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Electric Circuit Data Collection: An Analysis of Health Care Facilities

Over the last few decades, there has been significant technological innovation along the entire electrical power chain. Factors such as today's energy codes are driving down the electrical loads presented by end-use equipment. Thus, the service, feeder, and branch circuit load design requirements in NFPA 70®, National Electrical Code® (NEC®), such as the load growth assumptions that justify spare capacity, have been called into question. The changing landscape of building operations and corresponding technological advances have also resulted in data-rich environments. While electrical data collection and the availability of relevant data have historically been lacking, insights from validated electrical data have become more prevalent today and are being utilized in the code development process to assess existing regulations or substantiate code changes.

Project Goal & Approach

The goal of this project was to implement a data collection plan to provide sufficient receptacle demand and load data for a variety of occupancies, to provide a technical basis for considering revisions to the service, feeder and branch circuit design requirements in the National Electrical Code®. The project aimed to provide the necessary data and analytics for the targeted spaces (e.g. patient care areas in health care facilities) addressed by this project, and also set a clear approach for future efforts addressing other occupancies. The scope of this project was as follows:

- Demand and loading of electrical receptacles (i.e., general and dedicated equipment receptacles), including all peak demand (i.e., worst case) scenarios.
- Focus on circuits with 120 volts and 15 or 20 amps.
- Circuit and Panel level data in health care facilities was collected for a period of one-year during a global pandemic.
- Geographic diversity of participating facilities, reflecting the diversity of key drivers of this issue.

Summary Observations

The data analysis resulted in the following summary observations:

1. Current NEC® demand factors for patient care areas in hospitals result in systems that are at least twice as large as needed for all receptacle loads. In all cases where receptacle information was available, there is significant spare capacity above the peak load experienced by a system over the metered period of one year. The oversizing increases at higher levels in the distribution system.
2. Oversizing is a bigger issue for dedicated receptacles than it is for general receptacles.
3. These results are consistent across geographies and hospital size, age, and type.
4. The receptacle loads for a hospital patient care area do not vary over a year.
5. The receptacle loads for a hospital do not appear to substantially increase during a pandemic.

The results of this study demonstrate that the hospital demand factors contained in the current (2020) edition of the National Electrical Code may result in electrical systems that are between 100 percent and 700 percent larger than the actual loads. These findings are generally consistent with other studies and/or analysis of healthcare plug loads.

This data confirms what many hospital electrical engineers have generally assumed — that the current demand factors often cause electrical equipment in hospitals to be oversized. The data strongly suggests this remains true even in pandemic situations. This data collection and analysis effort suggests that the current demand factors for general receptacles and dedicated receptacles in patient care areas of health care facilities may be reduced, especially at higher levels of a system. Further research is needed, however, on other occupancies.

NFPA codes and standards prescribe the minimum requirements to ensure safety, thus, any potential changes are in the hands of NFPA's consensus process. However, the availability of good quality data of a sufficient quantity like this, can help code-making bodies make more informed decisions.

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