



Department of Public Works
Infrastructure Services Division

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February 8, 2005

Alderman Robert J. Bauman, Chair
Public Improvements Committee
Room 205, City Hall

Subject: Common Council Resolution File No.041453

Dear Alderman Bauman:

The attached Summary Report on Street Lighting Operations has been prepared in response to the referenced Council Resolution File and your communication dated January 26, 2005.

The report is complete and is also being submitted at the Public Improvement Committee meeting on February 9, 2005.

Please contact me if there is additional information required.

Very truly yours,

Jeffrey S. Polenske, P.E.
City Engineer

Jeffrey J. Mantes
Commissioner of Public Works

DEM/djm

Attachment

C: Members of the Common Council

**City of Milwaukee – Department of Public Works
Infrastructure Services Division**

**Summary Report on Street Lighting Operations
prepared for
Milwaukee Common Council – Public Improvements Committee
February, 2005**

BACKGROUND

City of Milwaukee, Infrastructure Services is responsible for constructing, operating and maintaining:

- Approximately 67,000 street lights
- Approximately 9,000 alley lights
- Approximately 300 electrical power substations
- Approximately 1290 miles of lighted streets (~8 million feet of cable).

The system is large and complex with a majority of facilities located underground. Each substation receives electrical power from We Energies lines, reduces it to proper voltages and redistributes the power to the street light circuits. The current age of the substations are 30-35 years and are nearing the end of their average 40-year service life. Substations include underground and above ground substations and pad or pole mounted electrical cabinets

Control System - Electrical substations are interconnected and operated through ten separate communication control circuits, which receive an on/off signal from a centrally located master controller unit located at 1540 West Canal Street. This central control unit is over 60 years old, technically outdated and will be replaced with a state of the art controller system. This system does not monitor the operational status of the street lights only the on/off sequence. Only 85% of the street lights in the City are controlled by this master controller and therefore, not all street lights are turned on/off at the same time.

Burn time – Street light on/off times are controlled by a master system photocell located at 1540 West Canal Street, which measures the light in the atmosphere. The lights are turned on when the sky reaches a pre-set level of darkness, and turned off when daylight reaches a pre-determined level. These measurements are not set to any specific time of day and will vary on any given day based on the available light and cloudiness. In December 2004, the earliest the lights were on was 4:32 pm and the latest 5:03 pm. Delays can be added to this sequence by varying the sensitivity of the photocell or activating a timed delay system.

The street lights controlled by this master photocell will turn on at the same time, with the notable exception being street lights in the Central Business District. These are turned on approximately three minutes earlier to compensate for increased darkness due to building shadows. A number of outlying areas of the City (~10 percent of the street lights) and all alley lights, do not have communications established to the master controller system and are operated on individual photocells. These lights operate independently of the master controller and generally turn on earlier than other lights.

Current street light burn times have been established based on funds allocated for electrical energy in the Division's operating budget. Average on/off times are then established to provide street light burn times consistent with the amount of funds available, and adjustments are made as necessary to the master controller to reflect these averages.

Total recent burn time hours were:

- 381.85 hours in November, 2004; average of 12.7 hours/day
- 404.85 hours in December, 2004; average of 13.1 hours/day
- 437.52 hours in January, 2005; average of 14.1 hours/day

Based on the electrical energy budget for 2005, no significant change in burn times is anticipated to occur, other than minor variations due to atmospheric conditions.

OUTAGES

Types and notification - Outages can range from a single lamp failure to large area outages. Specifically "area dark" outages are defined as three or more lights being out. Reports of outages are received on a 24-hour basis to our central dispatch (286-3481) from citizens, Alderman, Police, County Transit Company or other City departments. There are limited personnel in the field during the evening and we rely heavily on others to identify problems to us. Unfortunately, we can only respond to situations we are made aware of. The new controller system previously mentioned will have power monitoring capabilities to enable us to detect system-wide outages ourselves.

Causes - Outages are caused by a variety of conditions. The most common is excessive moisture (heavy rains, icing, melting snow and dissipating frost) that affects the wiring and circuits. Increased activity is prevalent at this time of the year. Other outages are caused by excavation damages by private contractors or City departments. Lighting facilities are also damaged by vehicle knockdowns and vandalism. Finally, all mechanical systems are subject to unpredictable equipment failures based on their age. These failures range from large transformers to cables and controls. Continued replacement and upgrading of equipment through the Capital Program is required in order to reduce the potential of these occurrences.

Response goals - The type of outage and the available personnel dictate the response effort. The Division's policy is to ensure that the lights are kept on. To this end, the priorities are:

1. Emergencies, involving equipment knock down and potentially live circuits.
2. Area dark outages, which can involve substations, circuits or lights.
3. Single unit outages, involving lamp replacements or minor wiring repairs.
4. Alley lights outages, which are typically lamp replacements.

The goal for "area dark" outages is to restore service within 24 hours. In 2004, a total of 2,296 such outages were identified, of which 2,281 (99.3%) were repaired within 24 hours.

In addition, the goal for handling single unit outages is to repair them within 30 days. In 2004, a total of 2,443 single unit outages were identified, of which 1,930 (79%) were repaired within 30 days. Alley light outages have a repair goal of 72 hours. In 2004, a total of 1,784 lights were repaired with 1,622 (91%) repaired within 72 hours.

While the above indicates some areas for improvement, all area-wide outages are promptly addressed once identified and brought back on line as quickly as possible.

Current workload - As of February 1, 2004, there were:

- 68 single unit outages, which require underground work (43 on the south side and 25 on the north side). The oldest outage report is from May 2004 at a bridge underpass and is included on an area-wide replacement schedule.
- 152 single unit outages, which include alley lights and do not require underground work (75 on the south side and 77 on the north side). The oldest is from October 2004.

These outages are in a constant state of flux and change weekly. The total of ~220 single units requiring some repair at any given time in a system of 76,000 lights represents a failure rate of 0.29% (One outage for every 345 units that are on). This is considered an extremely low failure rate.

SERVICE REQUESTS

Calls requesting service related to the street lighting operation vary and are not all related to outages. On average, there are 30 calls per day requesting some type of service. In situations where there are heavy rains, thunderstorms, or icing, just the calls relating to outages have peaked at 30 reports in a day. Supplemental crews and overtime are assigned in order to respond to those reports in a timely manner.

STREET LIGHTING RESOURCES

Staffing - The 2005 Budget authorized 45 Electrical Mechanic and 22 Electrical Worker positions in the Street Lighting area. This total number has remained consistent over the past few years and is adequate to maintain a balanced response effort. Crews are staffed to work in several different functional areas focusing on outage locations. This repair work is completed during the day shift when street light circuits are not energized. Second and third shifts have limited personnel scheduled to respond to various emergency situations.

Schedules – First shift - There are 4-5 crews dedicated to “area dark” repairs. These crews consist of one Electrical Mechanic and one Laborer with a Laborer added during the winter months due to the snow and frozen ground. When not responding to area dark locations, these crews concentrate on single unit outages, which require underground work. If there is a high volume of area dark outages, this workforce is supplemented with crews from other functional areas including Transformer Crew, Line Crew, Pole Crews and substation Mechanics. In addition, two crews handle routine streetlight maintenance repair activities during the day and consist of one Electrical Mechanic and one Electrical Worker. These crews are responsible for the replacement of ballasts, igniters, burned wiring, broken optical assemblies etc. Due to the recent experience of outages, an additional two crews have been added to this function. As staffing is available, pro-active area-wide lamp replacements are conducted throughout the year. During 2004, 2,679 lamps were grouped replaced with an additional 3,019 replaced on a scattered basis.

Second shift - Two Electrical Mechanics, one Utility Worker and one Electrical Workers are routinely scheduled on second shift. Activities included response to emergency work, pole knockdowns, cable damages, lockouts, Police actions, locating services, etc. They also respond to area dark troubles and if the outage is more than a lamp replacement, the Mechanic will attempt to troubleshoot the problem. Mechanics on second and third shift do not work on energized equipment at night but will generate reports for the needed service on the first shift.

Third shift - The third shift Electrical Mechanic's assignments are the same as the second shift Mechanic. Scheduling permits coverage of two Mechanics on three days and one Mechanic on the remaining four days of the week.

Vacancies – The largest impact to the ability to complete work and respond in a timely manner to system outages is available personnel. While the workforce can be depleted by routine absences relating to vacation, sick and injury; delays in filling of vacancies will increase this impact. In 2004, six new hires plus one graduated Electrical Mechanic Apprentice filled long-term vacancies in Electrical Mechanic positions. Four of those six have completed training and two are nearing completion. The impact of these vacancies resulted in shifting of priorities from performing routine maintenance to increased response. As the workforce regains to full strength, the major impact will be increased pro-active maintenance items to reduce the potential for future outages. In addition, the City currently has eight Apprentices in the City's apprenticeship program and the majority of those individuals are slated to fill positions in street lighting. Although the majority of these Apprentices have several years left to complete their training, the future addition of those individuals to the position of Electrical Mechanic will be a great benefit.

Additional resources - Due to the increase of outages, two additional crews for above ground repairs were assigned as mentioned above. In addition, a third-shift Electrical Mechanic will soon be scheduled for additional coverage. Collectively, Engineering and Street Lighting Operations are identifying neighborhoods in which excessive outages are due to cabling failures and are planning to implement area cable replacements and upgrades as funding is available.

The Division remains committed to providing an efficient and reliable street lighting system and have dedicated staff responding to these issues 24 hours a day. While the recent activity has been above normal averages, we are deploying as many available resources as possible to address this interim need.