Inventory of Department of Public Works Infrastructure Databases

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To the Honorable
the Common Council
City of Milwaukee

Council Members:

The attached report describes and inventories the manual and automated databases used by the Department of Public Works to manage four types of City infrastructure assets: streets and alleys, bridges, sewers, and water mains.

The Inventory of Department of Public Works Infrastructure Databases indicates that infrastructure data maintained by DPW for the above four infrastructure classes is comprehensive, extensive, and detailed. With these databases DPW is able to address a wide variety of questions and issues about the construction history and condition of any particular street, alley, bridge, sewer, or water main. However, these databases were developed independently based on functional needs, with each division or section developing its own databases. Most if not all of these databases contain some duplicate information, while others may have unused or underutilized functionality.

Appreciation is expressed to the Department of Public Works for the full cooperation extended to the auditors.

Very truly yours,

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Comptroller

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Scope and Objectives

The purpose of this report is to provide an inventory of the manual and automated databases used by the Department of Public Works (DPW) to manage four types of City infrastructure assets: streets and alleys, bridges, sewers, and water mains.

The database inventory was based on interviews with DPW staff and review of descriptive database documentation. This review did not include an audit of the databases to determine the accuracy or reliability of actual infrastructure data. Also, this review did not include an evaluation of City infrastructure planning and management practices.

Infrastructure Databases

The inventory of databases indicates that infrastructure data maintained by DPW for the above four infrastructure classes is comprehensive, extensive, and detailed. The audit identified 22 computer databases for these infrastructure classes, containing over 925,000 records. In addition, four manual files were identified containing over 78,000 records. With these databases DPW is able to address a wide variety of questions and issues about the construction history and condition of any particular street, alley, bridge, sewer, or water main. However, these databases were developed independently based on functional needs, with each division or section developing its own databases. Most if not all of these databases contain some duplicate information, while others may have unused or underutilized functionality.

I. Streets and Alleys

The City has a very large and complex network of streets and allies. DPW has the responsibility to construct, repair and replace this network of about 1,400 miles of streets, including around 19,000 street segments. DPW utilizes about 25 different street design profiles, which call for variations in construction materials and methods. DPW estimates that the useful life of a street is between 25 and 50 years depending on the type of pavement and whether it is an arterial or residential street.

DPW reports disclose a significant decrease in paving activity in recent years, detailed below. In 2001 about 21.8 miles of major and residential streets were repaved while in 2003 the paving activity level totaled 11.9 miles. It would be inappropriate to derive any sound conclusion from one or two years of paving activity. For instance, in 2002 contracting for paving projects was delayed pending the outcome of potential State aid reductions proposed by former Governor McCallum. Increased special assessments also impact street replacement cycles.

Year Paved	Street Miles Paved	Alley Miles Paved	Total Miles Paved	Total Cost Millions
2001	21.8	2.1	23.9	$19.9
2002	12.5	1.9	14.4	$12.7
2003	11.9	1.6	13.5	$17.9

Nevertheless, it would be appropriate to analyze the level of paving miles completed by type of pavement over the past five to ten years to determine if the City is creating a deferred paving capital maintenance backlog. As part of its ongoing capital monitoring activities, the Budget Office has calculated the replacement cycles of major types of infrastructure, concluding that the replacement cycle for all streets is 81 years. The Budget Office also indicated that for about 70% of all City streets, original paving or re-paving has occurred within the last 40 years.

Such an evaluation of infrastructure planning and management was beyond the scope of this review. A comprehensive audit of the Paving Program should be conducted, given the significant financial, operational, and public consequences that could result from infrastructure maintenance deferral.

DPW has maintained records of streets and alleys for over a century through its engineering drawings, manual card files and automated databases. Today, DPW uses a complex record system including multiple card files and databases, each developed to support the following functions:

- Paving Program Planning – Identifying streets for paving and replacement and assuring that the work is performed within budget.
- Street and Alley Maintenance – Identifying those streets needing maintenance work and assuring that the work is performed within budget.
- State Reporting - Reporting the physical characteristics and condition assessment of all streets within the City every two years, as required by the State.

DPW currently uses eight automated databases consisting of six dBase files, one oracle file and one commercial software application. Further, DPW maintains two major manual card files and two spreadsheets for streets and alleys. The databases are generally not interfaced to share data; so much of the data must be entered manually into each database. It appears that substantial duplication of data exists in these DPW databases.

A. Paving Program Planning

Overview

Paving Program planning involves the development of two six-year Paving Programs, one for major arterial and collector streets and the other for local residential streets. It also involves development of an annual Paving Program. The Major Street Paving Program is included in the City's capital budget, with about 80 percent State and Federal funding. Local streets, bridges and alleys have their own capital line items in the budget.

Potential projects are prioritized by year in the six-year Paving Programs, based on physical condition noted during inspections. The six-year Paving Programs are updated annually. Selection of projects for the annual Final Paving Program does not follow directly from the six year Programs, but rather is a dynamic process involving other factors in addition to physical condition. These factors include available funding, aldermanic and citizen requests, changes in the scope of work, the timing of related projects such as bridge replacements, and coordination with existing sewer, water and development projects. According to DPW, in each of the last two years about 25 percent of the projects proposed by DPW were rejected at Common Council hearings due to citizen opposition to proposed special assessments. DPW indicates that approximately 300 paving projects have been deleted at public hearings one or more times due to citizen opposition. All of these factors could result in the Final Paving Program changing by about 50 percent from the list of projects available at the time the budget request is first developed a year earlier.

The following process is used once a potential paving project is identified:

- A project history card is prepared with a preliminary "boxcar" cost estimate.
- The project is included in the six-year Paving Program and assigned a scheduled year to complete.

- The project is included in City Engineer letters to utilities when scheduled within two years.
- Field information is gathered within one year of a project being scheduled for construction.
- The project is designed.
- Material quantities are estimated, with quantity estimates for each assessable property.
- Special assessments are estimated for each property.
- Some aldermen survey assessable property owners before projects are scheduled for Common Council hearings.
- Contracts are developed and let after approval by the Common Council.
- The project is constructed and information is added to the Road Life construction history databases.
- Special assessments are adjusted for actual work and property owners are billed.

By June 2004, the 2005 Paving Program will have been established for Common Council hearings beginning in September 2004. Also, the 2006 Paving Program will be under development for the 2006 budget submittal.

Databases

To support this process, the Transportation Section of the DPW Infrastructure Services Division maintains the following five major databases and two spreadsheets used for planning and implementing the Paving Program. Each of the databases is detailed in the Street and Alley Database Profiles in Appendix 1:

1. Project history manual card file with a complete project history of a street segment.
2. Estimating computer database used to track Paving Program estimates and work performed.
3. Preliminary "Box Car" estimate computer database providing an approximate project cost estimate for planning purposes with data at the project level.
4. Project Programming computer database with start-to-finish data at the project level, used for scheduling.
5. Cost estimate computer spreadsheet based on the final project cost estimate database with material quantities and cost estimates allocated to each property for the Common Council hearings.

6. Special assessments computer database with data at the individual property level, used to allocate final costs for special assessments.
7. Special assessments computer spreadsheet based on the database with assessments allocated to each property, used to bring costs into the final estimate computer database.

The Field Operations Section of the DPW Infrastructure Services Division maintains the following three major databases used for street and alley Paving Program planning and design. that are also detailed in the Street and Alley Database Profiles in Appendix 1:

8. Road Life manual card file on the construction history of every street segment, intersection, and alley.
9. Road Life computer database on the construction history of every street segment and intersection.
10. Road Life computer database on the construction history of every alley.

Though most of these databases have redundant information that has to be input separately, they do provide information on a functional level to facilitate DPW's responsibilities. However, a switch to fewer integrated databases meeting DPW's needs would be more efficient.

B. Paving Construction Contract Administration

Overview

After paving contracts are awarded, DPW inspects construction work and pays the contractors. DPW tracks the progress of construction with daily inspections that compare the type and quantities of actual construction materials against the bid specifications. DPW uses this information to make payments to the contractors.

Databases

To support the contract administration function, the Construction Section of the DPW Infrastructure Services Division maintains the following major database that is also detailed in the Street and Alley Database Profiles in Appendix 1.

11. Construction contract administration computer database to track construction activities and contractor payments.

C. Street and Alley Maintenance

Overview

Street and alley maintenance involves crack filling and resurfacing work by City staff and outside contractors. The maintenance work crews operate from three DPW Districts. DPW District supervisors inspect the streets and schedule the maintenance activities. Maintenance is funded by the City's operations and maintenance budget.

DPW staff indicates that street and alley maintenance work has been reduced significantly in recent years. About five years ago there were three seasonal maintenance crews in each of the three DPW Districts. This was reduced to one crew in each District, with additional work by outside contractors. DPW staff asserts that there was no maintenance crack filling done by City work crews in 2003 due to budget constraints. According to DPW staff, routine alley maintenance was stopped three years ago and has not resumed. Alley crack filling is apparently done only in limited situations upon request from aldermen and citizens.

Databases

To support the maintenance function, the Streets and Bridges Unit of the DPW Infrastructure Services Division maintains the following major database that is also detailed in the Street and Alley Database Profiles in Appendix 1.

12. "ArcView" computer application database containing about 25 years of street and alley maintenance data history.

The ArcView computer application was developed by the Information and Technology Management Division of the Department of Administration (DOA) and works with the City's Geographic Information System (GIS) in. There appears to be a substantial duplication of street physical description and construction data in the ArcView and Road Life databases. The DOA also supports a Computer Aided Design (CAD) application that is used by DPW engineers to design paving projects.

D. State Reporting

Overview

The City receives substantial State funding for the annual Paving Program and the State requires an inventory report on all City streets including physical condition ratings. To ensure that the street inventory and condition ratings are both current and accurate, the State requires physical inspections of all streets once every two years. The City purchased the Pavement Management Application (PMA) computer database to satisfy these reporting requirements. DPW staff asserts that because the City has this advanced computerized evaluation system, the State permits the City to perform a complete inventory only once every eight years.

Databases

The Transportation Section of the DPW Infrastructure Services Division maintains this PMA database, which is detailed further in the Street and Alley Database Profiles in Appendix 1.

13. Pavement Management Application database containing physical description data, construction data and physical condition ratings for all City street segments.

The PMA calculates a Pavement Quality Index (PQI) condition rating for every street segment. DPW hired the PMA vendor in 2000 to conduct physical inspections and obtain the data needed by the PMA to generate the PQI condition ratings, at a cost of about $150,000. Another comprehensive physical inspection will be needed for the 2008 street inventory report to the State. The PMA also provides a 40-year forecast of street replacements, which is used by DPW to help determine the annual Paving Program budget request. PMA software licensing, vendor support, and related DPW staff effort cost the Department about $160,000 a year according to DPW.

According to DPW, the PQI is but one of the factors considered in developing the annual and six-year City Paving Programs, which are developed using the databases identified above under Paving Program Planning. DPW indicates that the Paving Program cannot be based primarily on the PQI street condition ratings because of the other considerations also noted under Paving Program Planning, including aldermanic requests and complaints, utility projects, bridge replacements, etc. As a result, actual City paving projects often consist of street segments with varied PQIs.

The PMA appears to have project planning and management functionality that is not fully utilized. The older databases and manual card files developed by the Department apparently remain the major reference sources for DPW at the project level. There also appears to be substantial duplication of data in the PMA, Road Life and other DPW infrastructure databases, although some data is shared.

II. Bridges

Overview

DPW is responsible for properly maintaining bridges and some overpasses within the City. The Federal Highway Act requires an inspection of all bridges and some overpasses and a condition assessment at least every two years, with more frequent inspections for those bridges with a lower "sufficiency rating". This sufficiency rating is based on a scoring system that measures physical condition and functional adequacy. These condition assessments are a nationally recognized set of measurement benchmarks used to identify bridges to be repaired or replaced, as well as funding sources. The City does not usually inspect non-City owned bridges, such as railroad bridges and freeway overpasses.

Two-man DPW inspection teams perform bridge inspections. Engineers and inspectors on these teams initially receive 80 hours of training, and are required to attend State mandated refresher training as changes in regulations occur. A Wisconsin Department of Transportation (WDOT) inspection form is completed for each bridge inspection. The WDOT form requires Federal National Bridge Infrastructure (NBI) numeric valuation ratings provided by the inspectors for various parts of the bridge. The completed form is forwarded to WDOT, which computes the sufficiency rating using the NBI valuations. The WDOT rating is used to determine the bridge's condition for any subsequent repairs or replacement and eligibility for funding.

The City is responsible for 196 bridges, bridge segments and some overpasses, with about 177 or 90 percent subject to Federal inspection requirements. Annually, a spreadsheet is prepared identifying bridges in need of repair work or replacement using the WDOT reports and sufficiency ratings. This spreadsheet is used by the Field Operations Section of the DPW Infrastructure Services Division for inclusion with the streets and alleys in

the six-year capital plan. Repair work is handled by the Field Operations Section and is funded through the DPW operations and maintenance budget. Bridge replacement and major repair work is funded in the capital budget, with about 80 percent of required funding from the State and Federal governments.

Databases

To support the maintenance, repair and replacement of bridges and overpasses, the Field Operations Section of the DPW Infrastructure Services Division maintains the following paper files and spreadsheets, which are further detailed in the Bridge Database Profiles in Appendix 2:

1. Comprehensive bridge files on each bridge, including design and inspection documents and photographs.
2. Inventory of bridges computer spreadsheet, including appraised market value.
3. Bridge assessment computer spreadsheet, with sufficiency ratings for the last two years.
4. Bridge assessment computer spreadsheet, with sufficiency ratings for only the most recent year.
5. Bridge inspection computer spreadsheet, with sufficiency ratings for the most recent year and inspection requirements.

According to DPW, bridge maintenance work has been reduced in recent years due to City budget constraints. Some preventative maintenance projects, such as bridge painting, have been delayed or postponed until other funding sources are available.

III. Sewers

Overview

DPW is responsible for the construction, replacement and maintenance of about 2,436 miles of sewer mains and collectors within the City. About 95 percent of the cost of sewer maintenance is budgeted and reported in the City's Sewer Maintenance Fund. The City expended about $24 million on sewer maintenance in 2003. There are three types of sewers, sanitary, storm water, and combined. To determine maintenance requirements, approximately 85 miles of sewers are video inspected annually by DPW. Sewer maintenance work is coordinated with street maintenance wherever possible. DPW does not maintain the arterial or intercepting sewers, deep tunnel storage system, or the

sewerage treatment plants, which are owned and maintained by the Milwaukee Metropolitan Sewerage District (MMSD). DPW also does not maintain the laterals that run from buildings and houses to the sewer mains, which are the responsibility of the property owners.

The age of sewers varies greatly in the City. The following is a breakdown of sewers by age and mileage.

Sewer Age	Sewer Miles	Percent of Total
>100 years old	130	5%
75 to 99 years old	430	18%
50 to 74 years old	552	22%
25 to 49 years old	1,042	43%
< 25 years old	284	12%
Total	2,438	100%

DPW develops a multi-year sewer maintenance program based on annual evaluations of sewer mains and collectors. Video inspections of sewer mains and collectors are conducted and a condition assessment rating between 1 and 100 is given each sewer segment, where a 100 is the best. Currently, sewer segments receiving a score less than 65 will be placed on a database of potential projects for replacement. Inspections are scheduled based on age, backwater complaints, maintenance problems and history. According to DPW, emergency maintenance takes priority over scheduled maintenance and replacements.

The following process is used after inspections identify problem sewers:

- An inspection report for the problem segment is received and the condition assessment rating is recorded in the sewer main database.
- Potential projects that are not an emergency (i.e. the sewer is not collapsed or broken) are identified and an estimate of cost is prepared.
- Sewer mains and collectors receiving the lowest condition assessment rating are considered for replacement in the next annual Sewer Capital Program.
- The project is included in the annual Sewer Capital Program and assigned a monthly bid date.

- Field information is gathered within one year of a project being scheduled for construction.
- The project is designed.
- Sanitary and combined sewer projects are submitted to MMSD and the Department of Natural Resources for approval.
- Contracts are let after approval by the Common Council.
- The project is constructed and "as built" information is added to the Sewer Inventory, Digitized Maps, and Construction Contract Administration databases.

Databases

To support sewer operations, the Environmental and Construction Sections of the DPW Infrastructure Services Division maintain the following five automated databases and manual files, which are further detailed in the Sewer Database Profiles in Appendix 3:

1. Sewer inventory computer database for the sewer mains, collectors and related sewer assets.
2. Digitized computer maps of all sewer sections developed by ITMD.
3. Paper hand-drawn maps of all sewer sections.
4. Potential sewer projects computer database.
5. Construction contract administration database.

IV. Water Mains

Overview

The DPW Milwaukee Water Works (MWW), a public utility owned and operated by the City, is responsible for the delivery of water to the citizens of Milwaukee and also other neighboring municipalities. The MWW maintains over 1,950 miles of water mains in the City. MWW is not able to inspect mains for damage in the same manner as performed for sewers, because water mains must remain full and under pressure. Therefore, MWW identifies water mains needing repairs and replacement based on a number of factors including the ranking in the Water Main Experience database, water quality concerns, hydraulic characteristics, and coordination with paving and other construction projects.

All repair and replacement work performed by MWW is funded out of its operating revenues. There are some limited charges to customers for lateral work or initial connection to water service. MWW accounts for and tracks all of its mains and appurtenances.

MWW identifies segments of water mains for replacement based on the factors detailed above . If an older main needs to be upgraded because it is too small, or new service is required, MWW schedules the project.

Databases

MWW maintains very detailed information on all of its infrastructure assets, including water mains. However, for security reasons, MWW was unwilling to provide the description and location of all the related databases. Therefore, information in this report is incomplete as far as MWW inventory information of water mains. MWW and ITMD provided the information in this section. These databases are detailed further in the Water Main Database Profiles in Appendix 4.

To support this operation, MWW has three databases available, consisting of:

1. Water Main Break Database – a computer database listing by location of all water main breaks in the system.
2. Water Main Experience Database – a computer database with historical breakage information by water main segment for replacement planning.
3. Water Main Replacement Program Database – a computer database that tracks project information from identification as a potential project to award of the construction contract.

Appendices 1 through 4
Infrastructure Database Profiles
For Streets & Alleys, Bridges, Sewers and Water Mains

Appendix 1: Street and Alley Database Profiles

Appendix 2: Bridge Database Profiles

Appendix 3: Sewer Database Profiles

Appendix 4: Water Main Database Profiles

Appendix 1: Street and Alley Database Profiles

1) Project History Manual Card File

Data Custodian: DPW, Infrastructure Services Division, Transportation Section, Project Programming, Programming Area 286-2460.

General Description: This file is a set of cards for each potential project containing information regarding project history and scheduling resulting from input by citizens, aldermen, maintenance forces, utilities, and other sources, along with potential project information and any other notification received by DPW. Once identified as a potential project, information from the cards is loaded into both the Box Car and Project Programming computer applications.

Media and Programs Used: Manual card files

Types of Records/Data Elements: These files contain information regarding the project history based on communication with citizens, aldermen, maintenance forces, field viewing recommendations for timing, utility companies and the police department.

Detailed Data Records/Data Elements: The approximately 19,000 cards contain a hard copy of the history of all correspondence regarding the project including:

- Location information
- Who reported problems and requested programming
- The problem or defect, such as cracked pavement, pot holes, etc
- The timing recommended based upon a field review of the project.

Stated Use of the Database: This card file is used to begin the process of identifying repaving and maintenance work projects and becomes the history file of the completed project.

Key Reports, Screens generated or made available: None

Data Maintenance Process: Information is manually recorded on cards as received.

Documentation: Letters from citizens, aldermanic requests and police reports

Other Points: None

Key Terms and Definitions related to this database: None

Appendix 1: Street and Alley Database Profiles

2) Estimating Database

Database Custodian: DPW, Infrastructure Services Division, Transportation Section, Project Programming, Estimating Area 286-3717.

General Description: This database is used to track projects with estimates of cost and material quantities, bidding information, and actual quantities constructed.

Media and Programs Used: This is a dBase computer database, originally developed by the City in 1986 and modified as needed since then.

Types of Records/Data Elements: This database is very detailed and contains descriptive location and construction data, including cost data, estimating data, public hearing data, bidding data, and final construction data.

Detailed Data Records/Data Elements: This database contains 10 files. The files are interrelated by either a project number or an estimate number. Detailed file information consists of:

Main Files:

Basic Project Information – 3783 records containing 146 data-fields each.

- Location – Aldermanic district, project street limits, project number, etc.
- Specifications – Construction type, length, area, typical widths, anticipated construction year, estimated sewer costs and actual construction quantities.
- Cost information – Primary estimates, bidding estimates, actual amounts, state aids where identified.
- Bidding information – winner and two runner-ups.
- Hearing information – public and Common Council, plus results.

Formal Project Titles – 5,652 records containing 11 data-fields.

- ID numbers
- Project year, project title (limits) and type of work
- Aldermanic district information

Bid Item Detail – One record per bid item, per estimate., with 67,856 records containing 12 data-fields

- Bid item and estimate ID numbers
- Estimated and actual quantity and estimated unit cost
- Bid unit prices

Bid Item Description – 779 records containing 14 data-fields.

- ID number
- Item Specifications

Bid History – 27,109 records containing 14 data-fields.

- Official Notice and bid item ID number
- Bid detail including unit price for 3 low bidders, contract date, etc.
- Estimated quantity and cost
- Potential EBE participation

Appendix 1: Street and Alley Database Profiles

Ancillary Files:
Tax-key Information – 44,543 records containing 2 data-fields
Contractor Information – 37 records containing 3 data-fields
Informal Project Titles – 8,177 records containing 5 data-fields
Flyer Notes – 10,056 records containing 3 data-fields
Flyer Revision Dates – 2,917 files containing 2 data fields

Stated Uses of the Database: This database is used to develop and track estimates for paving projects and tracks work performed. The data is frequently used to prepare ad-hoc reports in response to inquiries regarding City paving practices and experience.

Key Reports, Screens generated or made available:

- Project title and description
- Bidder estimates
- Detailed bid description
- Project estimate
- Contractor information
- Informal project titles
- Project Letting Documentation.

Database Maintenance Process: This database is maintained constantly during the year, updated as paving project changes are propagated by the programming office, as estimates are completed, as projects are let to contract and as project are completed.

Documentation: Input documents are from City Engineer letters, Paving Program, and bid documents. Output consists of formal estimate summaries, special assessment spreadsheets, "Boxcar" estimates. The data is maintained by manual entry.

Other Points: This system contains historical data from 1986 to present.

Key Terms and Definitions related to this Database: "Boxcar" estimates are preliminary estimates of project costs.

3) "Boxcar" Cost Estimates

Database Custodian: DPW, Infrastructure Services Division, Transportation Section, Project Programming, Estimating Area 286-3717.

General Description: Preliminary cost estimates of potential paving projects.

Media and Programs Used: This is a dBase program originally developed in 1986 and modified as needed since then.

Types of Records/Data Elements: This database is a program developed to provide preliminary estimates for potential projects and is used for budgeting purposes.

Detailed Data Records/Data Elements: This database consists of four files. Three contain data relating directly to the potential projects and the fourth contains standard bid item data for each construction year. The three project files are related to each other by the project ID number, and in the case of the bid item detail file, to the bid item description file by the bid item number. Detail file information consists of:

Project Segment Item Details – 23,420 records containing 11 data-fields.

- Project ID number
- Item quantities and cost

Project Segment Summary – 3,362 records containing 26 data-fields.

- Project and logical segment ID number
- Logical segment construction information (dimensions, old and new pavement types, fraction of walk replaced or new, fraction of curb replaced or new, etc.)
- Logical segment design cost information

Project Information – Potential project summary data with 3,467 records containing 16 data-fields.

- Project ID number and expected construction year
- Location information
- Aldermanic district information
- Estimated Project Costs and Estimate preparation date

Standard Costing – Bid item textual descriptions and standard unit costs by program year with 1,944 records containing 9 data-fields.

- Bid item ID
- Text description
- Standard bid pricing

Stated Uses of the Database: Data is used to prepare preliminary estimates for potential projects in order to set up funding for the paving program.

Key Reports, Screens generated or made available: Boxcar Estimates of project cost by project

Appendix 1: Street and Alley Database Profiles

Database Maintenance Process: Standard cost data is updated annually by staff, based on experience from past bids. Potential projects are identified by the Programming Office. Existing pavement information is obtained from data the in the Road Life file by the Programming Office.

Documentation: Information from the project cards, engineering estimates and printouts.

Other Points: None

Key Terms and Definitions related to this Database: A logical segment is one for which the pavement types and the cross sectional dimensions of the project do not vary in the "Boxcar" estimate database. Often the logical segment will correspond to the entire project resulting in only one logical segment in the project. In those cases where there is a significant change in dimensions or pavement types over the length of the project, a logical segment would begin at each point of change.

4) Project Programming

Database Custodian: DPW, Infrastructure Services Division, Transportation Section, Project Programming 286-2460.

General Description: This database assists in the development of the City's paving program. Data in this database is shared with the Estimating Database.

Media and Programs Used: This is a dBase application first developed in-house in 1986 and redeveloped in 2001.

Types of Records/Data Elements: This program is designed to assist and track potential paving projects and any changes made to the funding or scheduling.

Detailed Data Records/Data Elements: This database consists of 1 main file and 14 ancillary files. The main file contains summary data relating to each potential and actual project in the paving program. Each file is related to the other by a key field; however, all files are mutually exclusive. Detailed file information consists of:

Main File: 3,858 records consisting of 175 data-fields

- Project ID numbers
- Status and project date
- Type of work
- Official Notice information
- Location, district information, aldermanic district
- Construction information (year built, year repaved, dimensions etc.) PQI
- Funding, budget and assessment summary information

Ancillary Files:

Project Titles – Tiles of all potential and actual projects, with 5,854 records consisting of 3 data-fields

Pavement Type and Text Description – Lookup table of pavement types, with 14 records consisting of 4 data-fields

Rehabilitation Types – Lookup table of rehabilitation types, with 57 records consisting of 6 data-fields

Work Type – Lookup table, with 10 records consisting of 2 data-fields

Road Type – Lookup table, with 8 records consisting of 4 data-fields

Funding Sources – Lookup table, with 22 records consisting of 3 data-fields

Internal Cross References – Relates key values to each other for projects, with 6,676 records consisting of 5 data-fields

Project Number– 3,506 records consisting of 3 data-fields

Reason project identified as potential project or requesting body – Lookup table, with 9 records consisting of 2 data-fields

Nature of Work – Lookup table, with 12 records consisting of 3 data-fields

Reason for change to City Engineer (CE) letter –Lookup table, with 10 records consisting of 2 data-fields

Appendix 1: Street and Alley Database Profiles

CE letter Dates – Change log to City Engineer letters, with 3,259 records consisting of 5 data-fields
CE letter Project Number cross reference – 182 records consisting of 7 data-fields

Stated Uses of the Database: This database tracks the status of each potential project from the six-year plan to the final billing.

Key Reports, Screens Generated or made available:

- Annual preliminary and final paving program
- City Engineer letters, issued every 3 weeks, describing status of program

Database Maintenance Process: Files are maintained constantly as projects progress, and are updated annually for the six-year program information provided by ArcView and Pavement Management Systems.

Documentation: Printouts from Road Life, ArcView and Pavement Mgmt Application, provided annually and supervisor/inspection reports weekly.

Other Points: This data is manually updated as warranted by changes in the Paving Program, due to input from street maintenance, aldermen, citizens, the Department of City Development, utilities and other municipalities. Certain cost estimate information is updated automatically when the primary estimation system data is updated.

Key Terms and Definitions related to this Database: City Engineer letters are the official notifications of project status issued by the City Engineer. The Paving Program is a long term, generally six year, compilation of potential paving projects, of which only those in the next year are "firm" with the rest being subject to significant modification.

5) Cost Estimate Computer Spreadsheet

Data Custodian: DPW, Infrastructure Services Division, Transportation Section, Project Programming, Estimating Area 286-3717.

General Description: This spreadsheet file is prepared by the Estimating area for each potential paving project. A summary of the data contained in the spreadsheet is entered into the Estimating and Project Programming dBase systems. Its purpose is to identify project estimated quantity and cost on a property by property basis. It is electronically transferred to the Special Assessment area for further refinement.

Media and Programs Used: This is a Microsoft Excel computer spreadsheet used to prepare an estimate of the project construction quantities and costs.

Types of Records/Data Elements: These files contain information regarding the type of construction to be performed by specification and its relevant estimated costs for each affected property.

Detailed Data Records/Data Elements: These spreadsheets contain construction specifications and cost estimates within a specific project on a property by property bases, including:

- Location information (project, property address and tax key code)
- Construction specification (amount of concrete, asphalt etc. to be used)
- Cost estimates by specification and total.

Stated Use of the Database: Provides estimated quantity and cost information to Special Assessments who then prepare the estimates for public hearing where the aldermen and taxpayers consider the merits of each particular project, and determine if the project can proceed to the construction phase.

Key Reports, screens Generated or made available: Spreadsheet printout on a property by property bases.

Data Maintenance Process: The tax keys and property descriptions are retrieved electronically from the City mainframe computer system by way of the Estimating dBase system. The detailed construction quantities and unit costs are determined for each property by the estimating section and manually entered into the spreadsheet.

Documentation: Extracted data from the Project Cost Estimate Database.

Other Points: None

Key Terms and Definitions related to this database: None

6) Special Assessments

Database Custodian: DPW, Infrastructure Services Division, Transportation Section, Project Programming, Special Assessments Area 286-3254.

General Description: This database assists in the computation, tracking and application of assessments to property owners for street work performed.

Media and Programs Used: This is a dBase computer database developed around 1986 with maintenance as needed since then.

Types of Records/Data Elements: The data in this database relates to each of the properties, as well as to the project as a whole. The data provides a recent history of the paving assessments.

Detailed Data Records/Data Elements: This database consists of 2 main and 3 ancillary data-files. Each file is related; however, each is mutually exclusive of the other. Detailed file information is as follows:

Main Files:

Project Level Data – 2,228 records consisting of 46 data-fields

- Project ID & location
- Hearing and adoption information
- Aldermanic information
- Estimate information
- Contract information (contractor, start and end dates)

Property Based Information –15,023 records consisting of 12 data-fields

- Project ID
- Property ownership, location and assessment information
- Estimation and billing information

Ancillary Files:

Quarter Section References (GIS) – 1,450 records consisting of 4 data fields
History of Project by Project Level – 3,968 records consisting of 44 data-fields
History of Project by Property – 37,396 records consisting of 11 data-fields

Stated Uses of the Database: This database provides the information to DPW Planning, the taxpayer and the Assessor regarding the assessment of various street projects.

Key Reports, Screens generated or made available: Notification to taxpayers of hearings and assessments, notification to Treasurer of Special Assessments.

Database Maintenance Process: This database is maintained continuously as estimates are received from Estimating, certificates of completion are received from the field, as changes are received from Project Programming and as correspondence is received from the public.

Appendix 1: Street and Alley Database Profiles

Documentation: Letters, spreadsheets, downloaded property information from the City mainframe computer system, plus related data transferred from the estimation programs.

Other Points: None

Key Terms and Definitions related to this Database: None

7) Special Assessment Computer Spreadsheet

Data Custodian: DPW, Infrastructure Services Division, Transportation Section, Project Programming, Special Assessment Area 286-3565.

General Description: This spreadsheet is used to prepare the actual assessment for each property owner in an affected project. The Common Council and property owners use these projections at the public hearings to establish those projects for acceptance.

Media and Programs Used: This is a Microsoft Excel computer spreadsheet with extract information from both the project estimate cost database and the special assessment database.

Types of Records/Data Elements: This spreadsheet contains information regarding the type of construction to be performed by specification and its relevant actual costs for each affected property.

Detailed Data Records/Data Elements: This spreadsheet contains construction specifications and cost estimates within a specific project on a property by property bases, including:

- Location information (project, property address and tax key code)
- Construction specification (i.e. amount of concrete, asphalt etc. to be used)
- Actual cost calculated by specification and total.

Stated Use of the Database: This spreadsheet is used to provide the actual special assessment per property for any given project.

Key Reports, screens Generated or made available: None

Data Maintenance Process: The estimated construction quantities and costs for each property are provided by Estimating as estimates are completed. Special Assessments then determines the appropriate assessable costs for each property. This data is then entered into the Special Assessments dBase system for further processing. After construction of a project is completed, the field districts use the spreadsheet to determine the actual construction quantities and costs associated with each property.

Documentation: Construction totals, field district measurements and FMIS invoice information.

Other Points: None

Key Terms and Definitions related to this database: Financial Management Information System (FMIS) the City's automated accounting system.

8) Road Life Manual Card File

Database Custodian: DPW Infrastructure Services Division, Construction Section, Contract Administration Area 286-2497.

General Description: Manual card file providing a complete history of every street segment, intersection and alley in the City of Milwaukee.

Media and Programs Used: This is a manual card file, including a graphical presentation of road surfaces.

Types of Records/Data Elements: A complete history including location, when built, rebuilt or retired, construction used and dimensions.

Detailed Data Records/Data Elements: Detailed information on each street segment, intersection, and alley, approximately 20,000 cards with:

- Location information and City ID
- Size, depth and make-up of road
- Dates dedicated, built, rebuilt and retired
- Graphical presentations of changes to road surface, including cuts

Stated Uses of the Database: Provides a complete history of each segment, and is therefore used by the Construction Section for planning and as a reference by contractors. This database is the grandfather of all other street and alley databases.

Key Reports, Screens generated or made available: None.

Database Maintenance Process: This database is updated as changes to the street segments and alleys are made.

Documentation: Card file and completed work-orders.

Other Points: None

Key Terms and Definitions related to this Database: None

Appendix 1: Street and Alley Database Profiles

9) Road Life Computer Database - Streets

Database Custodian: DPW Infrastructure Services Division, Construction Section, Contract Administration Area 286-2497.

General Description: Computer database with history and inventory of all street segments and intersections.

Media and Programs Used: This was an ADABAS database accessed through Natural and SuperNatural computer languages on the City mainframe computer system and has been updated to an Oracle database program with the updated being completed during this review.

Types of Records/Data Elements: Complete history including location, when built, rebuilt or retired, construction used and dimensions.

Detailed Data Records/Data Elements: This database has 22,015 non-intersection segments. Detailed information consists of:

- Location information and City ID
- Size, depth and make-up of street segment
- Dates dedicated, built, rebuilt and retired.

Stated Uses of the Database: Provides a history of each street segment, along with reports identifying the surface area, age and construction type.

Key Reports, Screens generated or made available: Textual display of data contained in the database.

Database Maintenance Process: This database is updated annually between the months of November and April by Construction inspectors following the construction season.

Documentation: Card file and completed work-orders.

Other Points: The data contained in this file has been used as the bases of all other street database programs. Data from the mainframe version of this database was extracted and reports generated on demand, including charts portraying the quantity of pavement by age for the various pavement types and roadway classifications.

Key Terms and Definitions related to this Database: None

Appendix 1: Street and Alley Database Profiles

10) Road Life Computer Database - Alleys

Database Custodian: DPW Infrastructure Services Division, Transportation Section, Robert Streng 286-2386.

General Description: This database is a computerized history and inventory of all alleys.

Media and Programs Used: This is a dBase program residing in DPW.

Types of Records/Data Elements: A complete history including location, when built, rebuilt or retired, construction used and dimensions.

Detailed Data Records/Data Elements: There are two files in this database, one for the name, location and project ID, the other for construction data. The name file has 4,202 records consisting of 51 data fields and the data file has 14,498 records with 20 data fields. Detailed information consists of:

- Location information and City ID
- Size, depth and make-up of pavement
- Dates dedicated, built, rebuilt and retired.

Stated Uses of the Database: Provides a history of each alley, along with graphical reports identifying the surface area of the City's alleys by age and construction type.

Key Reports, Screens generated or made available: Surface area bar graphs.

Database Maintenance Process: This database is updated as changes to the alleys are made.

Documentation: Card file and completed work-orders.

Other Points: Some of the alley data contained in this file can also be found in the ArcView application. The data in this system is updated manually on an annual basis from data forms prepared by the Construction section during the winter following the construction event.

Key Terms and Definitions related to this Database: None

Appendix 1: Street and Alley Database Profiles

11) Construction Contract Administration

Database Custodian: DPW, Infrastructure Services Division, Construction Section, Contract Administration Area, 286-2497.

General Description: System to track construction and payments to contractors for Paving and Sewer construction.

Media and Programs Used: This is a system of dBase programs initially developed by DPW in 1986 and maintained as needed.

Types of Records/Data Elements: This database was developed to track the progress of construction on paving and sewer projects and to prepare contractor payment documents.

Detailed Data Records/Data Elements: This database consists of two sets of files, one for Paving and one for Sewers with substantially similar configurations. There are 7 main files in each system. The files within each system are interrelated by contract, project and bid item numbers. Detail file information consists of:

Standard Bid Items – Reference file of textual description of each bid item, with approximately 800 records for Paving and 1,200 for Sewers.

Estimated Quantities and Unit Bid Prices – Preconstruction estimate of quantities and contractor unit bid prices for each bid item on each project. Paving has 34,000 records for 1990 through the present. Sewers has 11,000 records from 1991 through the present.

Inspector Quantities – Log of quantities reported completed by bid item each day for each project. Paving has 60,000 records for 1990 through the present. Sewers has 35,000 records from 1991 through the present.

General Project Data – Project location, significant dates, construction supervisor and contractor data. Paving has 3,100 records for 1986 through the present. Sewers has 700 records from 1991 through the present.

Payment Log – Record of the totals paid on each payment for each contract by date. Paving has 3,900 records from 1990 through the present. Sewers has 3,300 records from 1989 through the present.

General Contract Data –Significant contract dates, contractor data, contract location data. Paving has 450 records from 1994 through the present. Sewers has 275 records from 1998 through the present.

Sewer Quantities – Total quantities constructed by contract for each bid item for Sewers, with 10,500 records from 1990 to present.

Paving Quantity Log – Quantity and price recorded against each bid item on each paving payment, with 100,000 records from 1990 through the present.

Stated Use of the Database: The primary use for these systems is to track the quantities of work performed by contractors on each item on Paving and Sewer contracts for the purpose of making contractor payments.

Appendix 1: Street and Alley Database Profiles

Key Reports, Screens Generated or made Available: Partial and Final Payment Estimates for work performed.

Database Maintenance Process: The data in this database is maintained on a continuous basis as contracts are let and as the contractors perform work. For Paving contracts, the items, estimated quantities and unit bid prices by project are imported electronically from the Estimating system described earlier. For Sewer contracts, this information is entered manually. The amount of work performed by the contractor on each bid item, on each project each day is recorded manually from reports prepared by the construction inspectors monitoring the construction in the field.

Documentation: Input is from daily inspector reports and bid documents. Output is Partial and Final Payment Estimate forms.

Other Points: None

Key Terms and Definitions related to this Database: None

12) ArcView

Database Custodian: DPW, Infrastructure Services Division, Field Operations Section, Streets & Bridges Area , Daryl Sobczak 286-5533.

General Description: Geographic Information System (GIS) and database of streets by segment and intersection

Media and Programs Used: Proprietary computer application residing on a desktop computer at 152 N. 6th Street.

Types of Records/Data Elements: Data on street maintenance, street segments and intersections, and property lines, with geographical location.

Detailed Data Records/Data Elements: This database consists of 2 files of 19,000 records each, with 103 and 10 data fields. This is a very detailed database with property locations, addresses, tax key codes and property lines from the DIME file, containing:

- Street segments and intersections
- I.D. numbers
- History of maintenance by segment (crack fills etc)
- Construction type (i.e. concrete 8")
- Year built
- Dimensions

Stated Uses of the Database: Identifies streets and intersections for street maintenance activities.

Key Reports, Screens generated or made available:

- Graphical images of street and the maintenance performed
- Maps by any geography (i.e. aldermanic district, quarter-section and smaller)
- Extract of streets needing repair and crack filling

Database Maintenance Process: System is updated during the winter by available staff, based on prior season maintenance performed.

Documentation: Supported by DIME file for street level GIS data and completed work orders on repairs.

Other Points: This database has computation capability.

Key Terms and Definitions related to this Database:

- GIS – Geographic Information System - produces pictures and maps
- DIME file is maintained by the Department of Administration, Information and Technology Management Division (ITMD)

13) Pavement Management Application (PMA)

Database Custodian: DPW, Infrastructure Services Division, Transportation Section, Major Projects, Jeffery Mantes 286-2451.

General Description: The PMA database contains physical description data, construction data and physical condition ratings for all City street segments.

Media and Programs Used: This is a proprietary database.

Types of Records/Data Elements: Data on street construction by street segment, evaluations for street condition and budget modeling.

Detailed Data Records/Data Elements: This database consists of over 19,000 records with 150 data-fields, containing:

- Segment location information
- Construction information (type, dimensions, history, etc)
- Street type and utilization
- Twenty five separate indicators used to calculate a Pavement Quality Index (PQI) condition rating.
- Budgetary information, historic and current.

Stated Uses of the Database: The main use of this database is to provide an inventory of streets with condition ratings for State reporting and project planning purposes.

Key Reports, Screens generated or made available: Provides a biannual report to the State and an annual extract spreadsheet for project planning.

Database Maintenance Process: The pavement distresses should be evaluated for each major street and collector every 4 to 7 years. All streets in the City were evaluated within the past three years. Each year the construction events from the prior construction season are entered into the system.

Documentation: Update information is from completed work-orders and inspections.

Other Points: The PMA appears to have project planning and management functionality that is not fully utilized by DPW.

Key Terms and Definitions related to this Database:

- Pavement Quality Index (PQI), an internationally accepted quality scale for street condition assessment.
- Road Comfort Index (RCI), one of three condition indicators used to compute PQI.
- Surface Distress Index (SDI), used in PQI calculation.
- SAI, Surface Adequacy Index, used to calculate PQI.

Appendix 2: Bridge Database Profiles

1) Inventory of Bridges

Database Custodian: DPW, Infrastructure Services Division, Field Operations Section, Structural Design 286-3294.

General Description: Listing of all City owned bridges, with estimated market value.

Media and Programs Used: This is a Microsoft Excel computer spreadsheet.

Types of Records/Data Elements: Each record identifies a single bridge or bridge segments, including identification numbers, age, bridge type, useful life and dimensions.

Detailed Data Records/Data Elements: This database consists of 251 records, with 19 data fields, containing:

- Bridge identification numbers (City and State)
- Location
- What the bridge spans
- Year of construction
- Dimensions, length, width, roadway width, deck area
- Construction materials
- Type of bridge (i.e. lift, deck girder etc)
- Replacement cost and useful life
- Organization responsible for maintenance, City, State, County, etc.
- Current sufficiency rating.

Stated Uses of the Database: Used to provide information for the City's Comprehensive Annual Financial Report (CAFR).

Key Reports, Screens generated or made available: Printout of the spreadsheet.

Database Maintenance Process: This spreadsheet is updated whenever changes warrant.

Documentation: The Bridge Listing by Ratings spreadsheet supports this spreadsheet.

Other Points: This is a relatively new spreadsheet prepared for American Appraisal in their process of identifying and valuing infrastructure assets. It is being kept by DPW as an inventory listing to support the City's CAFR.

Key Terms and Definitions related to this Database:

- Bridge, includes both complete bridges and bridge segments.
- Responsible party, a bridge over railroad tracks is maintained by the City, while a railroad bridge over a street is maintained by the railroad.

2) Comparative Report

Database Custodian: DPW, Infrastructure Services Division, Field Operations Section, Structural Design 286-3294.

General Description: Listing of bridges by sufficiency rating over two rating periods (four years).

Media and Programs Used: This is a Microsoft Excel computer spreadsheet.

Types of Records/Data Elements: Bridge ID, location, year built and two cycles of evaluation.

Detailed Data Records/Data Elements: This database consists of 251 records, with 7 data fields, containing:

- Bridge identification numbers (City and State)
- Location address
- Year built
- Two cycles of evaluation sufficiency ratings.

Stated Uses of the Database: This database is used to assist in identifying bridges needing replacement or major repairs eligible for State and Federal funding. Information on this spreadsheet is sorted by bridge number.

Key Reports, Screens generated or made available: Printout of the spreadsheet.

Database Maintenance Process: This spreadsheet is updated bi-annually, upon receipt of State evaluation forms.

Documentation: State evaluation forms are used to provide update information for this spreadsheet.

Other Points: None

Key Terms and Definitions related to this Database:

- Bridge, includes both complete bridges and bridge segments.
- State Sufficiency Rating is an evaluation number on the entire bridge between 1 and 100, with 100 being best. Numbers less than 50 indicate a bridge in need of replacement.

Appendix 2: Bridge Database Profiles

3) Bridge Listing by Rating

Database Custodian: DPW, Infrastructure Services Division, Field Operations Section, Structural Design 286-3294.

General Description: A listing of City bridges by sufficiency ratings.

Media and Programs Used: This is a Microsoft Excel computer spreadsheet.

Types of Records/Data Elements: Bridge identification, location, evaluation ratings and State sufficiency ratings.

Detailed Data Records/Data Elements: This database consists of 251 records, with 7 data fields, containing:

- Bridge identification numbers (City and State)
- Bridge location address
- Bridge component evaluation ratings for bridge deck, superstructure and sub-structure
- State sufficiency rating.

Stated Uses of the Database: Identify bridges needing replacement for the six-year plan.

Key Reports, Screens generated or made available: Printout of the spreadsheet.

Database Maintenance Process: Information on the state evaluation form is used to update this spreadsheet. Maintenance is performed during the winter months.

Documentation: State evaluation forms are used to provide update information for this spreadsheet.

Other Points: None

Key Terms and Definitions related to this Database:

- Bridge, includes both complete bridges and bridge segments.
- City Evaluation Ratings for the various bridge components between 1 and 100, with 100 being best.
- State Sufficiency Rating is an evaluation number on the entire bridge between 1 and 100, with 100 being the best. Numbers less than 50 indicate a bridge in need of replacement.

4) Inspection Report

Database Custodian: DPW, Infrastructure Services Division, Field Operations Section, Structural Design 286-3294.

General Description: Listing of bridges in need of inspection by rating.

Media and Programs Used: This is a Microsoft Excel computer spreadsheet.

Types of Records/Data Elements: Bridge identification, location, evaluation ratings and State sufficiency rating.

Detailed Data Records/Data Elements: This database consists of 251 records, with 7 data fields, containing:

- Bridge identification numbers (State & City)
- Inspection priority codes
- Bridge Location (address)
- Year built
- Old Bridge number (or new)
- Railroad Bridges.

Stated Uses of the Database: This spreadsheet drives inspections of bridges.

Key Reports, Screens generated or made available: Printout of the spreadsheet.

Database Maintenance Process: Updated semi-annually by inspections.

Documentation: Inspection files, including the state inspection forms.

Other Points: None

Key Terms and Definitions related to this Database:

- Bridge includes both complete bridges and bridge segments.
- Fracture indicates that bridge steel is cracked.
- Scour Critical indicates high water problems.
- Culvert indicates a bridge over water channels that are not rivers or creeks.

5) Comprehensive Bridge Files

Database Custodian: DPW, Infrastructure Services Division, Field Operations Section, Structural Design 286-3294.

General Description: Individual bridge histories, including inspections.

Media and Programs Used: All are paper manual files, with photographs and drawings, with some dating back to 1844.

Types of Records/Data Elements: Complete history of individual bridges including inspections.

Detailed Data Records/Data Elements:

- Bridge numbers and location, filed by number
- Complete inspection reports
- Photographs of bridge and any damage
- Bridge plans including construction materials and date of construction
- Remodeling plans, if any.

Stated uses of the database: Hard copy of State reports filed with the State bi-annually, inspection reports used to update spreadsheets. Provides historical information on age and construction of the bridge.

Key Reports, Screens Generated or made available: State inspection reports and bridge evaluation numbers.

Database Maintenance Process: These files are maintained, as bridges are inspected, built, or remodeled.

Documentation: Paper copy of all information as described above.

Other Points: These files are probably the most current.

Key Terms and Definitions related to this Database: None

Appendix 3: Sewer Database Profiles

1) Sewer Inventory

Database Custodian: Department of Administration, Information and Technology Management Division (ITMD), Geographical Information Systems (GIS) Team, Nancy Olson 286-8710. Data is housed in the ITMD (GIS) Oracle Database while the maintenance and updates are performed by Sewer Engineering.

General Description: This is a computerized database that resides at ITMD. This database is used in conjunction with maps that track the route and location of all of the City's sewers, manholes, pipes etc.

Media and Programs Used: Oracle database with three main files. This is a GIS application.

Types of Records/Data Elements: These files contain current and historic data on all sewer assets.

Detailed Data Records/Data Elements: There are three main data files connected to the GIS system that produces maps and other data reports dealing with sewers.

Pipe Record File, consisting of about 29,000 records, with 51 data fields, containing:

- GIS locaters including address, street segment, Dime file code, etc.
- Descriptions, including ID numbers, type, size, materials, length and date constructed
- Condition assessment and related dates
- Up and downstream connectors and manholes
- Utilization.

Manhole Records File, identifying all sewer manholes in the City and consisting of over 39,000 records, with 51 data fields, containing:

- GIS locators, address, owner (i.e. City), DIME file information.
- Manhole ID number, construction type, plan number, elevation, year built.

Pipe Retirement File, consisting of about 35,000 records, with 51 data fields, containing:

- GIS locaters, including address, street segment, DIME file code, etc.
- Descriptions, including ID numbers, type, size, materials, length, and date constructed
- Condition assessment and related dates
- Up and downstream connectors and manholes.

Stated uses of the Database: This database is used for budget planning, problem tracking, and reporting sewer conditions.

Key Reports, screens generated or made available:

- Individual asset record screens

Appendix 3: Sewer Database Profiles

- Condition reports
- Sewer testing schedules
- Retirement reports
- Planned (Budgeted) work by street segment.

Database Maintenance Process: Changes to the database files are made at completion of work performed by Sewer staff (completed work orders are source documents), when sewers are identified as needing repairs and completion of contracted sewer inspections.

Other Points: Information for sewers pertaining to planned replacement or repair work is transmitted to the Transportation Section for coordination.

Key Terms and Definitions related to this Database: None

Appendix 3: Sewer Database Profiles

2) Digitized Maps

Database Custodian: Department of Administration, Information and Technology Management Division (ITMD), Geographical Information Systems (GIS) Team, Nancy Olson 286-8710.

General Description: Computerized maps that resides on DPW servers in the Environmental Section of DPW Infrastructure Services Division. This database produces detailed maps and engineering drawings indicating the location and construction of various sewer components.

Media and Programs Used: These are Computer Aided Design (CAD) files with 63 potential layers of drawings for each street or sewer segment.

Types of Records/Data Elements: These files can have an infinite amount of scaled drawings of each sewer component and GIS locators to allow the drawings to produce detailed maps.

Detailed Data Records/Data Elements: Graphical elements are linked to the database described above under "Sewer Inventory".

Stated uses of the Database: These files are used for design and repair maps for the field crews, contractors and engineering staff to plan work to be performed, estimate budget costs, and provide graphical images of the assets involved.

Key Reports, screens generated or made available:

- Individual asset drawings
- Detailed maps of each asset.

Database Maintenance Process: Changes to the database files are made during the planning stages by the design engineers, and as completed changes are added as the repair or replacement process is completed.

Other Points: Information for sewers pertaining to planned replacement or repair work is transmitted to the Transportation Section.

Key terms and Definitions related to this Database: None

Appendix 3: Sewer Database Profiles

3) Sewer History Maps

Database Custodian: DPW, Infrastructure Services Division, Environmental Section, Martin Aquino 286- 2462.

General Description: Hand-drawn maps indicating the location of various sewers, laterals, and manholes, some dating back about 100 years.

Media and Programs Used: These are paper documents.

Types of Records/Data Elements: These maps contain the historical information of some of the oldest sewer assets in the City.

Detailed Data Records/Data Elements: These maps show the location and construction of all sewer mains, laterals and manholes.

Stated uses of the Database: This database is used as a basis for all computerized sewer files (pipes, manholes, and pipe history).

Key Reports, screens generated or made available: None

Database Maintenance Process: These maps are kept in the Environmental Section and updated as projects take place.

Other Points: None

Key Terms and Definitions related to this Database: None

4) Potential Projects

Database Custodian: DPW, Infrastructure Services Division, Environmental Section, Martin Aquino 286- 2462.

General Description: This is a database of potential projects.

Media and Programs Used: This is a Microsoft Access computer database.

Types of Records/Data Elements: This database contains information on all potential projects with condition assessments.

Detailed Data Records/Data Elements: This database consists of about 1,500 records, with 146 data fields, containing:

- Project information, including status, year, ID number, aldermanic district, location
- Index rating (condition assessment)
- Sewer type and size
- Construction information, including construction review and sign-off
- Other underground information, such as utilities
- Cost estimates
- Bid information, including final bids.

Stated uses of the Database: This database is used to identify potential repair and replacement projects by condition assessment, and develop the annual sewer capital budget.

Key Reports, screens generated or made available: Project specific status reports.

Database Maintenance Process: This database is updated based on receipt of condition assessments that are less than a rating of 65, and then as status changes (i.e. approval, construction etc.).

Other Points: Sewer projects are coordinated with other infrastructure projects.

Key Terms and Definitions related to this Database: None

5) Construction Contract Administration

Database Custodian: DPW, Infrastructure Services Division, Construction Section, Contract Administration Area, 286-2497.

General Description: System to track construction and payments to contractors for Paving and Sewer construction.

Media and Programs Used: This is a system of dBase programs initially developed by DPW in 1986 and maintained as needed.

Types of Records/Data Elements: This database was developed to track the progress of construction on paving and sewer projects and to prepare contractor payment documents.

Detailed Data Records/Data Elements: This database consists of two sets of files, one for Paving and one for Sewers with substantially similar configurations. There are 7 main files in each system. The files within each system are interrelated by contract, project and bid item numbers. Detail file information consists of:

Standard Bid Items – Reference file of textual description of each bid item, with approximately 800 records for Paving and 1,200 for Sewers.

Estimated Quantities and Unit Bid Prices – Preconstruction estimate of quantities and contractor unit bid prices for each bid item on each project. Paving has 34,000 records for 1990 through the present. Sewers has 11,000 records from 1991 through the present.

Inspector Quantities – Log of quantities reported completed by bid item each day for each project. Paving has 60,000 records for 1990 through the present. Sewers has 35,000 records from 1991 through the present.

General Project Data – Project location, significant dates, construction supervisor and contractor data. Paving has 3,100 records for 1986 through the present. Sewers has 700 records from 1991 through the present.

Payment Log – Record of the totals paid on each payment for each contract by date. Paving has 3,900 records from 1990 through the present. Sewers has 3,300 records from 1989 through the present.

General Contract Data –Significant contract dates, contractor data, contract location data. Paving has 450 records from 1994 through the present. Sewers has 275 records from 1998 through the present.

Sewer Quantities – Total quantities constructed by contract for each bid item for Sewers, with 10,500 records from 1990 to present.

Paving Quantity Log – Quantity and price recorded against each bid item on each paving payment, with 100,000 records from 1990 through the present.

Stated Use of the Database: The primary use for these systems is to track the quantities of work performed by contractors on each item on Paving and Sewer contracts for the purpose of making contractor payments.

Appendix 3: Sewer Database Profiles

Key Reports, Screens Generated or made Available: Partial and Final Payment Estimates for work performed.

Database Maintenance Process: The data in this database is maintained on a continuous basis as contracts are let and as the contractors perform work. For Paving contracts, the items, estimated quantities and unit bid prices by project are imported electronically from the Estimating system described earlier. For Sewer contracts, this information is entered manually. The amount of work performed by the contractor on each bid item, on each project each day is recorded manually from reports prepared by the construction inspectors monitoring the construction in the field.

Documentation: Input is from daily inspector reports and bid documents. Output is Partial and Final Payment Estimate forms.

Other Points: None

Key Terms and Definitions related to this Database: None

Appendix 4: Water Main Database Profiles

1) Water Main Break Database

Database Custodian: Milwaukee Water Works, Water Engineering Section

General Description: This database is used to document all water main breaks in the Water Works distribution area.

Media and Programs Used: This is a Microsoft Access computer database.

Types of Records/Data Elements: This database tracks breaks by date, location and water main information.

Detailed Data Records/Data Elements: This database consists of approximately 27,000 records (14,000 water main breaks on active water mains and 13,000 water main breaks on abandoned/relayed water mains), with 18 data fields, containing:

- Date of break
- Location (address, street segment, GIS locater and quarter section)
- Date and type of repair
- Water main information (material type, year installed, size).

Stated uses of the Database: This database is used to track breakage and repairs to water mains.

Key Reports, screens generated or made available: Water main break report.

Data maintenance Procedures: This database is updated as activities occur starting with reports of breakage, through the repair, replacement, relay or abandonment of each water main.

Other Points: Only water main breaks are recorded in this database.

Key Terms and Definitions related to this Database: None

Appendix 4: Water Main Database Profiles

2) Water Main Experience Database

Database Custodian: Milwaukee Water Works, Water Engineering Section

General Description: This database is used to document specific water main break activity and is used to identify potential projects for the Yearly Water Main Replacement Program.

Media and Programs Used: This is a Microsoft Access computer database.

Types of Records/Data Elements: This database tracks break location, and break activity per 100 feet of main. Records are created when four breaks per segment have occurred.

Detailed Data Records/Data Elements: This database has about 2,100 records, detailing about 200 miles of water mains out of the 1,950 miles located throughout the City. Each record consists of 57 data fields, containing:

- Location (address, street segment, and quarter section)
- Dates of breaks and repairs
- Water main information (type, size, and length).

Stated uses of the Database: This database is used to assemble the Yearly Water Main Replacement Program.

Key Reports, screens generated or made available: None

Data maintenance Procedures: This database is updated throughout the year as water main breaks occur.

Other Points: This is only a partial database of all water mains controlled by MWW.

Key Terms and Definitions related to this Database: None

Appendix 4: Water Main Database Profiles

3) Water Main Replacement Program Database

Database Custodian: Milwaukee Water Works, Water Engineering Section .

General Description: This database is used to track all water main projects from identification as potential projects through the awarding of a contract.

Media and Programs Used: This is a Microsoft Access computer database developed in 1989.

Types of Records/Data Elements: This database tracks projects by project number, work order, and location.

Detailed Data Records/Data Elements: This database consists of approximately 4,000 records, with 120 data fields, containing:

- Project ID number
- Project Work Order
- Location (street segment, work limits, quarter section, and Aldermanic District)
- Preliminary and Final Cost Estimates
- Dates and Numbers of Common Council Approvals
- Drafting and Design Work Information
- DNR Approvals
- Contract Information.

Stated uses of the Database: This database is used to track replacement of water mains until a construction contract is awarded.

Key Reports, screens generated or made available: Water main replacement program report by program year and year to date internal status reports.

Data maintenance Procedures: This database is updated as activities occur starting with creation of the water main project as part of the yearly water main replacement program . Project records are added when necessary throughout the year.

Other Points: None

Key Terms and Definitions related to this Database: None

City of Milwaukee

Department of Public Works
Infrastructure Services Division

Mariano A. Schifalacqua
Commissioner of Public Works

James P. Purko
Director of Operations

Jeffrey S. Polenske
City Engineer

July 19, 2004

Mr. W. Martin Morics
City Comptroller
Office of the Comptroller
Room 404, City Hall

Subject: Infrastructure Services Database Audit

Dear Mr. Morics:

We have read your report concerning our database programs used to monitor various aspects of our Division. We found the audit to be fairly representative of our database systems. Many of these systems were developed by individuals within there areas to control aspects of their responsibilities. These systems have served us well in the past and have helped in streamlining our operations. Over the years, we have taken steps to combine shared information electronically between the systems.

We recognize the need to continue to upgrade these systems to become more efficient. Over the past several years, we have been working with the Administration Division of DPW to research available systems to replace ours. Our research resulted in a decision to have the Administration Division staff develop a new comprehensive database system. A combined system will provide many advantages for the sharing of common information while providing better project control and tracking. The heart of the new system, regarding scheduling, should be designed within the next two months. The design of the remaining segments of the system will follow. We are optimistic that the new integrated system could be functioning by December 2005.

Very truly yours,

Jeffrey S. Polenske, P.E
City Engineer

CAW:sdp
c: Commissioner of the Department
of Public Works

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