

**APPENDIX G – MAINTENANCE AND REPLACEMENT COST**

A. Annual Recurring Maintenance Costs:

1. Annual recurring maintenance costs can be divided into two general classifications: preventative maintenance and “routine” maintenance repairs.
2. All Wake County facilities, as owner-occupied facilities, are expected to receive preventative maintenance and routine maintenance repairs.
3. To evaluate the cost of *preventative maintenance* for a building component or system, the best approach is to itemize all of the elements of the component or system and develop a list of work items necessary to inspect, maintain, and repair it on a routine basis (daily, weekly, bi-weekly, monthly, quarterly, and annually). From this list, an estimate of man-hours and parts can be developed and then costed. For example, a centrifugal fan may require a 10-minute inspection every working day, a 30-minute inspection and adjusted monthly, and a yearly cleaning and inspection that takes 4 hours. Thus, on an annual basis, this fan’s preventative maintenance requires approximately 43 man-hours per year.
4. Some building components, such as roofs, fenestration, cladding, etc. have relatively small preventative maintenance requirements, while others, such as elevators and escalators, doors, etc. have higher preventative maintenance needs.
5. *Maintenance repair* is the amount that must be spent each year for replacement parts that, individually, fail during the economic life of the building component or system. While the cost of maintenance repairs in the early years will normally be lower than in later years, for purposes of analysis these costs are “averaged” on an annual basis over the economic life.

B. **Mechanical Systems:** The following table has been developed from information published by the Trane Company and other sources:

Mechanical Component or System	Annual Recurring Maintenance Cost (Percent of Initial Cost)
DX Packaged Units	7.0
Water Chillers: DX	7.0
Rotary Compressor	3.5
Absorption	3.5
Cooling Towers, Galvanized Steel	5.5
Air-Handling Systems	3.0
Fan Coil Units	3.0
Pumps	3.3
Piping: Black Steel	5.0
Galvanized Steel	3.0
Copper	2.0
Fans	3.0
Coils	3.3
Control Systems	10.0

- C. **Electrical Systems:** General electrical system and component maintenance costs can be estimated as follows:

Electrical Component or System	Annual Recurring Maintenance Cost (Percent of Initial Cost)
Power Wiring	4.0
Low Voltage Wiring	2.0
Motor Starters	2.5
Switches	2.5

- D. **Light Fixtures:** Light fixture cleaning costs can be difficult to determine and the following data can be used in absence of more specific information:

Type of Fixture	MH to Clean
Incandescent, pendant	0.05
Incandescent, recessed	0.07
Fluorescent, pendant, open	0.10
Fluorescent, surface, enclosed	0.15
Fluorescent, recessed, enclosed	0.10
HID, 10' mounting	0.10
HID, 15' mounting	0.15
HID, 20' mounting	0.25
HID, 30' mounting	0.60
HID, 40' mounting	1.00

1. Multiplying these man-hours by the average cost for maintenance personnel yields cleaning cost per fixture. Multiplying by the total number of fixtures, times the number of times per year the fixtures are cleaned, yields the total cleaning cost for the facility.
2. Repair and Replacement Costs:
  - a. Repair and replacement costs are costs that occur at multi-year intervals during the economic life of a building component or system. Typical *repair costs*, for example, may include a cladding system that requires re-caulking every 7-10 years, a chiller that requires eddy current testing every 5 years, or a revolving door that requires new bearings every 3 years. Replacement costs occur, however, simply because the component or system has reached the end of its economic life. Appendix C summarizes the estimated economic life for a large number of building components and systems and can be used as a guide to estimate anticipated replacement costs.
  - b. For lighting systems, group relamping is generally recommended at 60% of the average lamp life, as summarized in the following table:

Lamp Type	Average Life (hours)	Relamping Period (years, based on 3000 hrs/year use)
Low pressure sodium	18,000	4
High pressure sodium	12-15,000	3
Metal halide	10-15,000	3
Mercury Vapor	24,000	5
Fluorescent	20,000	4