Polytechnic University

Department of Civil & Environmental Engineering

Excerpts from…

Parking Meter Operability Study

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Prepared for New York City Department of Transportation
Parking Division

by

Prof. Dimitrios G. Goulias
Polytechnic University
(Principal Investigator)

& Shmuel Z. Yahalom
State University of New York
Maritime College

Region 2 University Transportation Research Center

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This research project was undertaken by Polytechnic University and the State University of New York, Maritime College. Professors Dimitrios G Goulias (Principal Investigator) and Shmuel Yahalom, directed the work and analysis based on the recommendations of the New York City Department of Transportation, Parking Division. Prof. John Falcocchio provided his guidance in the development and analysis of the study. Research assistants from Polytechnic University and the State University of New York – Maritime College assisted in the analysis of the study

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Chapter 1. Introduction

The New York City Department of Transportation (NYCDOT) Parking Division is responsible for the largest parking meter network in the United States. The efficient operation and maintenance of this system provides an important and sizable source of revenue for New York City. This study addressed the need of the NYCDOT Parking Division to review its current operations and evaluate operability measures. The study was undertaken in coordination with the research unit, the maintenance and revenue collection units, and the computer services unit. The objective of the study was to examine and evaluate the current definition of operability, review meter inspection/maintenance and revenue collection operations, identify improvements, and provide a systematic method of implementing these improvements to increase efficiency, and ultimately, revenue. The study was organized in two phases. In the first phase, the current practice was reviewed using one-year historical data for identifying potential improvements in meter inspection/maintenance and revenue collection operations. In the second phase, testing of the assumptions and fine-tuning of the suggested improvement methods were conducted using field data. Several meetings took place over the duration of the study for presenting the findings and fine-tuning the methodology. This document is the final report of the study.

There are approximately 66,000 parking meters in New York City, which are grouped into 224 geographic ***areas.*** Of these, approximately 63,000 are on-street meters, which account for 179 ***areas.*** Those remaining are off-street meters, located in municipal parking lots and garages. Because most of the off-street mechanical meters are being replaced by munimeters, which have a high level of operability, this study focuses on the on-street meters.

The NYCDOT Parking Division consists of four units: Meter Maintenance, Meter Revenue Collection, Parking Control, and Computer Services.

The Meter Maintenance Unit inspects between 15,000 and 20,000 meters daily, with each inspector averaging 350 meters. Because some meters are inspected more frequently than others, all of the meters are inspected at least once within a 10-day cycle. Approximately 10% of the meters inspected require maintenance and are repaired on the spot. Examples of maintenance and inspection data records (described in detail in the interim report) collected during these operations are shown in Appendix A.

- Each agent in the Meter Revenue Collection Unit collects revenue from approximately 400 meters daily. Some meters are visited more frequently than others. The revenue from all the meters is collected at least once within a 24-day interval. Examples of the revenue collection records (described in detail in the interim report) are shown in Appendix A.

- The Parking Control Unit is responsible for issuing parking summonses, making arrests for meter vandalism, and making minor repairs to the meters, such as clearing coin jams and removing plastic strips. Each officer patrols approximately 200 meters daily.

- The Computer Services Unit maintains the Parking Information Management System (PIMS) and prepares reports regarding meter operations.

In April 1994, NYCDOT implemented the Meter Shield Program, which was adopted to increase the monitoring of meter areas with high revenue potential that have low levels of operability due to a history of vandalism. The targeted areas require the frequent and combined forces of the maintenance, revenue collection, and parking control personnel.

1.1 Background

In order to define problems and needs and to suggest improvements, it was important to fully understand the current conditions and the historical patterns of meter operability and revenue. The current maintenance and collection programs were studied and the PIMS structure and data retrieval methods were reviewed. To determine the historical patterns, it was necessary to determine the area characteristics and then group the areas into categories: by borough, by type of parking (on-street or off-street), by business type, by revenue level and characteristics, and by vandalism potential. The historical data for each grouping was then reviewed and analyzed in terms of operability, revenue, and inspection and revenue collection frequencies.

Once NYCDOT's meter operations were reviewed, the experiences and practices of other cities were examined. A survey was conducted in March 1996 in which questionnaires were sent to forty-five agencies responsible for parking meter networks throughout North America. The questionnaires included questions regarding meter operability, meter maintenance, revenue collection, and meter surveillance. Eleven agencies responded. Of these, the largest system was in Chicago (approximately 27,500 meters) and the smallest was in Ottawa (approximately 3,000 meters). A review of these surveys revealed that there is no standard practice in operating a parking meter system. With New York City's parking meter system over two times as large as the largest responding city, it was evident that the intrinsic characteristics of this network are far more complex than any other system. Survey response details are shown in Appendix B.

1.2 Current Practice

Meter inspection/maintenance operations are conducted by area, with inspection/repair status reported by individual meter. The effectiveness of these operations is measured by the operability, which is defined as the percentage of operable meters out of the total number of meters. For meter revenue collection purposes, meters within an *area* are organized into smaller groups based on the key cables carried by the revenue collection agents. Each *cable* holds approximately 60 to 75 keys for meters in close proximity to one another. Revenue is collected and reported by *cable* unit, not by meter. Consequently, the revenue of individual meters is not known. The effectiveness of these operations is measured by comparing the actual revenue per *cable* to the maximum revenue achievable per *cable* Although meter maintenance and revenue collection operations are intimately related, they cannot be readily coordinated because meters are grouped and their status reported differently, as described previously.

The efficiency level of the maintenance and revenue collection operations is improved by adjusting the inspection and collection frequencies based on the historical data. These adjustments are made empirically, and may even occur daily. Some consequences of this fine-tuning include: i) cables within the same ***area*** may or may not have the same revenue collection frequencies, resulting in inefficient use of resources, ii) *cables* are redefined frequently, and **iii)** the accuracy of long term evaluation of the operations is difficult because meter groupings and inspection/collection frequencies are dynamic in nature. For a parking meter network of this magnitude, these operations should be examined and appropriately adjusted with a systematic method, rather than empirically on a case-by-case basis. To this end, a systematic methodology for examining the current status of meter operations and identifying potential improvements is presented herein. The existing definition of operability has been reviewed and suggested improvements are presented along with methods for estimating daily operability. A suggested inspection frequency is proposed based on the analysis of the history of meter defects and their impact on operability. Similarly, a methodology which considers revenue based on the physical capacity constraints of the meter coin box and coin canister and which identifies an optimum collection frequency for each cable will be discussed. A method for evaluating the cost associated with an increase in meter operability is also presented.

1.3 Organization of Report

In Chapter 2 "Historical and Field Data'., the one-year historical data, the method of selecting sample *cables*, and the field data collection are described. The analyses performed for identifying improvements related to operability are presented in Chapter 3 “Improvements in Operability Evaluation & Prediction Methods”. Chapter 4 “Improvements in Revenue Collection Operations” presents the analyses and suggested improvements relating to revenue collection. The methodology for examining current meter revenue collection operations and implementing improvements relating to operability and revenue collection are presented in Chapter 5 “Step-by-step Procedures for Implementing Operability-Related Improvements” and Chapter 6 “Step-by-step Procedures for Implementing Revenue Collection-Related Improvements”, respectively. Chapter 7 “Conclusions and Recommendations” presents an overview of the potential improvements and implications.

Chapter 7. Conclusions and Recommendations

The suggested improvements in current parking meter operations presented herein can be used to further improve the efficiency of meter inspection, maintenance and revenue collection operations. The suggested methods permit: 1) the accurate evaluation of current practices and conditions, 2) the forecast of future trends, and 3) the determination of optimal inspection and revenue collection frequencies and the calculation of the costs and benefits associated with these changes and with changes in operability. Specifically:

3.2.1 Calculating Operability Left

The improved method of calculating operability left, which accounts for the operability of the uninspected meters, provides an accurate measure of current inspection and maintenance efficiency.

3.2.2 Estimating Daily Operability for Areas Without Daily Inspections

In conjunction with the improved method of calculating ***operability left,*** determining this daily operability provides a powerful tool for evaluating the status of operability.

3.2.3 *Predicting Future Operability*

Once the daily operability is estimated, future trends can be predicted and used to evaluate and plan management strategies at any time.

3.2.4 Estimating Cost of 1% Increase in Operability

By simulating an increase in operability, the associated costs and revenues can be evaluated to determine future management options. The simulation also provides the data necessary to implement the change - the number of additional meters to be inspected and repaired to achieve the desired increase in operability.

3.2.5 *Operability Simulation (Optimum Inspection/Maintenance Cycle)*

The simulation in Section **3.2.4** started with a desired level of operability and calculated the resulting inspection frequency. In the simulation discussed in Section 3.2.5, the inspection frequency is varied to produce a desired/minimum acceptable operability, based on the numbers of overlapping and accumulated defective meters.

4.2.1 Evaluating Current Revenue Collection Practice

By comparing the actual revenue collected to the potential maximum revenue, it is possible to identify how well the current revenue collection activities are being performed.

4.2.2 Evaluation of Revenue Collection Frequency (Cycle Length)

By comparing the actual revenue collected to the meter coin box and coin canister capacities, the current revenue collection frequency can be evaluated.

4.2.3 Optimization of Revenue Collection Frequency (Cycle Length)

By adjusting the revenue collection frequency to coincide with the maximum coin box and coin canister capacities, the revenue yield per collection can be maximized (the labor costs associated with collection activities are minimized).

4.2.4 Calculating Cable Operability and Net Revenue Loss

By using ***cable*** data to evaluate operability and the associated net revenue loss, rather than areawide operability, more accurate results are achieved. Areawide operability values do not hint at the variations in ***cable*** operability. One ***cable*** with low operability, hence low revenue, may be overlooked, resulting in a missed opportunity to maximize revenue and improve service.

4.2.5 Meter Defect Study

By studying the number, types, and trends of defects occurring, an effective strategy can be established to reduce/eliminate the defects associated with vandalism.

The review of the current parking meter operation practices, in conjunction with the historic and field data analyses, identified the above areas for potential improvements. The benefits from the implementation of these methods would potentially ***result in: i) an increase of*** meter operability and ii) the efficiency of revenue collection and inspection/maintenance activities with a potential increase in net revenue.

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