Development of a GIS-Based Rights of Way Outdoor Advertising Sign Information System

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16. Abstract

Due to the increased workload and new requirements being legislated to manage and maintain data on billboard advertising, ConnDOT staff sought to develop an effective means to address these needs using a concept provided by ConnDOT's photolog group. Research was conducted to define data acquisition and management needs. Field photolog vans were outfitted with side-facing image and data acquisition systems, coupled with GPS data and complimentary digital images via hand-held cameras. A database was developed to collect, maintain and provide instantaneous access to billboard advertising data and information. The system has been implemented and shown to have a cost benefit ratio of 1.94 over a ten-year period of use.

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Development of a GIS-Based Rights-of-Way Outdoor Advertising Sign Information System (OASIS)

Summary Report

Image and Data Needs in the Office of Rights-of-Way

Since 1972, the Division of Rights-of-Way's (ROW) Outdoor Advertising Control Section (OACS) has manually maintained an inventory of outdoor advertising signs. The manual inventory included pertinent information on the sign location, classification and condition, and still Polaroid photographs of the signage. New sign locations required on site review, and the data obtained were then plotted by hand on construction plans or rights-of-way maps to record sign deployment. Copies of all reports, data, photographs, maps and historical records were stored in a cumbersome paper file system. In addition the OACS unit was responsible for site inspections, photographing and classifying approximately nineteen hundred (1900) locations throughout the State of Connecticut, containing approximately thirty-five hundred (3500) signs. OACS staff also reviewed proposed locations for compliance with regulations enacted by federal and state legislative bodies, and coordinated the removal of illegally constructed signs.

The success ConnDOT's Data Services Section (DSS) has had in developing management tools for specialized operations prompted ROW and Research personnel to review this problem in light of staffing limitations and expected growth in this area of the Department. A research project was developed that focused on providing automated data acquisition and storage systems to enhance the advertising sign-inventory process. Specifically, in the areas of data collection, storage, and dissemination of information and integration with related information systems in ROW were

addressed. This effort was further prompted by new legislative mandates on outdoor advertising and aided by technological developments within the Department that deal with imaging, data collection its distribution and use.

Project Objective

The project objective was to develop and implement an automated image- and data-acquisition and retrieval system for ROW. The system would be integrated with current field photolog activities and data processing operations.

Summary of Project Activities

A Project Advisory Group was established, which was chaired by ROW personnel. This action assured compliance with ROW project expectations and facilitated the work and implementation processes.

Research staff initially conducted a detailed survey of OACS needs and followed up with on-site interviews of affected staff and management. Several areas of technical and managerial concern were documented. In summary they were: 1) unacceptable image quality from Polaroid prints that often required additional field trips for re-filming; 2) a time-consuming collection process; 3) a storage medium susceptible to document misplacement; 4) no image and data backup and no fire protection; 5) difficulty in accessing information; 6) inconsistent data structuring due to subjectivity of inspections; and, 7) no provision for access to the Department's local area network or Geographic Information System (GIS).

Initial efforts addressed upgrading ROW information capability. New PC's were obtained with adequate speed and memory to handle GIS mapping and database applications. A side-

mounted video module (see Figure 1) was purchased and installed in one of DSS' photolog vehicles to address ROW imagery needs. The module is a full-frame, standard resolution (640 X 480 pixels) digital video camera on an adjustable mount (to permit changes in camera angle), and related software. It was installed at the vendor's facility in the spring of 1997. A modification was also made to the rater keyboard in the van to allow the photolog operator to manually flag billboard advertisements during field operations. By depressing a key as the photolog vehicle passes a billboard (See Figure 2), the operator provides input which is used to produce an automated billboard-database at the end of the photolog season. The database is referenced longitudinally by distance from a fixed point (chainage) and is then cross-referenced to GIS (latitude and longitude) data. Billboard locations can then be graphically displayed in a GIS (See Figure 3).

Figure 1: ROW Imaging Module – Installed in 1997

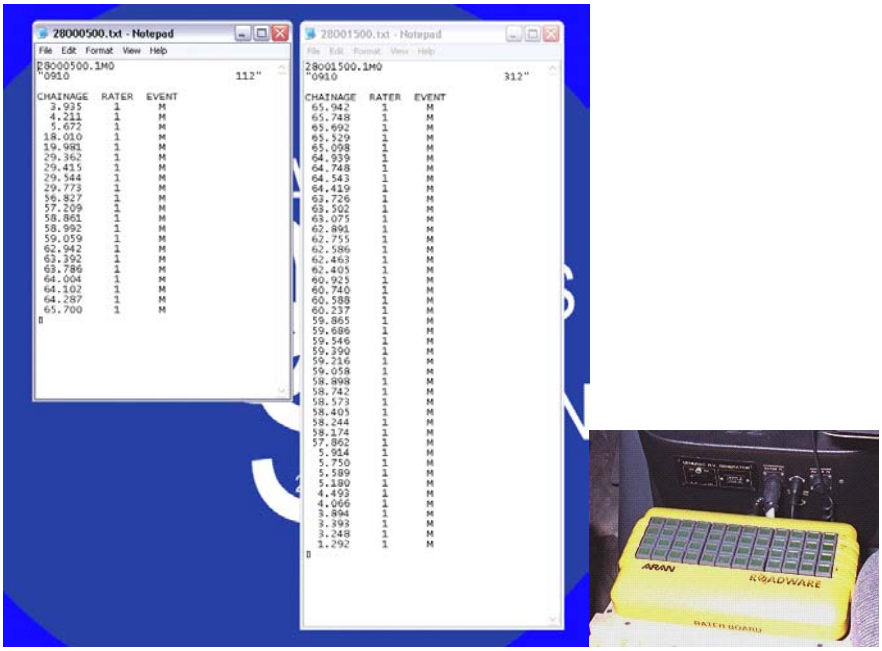

Figure 2: Rater Keyboard & Example of Resulting File Output (Route 91 data collected in 2002 is shown for log and reverse directions)

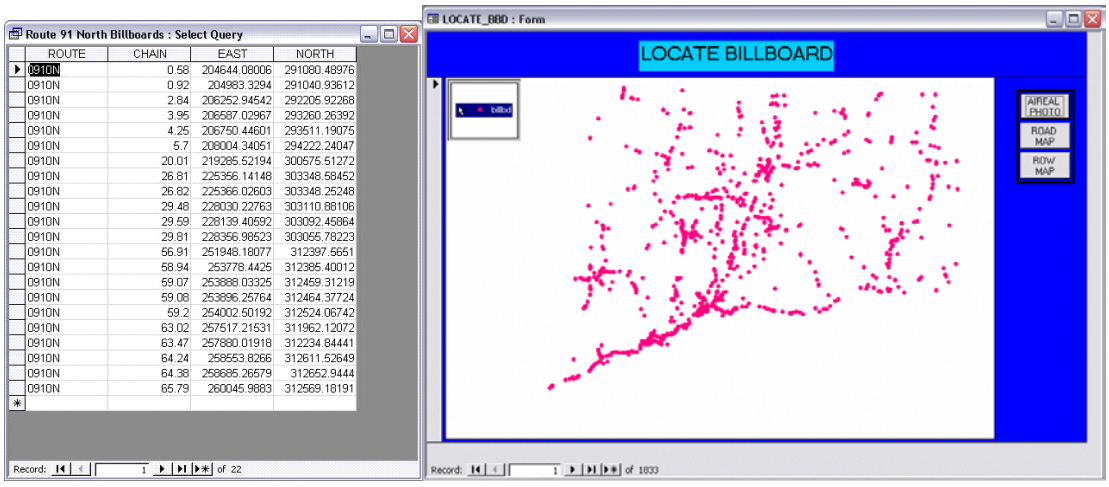

Figure 3: GIS-Ready MS Access Table; Below: Photolog Van-Generated GPS Points (2000 data)

Procedures for the field collection and office processing of images and data were established in two phases. Initially, the photolog vehicle ROW Video module was field tested to permit assessment of the resultant images and data by the Project Advisory Group. For this evaluation, sections of roads with representative outdoor advertising structures were selected by ROW and photologged at various vehicle speeds (20-60 MPH) and camera angles in both the horizontal and vertical planes. Digital images obtained were used to determine the optimal camera orientation and vehicle speed needed to capture required ROW data. The camera angle and position determined allowed a discernible overlap between the front and side image (see Figure 4), which makes it easier for the user to confirm side position as it relates to front-facing position.

Figure 4: Image Overlap

Editing procedures for ROW images was difficult and went through many changes as the system was developed and implemented. In 1999, side images were integrated into the standard photolog image editing process and in 2000 side imagery was incorporated into the new *DigitalHIWAY* viewing software.

Photolog images are now edited with software called *DigitalHIWAY Kompressor*. DSS has a contract for premastering of images and data to DVD. All discs are checked for quality by DSS upon receipt.

Based on an extensive review of the photolog images obtained, it was determined that all the data needs of OACS personnel were not addressed. For example, occasionally, billboard images fall too far from the roadway for the photolog camera to discern useful information (See Figure 5). Further, the Polaroid images previously used lacked clarity. Better quality "point and shoot" 35mm cameras replaced the Polaroid, and these have since been replaced by digital cameras.

Figure 5: Billboard Out of Vehicle Camera Range

To field verify the use of hand-held cameras, I-91 was chosen as the test case. The route was inventoried by OACS inspectors and Research personnel using hand-held 35mm cameras. Signs were photographed in a manner to illustrate and define detail (See Figure 6) and the resulting images assessed by the Advisory Group. Based on the group's evaluation, photographic guidelines were established and a standardized legend and related data requirements were developed.

Figure 6: Billboard Detail Photograph (OACS Photo)

An updated OACS database was installed on a notebook PC for use by field inspectors. This system provided ready access to outdoor advertising signage data for input or editing by Permit Number, Town or Route (See Figure 7).

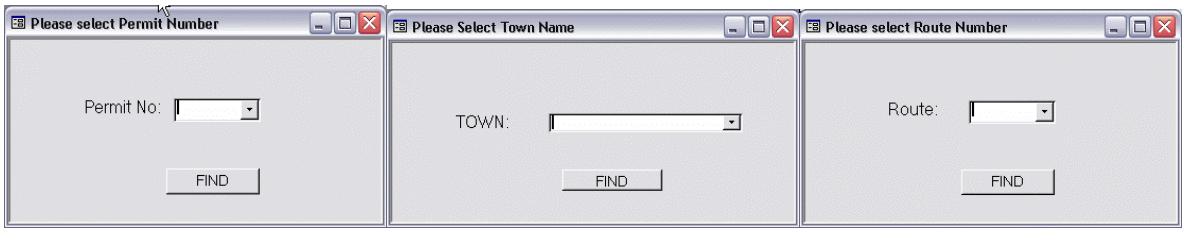

Figure 7: Route, Permit or Town Billboard Search

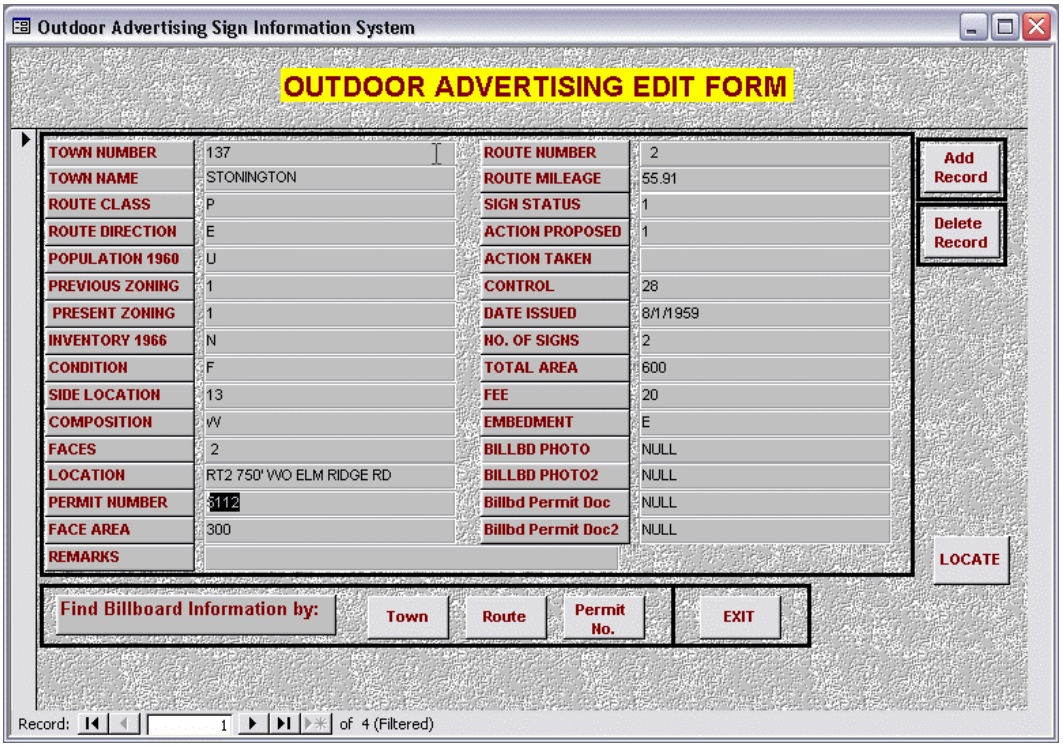

Figure 8: OASIS Data Input Form

All OASIS information is displayed in the database as shown in Figure 8. DSS and ROW field tests showed that approximately half of the 1800 permitted signs are recognizable from photolog. These are updated annually and can be easily entered into the OASIS by exporting the image file from *DigitalHIWAY* and then linking it to the OASIS database. Inspection photographs of various displays

continue to be integrated into the system. Field-acquired data are then downloaded to office PCs after a field trip. These data are given distinct filenames and entered into an Access database via a multi-media field as a hyperlink (See Figure 9). This system allows images and corresponding database information to be viewed simultaneously when using GIS software. For example, in 2002 approximately 200 images were acquired to supplement photolog data and digitized permitting information. ROW field personnel continue to use a notebook PC loaded with the OASIS database to record on-site data updates.

Plog_BB2000 : Table

ROUTE	CHAIN	EAST	NORTH	PLOGIMAGE
0910S	1.16	205144.95303	291023.74147	
0950N	11.84	176396.44937	237978.05299	rte95nb\BB_11.83.jpg
0950N	12.51	176660.12205	238595.33988	rte95nb\BB_12.60.jpg
0950N	13.25	177040.88681	239227.00602	rte95nb\BB_13.20.jpg
0950N	23.56	182460.44722	247327.59093	rte95nb\BB_23.62.jpg
0950N	23.72	182546.43047	247465.20472	rte95nb\BB_23.77.jpg
0950N	25.21	182951.07369	248853.61298	rte95nb\BB_25.29.jpg
0950N	35.99	185647.65181	258879.96086	rte95nb\BB_36.10.jpg
0950N	38.3	186832.4359	260724.00456	rte95nb\BB_38.40.jpg
0950N	43.41	189638.83266	264637.87455	rte95nb\BB_43.55.jpg
0950N	43.82	189711.60457	265035.81779	rte95nb\BB_43.96.jpg
0950N	44.26	189564.74152	265450.85589	rte95nb\BB_44.00.jpg
0950N	44.65	189496.90519	265837.80046	rte95nb\BB_44.43.jpg
0950N	44.96	189477.15212	266146.20234	rte95nb\BB_45.08.jpg
0950N	45.62	189581.21009	266798.42422	rte95nb\BB_45.76.jpg
0950N	45.9	189700.60864	267051.65581	rte95nb\BB_45.79.jpg
0950N	46.38	189916.40719	267478.67157	rte95nb\BB_46.53.jpg
0950N	47.65	190803.75988	268353.71412	rte95nb\BB_47.80.jpg
0950N	47.96	190911.69629	268644.66236	rte95nb\BB_44.79.jpg
0950N	48.3	190848.41199	268976.37358	rte95nb\BB_48.10.jpg
0950N	48.69	190648.95298	269314.55627	rte95nb\BB_48.49.jpg
0950N	49.17	190468.54474	269758.41239	rte95nb\BB_48.91.jpg
0950N	49.37	190430.3825	269957.10281	rte95nb\BB_49.32.jpg
0950N	49.6	190410.7389	270186.09265	rte95nb\BB_49.55.jpg
0950N	50.57	190510.45655	271132.34559	rte95nb\BB_50.71.jpg
0950N	50.96	190795.0778	271401.33711	rte95nb\BB_51.11.jpg
0950N	52.02	191495.01949	272195.663	rte95nb\BB_52.13.jpg
0950N	52.36	191778.26877	272382.77001	rte95nb\BB_52.20.jpg
0950N	62.96	196896.71159	280475.89922	
0950N	63.6	196869.54427	281099.81343	rte95nb\BB_63.77.jpg
0950N	64.68	197448.32982	282016.05317	
0950N	64.8	197514.31522	282116.94095	rte95nb\BB_64.97.jpg
0950N	65.26	197797.26991	282481.80403	rte95nb\BB_65.31.jpg
0950N	69.28	200394.68988	285546.04656	rte95nb\BB_69.48.jpg
0950N	69.67	200606.50038	285874.91589	rte95nb\BB_69.89.jpg
0950N	70.03	200860.15915	286131.3939	rte95nb\BB_70.23.jpg
0950N	70.04	200867.91831	286137.1955	
0950N	70.18	200985.55241	286214.66921	rte95nb\BB_70.39.jpg
0950N	70.78	201527.06875	286478.63714	rte95nb\BB_72.77.jpg
0950N	70.95	201654.27813	286592.06495	rte95nb\BB_72.94.jpg
0950N	72.82	202495.66597	288255.21918	

Record: 376 of 492

Figure 9: Image Path Accessible Via Hyperlinks

Implementation of OASIS

Implementation involved providing user-PCs that were linked to the Department's local-area-network (LAN). This facilitated OASIS data sharing. Additionally, *DigitalHIWAY Server* was set up by DSS and the Department's Information Systems Group in the fall of 1999. Staff training was provided upon installation of the OASIS database and *DigitalHIWAY*.

OACS staffing limitations have prevented annual updates to the database and continued work on the GIS. The database is currently up-to-date, based on information provided by OACS. Today, desktop imaging is frequently used in place of field trips for review, confirmation and documentation of outdoor advertising signs.

Conclusions

An Outdoor Advertising Sign Information System (OASIS) has been successfully implemented in Rights of Way's Outdoor Advertising Control Section. It is accessible by 39 personnel in other sections within ROW. The system consists of network and DVD access to photolog's *DigitalHIWAY* image and data viewing tools, along with an Access database containing all traditional OACS data fields pertaining to permitted billboards.

Benefit Cost Analysis

A benefit cost analysis for this project has been performed over the last year (calendar 2002). This analysis shows that initially the benefit cost is 1.94 and demonstrates the cost-effectiveness of this project. Based on past experience it is projected that the benefit cost ratio will increase with system familiarity (Appendix A details this analysis).

Selected Reference

1- Coleman, D.M., “Final Report: Development and Implementation of Digital Versatile Disc for the Storage of Digital Photolog Images in Connecticut,” ConnDOT Report No. 2224-F-01-2, July 2001.

Appendix A: Project Benefit Cost Analysis

Salaries	$32,780
Computer Hardware & Software	$76,500
Media Materials	$17,500
Contract Services	$95,000
	$221,780

Benefit Cost Analysis

	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
	Yearly savings									
	$40,000	$40,000	$40,000	$40,000	$40,000	$88,000	$88,000	$88,000	$88,000	$88,000
	Yearly maintenance and other recurring costs									
	$3,500	$3,500	$3,500	$3,500	$3,500	$2,000	$2,000	$2,000	$2,000	$2,000
Capital cost	**Net yearly savings (savings minus maintenance and other recurring costs)**									
-$221,780	$36,500	$36,500	$36,500	$36,500	$36,500	$86,000	$86,000	$86,000	$86,000	$86,000

Parameter	Value		Explanation
Cum. 10-Yr. Savings	$612,500		Total savings
SPB	3.62	years	Simple payback = capital cost/net yearly savings
Discount Rate	5.00%		Rate used to calculate time value of money
NPV	$217,124		Net present value of all costs and savings
B/C Ratio	1.94		Ratio of net present value of all savings to net present value of all costs