The data and parameters related to the simulation are given in the following:

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | **Simulation parameters and data**  **Basic value:**  **Modified IEEE 14-bus information:**  **Line data:**  **Distributed generators data:**   |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | | Number | Type |  |  |  |  | a | b | c | | #1 | Generator | 300 | 0 | 100 | -80 | 0.0430292 | 20 | 0 | | #2 | Generator | 200 | 0 | 150 | -100 | 0.35 | 20 | 0 |   **Network data:**   |  |  |  |  |  | | --- | --- | --- | --- | --- | | From | To | R | X | Current Capacity (Amp) | | 1 | 2 | 0.0922 | 0.0477 | 500 | | 2 | 3 | 0.493 | 0.2511 | 500 | | 3 | 4 | 0.366 | 0.1864 | 500 | | 4 | 5 | 0.3811 | 0.1941 | 500 | | 4 | 7 | 0.819 | 0.707 | 500 | | 6 | 13 | 0.1872 | 0.6188 | 500 | | 7 | 8 | 1.7114 | 1.2351 | 500 | | 7 | 9 | 1.03 | 0.74 | 500 | | 9 | 10 | 1.04 | 0.74 | 500 | | 10 | 11 | 0.1966 | 0.065 | 500 | | 13 | 12 | 0.3744 | 0.1238 | 500 | | 13 | 14 | 1.468 | 1.155 | 500 |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | | Time (hour) | Demands’ Zones (#bus) (pu) | | | | | | | | #2 | #5 | #9 | #10 | #11 | #12 | #13 | | #1 | 0.05 | 0.01 | 0.01 | 0.01 | 0.0073 | 0.01 | 0.001 | | #2 | 0.05 | 0.01 | 0.01 | 0.01 | 0.0073 | 0.01 | 0.02 | | #3 | 0.2 | 0.014 | 0.014 | 0.014 | 0.0077 | 0.014 | 0.02 | | #4 | 0.2 | 0.014 | 0.024 | 0.014 | 0.0077 | 0.014 | 0.01 | | #5 | 0.2 | 0.014 | 0.044 | 0.014 | 0.0077 | 0.014 | 0.01 | | #6 | 0.3 | 0.017 | 0.067 | 0.017 | 0.0080 | 0.017 | 0.011 | | #7 | 0.3 | 0.017 | 0.077 | 0.017 | 0.0080 | 0.017 | 0.017 | | #8 | 0.18 | 0.022 | 0.122 | 0.022 | 0.0085 | 0.122 | 0.022 | | #9 | 0.18 | 0.022 | 0.122 | 0.022 | 0.0085 | 0.122 | 0.122 | | #10 | 0.25 | 0.035 | 0.135 | 0.035 | 0.0095 | 0.235 | 0.135 | | #11 | 0.3 | 0.042 | 0.152 | 0.052 | 0.023 | 0.252 | 0.152 | | #12 | 0.3193 | 0.048 | 0.158 | 0.158 | 0.034 | 0.358 | 0.158 | | #13 | 0.3 | 0.0468 | 0.160 | 0.160 | 0.035 | 0.360 | 0.16 | | #14 | 0.285 | 0.053 | 0.1982 | 0.2909 | 0.0353 | 0.3616 | 0.2364 | | #15 | 0.28 | 0.050 | 0.150 | 0.250 | 0.030 | 0.35 | 0.15 | | #16 | 0.27 | 0.04 | 0.140 | 0.240 | 0.025 | 0.34 | 0.14 | | #17 | 0.245 | 0.015 | 0.115 | 0.215 | 0.010 | 0.315 | 0.115 | | #18 | 0.225 | 0.009 | 0.109 | 0.029 | 0.0081 | 0.090 | 0.109 | | #19 | 0.12 | 0.008 | 0.108 | 0.028 | 0.0070 | 0.081 | 0.108 | | #20 | 0.115 | 0.006 | 0.01 | 0.016 | 0.0055 | 0.070 | 0.080 | | #21 | 0.115 | 0.006 | 0.01 | 0.006 | 0.0081 | 0.006 | 0.065 | | #22 | 0.11 | 0.005 | 0.006 | 0.006 | 0.0081 | 0.0055 | 0.054 | | #23 | 0.109 | 0.005 | 0.006 | 0.006 | 0.0053 | 0.006 | 0.043 | | #24 | 0.1 | 0.003 | 0.003 | 0.003 | 0.002 | 0.001 | 0.008 |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | | Time (#hour) | Reactive loads zones (#bus) (pu) | | | | | | | | #2 | #5 | #9 | #10 | #11 | #12 | #13 | | #1 | 0.001 | 0.04 | 0.001 | 0.003 | 0.012 | 0.003 | 0.002 | | #2 | 0.01 | 0.05 | 0.001 | 0.005 | 0.012 | 0.004 | 0.002 | | #3 | 0.01 | 0.05 | 0.0015 | 0.005 | 0.012 | 0.005 | 0.002 | | #4 | 0.01 | 0.05 | 0.0010 | 0.005 | 0.012 | 0.005 | 0.003 | | #5 | 0.02 | 0.10 | 0.0070 | 0.001 | 0.021 | 0.01 | 0.0031 | | #6 | 0.02 | 0.16 | 0.0070 | 0.001 | 0.020 | 0.01 | 0.0040 | | #7 | 0.14 | 0.16 | 0.0070 | 0.001 | 0.020 | 0.01 | 0.0040 | | #8 | 0.15 | 0.17 | 0.02 | 0.0002 | 0.023 | 0.02 | 0.0043 | | #9 | 0.15 | 0.17 | 0.02 | 0.002 | 0.021 | 0.02 | 0.0071 | | #10 | 0.15 | 0.18 | 0.05 | 0.014 | 0.035 | 0.05 | 0.015 | | #11 | 0.16 | 0.16 | 0.06 | 0.017 | 0.035 | 0.012 | 0.015 | | #12 | 0.15 | 0.16 | 0.05 | 0.025 | 0.035 | 0.0162 | 0.015 | | #13 | 0.184 | 0.19 | 0.062 | 0.0378 | 0.0382 | 0.015 | 0.019 | | #14 | 0.15 | 0.193 | 0.015 | 0.015 | 0.05 | 0.01 | 0.015 | | #15 | 0.17 | 0.15 | 0.015 | 0.015 | 0.05 | 0.01 | 0.009 | | #16 | 0.15 | 0.10 | 0.015 | 0.04 | 0.05 | 0.005 | 0.007 | | #17 | 0.15 | 0.10 | 0.008 | 0.04 | 0.05 | 0.005 | 0.007 | | #18 | 0.15 | 0.10 | 0.008 | 0.04 | 0.05 | 0.005 | 0.005 | | #19 | 0.04 | 0.12 | 0.004 | 0.003 | 0.002 | 0.004 | 0.002 | | #20 | 0.04 | 0.12 | 0.004 | 0.003 | 0.002 | 0.002 | 0.002 | | #21 | 0.04 | 0.04 | 0.004 | 0.003 | 0.002 | 0.002 | 0.002 | | #22 | 0.03 | 0.02 | 0.002 | 0.003 | 0.002 | 0.002 | 0.002 | | #23 | 0.02 | 0.01 | 0.002 | 0.003 | 0.002 | 0.002 | 0.002 | | #24 | 0.001 | 0.04 | 0.001 | 0.003 | 0.012 | 0.003 | 0.0012 |  |  |  |  | | --- | --- | --- | | Description | Lifetime (year) | Rating (kVA) | | Substation Transformer | 15 | 2000 |   **Electrical system parameters:**   |  |  | | --- | --- | | ***Parameter*** | ***Value*** | |  | 1.06 (p.u.) | |  | 0.94(p.u.) | |  | 1.06(p.u.) | |  | (degree) | |  |

**Traffic network’s characteristics:**

The OD traffic demands data can be found in [1], [2]. The Edmonton traffic demand dataset, which captures hourly traffic flows for one year, is divided into training (75%), validation (15%), and testing sets (10%) for forecasting performance assessment. The following data is related to a typical day.

[1] City of Edmonton Traffic Flow Map. Accessed: Dec. 1, 2022. [Online]. Available: [Downtown Area | Traffic Flow Map.](https://gis.edmonton.ca/portal/apps/webappviewer/index.html?id=72775c70fba343d792631283b44f27cc)

[2] Traffic Volumes, Edmonton [Online]. Available: [Traffic Volumes and Turning Movements | City of Edmonton.](https://www.edmonton.ca/transportation/traffic_reports/traffic-volumes-turning-movements)

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Actual traffic flows of the OD pairs for a typical day | | | | |
| Time (hour) | OD #1 | OD #2 | OD #3 | OD #4 |
| #1 | 70 | 31 | 12 | 9 |
| #2 | 63 | 25 | 8 | 4 |
| #3 | 55 | 22 | 9 | 6 |
| #4 | 44 | 18 | 9 | 4 |
| #5 | 40 | 18 | 9 | 4 |
| #6 | 45 | 17 | 9 | 5 |
| #7 | 54 | 21 | 8 | 8 |
| #8 | 59 | 18 | 11 | 6 |
| #9 | 70 | 23 | 20 | 7 |
| #10 | 88 | 24 | 25 | 12 |
| #11 | 108 | 34 | 32 | 13 |
| #12 | 113 | 36 | 26 | 10 |
| #13 | 103 | 26 | 30 | 14 |
| #14 | 114 | 49 | 43 | 15 |
| #15 | 135 | 36 | 32 | 17 |
| #16 | 102 | 36 | 31 | 16 |
| #17 | 105 | 35 | 29 | 14 |
| #18 | 113 | 41 | 28 | 11 |
| #19 | 144 | 54 | 31 | 15 |
| #20 | 112 | 40 | 36 | 23 |
| #21 | 102 | 33 | 43 | 17 |
| #22 | 96 | 36 | 29 | 22 |
| #23 | 96 | 34 | 23 | 18 |
| #24 | 86 | 37 | 19 | 14 |

**Structure of the Traffic network:**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Road #1 | From #node | 1 | Road #15 | From #node | 7 |
| To #node | 2 | To #node | 16 |
| Road #2 | From #node | 2 | Road #16 | From #node | 8 |
| To #node | 3 | To #node | 17 |
| Road #3 | From #node | 3 | Road #17 | From #node | 9 |
| To #node | 4 | To #node | 18 |
| Road #4 | From #node | 1 | Road #18 | From #node | 10 |
| To #node | 5 | To #node | 11 |
| Road #5 | From #node | 2 | Road #19 | From #node | 10 |
| To #node | 6 | To #node | 12 |
| Road #6 | From #node | 3 | Road #20 | From #node | 11 |
| To #node | 7 | To #node | 13 |
| Road #7 | From #node | 4 | Road #21 | From #node | 12 |
| To #node | 8 | To #node | 13 |
| Road #8 | From #node | 4 | Road #22 | From #node | 12 |
| To #node | 9 | To #node | 14 |
| Road #9 | From #node | 5 | Road #23 | From #node | 13 |
| To #node | 6 | To #node | 15 |
| Road #10 | From #node | 6 | Road #24 | From #node | 14 |
| To #node | 7 | To #node | 15 |
| Road #11 | From #node | 7 | Road #25 | From #node | 15 |
| To #node | 8 | To #node | 16 |
| Road #12 | From #node | 8 | Road #26 | From #node | 16 |
| To #node | 9 | To #node | 17 |
| Road #13 | From #node | 5 | Road #27 | From #node | 17 |
| To #node | 10 | To #node | 18 |
| Road #14 | From #node | 6 |
| To #node | 11 |

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Roads’ Non congested Travel times coefficients** | | | | | | | | | | | | | |
| Road #1 | Road #2 | Road #3 | Road #4 | Road #5 | Road #6 | Road #7 | Road #8 | Road #9 | Road #10 | Road #11 | Road #12 | Road #13 | Road #14 |
| 4.2 | 3.36 | 5.04 | 3.96 | 7.64 | 7.08 | 3.48 | 7.08 | 9.68 | 2.04 | 3.72 | 4.2 | 6.04 | 6.88 |
| Road #15 | Road #16 | Road #17 | Road #18 | Road #19 | Road #20 | Road #21 | Road #22 | Road #23 | Road #24 | Road #25 | Road #26 | Road #27 | |
| 3.48 | 5.44 | 4.56 | 1.44 | 3.72 | 9.84 | 5.44 | 7.68 | 3.48 | 3.6 | 7.6 | 4.2 | 8.96 | |