

Automated Construction Data Management System

Bob McCullouch

Assistant Professor of Civil Engineering

Purdue University

INTRODUCTION

INDOT construction supervision personnel spend a considerable amount of time processing construction data. An informal survey revealed that five hours a day is spent by the PE or PS and the inspector. Based upon existing trends of increased construction activity without parallel increases in INDOT personnel, data management will continue to expand, making more demands on their time. Not much can be done to reduce the amount of construction data generated and managed, but a new, innovative automated data management system should be developed to solve this impending problem.

WORK ACTIVITIES

The INDOT Long Range Data Processing Committee (LRDPC) performed several work activities in order to reach the goal of defining a system. Work activities performed by the committee included: review existing INDOT computer systems; study construction forms; conduct a State DOT computer survey; review the Connecticut DOT system; investigate local computing capability; and evaluate hardware, software, development options, and costs and benefits.

SYSTEM FEATURES

Essential capabilities of the system include: a BAMS tie-in; computerized specs; user ease; and localized computing capability. Miscellaneous features that bring more automation to the system include: portable data collectors; asphalt/concrete plant tie-in; RF tags; bar code usage; lab equipment RS232 interface; laboratory information management system(LIMS); electronic signatures; document scanner; electronic clipboard capability; and Graphics Interfaced Transportation Information System (GITIS) Interface.

SYSTEM BENEFITS

States that have developed and are using this type of a system have documented some significant time benefits. In Connecticut a pay estimate would take a PE one week at 75 percent time. Now it is performed in one to two days. I stated earlier that about five hours per day on an INDOT project is spent on paperwork. Of this five, 3.5 were spent by the PE. In comparison, a PE in Connecticut spends about one to two hours a day on paperwork. This is a time savings of a couple hours per day compared to INDOT. In New Jersey, by the manual method, it would take 1.5 hours to produce a daily report, 1.5 hours to produce a weekly

report, and four hours to produce a monthly estimate. With the automated system these same reports are produced in ten minutes, fifteen minutes, and twenty minutes respectively.

COSTS AND BENEFITS

Below is a summary of expected system costs and benefits.

Startup Costs:

PC work stations (300 @ 3000)	=	\$900,000
PC software (300 @ \$650)	=	195,000
District hardware & software (6 @ \$55,000)	=	330,000
Mini software (6 @ \$11,000)	=	66,000
Training costs (estimated)	=	10,000
Extra Security (300 @ \$200)	=	<u>60,000</u>
Total startup cost	=	\$1,561,000

Annual Costs:

Communication	=	\$210,000
Maintenance (300 @ \$200)	=	60,000
Miscellaneous (Supplies, etc.)	=	10,000
Information Services Support (1 day/week = 8*52*\$20)	=	<u>8,320</u>
Total annual costs	=	\$288,320

The main savings identified by the committee are summarized below.

Postage	=	\$60,000
Position elimination	=	239,400
Form printing & storage	=	37,000
Permanent Record storage	=	17,000
Management inquiries	=	<u>40,000</u>
Total annual savings	=	\$393,400

The following monetary savings are due to expected reductions in time for processing paperwork from various personnel.

District M&T clerks (1 per district @ 30 hr/wk)	=	\$79,560
District Testing Engineer (1 per district @ 1 hr/wk)	=	6,240
District Const. Final clerk (1 per district @ 20 hr/wk)	=	65,520
District Const. Final clerk (1 per district @ 10 hr/wk)	=	42,120
Project Engr. & Proj. Sp. (316 @ 2 hr/day during const.)	=	1,540,500
District Const. Engr.	=	6,240
Central Finals	=	<u>2,080</u>
Total time savings	=	\$1,742,260

The annual cost savings do exceed the estimated annual costs, but what about recovering the startup costs (\$1.5 million) and the additional development cost for the complete system? To answer this question you have to place value on time saved by utilizing this system. The number calculated above (\$1,742,260) represents this value. Even though INDOT will not reap this in real money, its construction operations and personnel will benefit significantly.

RECOMMENDATIONS

Hardware Configuration. The LRDP is recommending a hardware option comprised of a PC in the field, a mini system at the district office, and utilizing the main frame at the central office. Data entry will occur at the field PC, transferred to the district hardware for storage and some processing, and later transferred to the main frame for storage and accessibility from other systems.

Outside Consultant. The committee recommends that if money is available, a consultant should be hired. One price received is \$3.3 million for the construction data system with delivery in a 13 month time period. With the recent state budget "belt tightening," this money may not be available. As a contingency plan, the committee is proposing another alternative.

System Development. The committee is recommending a short term and a long term approach. The short term solution will utilize the Paradox construction records program currently operating on selected projects. This program will be expanded and enhanced to perform the initial features described in the report. The long term solution could evolve from this initial one or, after exploring the Paradox capabilities, it may be decided to use a higher level language and an outside consultant to develop.

Implementation would occur in one district on new projects to adequately test it. At the same time it will also be available to the other five districts for their use and feedback.

To design and test this system some software and maybe a PC at the district office may need to be purchased. This shouldn't exceed more than \$7,000 (this includes the cost for a Paradox compiler). Development of the initial system would be supervised by the Long Range Data Processing Committee. This would also be coordinated with the committee involved in the construction records program and the Information Services department. One person from Information Services has been working on the construction records program, so this individual should be the one to work on this project.

Miscellaneous. Other recommendations from the committee are summarized below. The PC hardware should have 386 capability because of trends in software and hardware. A formal training program should be developed for system users. A system improvement depository should be established for incorporating user suggestions and revising the system. The Long Range Data Processing Committee should continue to function until the system is field implemented to help insure system capabilities.

CONCLUSIONS

Development and implementation of the system will require a considerable amount of effort, coordination, and cooperation. But, before this system can become a reality, it has to be perceived by INDOT management as necessary and

a priority. Two realities should not be overlooked. First, with transportation facilities continuing to deteriorate, and heavier use expected, more construction will be needed to keep pace with the demand. Second, because of a shrinking work force, less INDOT personnel will be available to manage construction projects. These realities should demand the development and utilization of an Automated Construction Data Management System by INDOT.