

AVL Implementation Plan

Prepared for:

**City of Rochester
Department of Environmental Services
City Hall
Rochester, New York 14614**

Submitted by:

**Applied GIS, Inc.
137 Jay Street
Schenectady, New York 12305**

In Collaboration With:

**Waypoint Technology Group, LLC
17 Computer Drive East
Albany, New York 12205**

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Table of Contents

Introduction.....	1
Implementation Methodology.....	1
Establish Project Team	1
Identify Funding Sources.....	1
Conduct Pilot Projects.....	2
Establish Priorities for Phased Implementation.....	2
Phase 1 Rollout.....	2
Determine Functional Requirements for High Priority Applications.....	2
Identify and Assign Functional Roles.....	2
Select Appropriate System.....	3
Acquire System Components.....	3
System Installation.....	3
Training.....	3
Staff Orientation.....	3
System Launch.....	4
Ongoing Operation and Maintenance.....	4
Phase 2 – N Rollouts.....	4
Cost Estimates.....	5
Schedule.....	8
Summary.....	8

Introduction

In the first component of this project an assessment was conducted on how AVL technology can be used within the Department of Environmental Services (DES). An analysis was subsequently completed examining the wide range of AVL technology on the market today and case studies were developed highlighting relevant examples of how this technology has been implemented. Additionally, individuals from DES, Applied GIS, and Waypoint Technology Group visited the Erie County Water Authority (ECWA) to see a demonstration of the AVL system being used by this organization. The goal of the visit was to gain a better understanding of ECWA's experiences using a radio-based system from Radio Satellite Integrators (RSI).

At the conclusion of the Needs Assessment and Technology Analysis phases of this project, a single system was not identified that sufficiently met all the requirements for broad implementation of AVL with the Department. Given this circumstance, the recommended implementation plan does not reference any specific system, but rather presents a general methodology for moving forward with this technology. Also included, below are detailed cost estimates and an implementation schedule.

Implementation Methodology

This section includes a description of the recommended methodology to be used for implementing AVL within the Department of Environmental Services. The methodology is structured into a series of tasks to be completed in sequence.

Establish Project Team

The AVL Implementation Team should be selected and assigned responsibility for managing the project and ensuring that work is completed to the satisfaction DES. This team should be comprised of individuals with an appropriate level of expertise as well as the authority to assist in the completion of all aspects of this project. A single project manager should be designated with responsibility for overall coordination and to serve as the primary point of contact for both internal and external (e.g. vendors, consultants) stakeholders.

Identify Funding Sources

In order to ensure adequate funding support on a continual basis, a long-term AVL funding plan should be developed. This funding plan should incorporate the need for a significant initial capital investment to acquire hardware and software, for system installation, and to fund appropriate staff training. In addition, on-going outlays for maintenance, replacement, and upgrades and, potentially, wireless service, will be required on a periodic basis.

Potential sources of revenue include city funds as well as grants available through the US Department of Transportation and other organizations.

Conduct Pilot Projects

It is recommended that a series of pilot projects be conducted as a means of gaining first-hand insight into different technical approaches. These pilots should focus on technology of greatest interest to DES. Specifically, DES has expressed a desire to further examine the potential of radio-based and passive (non-realtime) solutions. At the conclusion of these pilot projects findings should be summarized documenting the positive and negative aspects of each approach.

DES has determined that a suitable pilot project should include implementing AVL in approximately 14 street sweepers and up to 25 plow trucks. These vehicles would then be tracked during the different periods of the year when this equipment is in regular use.

Establish Priorities for Phased Implementation

As discussed in earlier reports, DES intends to use a phased approach to implement AVL within the department. This will allow DES to build upon a growing set of experience using AVL while also distributing the initial startup costs of several years.

The AVL Implementation Team should determine the order in which this technology should be implemented, within the department's bureaus. This prioritization should be based on a cost/benefit analysis as well as less tangible considerations such as an improved level of customer service. The Needs Assessment Report completed as part of this project should serve as a useful reference in the process.

Phase 1 Rollout

The following subtasks should be completed as part of the initial rollout of AVL within DES:

Determine Functional Requirements for High Priority Applications

Using the findings from the pilot projects, along with other considerations, determine the specific set of functionality required by those applications to be implemented in this phase of the system rollout. This should include specific system functionality (e.g., reporting intervals, historic playback, geofencing, etc.), telemetry requirements (e.g., plow up/down, etc.), and desired communication network.

Identify and Assign Functional Roles

A number of roles must be filled to support the ongoing operation of the Department's AVL system. These roles include those individuals involved in the operational use of the control center software (dispatching,

monitoring, etc.), as well as technical support and maintenance for the in-vehicle, communication network, and software and hardware aspects of the system. Ideally, each of these roles would be filled with existing staff. However, if this is not possible, additional staff or outside resources (e.g., consultants) may be required.

Select Appropriate System

An AVL system must be selected meeting the functional requirements established earlier for this phase of the implementation. Material compiled during in the Technology Analysis Report and pilot projects should be considered in this process. At this time, it may also be necessary to supplement this information with an updated review of additional AVL technology that may have become available in the interim.

Acquire System Components

All components of the selected system should be acquired including the in-vehicle equipment and control center software and hardware. If cellular technology is used for the communication network, DES will need to subscribe to the appropriate wireless plan. If a radio-based AVL solution is implemented, it may be necessary to purchase additional hardware components such as a base station, antennas and repeaters.

System Installation

All equipment should be installed and tested. It is possible that some of the work can be completed by DES staff while in other cases outside vendors should be contracted.

Training

DES staff should be trained on the operational use of the selected system. Topics to be covered should include:

- Operation of the control center software (e.g., view, configuration, etc.).
- Overview of in-vehicle equipment in terms of installation process and any regular maintenance, and troubleshooting.

Staff Orientation

In an effort to ease staff concerns and misconceptions, it is recommended that an orientation seminar to be conducted to clearly present the business case for implementing AVL technology within the department. DES policy should be presented regarding how this information will be used, expectations for how staff will interact with the system, and consequences for abuse, tampering, etc. A question and answer period should be used for general discussion and feedback.

DES is strongly encouraged to hold this orientation seminar at an early date in the system implementation process.

System Launch

Once all of the prior tasks have been completed, the AVL system should be officially launched. A formal announcement should be made indicating the system is now operational.

Ongoing Operation and Maintenance

At this stage in the implementation plan, the AVL system will be fully operational. However, a set of ongoing tasks will be required including staffing of the control center, scheduled maintenance, and system backup.

Phase 2 – N Rollouts

After the Phase 1 Rollout has been successfully completed, DES should wait a period of time (e.g., 6 months to 1 year) before continuing with the next round of AVL implementation. This will allow for an adequate period of time to gain experience. At the end of this period, the Department should select the next highest priority application and repeat all of the subtasks described in the Phase 1 Rollout task.

This cycle should be repeated until all AVL applications, identified as priorities, have been implemented. It is expected that this process will take 3 – 5 years to complete.

Cost Estimates

DES has not selected a specific AVL system as of the date of this report. However, the Department has provided general information on AVL implementation priorities. This information is summarized in the “Implementation Priorities Matrix” on the next page. This matrix includes information on the AVL application along with the DES division, number of vehicles, telemetry requirements, and communications mode (i.e., active or passive). These applications are sorted into 4 priority levels and assigned reference identifiers.

Following the “Implementation Priorities Matrix” is the “Implementation Cost Matrix” that contains cost estimates for each of the priority applications identified by DES. These figures are based on an analysis of the average cost of the systems identified in the Technology Analysis Report. Estimates have been provided for passive, cellular, and radio communications. This allows for a comparison of DES’s preferred approach versus the other communications options. Other important aspects of the cost matrix include:

- “Capital Costs” refer to one-time purchases such as the in-vehicle equipment, control center hardware and software, and radio transmitters and base station.
- “Operating Costs” refer to monthly ongoing expenses associated with the system. This applies primarily to the fees for cellular airtime. AVL systems based on passive or radio communications have no significant operating costs.
- No ongoing costs are included for telemetry given that DES’s preference is to use passive or radio-based systems.
- Total “Capital Costs” for radio-based systems include the cost of a single base radio and base station software license, rather than separate base stations for each application.
- Costs listed in this matrix do not include the purchase or installation of any required telemetry hardware, user training, staff time, equipment replacement, and costs associated with system maintenance and repair.

The figures contained in this section of the report should serve as a valuable reference for DES in evaluating the cost/benefit of these applications as well as variations in the costs for the communications component of the AVL system.

Implementation Priorities Matrix

Ref. ID	AVL Application [Division]	Priority	# of Vehicles	Telemetry	Active / Passive Communication
BS1	Board-up and HVAC Vans [Building Services]	1	3	Man-down	Active
RC1	Snow Plowing [Roadway Contractors]	1	48	None	Active
SS1A	Street Sweeping [Special Services]	1	14	Broom up/down	Passive
SS1B	Service Truck [Special Services]	1	1	Man-down	Active
SC2	Sidewalk Plowing [Sidewalk Contractors]	2	58	None	Active
SS2A	Snow Plowing/Salting [Special Services]	2	31	Plow up/down, salt used	Active
SS2B	Sidewalk Plowing [Special Services]	2	6	None	Active
SS2C	Snow Inspection Vehicles [Special Services]	2	16	None	Active
SWM3A	Recycling Collection [Solid Waste Management]	3	34	Man-down	Active
SWM3B	Refuse Collection [Solid Waste Management]	3	42	Tipper Activated, Man-down	Active
SWM3C	Refuse/ Recycling Supervision [Solid Waste Management]	3	5	Mobile data terminal to view route locations	Active
WD1	Grid Repair [Water Distribution]	3	60	Man-down	Active
BS4	Facility Maintenance [Building Services]	4	25	None	Passive
E4	Construction/Permit Inspection [Engineering]	4	8	None	Active
SP4	Loaders [Special Services]	4	4	None	Active
SM4A	Loaders [Street Maintenance]	4	7	None	Active
SM4B	Pick-up Trucks [Street Maintenance]	4	12	None	Active
SM4C	Pothole Patch Trucks [Street Maintenance]	4	5	Point of service button	Passive

Implementation Costs Matrix

Ref. ID	Priority	Vehicle/Function (# vehicles)	Passive		Cellular		Radio	
			Capital Costs	Operating Costs/Mo.	Capital Costs	Operating Costs/Mo.	Capital Costs	Operating Costs/Mo.
BS1	1	Board-up and HVAC Vans (3)	\$4,900	\$0	\$3,165	\$124	\$4,800*	\$0*
RC1	1	Snow Plowing (48)	\$54,400	\$0	\$44,043*	\$1,978*	\$76,800	\$0
SS1A	1	Street Sweeping (14)	\$17,000*	\$0*	\$13,158	\$577	\$22,400	\$0
SS1B	1	Service Truck (1)	\$2,700	\$0	\$1,348	\$41	\$1,600*	\$0*
SC2	2	Sidewalk Plowing (58)	\$65,400	\$0	\$53,127*	\$2,390*	\$92,800	\$0
SS2A	2	Snow Plowing/Salting (31)	\$35,700	\$0	\$28,600	\$1,277	\$49,600*	\$0*
SS2B	2	Sidewalk Plowing (6)	\$8,200	\$0	\$5,890*	\$247*	\$9,600	\$0
SS2C	2	Snow Inspection Vehicles (16)	\$19,200	\$0	\$14,974	\$659	\$25,600*	\$0*
SWM3A	3	Recycling Collection (34)	\$39,000	\$0	\$31,326	\$1,401	\$54,400*	\$0*
SWM3B	3	Refuse Collection (42)	\$47,800	\$0	\$38,593	\$1,730	\$67,200*	\$0*
SWM3C	3	Refuse/Recycling Supervision (5)	\$7,100	\$0	\$4,982	\$206	\$8,000*	\$0*
WD1	3	Grid Repair (60)	\$67,600	\$0	\$54,944	\$2,472	\$96,000*	\$0*
BS4	4	Facility Maintenance (25)	\$29,100*	\$0*	\$23,150	\$1,030	\$40,000	\$0
E4	4	Construction/Permit Inspection (8)	\$10,400	\$0	\$7,707*	\$330*	\$12,800	\$0
SP4	4	Loaders (4)	\$6,000	\$0	\$4,074	\$165	\$6,400*	\$0*
SM4A	4	Loaders (7)	\$9,300	\$0	\$6,799	\$288	\$11,200*	\$0*
SM4B	4	Pick-up Trucks (12)	\$14,800	\$0	\$11,341	\$494	\$19,200*	\$0*
SM4C	4	Pothole Patch trucks (5)	\$7,100*	\$0*	\$4,982	\$206	\$8,000	\$0
Total Units for Preferred Solution:			44		120		215	
Avg. Cost per Unit for Preferred Solution:			\$1,209	\$0	\$923	\$41	\$1,809	\$0
Estimated Total Cost Based on Preferred Solution:			\$53,200	\$0	\$110,768	\$4,944	\$389,000	\$0

* Preferred solution identified by DES.

Schedule

The tasks in this implementation plan are intended to be completed in sequential order. However, a start date for this project has not been set. Furthermore, it is likely that there will be lag time between some of these tasks while others may be completed with a degree of concurrency. For these reasons, the following tables, containing estimates for the duration of each task and a general Gantt chart, have been provided in lieu of a more traditional project schedule.

Task	Approximate Duration
Establish Project Team	2 – 4 weeks
Identify Funding Sources	1 – 2 months
Conduct Pilot Projects	2 – 4 months
Establish Priorities for Phased Implementation	1 – 2 weeks
Phase 1 Rollout	6 months – 1 year
Phase 2 – N Rollouts	1 – 2 years

Task	Month												
	1	2	3	4	5	6	7	8	9	10	11	12	
Establish Project Team													
Identify Funding Sources													
Conduct Pilot Projects													
Establish Priorities													
Phase 1 Rollout													
Phase 2 – N Rollouts													>>

Summary

The information included in this report is intended to guide DES through the process of implementing AVL department-wide. The recommended methodology is comprised of a logically organized set of tasks that can be followed at a pace consistent with the Department’s objectives for moving forward with this technology. The duration of each task is noted in the schedule providing DES with realistic timelines for implementing specific applications. Detailed cost estimates have been included for each of DES’s priority applications.

While this plan describes how to implement AVL, the ultimate success of this effort will depend on the Department’s commitment to supporting the system in terms of long-term funding, staffing, and training. Should DES choose to move forward with AVL implementation, the department is well positioned to realize significant benefits from the use of this technology.