

**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%
				<b>Total:</b>	<b>100%</b>
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%
				<b>Total:</b>	<b>85.59%</b>
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%
				<b>Total:</b>	<b>100%</b>

**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%
	<b>Total:</b>	<b>5282.82</b>	<b>362.89</b>	-	<b>100%</b>
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%
	<b>Total:</b>	<b>6637.42</b>	<b>544.42</b>	-	<b>100%</b>
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%
	<b>Total:</b>	<b>5179.85</b>	<b>373.26</b>	-	<b>100%</b>