

EPRI RD&D3 Feeder Database User's Guide

(Utility 1)



User's Guide Revision 2

April 25, 2013

This guide is to be used with the EPRI RD&D3 Distribution Feeder Database. The database is in csv format titled EPRI RD&D3 FEEDER DATABASE_Utility1Rev2.csv. This guide should be used as a reference to assist the user in understanding the contents of the feeder database. As the database is updated this guide will be modified to an updated revision to reflect the changes in the database.

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1. REVISION HISTORY

This section will be updated as the database and user's guide gets updated with newer revisions. Notes on the changes to this document and the user's guide will be made in the following sections.

1.1. Revision 0

Date: February 5, 2013

Notes:

- Initial Draft of Database User's Guide
- Paired to *EPRI RD&D3 FEEDER DATABASE_Rev0.csv*
- Database reflects the contents of a single California Distribution Utility
- 3190 total feeders in database

1.1. Revision 1

Date: March 26, 2013

Notes:

- Updated Draft of Database User's Guide based on updated feeder data since previous version.
- Paired to *EPRI RD&D3 FEEDER DATABASE_Utility1Rev1.csv*
- Database reflects the contents of a single California Distribution Utility
- 3195 total feeders in database

1.1. Revision 2

Date: April 25, 2013

Notes:

- No changed to database itself. Update to User's Guide only.
- Paired to *EPRI RD&D3 FEEDER DATABASE_Utility1Rev2.csv*
- Updated definition in User's Guide of 'Regulators' to clarify that this only includes voltage regulators on the feeder itself and not regulators that may be present at the substation (station LTC voltage regulators).

-Updated definition of '*3-PH miles*'; removed references to "backbone" and clarified that it consist of 3 phase taps and laterals.

-3195 total feeders in database

2. DESCRIPTION OF DATABASE

This database was assembled from participating utilities at the request of EPRI and Sandia National Laboratories with an emphasis on certain key feeder properties to be provided. It is important to note that not all feeder properties of interest were extracted for each utility, which is why some field columns might be blank as this type of data is not currently available. For instance at this time no field column exist for conductor type (1/0, 336.4kcmil, etc.). Due to the differences among each participating utility in reporting feeder data each utility will have a separate database (.csv) and User's Guide (.doc) file.

| | A | B | C | D | E | F | G |
|---|--------------------------------|------------------------|----------------------------|-------------------------------|------------------------------------|---------------------------------------|----------------------|
| 1 | Unique Feeder ID (EPRI) | Primary Voltage | Total 3-Phase miles | Overhead 3 Phase miles | Total 1 & 2 Phase miles | Overhead 1 & 2 Phase miles | SCADA Breaker |
| 2 | 000000001 | 4 | 7.15 | 3.58 | 8.93 | 4.46 | No |
| 3 | 000000002 | 4 | 12.92 | 6.46 | 3.84 | 1.77 | No |
| 4 | 000000003 | 4 | 23.9 | 11.95 | 35.57 | 17.79 | No |
| 5 | 000000004 | 12 | 15.57 | 7.79 | 27.36 | 13.68 | No |

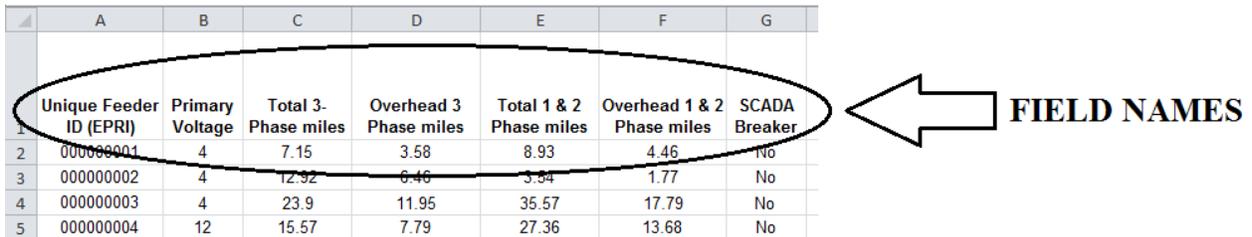


Figure 1. Database Field Names

2.1. Definitions of Field Names

Unique Feeder ID (EPRI) – A number assigned to that particular feeder to identify it within the database. This ID has been generated by EPRI in order to protect the confidentiality of the distribution utilities circuits.

Feeder Type and Topology

Primary Voltage – The kV in which the feeder is operated at. These values coincide with standard distribution operating levels and may have been consolidated to standardize the data, i.e. for instance feeders that list either 24.9kV or 25kV will be consolidated to a single value so as not to distinguish them from each other.

Total 3-Phase miles – Total length, in miles, of the feeder's 3-phase circuits (includes taps and laterals)

Overhead 3 Phase miles - Length, in miles, of the overhead portion of the feeder 3-phase circuits. *Note: Underground 3-Phase miles can be calculated by subtracting Overhead 3-Phase miles from Total 3-Phase miles.*

Total 1 & 2 Phase miles – Length, in miles, of the total single and two phase circuits off the feeder.

Overhead 1 & 2 Phase miles – Length, in miles, of the overhead portion of the single and two phase circuits off the feeder. *Note: Underground 1&2 Phase miles can be calculated by subtracting Overhead 1&2 Phase miles from Total 1&2 Phase miles.*

Customer Data

Dom Cust – The number of domestic (residential) customers being served from the feeder.

Com Cust – The number of commercial customers being served from the feeder.

Ind Cust – The number of industrial customers being served from the feeder.

Agr Cust – The number of agricultural customers being served from the feeder.

Oth Cust – The number of customers being served from the feeder that do not fall under the domestic, commercial, industrial, or agricultural customer category.

Total Cust – The total number of customers being served from the feeder, equal to the sum of the ‘Dom’, ‘Com’, ‘Ind’, ‘Agr’, and ‘Oth’ customer categories.

Device Data

Transformer Count – The total number of service transformers connected to the feeder

SCADA Breaker – A Boolean value, ‘YES’ or ‘NO’, on whether a circuit breaker is present at the substation serving the feeder.

Regulators – The total number of line voltage regulators connected to the feeder. *Note: This does not include regulators that may be present at the substation (station LTC voltage regulators). (A regulator is a device used to maintain a constant voltage level on the circuit)*

Capacitors – The total number of capacitor banks connected to the feeder. *(A device used to regulate voltage on the circuit through the addition of reactive power, VARs)*

Boosters – The total number of boosters connected to the feeder. *(A booster is a fixed tap autotransformer)*

Fuses – The total number of fuses present on the feeder.

Reclosers – The total number of reclosers on the feeder. *(Reclosers sense and interrupt fault currents and automatically restore service after momentary outage)*

Sectionalizers – The number of sectionalizers on the feeder. *(The sectionalizer is a self-contained, circuit-opening device used in conjunction with source-side protective devices, such as reclosers or circuit breakers, to automatically isolate faulted sections of electrical distribution systems)*

Stepdowns – The number of stepdown transformers on the feeder.

Switches – The number of switches on the feeder. (*simple device in either a closed or open position to isolate portions of the feeder*)

Interrupters – The number of circuit interrupters on the feeder. (*intelligent switch used for overcurrent protection on the distribution feeder*)

Load Data

Summer KW – The summer peak load on the feeder as measured at the substation.

Summer KVA Capability – The sum of the summer KVA rating for all service transformers tied to the feeder.

Winter KW – The winter peak load on the feeder as measured at the substation.

Winter KVA Capability – The sum of the winter KVA rating for all service transformers tied to the feeder.

DG Data

Number of DG systems – The number of distributed generators (DG) connected to the feeder. DG includes all forms of generation including wind, solar, and thermal units.

Number of PV systems – The number of photo-voltaic (PV) generators connected to the feeder.

kW DG – The sum of the rated kW output for all DG on the feeder.

kW PV (incl wind) – The sum of the rated output for all PV and wind generators connected to the feeder.

Sum of Non-PV kW – The sum of the rated output for all non-PV and non-wind systems connected to the feeder. This is calculated as the difference between kW DG and kW PV (incl wind). This value gives an idea of the size of thermal generating units connected to the feeder.

of PV 0-20kW / # of PV 20-200kW / # of PV >200kW – These fields divide the total number of PV systems into subgroups depending on their respective rated output. The sum of these three fields will be equal to the total number of PV systems on the feeder.

2.2. What's not in Database

- Location Data – In order to protect the confidential nature of the utility's distribution system GPS coordinates are not available in this database.

- Conductor Type – Although requested the type of conductor (1/0, 336.4kcmil) is not currently available as a feeder parameter.
- The Following items were requested but due to the difficulty in obtaining for all feeders they are not currently present in the database.
 - Main 3-Phase Conductor
 - LTC set points
 - Distance between voltage regulators
 - Voltage Regulator set points
 - Short Circuit Capacity at farthest 3-Phase node
 - Approximate service area (sq mi)
 - Feeder peak load time (month/hour)
 - Feeder minimum load
 - Feeder minimum load time (month/hour)

3. DATABASE STATISTICS

This section will give a brief statistical overview of the contents of the EPRI Feeder Database.

Summary:

Number of Feeders in Data – 3195

Most common kV rating – 12kV

Average 3-Phase Backbone: 29.20mi

Average circuit miles (3P+1&2PH): 44.25

3.1. Histograms

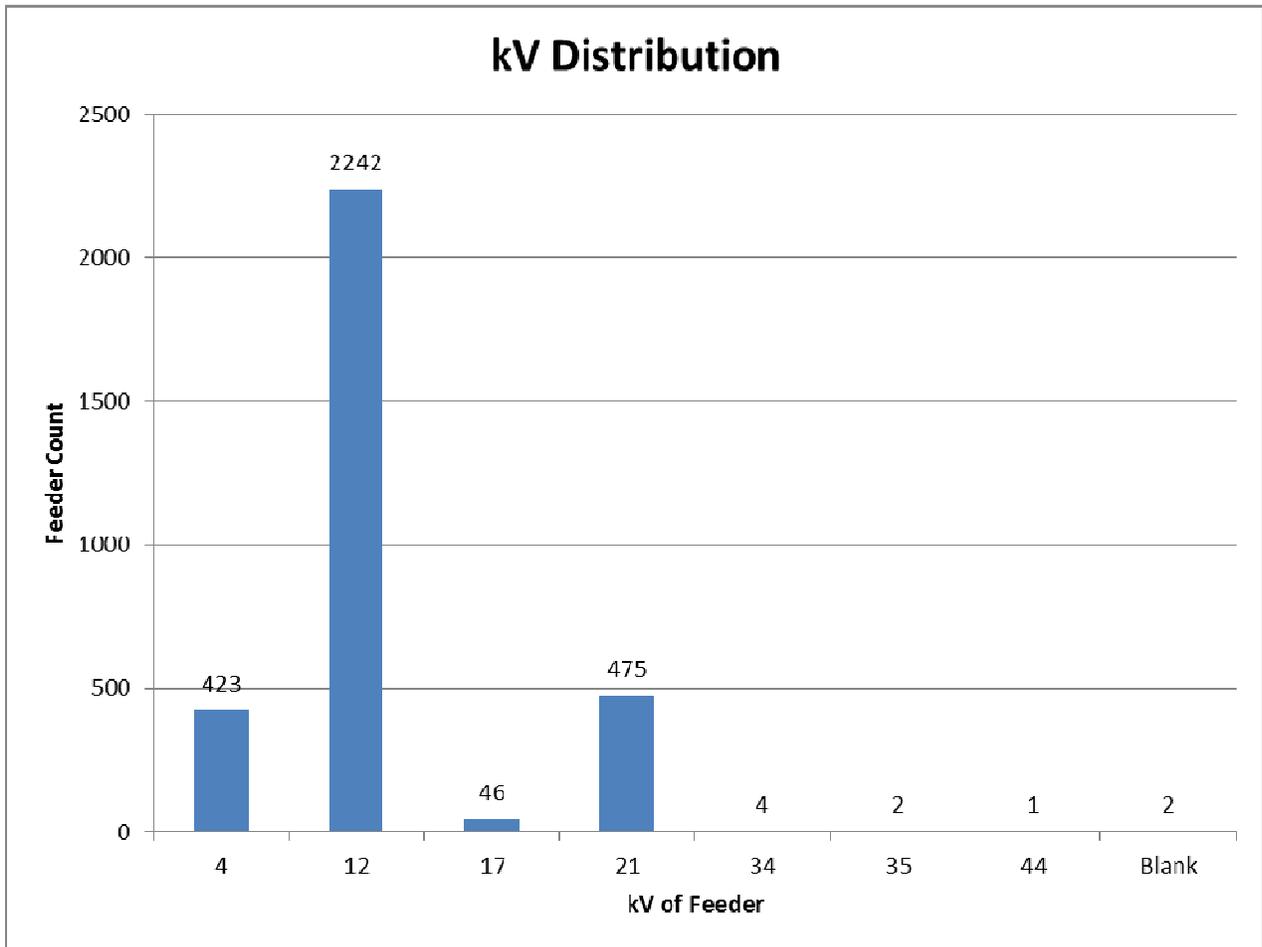


Figure 2. kV Distribution

*2 Feeders with no KV listed

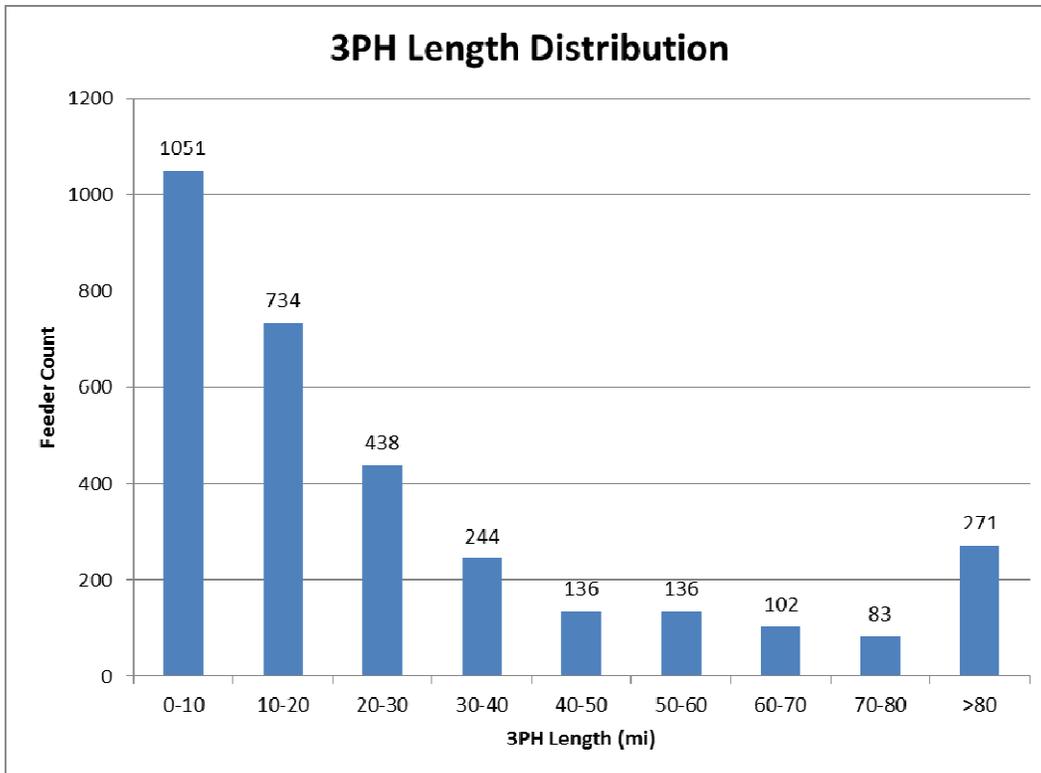


Figure 3. 3PH Length Distribution

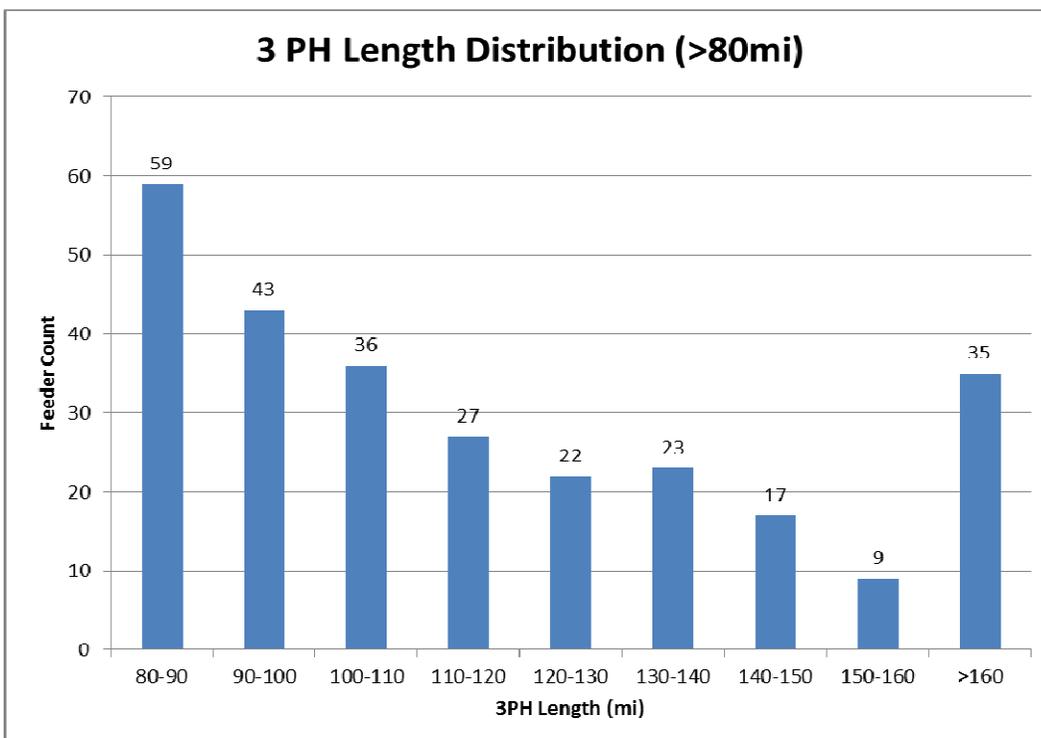


Figure 4. 3PH Length Distribution (Greater than 80 miles)

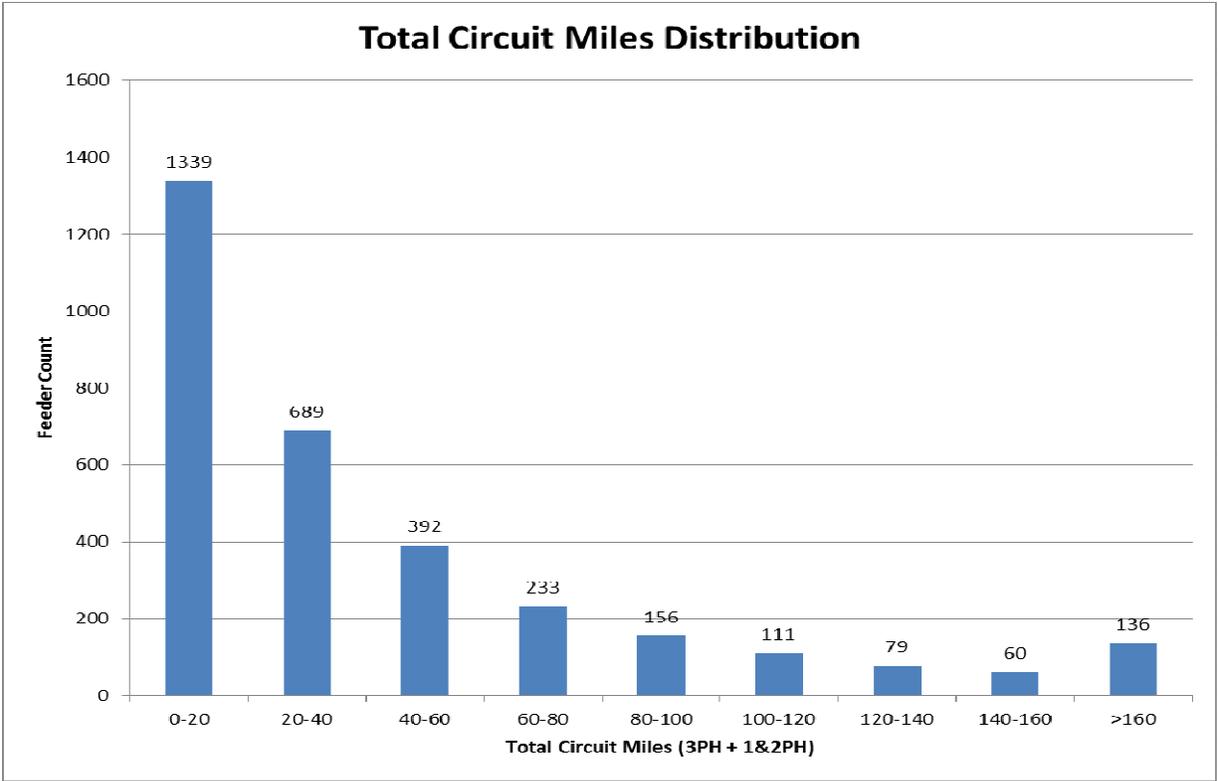


Figure 5. Total Circuit Miles Distribution

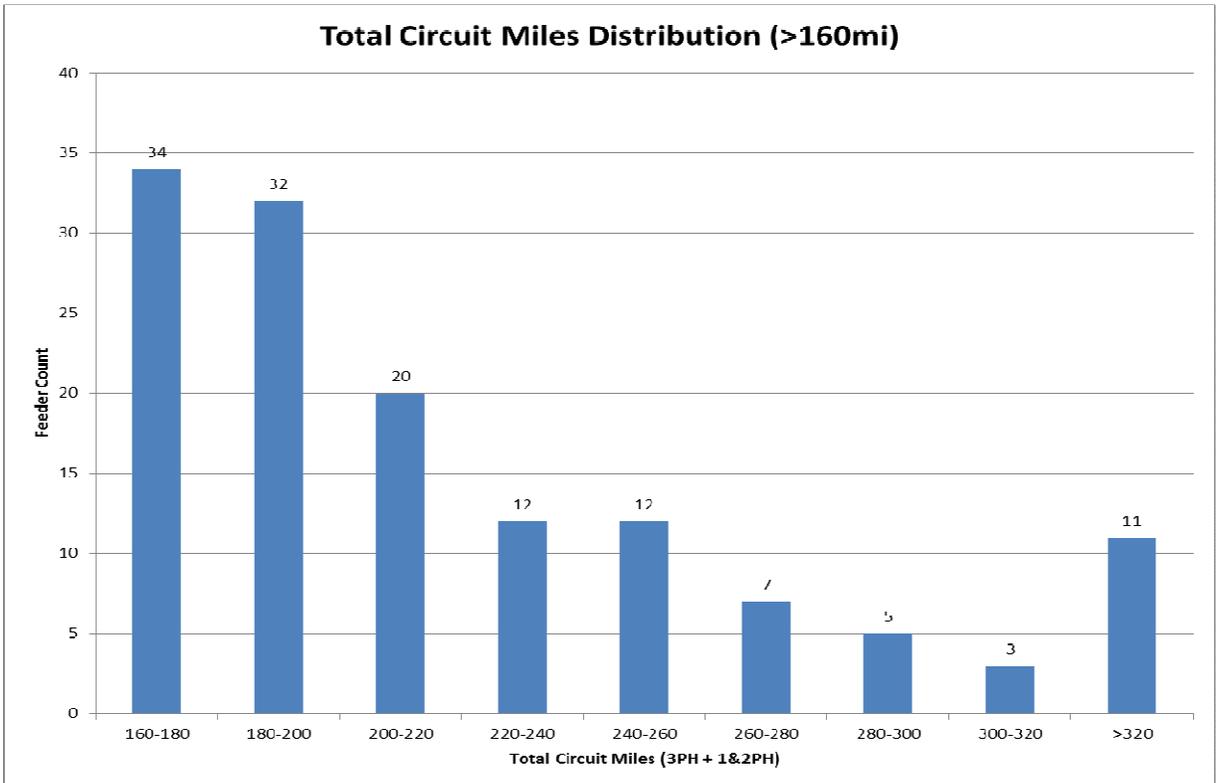


Figure 6. Total Circuit Miles Distribution (Greater than 160 miles)

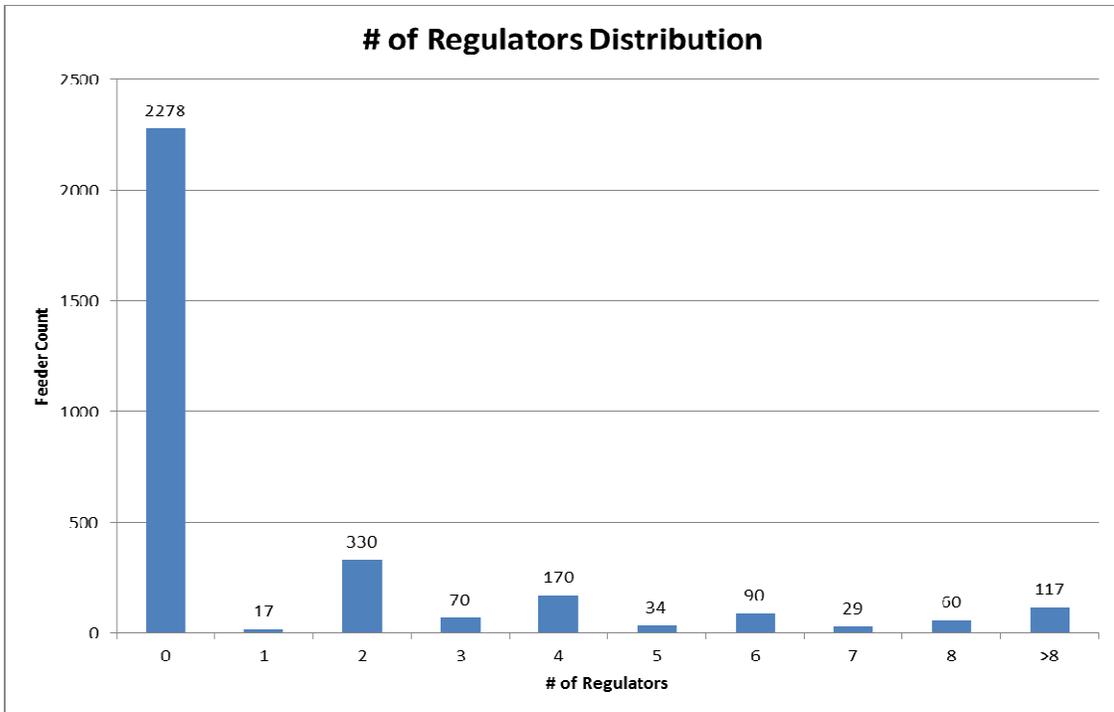


Figure 7. Regulators Distribution

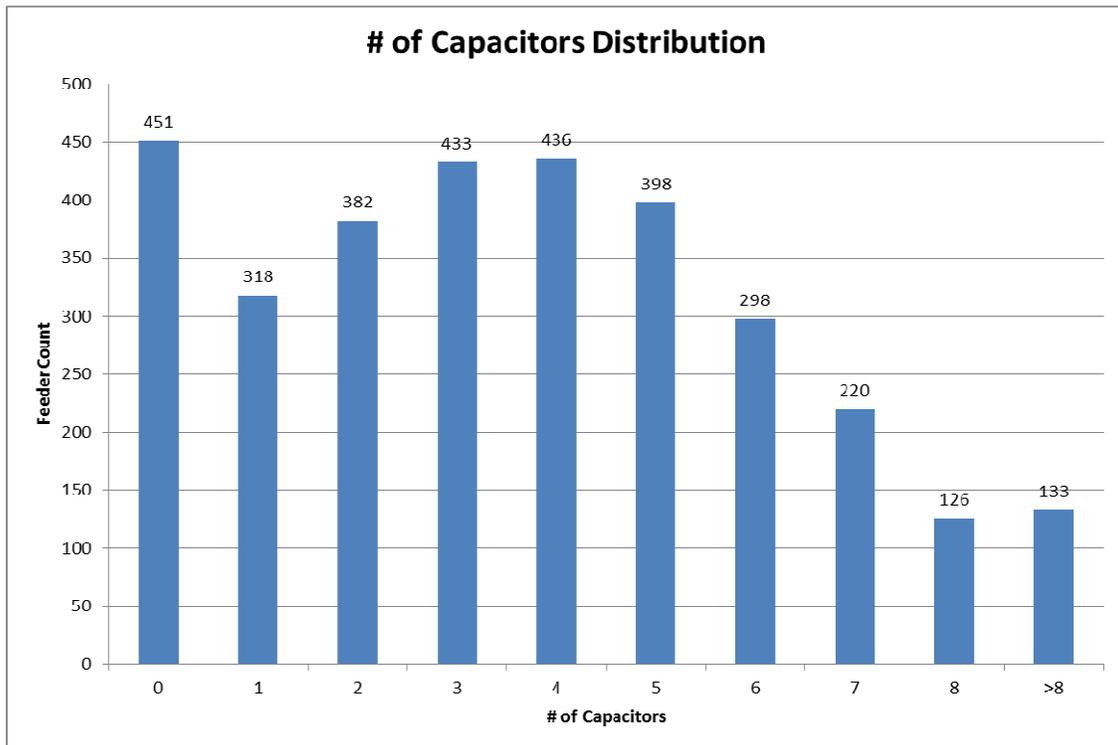


Figure 8. Capacitors Distribution

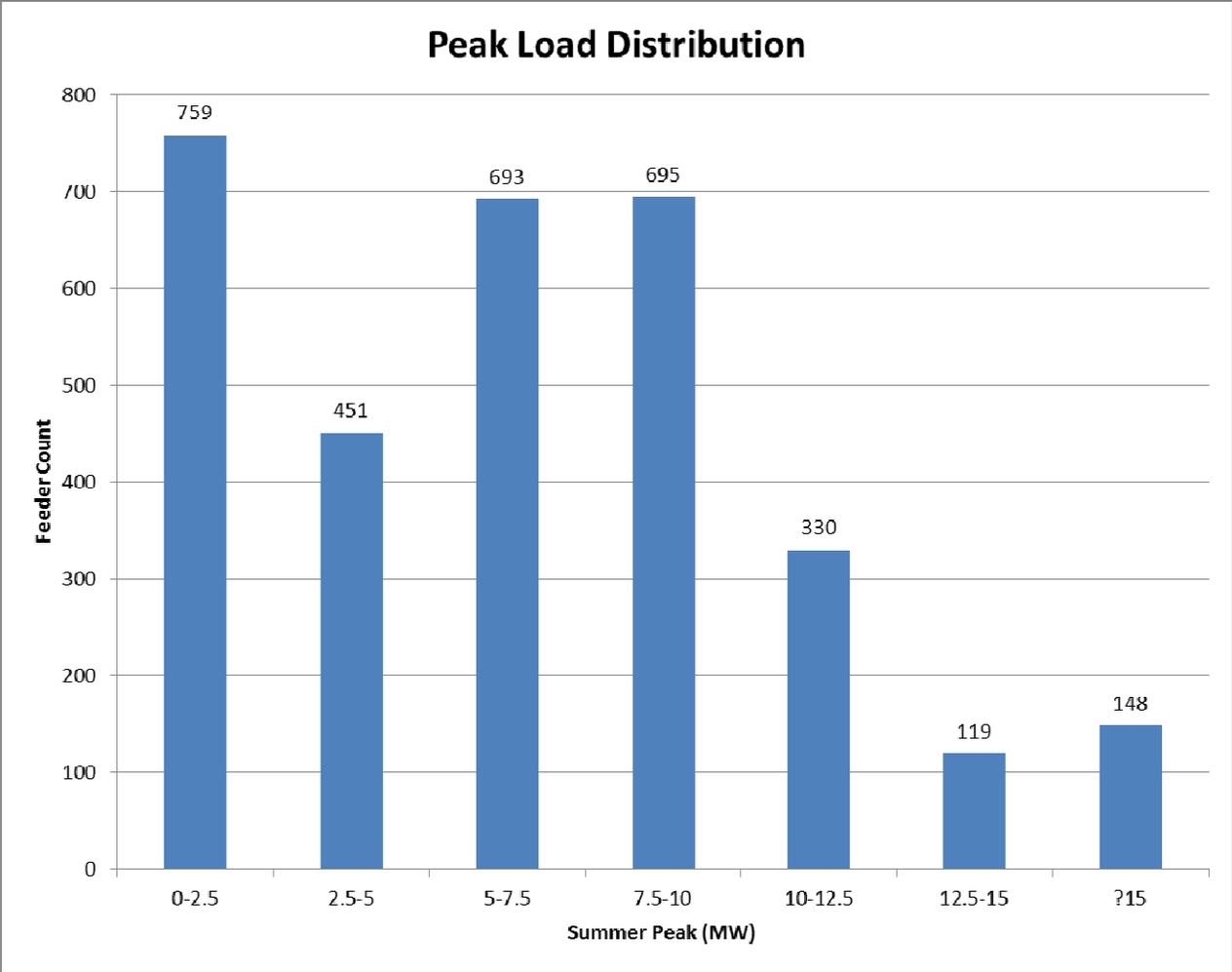


Figure 9. Peak Load Distribution

Table 1. Database Maximums (Total 3-Phase, Total Circuit Miles, Peak Load)

| Max 3-Phase Length: | | | | | | | | | | | |
|---------------------|----|------------------|------------|-------|-------|-------------|-------------|------|------|-------|-------|
| ID | kV | 3-PH Length (mi) | 1&2PH (mi) | # Reg | # Cap | Summer Peak | Winter Peak | # DG | # PV | DG KW | PV KW |
| 2239 | 21 | 310.74 | 54.52 | 11 | 10 | 12,556 | 11,343 | 63 | 63 | 639 | 581 |

| Greatest Total Circuit Miles: | | | | | | | | | | | |
|-------------------------------|----|------------------|------------|-------|-------|-------------|-------------|------|------|-------|-------|
| ID | kV | 3-PH Length (mi) | 1&2PH (mi) | # Reg | # Cap | Summer Peak | Winter Peak | # DG | # PV | DG KW | PV KW |
| 2445 | 21 | 252.32 | 271.08 | 8 | 17 | 16,630 | 11,453 | 177 | 177 | 2,414 | 2,196 |

| Max Peak Load | | | | | | | | | | | |
|---------------|----|------------------|------------|-------|-------|-------------|-------------|------|------|-------|-------|
| ID | kV | 3-PH Length (mi) | 1&2PH (mi) | # Reg | # Cap | Summer Peak | Winter Peak | # DG | # PV | DG KW | PV KW |
| 834 | 35 | 0.45 | 0 | 0 | 0 | 54,659 | 0 | 2 | - | 2,280 | - |

| Greatest # of Regulators | | | | | | | | | | | |
|--------------------------|----|------------------|------------|-------|-------|-------------|-------------|------|------|-------|-------|
| ID | kV | 3-PH Length (mi) | 1&2PH (mi) | # Reg | # Cap | Summer Peak | Winter Peak | # DG | # PV | DG KW | PV KW |
| 2477 | 12 | 128.17 | 86.97 | 27 | 7 | 6,949 | 7,400 | 15 | 15 | 58 | 47 |

| Greatest # of Capacitors | | | | | | | | | | | |
|--------------------------|----|------------------|------------|-------|-------|-------------|-------------|------|------|-------|-------|
| ID | kV | 3-PH Length (mi) | 1&2PH (mi) | # Reg | # Cap | Summer Peak | Winter Peak | # DG | # PV | DG KW | PV KW |
| 2445 | 21 | 252.32 | 271.08 | 8 | 17 | 16,630 | 11,453 | 177 | 177 | 2,414 | 2,196 |

3.2. Database Anomalies

- 15 Feeders w/ summer load and 0 summer capacity
- 11 Feeders w/ winter load and 0 winter capacity
- 31 Feeders with 0 Total Circuit Miles