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URBAN TRANSPORT INTERNATIONAL

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Automatic fleet control

Ferries in urban transport

Heathrow Express opens

"TEA 21" promise for u.t.

Maintenance

At New York City Transit (NYCT), the Department of Buses maintains and operates the largest bus fleet in North America. With 4,046 buses in service on 234 routes, NYCT moves 1.5 million daily customers to over 14000 destinations. We do it 24 hours a day, 7 days a week, running up an annual total of 102 million revenue miles. To keep this immense network running smoothly, a team of 2,800 maintenance mechanics and supervisors work round the clock in 18 bus depots and five central shops to service and repair the buses.

Planning maintenance on this scale is a complex and difficult task. Facing significant budget reductions, NYCT has found that it must examine the way fleets are maintained. Being serious about maintaining our own fleets has meant looking more closely at approaches similar to those in private industry. This involves some major changes in business practices:

• shift from reactive to preventive maintenance;
• adoption of standard repair times;
• use of recommended maintenance procedures.

For NYCT, this change in practice required implementing a computerised maintenance management system (CMMS) that would collect the data needed to manage maintenance in this way. To be successful, a CMMS must have three key ingredients. First, the computer application must be stable, comprehensive, and usable. Second, the data must be complete and accurate. Third the end user must understand the systems goals and have knowledge of the operation.

New York City Transit chose a Spear Technologies CMMS system. NYCT calls their system MIDAS (Maintenance Information Diagnostics and Analysis), and it is compliant with the standards developed for private industry by the American Trucking Association over a 30 year period. The release that is in place in NYCT is a custom application with requirements being provided by NYCT.

Spear has released several modules of its next generation CMMS, Spear 2000, which will expand on the capabilities of the version used by NYCT today. Spear 2000 provides a true graphical user interface and on-line imaging support.

With the release of Spear 2000, Spear Technologies is offering a state-of-the-art Windows 95/98/NT client/server system to compliment its UNIX based system, which is widely installed in the transportation industry. Spear 2000 incorporates all of the UNIX application functionality, as well as new capabilities.

In addition to providing robust functionality in a client/server configuration, Spear 2000 has been engineered with configurability as a primary design goal. As an example, customers can tailor their application by changing any on-screen/on-report text (i.e. prompts), field sizes, date format, currency format, and edit rules, as well as add new data elements to the application. These changes are made through utility programmes provided with Spear 2000. No programming modifications are required.

Spear 2000 is easy to use for both experienced and novice users. It has been designed with a powerful, yet easy to use, search engine that provides the capability to retrieve vital information for decision support. Spear 2000 was engineered from the outset to be certified Year 2000 compliant.

Spear 2000 is engineered for high performance and runs on an open system client/server platform that uses Windows 95/98 and Windows NT for the client software component, and uses virtually any hardware or operating system that supports the Oracle database for the server component, (i.e. Windows NT). Spear 2000 takes full advantage of 32-bit architecture and offers a scalable pricing model based on fleet size or miles of track to license any segment of the transportation industry.

In order for a CMMS system to be effective, they require a user who understands both maintenance operations and the long term analytic needs of preventive maintenance analysis. In a maintenance environment, system data entry must be done by those who can actually detail the repair activities, ideally the mechanic. Our success depended on the preparation and initial training of thousands of mechanics and line supervisors. Since traditional computer training has not worked with shop floor users, we looked for alternative approaches.

Dr. Lia Di Bello at CUNY Graduate School had established a record at NYCT's car equipment department for overcoming the typical long learning curve and designing educational interventions that seemed to bypass the need for "pre-requisite" knowledge of computers. Dr. Di Bello and her colleagues designed a series of hands-on simulations that basically compress the "incidental" learning that takes place on the job (over a period of a year or two) into a few days. We were also interested in her methods because the workshops seemed to reduce or eliminate user resistance. According to Dr. Di Bello, this may occur because the real basis for resistance is a misunderstanding about what the system is for. After an in-depth assessment at our sites, Di Bello's team designed alternative training to fit our mechanics.

For MIDAS, CUNY built a three module workshop, where teams of eight participants were asked to "run a depot" of 40 plastic buses with relatively complex interior components. The goals were to maintain 32 buses in service at all times (limiting the number out of service to eight), order all the materials (within a budget) needed for doing so and evaluate daily operator reports (each "day" being 20 minutes.) The activity was "rigged" so that the only way to meet these goals was to predict what was due to break next and to practise "preventive maintenance". The breakdown patterns of all components followed time/mileage cycle rules and were pre-calculated using a computer. The participants were given adequate tools to predict and calculate this breakdown, (printouts of every bus' repair history among other things), but were given other tools as well, including those similar to those used to do "reactive" maintenance.

In module one, the participants have to "wing it", while the trainers carefully document the cash flow, labour flow, inventory acquisitions and the number and type of on -the -road failures that result from failing to predict problems. Heavy fines are levied for expensive "reactive" problem-solving strategies, such as "cannibalising" an entire bus for a few cheap parts that will get other buses back on the road. Later, the participants are shown the consequences of their decision-making patterns and the underlying logic used. By the end of the first module, the "depot" is in crisis and the participants realise their budget is being expended to react to mounting problems. The activities are stopped and the team is sent to lunch.

In Module Two of the workshop, participants reflect on what they did, as recorded by the trainers. The participants discuss among themselves what led to various decisions and begin to identify practices that lead to bad outcomes vs. practices that are preventative. It is only at this point that the participants are truly open to new ideas about how to solve the problems of vehicle maintenance. They also begin to understand in detail the ways that their "gut feel" decisions reveal how they have actually misunderstood preventative maintenance. In the last part of Module Two, the participants are facilitated by the trainers in building a preventive maintenance approach. The participants then enter these data on an actual test region in the MIDAS system and create and assign the work orders according to this schedule.

During Module Three, the participants complete their data entry and print out their work assignment sheets and work orders. They run their miniature depot again using MIDAS and see the difference in profits and ease of workflow. Usually only after 5 "days" the team can afford to buy an additional bus to add to the fleet and thereby increase their revenue. After operating *as* MIDAS and then *with* MIDAS, participants navigate through the actual system more easily, know what to look for and ask informed questions.

in transition

Express Buses								
	One Division	System	One Division	System				
Fleet	82 GMC	82 GMC	85 GMC	85 GMC				
Average labor cost per bus	$ 22,144.43	$ 15,302.73	$ 19,522.85	$ 15,965.52				
Average parts cost per bus	$ 1,824.45	$ 3,202.30	$ 2,040.72	$ 2,143.04				
Average labor hours per bus	411.3	284.2	362.6	296.5				

Local Buses								
	One Division	System	One Division	System	One Division	System	One Division	System
Fleet	81 GMC	81 GMC	82 GMC	82 GMC	83 GMC	83 GMC	84 GMC	84 GMC
Average labor cost per bus	$ 31,673.47	$ 19,540.17	$ 20,591.92	$ 20,454.43	$ 24,646.90	$ 18,645.98	$ 25,485.07	$ 21,258.21
Average parts cost per bus	$ 1,930.08	$ 3,184.20	$ 3,220.46	$ 2,901.78	$ 1,121.38	$ 2,897.67	$ 2,133.94	$ 3,373.93
Average labor hours per bus	588.3	362.9	382.5	379.9	457.8	346.3	473.3	394.8

	One Division	System	One Division	System	One Division	System		
Fleet	87 GMC	87 GMC	90 TMC	90 TMC	96 Orion	96 Orion		
Average labor cost per bus	$ 23,386.68	$ 20,656.66	$ 22,437.26	$ 19,003.43	$ 29,846.68	$ 19,580.61		
Average parts cost per bus	$ 2,707.72	$ 2,681.34	$ 2,044.08	$ 3,404.40	$ 3,117.19	$ 2,973.18		
Average labor hours per bus	434.4	383.7	416.7	353.0	554.4	363.7		

Even computer-illiterate individuals showed little hesitation when given the real system.

Success in implementing this CMMS system (MIDAS) has allowed NYCT to begin the process of change. Instituting standard repair times, preventive maintenance and recommended procedures are the beginning. Easy access to live data on every detail of maintenance actions sets the stage for true "zero based" budgets, accurate life-cycle costing and return on investment projections that will make business decisions more informed. *(Chart 1)*

Our system is now used in 18 depots by 3,000 people to run 4,000 buses. After the initial training, there was virtually no resistance to MIDAS when it was implemented at the depots. In every case, a depot was able to become fully independent within six weeks of implementation. More important, the data entered by mechanics was at the level of detail needed for preventive maintenance analyses. *(See graph)*

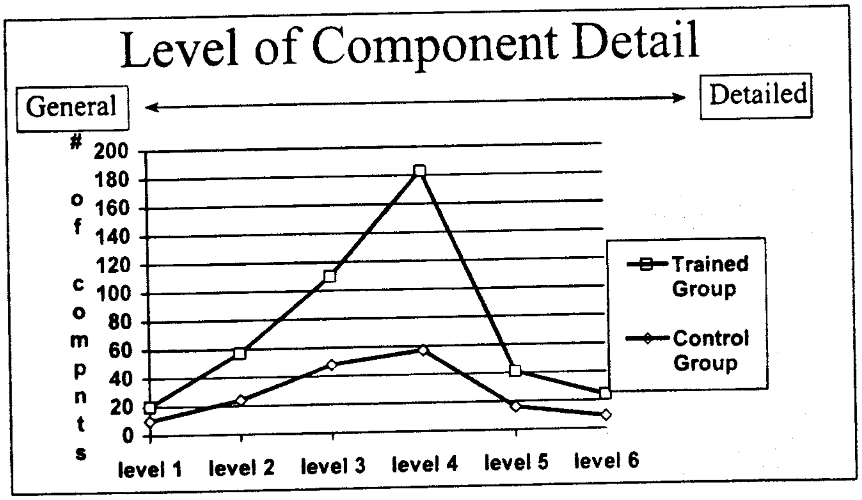
Our next steps are to use the existing vehicle maintenance reporting standard (VMRS) structure developed by the American Trucking Association (ATA) to jump-start a standard "Transit" reporting structure. This will eliminating the design, testing, implementation, validation iterations that would be a necessary part of any new initiative.

ATA has an established "two-way communications" protocol, which links VMRS users, and the ATA management systems council that is responsible for much of the success of this reporting standard. Participation in this proven system will allow the public transit sector to be assured of continued growth, accuracy and usefulness of the VMRS in our industry.

We use the new standards to benchmark our performance to various transit properties. These standards must then be compared in a meaningful way to the proven competitive efficiencies that exist in private industry. Self-measurement is a vital tool for transit managers and public boards to use in the evaluation of their agency's performance and must be a factor in any long-term decision making. Truck fleets are commonly compared to each other in areas such as maintenance efficiency, operating costs, cost per mile and many other categories. As a result, private fleets are very cost-effective and reliable.

Public transit agencies must move quickly toward having the ability to benchmark performance, perform real cost benefit analysis and make decisions based on actual data. The transit industry has begun to require that OEM labour operations code books be published in electronic formats to ease the recovery of warranty dollars. The further requirement that the labour operations codes follow the VMRS for system, assembly and part coding; the repair reason coding and the repair code would make the recovery of warranty dollars even more efficient and would aid transit in comparing premature part failure information between agencies. OEM's must provide real standard repair times that have been validated with any equipment purchase.

We are also working in partnership with Spear Inc. to have the ensure that the complete VMRS coding standards are in the next release of their product. We expect to deploy this new generation of software in late 1998. This will provide the first commercial off-the-shelf maintenance programme developed specifically for the transit industry that is capable of supporting multiple locations and the largest fleets. New York Transit is committed to the identification and classification of maintenance data at the source and in facilitating the shop-floor in direct data input of repair information at the time the work is done. ❒



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