Table 1: The description of variables

| Variables | Description |
|---|---|
| $i, j \in D$ | $i^{th}$ bin and $j^{th}$ bin respectively. |
| $D$ | Total bins for a particular region including depot. |
| $N$ | Bins for a particular CV excluding depot. |
| $A$ | Set of all the arcs formed from $i^{th}$ bin to $j^{th}$ bin for $\forall i, j \in$ D. |
| $C_{ij} \in \mathbb{R}^+$ | Distance cost from bin $i$ to bin $j$ for a CV. |
| $X_{ij} \in \{0, 1\}$ | Binary variable that is 1 if a CV is travelling between the bin $i$ and bin $j$. |
| $Y_i \in \{0, 1\}$ | A binary variable that is 1 if a CV has visited bin $i$. |
| $P_t \in [0.0, 100.0]$ | Cumulative fill percentage of CV for the time interval $t$. |
| $u_i \in [0, 100 - P_t]$ | The fill percentage of the CV visiting bin $i$ for a specific time interval. |
| $st \in D$ | The starting bin of a CV in a new time interval. |
| $w_1 \in [0.0, 1.0]$ | The weight assigned to the distance in the objective function |
| $w_2 \in [0.0, 1.0]$ | The weight assigned to the waste amount in the objective function |
| $f_i \in [0.0, 1.0]$ | The fill ratio of bin at bin $i$. |
| $BT \in \mathbb{R}^+$ | The conversion factor for fill of smart bin to fill of CV. |

Table 2: Observations for 6 CV per region

| Region | CV | Waste (Kg) | Distance (Km) | Waste/Distance | Percent collected |
|---|---|---|---|---|---|
| **Region 1** | CV 1 | 999.07 | 38.53 | 25.93 | 14.74% |
| | CV 2 | 990.67 | 47.20 | 20.99 | 13.68% |
| | CV 3 | 994.66 | 43.57 | 22.83 | 15.79% |
| | CV 4 | 998.21 | 72.55 | 13.76 | 20.00% |
| | CV 5 | 977.66 | 121.86 | 8.02 | 24.21% |
| | CV 6 | 322.56 | 39.19 | 8.23 | 11.58% |
| | | | | **Total:** | **100%** |
| **Region 2** | CV 1 | 999.71 | 62.64 | 15.96 | 12.61% |
| | CV 2 | 993.32 | 71.67 | 13.86 | 12.61% |
| | CV 3 | 985.38 | 56.82 | 17.34 | 14.41% |
| | CV 4 | 991.47 | 78.51 | 12.63 | 13.51% |
| | CV 5 | 990.43 | 64.48 | 15.36 | 13.51% |
| | CV 6 | 999.31 | 99.06 | 10.09 | 18.92% |
| | | | | **Total:** | **85.59%** |
| **Region 3** | CV 1 | 999.68 | 48.07 | 20.80 | 15.96% |
| | CV 2 | 998.71 | 55.13 | 18.12 | 15.96% |
| | CV 3 | 991.22 | 50.32 | 19.70 | 14.89% |
| | CV 4 | 998.88 | 74.83 | 13.35 | 21.28% |
| | CV 5 | 955.92 | 87.04 | 10.98 | 23.40% |
| | CV 6 | 235.45 | 57.88 | 4.07 | 8.51% |
| | | | | **Total:** | **100%** |

Table 3: Observation for unrestricted resources

| Region | CV | Waste (Kg) | Distance (Km) | Waste/Distance | Percent collected |
|---|---|---|---|---|---|
| **Region 1** | CV 1 | 999.07 | 38.53 | 25.93 | 14.74% |
| | CV 2 | 990.67 | 47.20 | 20.99 | 13.68% |
| | CV 3 | 994.66 | 43.57 | 22.83 | 15.79% |
| | CV 4 | 998.21 | 72.55 | 13.76 | 20.00% |
| | CV 5 | 977.66 | 121.86 | 8.02 | 24.21% |
| | CV 6 | 322.56 | 39.19 | 8.23 | 11.58% |
| | **Total:** | **5282.82** | **362.89** | - | **100%** |
| **Region 2** | CV 1 | 999.69 | 60.89 | 16.42 | 12.61 |
| | CV 2 | 992.96 | 70.29 | 14.13 | 13.51% |
| | CV 3 | 988.65 | 65.86 | 15.01 | 11.71% |
| | CV 4 | 997.20 | 68.30 | 14.60 | 15.32% |
| | CV 5 | 983.61 | 73.17 | 13.44 | 15.32% |
| | CV 6 | 934.99 | 94.22 | 9.92 | 14.41% |
| | CV 7 | 740.36 | 111.69 | 6.63 | 17.12% |
| | **Total:** | **6637.42** | **544.42** | - | **100%** |
| **Region 3** | CV 1 | 999.68 | 48.07 | 20.80 | 15.96% |
| | CV 2 | 998.71 | 55.13 | 18.12 | 15.96% |
| | CV 3 | 991.22 | 50.32 | 19.70 | 14.89% |
| | CV 4 | 998.88 | 74.83 | 13.35 | 21.28% |
| | CV 5 | 955.92 | 87.04 | 10.98 | 23.40% |
| | CV 6 | 235.45 | 57.88 | 4.07 | 8.51% |
| | **Total:** | **5179.85** | **373.26** | - | **100%** |