

CartêGraph System Audit

November 2007

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City Auditor's Office

November 30, 2007

Honorable Mayor and Members of the City Council:

I am pleased to present the City Auditor's Office's report of CartêGraph, an asset management system used by the City of Arlington. The purpose of the audit was to evaluate the adequacy of internal controls in CartêGraph, and ensure data accuracy and data integrity within the application.

Management concurs with our audit findings and related recommendations. Management's responses to our audit findings and recommendations, as well as target implementation dates and responsibilities, are included in the following report. Within twelve months, the City Auditor's Office will conduct a follow-up audit and comment on management's implementation of these audit recommendations.

We would like to thank Public Works staff for their cooperation and assistance during this project. We look forward to continuing our efforts to ensure that adequate controls exist within implemented systems and that those systems meet the business needs of the City.

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CartêGraph System Audit

Table of Contents

	<u>Page</u>
Executive Summary	1
Audit Scope and Methodology	2
Background	2
Detailed Audit Findings	
Applications Control Review – WORKdirector	4
Applications Control Review – PAVEMENTview	13
Application Security	16
Business Continuity and Contingency Planning	20
Post Implementation Review	22
Exhibit A – Non-City Owned Street Segments	

CartêGraph System Audit



Office of the City Auditor

Patrice Randle, CPA
City Auditor

Project #07-02

November 30, 2007

Executive Summary

***CartêGraph is working as
intended***

***Internal controls can be
strengthened to increase
the reliability of
information processed by
the system***

Opportunities for Improvement

- ***Audit trails of critical transactions***
- ***Data entry controls***
- ***Routine inventories***
- ***Managerial oversight of work order data and system alterations***
- ***Business continuity and disaster planning***
- ***Verification of street data***

As part of the 2007 Annual Audit Plan, the City Auditor's Office conducted an audit of CartêGraph, an asset management system utilized by the Public Works Department. The audit was conducted in accordance with standards set forth by the Information Systems Audit and Control Association and generally accepted government auditing standards, except for peer review. The objectives of the audit were to determine whether:

- Access to CartêGraph is appropriate, based on job requirements
- Controls over data input, data processing and data output are adequate
- Adequate audit trails exist for critical transactions
- Adequate disaster recovery and business continuity plans exist
- CartêGraph meets the City's business needs

The City Auditor's Office concluded that CartêGraph is working as intended, but identified several areas where internal controls could be strengthened.

The City Auditor's Office concluded that audit trails for some critical transactions were inadequate or nonexistent. Various internal control weaknesses also contributed to a lack of critical information in work order data fields, the ability to alter system-generated work order numbers, and the ability to alter closed and completed work orders. Internal control weaknesses also resulted in the duplication of work orders.

The City Auditor's Office noted that management included non-City owned streets in the database provided to an outside vendor to analyze street conditions. In addition, some platted but un-built streets were not identified as such in the street database.

The findings and recommendations are discussed in the Detailed Audit Findings section of this report.

Audit Scope and Methodology

The City Auditor's Office reviewed activity and data entered into CartêGraph since June 2005. The audit was conducted in accordance with information technology audit standards set forth by the Information Systems Audit and Control Association (ISACA) and generally accepted government auditing standards, except for the peer review.

The following methodology was used in completing the audit:

- Interviewed management and staff associated with system operations
- Gained an understanding of system operations
- Conducted sample transactions in the test database
- Used Audit Command Language (ACL) software for data analysis
- Examined audit trails and internal controls for critical activity
- Examined road surface images used for pavement condition scores
- Reviewed sample business continuity and disaster recovery plans
- Reviewed remote access to CartêGraph

Background

CartêGraph was first purchased in 1998 to track Public Works inventory and to manage work orders. Initially, the system was only used by the Streets Division to track citizen calls. In 2005, management decided to expand CartêGraph as a total asset management tool, including work order management. The system was expected to enable supervisors to better manage their personnel, improve tracking and reporting of work performed, and create a live link to the City's Geographic Information System (GIS) infrastructure.

The primary goal for expanding CartêGraph was to track and monitor replacement costs of over \$2.5 billion in street infrastructure, \$27 million in street light assets, and \$38.5 million in signal light assets - along with monitoring work orders for the Public Works Department.

CartêGraph includes:

- WORKdirector - primary module designed for work order entry and management. Within the WORKdirector module, work orders for the Streets, Traffic, Markings, Signs, Signals and Facility Services divisions are generated as a result of routine maintenance or calls from citizens. Labor and material costs associated with work orders are also entered, tracked and managed through WORKdirector. WORKdirector is capable of producing reports and queries to assist management in monitoring work order activity, and is currently used to track and manage inventory at the Traffic Division's main warehouse. As of June 2007, a total of 1,047 individual inventory items were tracked in CartêGraph. This module is currently operational.

- PAVEMENTview - designed to track road surface conditions. Within the PAVEMENTview module, City streets are segmented into sections. The overall street surface score is derived from the surface condition and the drivability index. This module is currently operational.
- PAVEMENTview Plus - designed to track road surfaces and provide information to estimate budgetary requirements for infrastructure improvements. The condition of each street segment is used to plan future street maintenance and/or replacement, based on available funds. This module is currently in operation.
- SIGNview - designed to track street signs. This module is currently operational. However, the Public Works Department is in the process of collecting data relating to sign type and its location which will result in a fully implemented sign inventory by January 2008.
- LIGHTview - designed to track electronics circuitry. This module is expected to be operational by January 2008.
- MARKINGview - designed to track street markings. This module is expected to be operational by January 2008.
- SIGNALview - designed to track traffic signals. This module is expected to be operational by April 2008.
- VERSAview - designed to track assets as deemed necessary by the Public Works Department. This module is currently being used to track a limited number of facility assets such as building locations and work order history. This module is expected to be operational by April 2008, which would include tracking all facility services assets such as equipment and machinery.
- STORMview - designed to track inventory, maintenance and mapping of all storm network components, from intake to final discharge point, with focus on Environmental Protection Agency (EPA) compliance requirements. The module is planned to be in operation by July 2008.

Detailed Audit Findings

Applications Control Review WORKdirector

The City Auditor's Office review of CartêGraph applications controls included assessment of data input, data processing and data output to ensure adequate internal controls and integrity of data. Sources for data input included:

- Work orders
- Labor and material data
- Inventory transactions
- Markings and signal assets
- Street segments and related data

The primary processing function in WORKdirector is the coordination of pending work orders for timely completion. Management uses labor data (work order and non-work order related) as a tracking and accountability tool.

CartêGraph is capable of generating many reports and queries to monitor progress on work orders and to ensure that inventory and assets are tracked. Custom reports can be generated to extract desired data for management review.

The CartêGraph system will allow management to compare standard labor hours and material usage to actual data. However, this capability is currently not used as Public Works management is in the process of researching industry standard labor and material usage. As a result, this audit was not focused on compliance or reasonableness of labor and material usage.

1. CartêGraph lacks data field controls.

The City Auditor's Office identified work orders with no activity codes, street coordinates, priority codes and dates of work performed. The application is set up to include these components so that management can monitor and analyze work performed.

Missing data in critical data entry fields is a result of lack of internal control in the data entry process. Strong data entry controls would require mandatory data entry in these fields. Some examples of data entry field controls include mandatory data entry for activity, location, priority code and work order begin date. A complete data set in work orders would provide valuable feedback surrounding type of work, location and time taken to complete the assigned tasks.

In addition, testing conducted by the City Auditor's Office identified inventory items without data in the materials description, material ID, material type and stock status fields. Incomplete data in the fields may result in the following:

- Inability to identify items
- Inability to identify which department inventory items belong to
- Inability to identify if items are stocked
- Errors in reports that are generated for materials management

If the stock status box is not checked, it is indicated as a non-stock item. However, it is difficult to assess if the field was intentionally left unmarked.

Recommendation:

The Public Works Director should require that the Information Systems Coordinator establish data field controls where applicable.

Management's Response:

Not all fields are required for data entry, at this time. Currently, only the "Department" and "Assigned To" fields are required, which prevents work orders from falling through the cracks. The Information Systems Coordinator will work with the CartêGraph Steering Committee to determine which fields must always be entered before a work order is closed, without making the system too cumbersome for the user.

In the Materials recordset, there are two primary fields used to identify the material item. Those two fields will be required, and the Information Systems Coordinator will build in a message to remind the user to enter the price quote for new items.

As an added measure, the Operations Support Services Division is currently drafting a business process requiring regular inventory and invoice/price reconciliations to ensure data has been appropriately entered.

Target Date: June 1, 2008

*Responsibility: Information Systems Coordinator
CartêGraph Steering Committee
CartêGraph Users*

2. System-generated work order numbering methodology can be altered.

All work orders consist of a system-generated and assigned work order number in CartêGraph. Numbers are assigned in numerical order; however the assigned number can be altered to another format. During audit testing, the City Auditor's Office was able to alter the work order number to other formats, including alpha, numeric, and alphanumeric values.

CartêGraph is designed to issue system-generated work order numbers in numerical order for ease of tracking and monitoring. The ability to alter the system-generated work order numbers is attributable to a lack of field edit controls in the data field. Without adequate controls, work orders could be manipulated to be excluded in reports and queries, altered after closure, or manipulated to match labor and material costs.

Recommendation:

The Public Works Director should require that the Information Systems Coordinator disallow alterations to system-generated work order numbers.

Management's Response:

The CartêGraph system sets the work order number field to be alterable by default. The Information Systems Coordinator has now locked down the work order number field to be read-only.

Target Date: Completed
Responsibility: Information Systems Coordinator

3. Closed and completed work orders can be altered.

A work order is considered to be closed and completed when work crews complete assigned tasks. Closed and completed work orders consist of final labor and material costs and time taken to complete the task. However, during audit testing, the City Auditor's Office was able to alter labor and material data in a sample of closed and completed work orders.

Alterations to closed and completed work orders should be disallowed in order to maintain data integrity. Under current conditions, work orders could be manipulated to include more or less labor and material than was actually used, alter closure dates to show faster turnaround or alter the location to show an area other than the area where work was actually performed. Currently, the system does not "lock down" closed and completed work orders.

Recommendation:

The Public Works Director should require that alterations to closed and completed work orders be restricted to the system administrator.

Management's Response:

CartêGraph Systems is currently in the process of developing a customized script to restrict user alterations to closed work orders. This security modification was initiated in April 2007.

Target Date: February 28, 2008
Responsibility: Information Systems Coordinator
CartêGraph Systems

Recommendation:

The Public Works Director should request that all work order activity after closure be logged into an audit trail and periodically reviewed by appropriate management.

Management's Response:

After the custom script is completed, the Information Systems Coordinator will develop custom archive reports that show edits made on closed work orders.

Target Date: July 1, 2008

Responsibility: Information Systems Coordinator

4. Users manually duplicated work orders.

The City Auditor's Office noted that users created duplicate work orders. System controls prevent the use of the same work order number; however, users appear to have entered the same job twice using unique work order numbers. When duplicate work orders are identified by the Public Works Department, comments are added to the work order record to identify that the work order is a duplicate. Based on review of the comments field, the City Auditor's Office noted 58 duplicate sign work orders, 13 duplicate markings work orders and 131 duplicate Street Division work orders between April 2006 and August 2007. The number of duplicates equals at least 3% of all work orders. Additional duplicate work orders may be in existence but not identified as such by the Public Works Department.

Duplicate work orders result in poor resource utilization because the possibility exists of two crews being dispatched to the same location. The possibility of labor and material costs being allocated twice to the work order also exists.

Prevention of duplicate work orders can be performed through operational controls, such as having a designated work order entry staff. Such a staff would be more likely to identify duplicate work orders. In addition, system controls could alert users if the same activity code existed for the same location, to prevent duplicate work orders being established for the same job.

Recommendation:

The Public Works Director should establish operational controls to prevent work order duplication.

Management's Response:

It is not unusual to have duplicated work orders in the system, as multiple citizens may call in to report a single problem. The business process for field operations personnel to handle duplicate work orders is to tie all duplicate work orders together into one project work order. We will continue to provide training for field operations on this business process. As an added measure, we will also begin the process of implementing a tool in the request system to allow the user to lookup similar issues in nearby vicinities.

Target Date: July 1, 2008

*Responsibility: Information Systems Coordinator
Asset Analyst*

5. Administrative work orders cannot be identified easily.

Current operational procedures require use of administrative work orders to identify labor hours not spent on tasks directly serving the citizens of Arlington. Currently, administrative work is categorized into 22 activity codes. However, the system does not identify these activity codes as “administrative” in nature.

The City Auditor’s Office noted administrative work orders using a “217 - Other” activity code without adequate data in other fields to clearly identify the type of work order. The same “217” activity code has also been used for tasks that appear to be non-administrative, such as work including material and equipment costs. The administrative work orders that appear to be regular work orders at times included material and equipment costs. Overall, the City Auditor’s Office was unable to clearly identify the nature of the work performed on “217” work orders. The resulting ambiguity makes it difficult for management to assess if material and equipment costs should indeed be included in the “217” work order.

Recommendation:

The Public Works Director should require that the system administrator establish a field in the work order data entry process to clearly identify administrative work orders. The new field should be used to lock out material and equipment usage data entry, which an administrative work order should not have.

Management’s Response:

Currently, there is a form for users to enter administrative work orders. This form does not allow the user to enter equipment or materials in the work order. However, some users use the regular work order form that does not prevent data entry in the equipment and material recordsets. Public Works will comply with this statement through additional user training on the administrative work order form. Also, the Information Systems Coordinator will remove the 217 (Other) activity code to prevent users from using this activity for administrative work orders.

Target Date: July 1, 2008

*Responsibility: Information Systems Coordinator
CartêGraph Steering Committee*

6. On-hand inventory figures were not verified or reconciled.

Over 1,000 traffic inventory items are tracked through CartêGraph. A sample of 40 inventory items was selected to verify if shelf quantities indicated on CartêGraph were accurate. The physical inventory counts for five of the 40 (12.5%) selected items did not match quantities listed as being on-hand in CartêGraph.

The variance in inventory counts may be a result of data entry errors, theft or misuse. As explained earlier (page 4), material standards do not currently exist but are planned for the future. Lack of material standards could encourage misuse of inventory by staff, which may go undetected by management.

Recommendation:

The Public Works Director should require routine inventory reconciliations.

Management's Response:

The Operations Support Division has been performing inventory reconciliations since January 2007. Process documentation detailing inventory reconciliations plans and schedules is in development.

Target Date: Completed
Responsibility: Field Operations Warehouse
Operations Support Services

7. Changes to inventory values are not captured in an audit trail.

Existing audit trails do not track changes made to inventory values. The ability to change material costs in CartêGraph is limited to two material handlers in the warehouse.

During testing, the City Auditor's Office was able to alter costs for materials used, alter the stated vendor price, and enter a price different from the stated vendor price in the work order material log. Per the Information System Coordinator, the ability to track changes to the inventory value field is available in CartêGraph but has not been activated by default. Activating the track changes feature by default could be done with relative ease. Lack of tracking capability could result in the inability to detect unauthorized changes to material costs in work orders, unauthorized changes to inventory cost due to theft, manipulation of overall material values, and/or inadvertent errors.

Recommendation:

The Public Works Director should require that the Information System Coordinator enable the audit trail to capture changes made to material values. Management should periodically review inventory value changes and document the review process.

Management's Response:

The CartêGraph system by design reports archive information on primary recordsets, but does not report edits made on sub-recordsets tied to the primary recordsets such as material prices. Public Works is in the process of obtaining a quote from CartêGraph Systems for a modification to allow this type of archive reporting.

Target Date: December 31, 2008
Responsibility: CartêGraph Systems
Information Systems Coordinator

8. Inaccuracies in labor and material costs exist within closed work orders.

The City Auditor's Office noted that some closed work orders did not have labor or material costs. Work orders without labor or material costs may be attributable to:

- Duplicate work orders
- Not linking work orders, when one job consists of multiple work orders opened by multiple work crews
- Failure to enter labor hours and material costs
- Inadequate utilization of CartêGraph reports that would identify incomplete work orders

Incomplete labor and material costs in closed work orders result in poor data integrity and actual cost computation inaccuracies. For the period of February 6, 2006 through August 1, 2007, the City Auditor's Office noted that 639 of 29,675 (2.15%) work orders did not have any reported labor costs. CartêGraph is intended to provide managers with cost data associated with the maintenance and construction of infrastructure assets. Such data would be deemed inaccurate with incomplete data.

- The ability to link work orders within CartêGraph can be established on the signals work order form.
- Managerial review of CartêGraph reports that identify completed work orders with no labor or material would enable staff to investigate and link work orders, when applicable. If staff has not entered labor or material costs, they could do so upon management's discovery.
- A CartêGraph warning when attempting to close out a work order without labor or material would remind crews of required data entry or to link work orders, if applicable.

Recommendation:

The Public Works Director should require that the Information Systems Coordinator establish internal controls in CartêGraph that would help prevent closure of work orders without the required labor and material data.

Management's Response:

It is acceptable to have no material costs because many work orders only require a field inspection, a follow-up call, or are administrative in nature. However, in order to comply with this recommendation the CartêGraph Steering Committee will identify which activities (such as pothole repairs, micro-seal, and new sign installation) would always require labor and materials. Once these activities are identified, the Information Systems Coordinator will build in system controls to ensure materials and labor are entered for these work orders.

Target Date: December 31, 2008

*Responsibility: CartêGraph Steering Committee
Information Systems Coordinator*

Recommendation:

The Public Works Director should require that management review available reports in CartêGraph that would identify existing incomplete work order data.

Management's Response:

The Information Systems Coordinator will create a report that will list closed work orders with no labor costs for supervisors. Supervisors will be required to review these reports regularly to identify incomplete work orders.

Target Date: December 31, 2007

*Responsibility: Information Systems Coordinator
Public Works Field Operations Managers*

9. Inaccuracies in inventory values exist.

The City Auditor's Office selected a sample of 80 items from the CartêGraph inventory module for value verification. Warehouse staff was unable to provide documentation (invoices, purchase orders, etc.) to support inventory values for 48 of the 80 (60%) items, as summarized below.

Category	Number
Documentation unavailable to support inventory values	48
Documentation available to support inventory values	32
Total sample	80

In addition, documentation provided for 12 of the 32 (37.5%) items with support did not match inventory values recorded on the system.

Category	Number
Documentation (invoices, PO's) did not match CartêGraph value	12
Documentation (invoices, PO's) agreed with CartêGraph value	20
Total sample – items with supporting documentation	32

Errors in material values result in erroneous maintenance costs of City-owned infrastructure. Sampled inventory items with no documentation to support inventory values were old items transferred from other warehouse locations, resulting in inaccuracies that migrated from the old manual inventory tracking system. The City Auditor's Office also noted that six of the sampled items were included in the inventory for Street Division tracking purposes only and another six were identified as obsolete or one-time purchase items that should be retired.

Recommendation:

The Public Works Director should improve the integrity of material data in CartêGraph by:

- Verifying values
- Retaining documents to support values of inventory items
- Retiring obsolete inventory items
- Monitoring audit trails to ensure that retired items are properly classified
- Segregating Street and Traffic Division inventory within CartêGraph
- Improving managerial oversight of inventory activity

Management's Response:

The Operations Support Services division is currently developing business processes for managing and streamlining warehouse activities. To comply with this statement, the completed business processes will address the operational improvement points made in this recommendation.

Target Date: December 31, 2007

*Responsibility: Field Operations Warehouse
Operations Support Services*

Applications Control Review PAVEMENTview

CartêGraph's PAVEMENTview module provides data related to street surface conditions scores. The City contracted with Applied Research Associates (ARA) Services to assess the streets in Arlington by determining the surface condition, drivability and distress indices for each street segment. The drivability and distress indices formulate the overall street condition score. The City segments street condition scores into the four categories listed below.

Condition	Score
Excellent	85 - 100
Good	70 - 84
Fair	60 - 69
Poor	Below 59

Preventive maintenance (mill-overlay or micro seal) of street surfaces is planned based on current condition score. The image viewer application holds video images of street surfaces, as taped by the vendor during street condition analysis.

10. Some street segments did not consist of current, updated data to reflect current status and street dimensions.

Data analysis performed by the City Auditor's Office indicated that 175 (1.5%) road segments owned by the City of Arlington did not consist of current, complete and up-to-date information. The majority of the streets with inaccurate information consisted of platted street segments that had not been built. Platted streets were not classified as being unbuilt. In addition, the City Auditor's Office noted some retired streets that were not properly classified as retired. The exception ratio is low compared to over 12,000 street segments currently in PAVEMENTview.

Data in PAVEMENTview should be current and up-to-date, considering events such as street maintenance are planned based on PAVEMENTview data. The system administrator is capable of running a report or query that would identify incomplete data sets, including streets without dimensions and streets in platted status for extended periods

Recommendation:

The Public Works Director should require that the Information Systems Coordinator establish monitoring tools to identify incomplete data in the PAVEMENTview module.

Management's Response:

The Pavement Asset Analyst will create a report showing which street segments do not have complete data such as street names, condition ratings, and pavement type. The Pavement Asset Analyst will run this report routinely.

Target Date: December 31, 2007
Responsibility: Pavement Asset Analyst
Information Systems Coordinator

11. An audit trail for segment score changes and segment deletions does not exist.

The audit trail in the CartêGraph PAVEMENTview module did not record alterations to the street surface scores or complete deletions of existing street segments. The City Auditor's Office entered a total of eight street segments into the CartêGraph test database. Audit testing included changes to pavement dimensions, classifications, surface type, location alterations, changes to the overall condition index (OCI) score and segment deletions. None of these changes were documented within an audit trail. Generally accepted information technology standards require audit trails of critical transactions to ensure management review and accuracy.

The CartêGraph application appears to have been designed without audit trails. Lack of monitoring deleted segments or score changes may lead to poor data integrity and/or data manipulation. Left unchecked, inaccuracies could migrate to the Public Works planning process for street improvement costs.

Recommendation:

The Public Works Director should require that the system administrator enhance current audit trails by including alterations to street surface scores and segment deletions. Changes to scores and segment deletions should be routinely reviewed for appropriateness and documented.

Management's Response:

The CartêGraph system by design reports archive information on primary recordsets, but does not report edits made on sub-recordsets tied to the primary recordsets such as street segment deletions and surface scores. Public Works is in the process of obtaining a quote from CartêGraph Systems for a modification to allow this type of archive reporting.

Target Date: December 31, 2008
Responsibility: CartêGraph Systems
Information Systems Coordinator

12. Street surface conditions were assessed on street segments not owned by the City of Arlington.

The GIS file that was provided to the vendor for surface analysis consisted of street segments not belonging to the City of Arlington. Street segments analyzed by the vendor included streets owned by the State of Texas, the Town of Pantego, the City of Dalworthington Gardens and others. The negative impact is the cost associated with street surface ratings that were not in Arlington. Generally, Public Works staff uses queries to isolate Arlington streets when performing analysis or projections of future maintenance needs.

Non-Arlington streets rated by the vendor with City of Arlington funds are listed below and graphically presented in Exhibit A to this report.

Entity	Number of Segments
Pantego	189
Dalworthington Gardens	117
Privately Owned	32
State of Texas	22
Grand Prairie	7
Kennedale	6
Fort Worth	5

Overall, a total of 12,578 street segments within the Arlington city limits and 378 street segments outside the Arlington city limits were rated by the vendor. The total cost incurred by the City for all segments rated by the vendor was \$474,072. Using an average cost per street segment, the streets that were rated outside City limits cost approximately \$13,867.

Recommendation:

The Public Works Director should ensure that all street segments outside the City of Arlington limits be excluded during future street surface analysis.

Management's Response:

At the time of the first survey, the official City Street GIS layer contained some streets that were not owned by the City. As the most reliable source of GIS information the City had at the time, that information was provided to the vendor who completed the pavement survey. The Pavement Asset Analyst has since gone through the data to clearly flag the City-owned streets. To comply with this finding, the current data of only City-owned streets will be provided to the vendor for the next survey, currently planned for Summer 2008.

Target Date: June 1, 2008

Responsibility: Information Systems Coordinator

Application Security

The City Auditor's Office's review of application security included a review of access to CartêGraph, assessment of data security and review of audit trails. Application security ensures that activities are logged and access to data is secure and granted on an as-needed basis. Effective audit trails track critical system activity such as alterations to existing work orders, changes to data tables, alterations to labor and materials and pavement rankings. In the event of system misuse, audit trails allow management to hold users responsible for system activity. Access to the application is currently based on the user's City network profile.

13. A methodology to communicate employee terminations to the Information Systems Coordinator does not exist.

Notification of employee terminations would enable the Information Systems Coordinator to revoke access to CartêGraph. In order to ensure data integrity, former employees should not be allowed access to the application. The City Auditor's Office noted that one former employee had an active access level. The access for two other former employees was revoked one and eight months after their actual termination dates. The City Auditor's Office did not note any evidence of data compromise or unauthorized record alteration as a result of the former employees having access to CartêGraph.

Currently the Information Technology and Workforce Services Departments are in the process of drafting a notification methodology for employee terminations. CartêGraph has a wide user base, including remote access capability to the application and temporary workers who use CartêGraph. Timely notification of employee termination to the system administrator is warranted.

Recommendation:

The Public Works Director should ensure that the Information Systems Coordinator revokes access to CartêGraph for terminated employees, based on notification from the Human Resources and Information Technology Departments.

Management's Response:

The Public Works Accounts Analyst sends Vacancy Reports to the Information Systems Coordinator on a regular basis. The Information Systems Coordinator reviews these reports for any changes that are necessary in CartêGraph. Future enhancements include integration with the Lawson system for immediate notification of personnel changes. To track employment changes for temporary employees, the Information Systems Coordinator will create a report of all temporary employees for field supervisors to run on a regular basis. The supervisor will review the report to determine which temporary employee(s) are no longer on contract with the City.

Target Date: January 31, 2008, additional enhancements planned

Responsibility: Information Systems Coordinator

14. Audit trails are inadequate.

- *An audit trail for alterations made to security settings does not exist.*

Alterations to security settings include adding new users, and granting, deleting and expanding permissions to existing users. Currently, the ability to alter security settings is limited to the system administrator. However, CartêGraph does not include audit trails that track security setting changes.

Checks and balances are an important part of system management, data integrity and transaction integrity. Lack of an audit trail that tracks security setting changes is an internal control weakness that prevents necessary monitoring by management.

- *The CartêGraph application is not capable of tracking activity related to the deletion of existing records.*

Current security settings allow employees in supervisory capacities and other selected employees to delete work orders, inventory records, and labor and material transactions. During the City Auditor's Office's testing of application security, deleted records did not appear in an audit trail.

Management's review of deleted records is a critical aspect of data integrity and system accuracy. If a verification methodology does not exist, employees could easily manipulate data, delete inventory records for personal gain or alter labor records without being detected by management. The City Auditor's Office found no evidence of manipulated data.

- *Information in audit trails is not categorized for easy monitoring.*

Information on existing audit trails is currently categorized by system user ID and can only be seen when the system administrator generates an activity report for a particular user. Therefore, if an activity report is not generated, any unauthorized activity could go undetected.

Reports of selected critical activity could be easily monitored by management. With such reports, critical activity such as deleted records, altered labor and material information, alterations to closed work orders or pavement condition data could then be routinely reviewed by managers. When the review process is conducted on a routine basis, unauthorized activity could be detected in a timely manner.

Recommendation:

The Public Works Director should request that the CartêGraph vendor enhance the system by including an audit trail of all security related activity. Management should routinely monitor activity listed in the audit trail.

Management's Response:

Currently, the ability to change security settings for CartêGraph users is limited to two people: the Information Systems Coordinator and the Pavement Asset Analyst. The Information Systems Coordinator will recommend that CartêGraph Systems enhance the software to track security changes on the database.

Target Date: January 31, 2008

Responsibility: CartêGraph Systems

Recommendation:

The Public Works Director should request that the CartêGraph vendor enhance the system by including all deleted activity in an audit trail. Management should monitor the audit trail on a routine basis.

Management's Response:

Currently, the ability to delete any record in CartêGraph is limited to two people: the Information Systems Coordinator and the Pavement Asset Analyst. The Information Systems Coordinator will recommend that CartêGraph Systems enhance the software to track system deletions.

Target Date: January 31, 2008

Responsibility: CartêGraph Systems

Recommendation:

The Public Works Director should seek assistance from the vendor to enable the Information Systems Coordinator to build reports based on critical activity. Selected critical activity reports should then be reviewed by management on a routine basis.

Management's Response:

Currently, the ability to make changes to database security settings and other critical activity on the back-end of the CartêGraph database is limited to two people: the Information Systems Coordinator and the Pavement Asset Analyst. If CartêGraph Systems makes the recommended changes in their system to allow for security tracking on the database, the Information Systems Coordinator or CartêGraph Systems can build a critical activity report that can be routinely reviewed by management.

Target Date: January 31, 2008

Responsibility: Information Systems Coordinator
CartêGraph Systems

15. CartêGraph's remote access feature is cumbersome.

The Traffic Division's Signs Crew uses CartêGraph's remote access feature. The Signs Crew remotely accesses work orders via wireless laptops and updates work order information while in

the field. However, remotely accessing CartêGraph has become cumbersome due to wireless connectivity issues. The City Auditor's Office observed decreased productivity within the Signs Crew due to multiple attempts to connect to the wireless network. This resulted in more time spent manually documenting work and entering work orders in CartêGraph upon return to their office.

The City Auditor's Office selected three locations to test connectivity:

- Collins and Brown intersection in north Arlington
- SW Green Oaks and Park Springs intersection in southwest Arlington
- Pioneer and Watson intersection in east Arlington

Only one of the three locations, SW Green Oaks and Park Springs enabled crews to log on to CartêGraph via wireless laptops.

Common causes of poor connectivity include, but are not limited to, the following:

- Citrix remote control software
- Virtual Private Network (VPN) connection
- Wireless infrastructure

The City's Information Technology Department has begun coordinating with Cingular Wireless and CartêGraph to resolve the connectivity issues. CartêGraph believes that future versions of its software would be better suited for remote access. The City Auditor's Office did not perform detailed audit testing for connectivity related issues as it was considered outside the scope of the current audit.

Recommendation:

The Public Works Director should coordinate with the Information Technology Department to resolve connectivity issues.

Management's Response:

The CartêGraph Phase II project focus is wireless access that would allow field users the ability to enter work orders in the field. However, technology like wireless hotspots and Virtual Private Network (VPN) has not proven to be sufficient to allow users to work in the field. After Public Works deployed wireless testers with one crew, it was determined that the remote access feature was cumbersome, and the project was put on hold. A Wireless Technology Steering Committee has been formed by IT, and is troubleshooting and testing various wireless projects. When IT develops a wireless solution that functions well, Public Works will deploy a new round of field testers.

Target Date: December 31, 2008

*Responsibility: Information Systems Coordinator
Information Technology*

Business Continuity and Contingency Planning

An effective business continuity and contingency plan enables a system to operate after a disaster. In the event of destruction of existing system hardware and operational facilities, an effective plan would enable CartêGraph staff to load backup tapes and the application to secondary hardware at a designated location and become operational. An effective contingency plan details an action plan for system users to follow, including individual assignments of responsibilities.

16. A business continuity and disaster recovery plan does not exist.

Ongoing business continuity related to CartêGraph is limited to creating daily backup tapes. A written plan and hardware to run the backup tapes does not exist and testing of any contingency plans has not been conducted.

The Information Technology Department has initiated efforts to launch a citywide business continuity plan. Disaster recovery plans typically consist of the following:

- Prioritization of activities that need to be recovered after a disaster
- A written plan that includes objectives, individual responsibilities and an action plan
- Identification of vendors that are capable of providing recovery services based on objectives
- Selection of a vendor and implementation of the disaster recovery plan
- Routine testing of the plan and documentation of testing efforts

Lack of an effective disaster recovery plan can result in many negative implications to the citizens of Arlington. During a disaster, citizens could be negatively impacted due to delays in processing work orders related to repair of City infrastructure. Administratively, CartêGraph would be a valuable tool to track labor and material costs experienced as a result of a natural disaster, information which may be important for federal agencies such as Federal Emergency Management Agency (FEMA).

Recommendation:

The Public Works Director should coordinate with the Information Technology Department to ensure that an effective disaster recovery and business continuity plan, based on prioritized tasks and objectives, is established. The plan should be tested and the results documented on a routine basis.

Management's Response:

In order to comply with this recommendation, the Information Systems Coordinator has scheduled a disaster recovery and business continuity plan to be completed as part of the FY 2007-2008 Work Plan for the PWT Information Systems Division. Provided IT is able to comply with the work plan schedule, this project should be completed by the end of FY 2008.

Target Date: *September 30, 2008*
Responsibility: *Information Systems Coordinator*
 Information Technology

Post Implementation Review

The post implementation review ensures that the expansion of CartêGraph has met the established business needs of the Public Works Department. Public Works management identified the following business objectives at the time of the CartêGraph expansion:

- Improve personnel management
- Improve tracking of work performed on City infrastructure
- Improve reporting/feedback capabilities
- Integrate work orders with GIS data
- Introduce a pavement management module that will rate street surface conditions

CartêGraph includes a wide array of reports that are available for monitoring system performance and data integrity. The system responded without failure during testing performed by the City Auditor's Office.

17. A system to record and monitor system downtime does not exist.

A tracking system that records instances of system downtime, causes of downtime and documentation of attempts to resolve issues with the vendor does not exist.

The key component of monitoring downtime is assessing compliance to system performance standards and requirements set forth by the users group when the system is purchased. The tracking system will also provide information to assess vendor compliance with the system maintenance contract. Detailed records would assist in any future legal actions, if needed, to recover any applicable damages filed against the system vendor.

An effective system downtime tracking system consists of the following:

- Date and time of downtime
- Time the vendor was notified of downtime
- Vendor resolution to the malfunction
- Date and time of resolution implementation
- Testing and management approval of system enhancements

A tracking system for routine CartêGraph maintenance also does not exist. If an enhancement or fix is required from the vendor, there is no tracking system in place to monitor the approval and/or progress of such request. The Information System Coordinator stated that no routine maintenance requests had been made to the vendor since implementation. System related concerns are currently communicated to the vendor via email.

An effective maintenance tracking system includes information pertaining to the following:

- Date of request
- Nature of request
- Correspondence with the vendor pertaining to the request
- Management's approval of request and solution (patch or other enhancement)
- Documentation of testing and test results prior to phasing an upgrade to live production

Detailed documentation related to system maintenance enables management to assess vendor compliance to the system maintenance contract and identify recurring issues.

Recommendation:

The Public Works Director should require that the Information Systems Coordinator track CartêGraph downtime and the causes of downtime.

Management's Response:

In order to comply with this recommendation, the Information Systems Coordinator and Support Systems Specialist will work together to develop a database or spreadsheet of system downtime. This will be included as part of a Quarterly Reporting Program for the department.

Target Date: March 31, 2008

*Responsibility: Information Systems Coordinator
Support Systems Specialist*

Recommendation:

The Public Works Director should require that the Information Systems Coordinator track maintenance requests made to the CartêGraph vendor.

Management's Response:

CartêGraph Systems recently moved to a new customer service system for which all support tickets are tracked by number. The Information Systems Coordinator will work with CartêGraph Systems to obtain regular reports of the support tickets and resolutions that have been completed for the City of Arlington.

Target Date: June 1, 2008

*Responsibility: Information Systems Coordinator
Support Systems Specialist*

Non-City Owned Street Segments

