen data extract batch process must start after midnight.
2. Route Optimization process must be completed and inspectors routes distributed to all inspectors devices by 6:30am.
3. **On Demand Updates** - Changes to scheduled inspections and/or new inspections for current day will be processed On Demand.
    a. **7:00am – 7:45am:** Daily timeframe when Inspectors load balancing occurs for current day inspections.
    b. Scheduled Inspections are changed in Hansen.
    c. On Demand updates may be triggered anytime/any day

B. Hansen Data Extraction Interface Program Specifications

COSA ITSD will develop service to extract/produce data from COSA systems for consumption by the Route Optimization system.

1. File Format = Fixed length with non-keyboard type delimiter.
2. Interface file will be stored on a shared drive on server where Route Optimization system exists.
3. Interface program will maintain an Audit log with the following information:
    a. Date / Time interface program Started & Ended
    b. Total count of Inspectors processed
    c. Total count of inspections processed
    d. Total count of records processed without
        i. email address
    e. Total count of records not processed due to
        i. No X/Y coordinates and/or Incomplete Address
        ii. Non-Assigned Inspector or Work Zone
    f. Refer to Error Handling section for more details on process variances and handling
4. Report must be generated to provide user with information from the audit log (item 3)
5. Interface program will be monitored for success.
    a. If any error is encountered during data extract processing, see Error Handling section

C. Scheduled Inspections Selection Criteria

1. Daily scheduled Hansen data extraction routine must only process inspections that meet the following criteria.
    a. <Completed Date> = blank
    b. <Status> = "No Action"
    c. <Scheduled Date> is <= Current Date

2. If On Demand update, then only process those scheduled inspections that have been changed since the last Daily Hansen Data Extract process.
    a. Need handling rules to capture scheduled inspection that was changed after the last interface process.
        i. Changes that would trigger the inspection to be reprocessed include
            1. Schedule date change to future date (same as delete(2))
            2. Deleted/cancelled Inspection request
            3. Inspector change
            4. Priority change
    b. <Change Code> = "C"- Cancel; "P"- Priority Change; "I"- Inspector Change; "N"- New Inspection; "A"-Address Change
        i. Attribute may be created during the Route Optimization Intake process. To be determined during Interface Specifications Requirements detail planning phase.

D. Interface Data

Following list of fields are to be passed to Route Optimization system for route scheduling. Items 1-18 & Item 21 should also be available to inspectors on their remote devices for reference while they are in the field.

A. Hansen Information:

1. **<Assigned To>** - Inspector Login-ID
2. **<AP #>** - Permit #
3. **<AP Name>** - Permit Name
4. **<Customer Name>** - Contact Name
5. **<Customer Phone>** - Contact Phone number
6. **<Customer E-mail>** - Contact email address (*required for customer notification*)
7. **<Address>** - AP Address
8. **<City Name>**
9. **<State Code>**
10. **<Zip Code>**
11. **<Location>** - Free Form Text Box
12. **<X Coordinate>**
13. **<Y Coordinate>**
14. **<Permit Type>**
15. **<INSPTYPE>** - Inspection Type (ref Appendix D – List A for list of inspection Types)
    i. Business user to provide descriptions for each inspection type.
16. **<Type of Work>** (Values: New, Existing)
17. **<Dept of Commerce>** (Values: Residential, Commercial)
18. **<Scheduled Date>** - Inspection Original Scheduled Date
19. **<Inspector Starting Point>** - starting location

B. The following fields are to be generated as part of the data extract interface program and passed to the Route Optimization system. Priority information is not to be used for route planning. This information is to be used to highlight prioritized tasks on inspector's mobile device displaying inspection points and information on those inspection points.

20. **<Updated Schedule Date> -** Current date in 'YYYY-MM-DD' format. The date the interface file is processed.
21. **<Priority> -** Inspection priority based on the following criteria:
    a. **<INSPTYPE>** includes COO. <Priority> = '1'
    b. **<Scheduled Date>** is 3+ days old. <Priority> = '2'
    c. **<Scheduled Date>** is 2 days old. <Priority> = '3'
    d. **<Scheduled Date>** is 1 day old. <Priority> = '4'

C. The following fields need to be configured in Hansen.

- *Requires research and development planning between APEX, ITSD Hansen Development Team and Business to finalize Hansen and/or Route Optimization requirements for this functionality.*
- *For **<Service Type/Time>,** initial deployment will only contain a single value defined by business management. Route Optimization system to include a toggle switch to allow for this functionality to be turned on/off during route optimization.*

22. **<Service Time> -** estimated time service will consume
    a. i.e. Default = '30 minutes'
    b. Management of time to be allowed by Application Administrator

D. Field Characteristics

These are initial set of field characteristics to clarify constraints on some fields. This table will be completed during the technology specifications development phase.

Interface Field Name	Hansen Field Name	Characteristic
Assigned To	ASSIGNTO	VARCHAR2(12)
Priority	PRIORITY	NUMBER(2)
Inspector Number	INSPNR	NUMBER(9)
INSPTYPE	INSPTYPE	VARCHAR2(10)
Scheduled Date	SCHEDDTTM	DATE/TIME
Location	LOC_DESC	VARCHAR2(254)
AP #	APNO	VARCHAR2(9)
AP Name	APNAME	VARCHAR2(30)
Permit Type	APTYPE	VARCHAR2(10)
Type of Work	WORKTYPE	VARCHAR2(6)
Dpt of Commerce	DEPTCM	VARCHAR2(6)
Address	IFACE.GET_ADDRESS_STRING(A.ADD	VARCHAR2(200)
X Coordinate	X_COORDINATE	NUMBER(7)
Y Coordinate	Y_COORDINATE	NUMBER(8)
Service Type	SVCTYPE	VARCHAR2(10)
Service Time	SVCTIMEMIN	NUMBER(4)
Updated Schedule Date	Last modified date within Hansen?	TBD
Additional fields to be finalized during interface process technology specifications development phase.		

E. Error Handling

1. Route Optimization Intake Process Failure
    a. Hansen Interface File not found (File System Watcher)
        i. Process parameters Configuration File change capabilities for tracking and reporting parameters
            1. Nightly Re-Occurring Process
            2. On-Demand Process

    b. Missing Routing attributes
        i. X/Y coordinates
        ii. Address
        iii. Inspector
        iv. Inspection Type
        v. Start/Stop Times
        vi. Inspectors Starting Location

2. Extract and/or routing not complete by designated time

3. Failure Log
    a. To be maintained based on Interface Process Configuration File parameters
    b. Database accessible for ad-hoc reporting by end-user
    c. To include defined severity levels

4. Failure Alerts
    a. Based on Severity Levels
    b. Alerts sent to Designated Application Administrators and/or System Administrators based on error severity.
    c. Web Service to be called for opening tickets in Incident Management system (Remedy)
        i. Based on severity level

Notes:

1. Inspection Results (Pass, Fail and notes) are entered directly into Hansen system by inspector.
2. Initial Implementation will use a user defined standard time for each service ticket. System will not have any Service Types to determine estimated time for each service.
3. Inspectors will monitor their assignments for any services where <Inspection Type> = anything that ends with '…COO'. Inspector will veer outside of planned route towards the end of the day to assure that all '…COO' services are completed. This may result with incomplete service tickets.
4. For the most part in speaking to the seniors, they are touching approximately 90% of their staff in some minor/major reshuffling every day.
5. X/Y look up Map will have to return work zones.
6. Interface File Delimiter to be defined by COSA
    a. ASCII code not available on keyboard

Appendix D - List A
Hansen System – List of Inspection Types

BANNER
BCKFLOWFIN
BILLBOARD
BILLBRDANN
BQCR
BUILDCOO
BUILDDEMO
BUILDFIN
BUILDFOUN
BUILDFRAM
BUILDGENIN
BUILDINSU
CERTIFICAT
CODEINV
CONSULT
CPS
DBLDGFIRE
DBLDGSTCD
DGFIN
DGRIN
DISABILITY
DRAINAGE
DUCTTEST
ELECCOO
ELECFIN
ELECGENIN
ELECPRE
ELECR
ENVELPEINS
ENVIRONCOO
EQCR
FBLSTRSHOT
FBONFIRE
FBOOTH
FCOURTESY
FDINV
FDLSCODE
FDROUTINE
FDSCHOOL
FGSSFINAL
FINALFA
FINALFS
FINIBLAST
FIREALARM
FIRECOO
FIREFILL
FIREFINAL
FIREFUEL
FIREINSTAL
FIRELANE
FIREMAIN
FIRENOX
FIREPRESS
FIREREMOVE
FIRESPKLR
FIREWKANNL
FLOATFOOD
FLOOD
FPSTEST
FSITE
FSITEPRTHT
FSPRAYBTH
FWPYREVENT
GASFIN
GASR
HEALTHCOO
HEALTHENVR
HEALTHFIN
HEALTHFOOD
HEALTHPF
HISTGENIN
HSMOVE
INFLATABLE
INSPTYPE
INVESTIGAT
IRRCOMFIN
IRRRESFIN
LANDFEN
LANDSCOO
LANDSFIN
LANDSPRE
MECHCOO
MECHFIN
MECHGENIN
MECHR
MEDGASFIN
MEDGASR
MQCR
NCDFIN
NCDGENIN
NIGHTCLUB
NONCONF
OAKWILT
OFFDIGIANN
OFFPREM
OFFPREMDIG
PEDESTRIAN
PLUMBCOO
PLUMBFIN
PLUMBGENIN
PLUMBR
PLUMBTOP
PQCR
RECWATRF
RECWATRR
RETWALL
RIOGENIN
SAWSBASIN
SAWSCOO
SAWSWPAP
SEWERFIN
SIDEWLKF
SIDEWLKPF
SIGNCOO
SIGNFIN
SIGNGENIN
SIR
SOUNDCERT
SPECELECA
SPECEVENT
SPECFIREP
SPECFIRER
SPECFOUND
SPECHVAC
SPECRPT
SPECSEPT
SPECSMOKE
SPECSTRUC
SQCR
STREETFIN
STREETPRE
STSCAPE
TRAFFICCOO
TRAFFICF
TRAFFICP
TREEFEN
TREEFENFUP
TREEFIN
TREEGENIN
TREEMITIGA
TREEPRE
UDFIN
UDR
UNDERGRND
WATERPIPE
ZNMGRSITE

Appendix E – Architecture Diagram (Production Environment)