

Chapter 5

Kandy Waste Collection Analysis

Nov-01

Area	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	Sum	Sum	226-9026	227-3146	47-2904	Compr	4WT	Total	C.F.	Wt (T/mth)	Wt(T/d)	Notes	
Within KMC																																	248	248	69	60			119	248	2.47	720.0	720.0	24.0
Care Kleen	8	9	9	10	9	10	7	11	7	9	5	9	9	7	7	9	5	9	12	8	9	9	8	8	6	8	7	10	7	7														
1. Deiyanevela	4	3	2	3	4	4	4	2	4	2	4	4	4	2	2	4	2	4	3	4	4	4	2	2	3	4	4	4	3	4	4	99						99	99	2.21	219.1		7.3	
2. Mahaiyawa	4	4	3	2	4	3	4	4	4	2	2	4	4	2	3	4	2	2	4	4	4	4	4	2	2	4	4	4	4	4	2	99						99	99	2.21	219.1		7.3	
3. Peradeniya	4	4	4	4	4	4	4	4	4	3	4	4	4	3	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	3	115				60		55	115	2.21	261.1		8.7		
4. Katugastota	3	4	2	3	3	3	3	3	3	2	3	3	3	3	3	2	3	3	3	3	3	3	3	3	3	3	3	3	3	3	88					88	0	88	2.21	176.0		5.9		
5. Aruppola	2	2	1	2	2	2	2	2	1	1	2	2	1	2	2	1	1	1	2	2	2	2	1	0	2	2	2	2	2	2	51	452					51	51	2.21	112.9	988.2	3.8		
Central Market	4	4	4	3	3	4	4	4	4	3	2	4	2	2	4	4	3	3	5	4	4	3	3	0	2	4	4	4	5	4	103	103					103	103	2.47	254.8	254.8	8.5		
IDPX	3	3	2	0	3	6	8	5	7	4	0	7	5	1	3	4	1	0	1	4	6	3	5	4	3	3	3	3	3	2	102						102	102	1.89	192.9		6.4		
IDPO	1	1	0	0	2	2	2	2	2	2	0	2	1	0	1	1	2	0	3	2	2	1	1	0	1	1	4	2	1	0	39	141					39	39	1.89	73.8	266.7	2.5		
Tobacco Co	1	1	0	0	0	0	0	1	0	0	0	1	0	0	1	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	6						6	6	2.47	14.8		0.5		
Le Kandyan Hotel	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3						3	3	1.23	3.7		0.1		
CEB	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1						1	1	1.89	1.9		1		
Private	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	10					0	0	2.21	0.0	20.4	0.0		
Sub-total	34	35	27	27	34	39	40	38	37	28	21	40	34	21	30	35	22	26	36	35	38	35	32	22	24	33	35	35	34	27	954	954					954		2250.0	2250.0	75.0			
Conservancy (bkts)	6	5	6	5	6	6	6	7	6	6	6	6	6	6	6	6	6	6	6	6	6	5	7	6	5	6	179	179							0.015	2.7	2.7	0.1						
Total KM SW trips	35	36	28	28	35	40	41	39	38	29	22	41	35	22	31	36	23	27	37	36	39	36	33	23	25	34	36	35	28	984	984					984		2252.7	2252.7	75.1				
Outside KMC																																												
Harispattuwa P.S.	1	2	0	0	1	2	1	2	1	1	0	2	2	0	2	2	1	0	2	1	1	1	0	3	0	2	1	2	1	0	34						34	34	2.21	75.3		2.5		
Bata Shoe Factory	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	4	38					4	4	0.72	2.9	78.1	0.1		
Total SWM disp.	36	38	28	28	36	43	42	41	39	31	22	43	37	22	33	39	24	27	39	37	40	37	33	26	25	36	37	39	36	28	1022	1022					1022		2330.8	2330.8	77.7			
Liquid wastes																																												
KMC gully sucker	4	5	2	0	7	4	4	6	4	5	2	4	4	3	4	2	7	2	4	3	5	4	5	2	4	3	5	4	5	6	119	119					119	5.54	659.5	659.5	22.0			

Notes:

1. CEB tractor assumed same tonnage as Bata

Days in mth 30

S-4

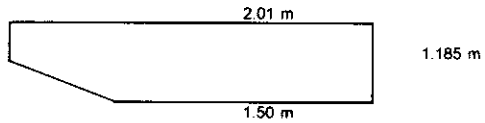
Dec-01

Area	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	Sum	Sum	226-9026	227-3146	47-2904	Compr	4WT	Total	C.F.	Wt (T/mth)	Wt(T/d)	Notes	
Within KMC																																	232	232	87	44			101	232	2.47	713.2	713.2	23.0
Care Kleen	7	8	8	7	4	0	4	5	5	9	8	8	9	7	10	7	8	9	7	7	10	8	7	11	8	9	8	9	8	8	9							101	232	2.47	713.2	713.2	23.0	
1. Deiyanevela	2	2	2	3	2	0	2	2	2	4	4	4	3	4	2	3	0	3	4	2	2	2	2	4	2	4	2	2	1	0	4	75						75	75	2.21	166.0		5.4	
2. Mahaiyawa	2	2	3	4	1	0	1	3	2	4	4	4	4	4	2	1	4	4	2	2	4	3	1	3	3	4	2	2	3	1	2	8	81						81	81	2.21	179.3		5.8
3. Peradeniya	3	4	4	5	4	2	0	3	3	4	4	4	4	4	3	4	4	3	4	4	3	4	4	3	4	4	2	4	4	3	2	3	107				57		50	107	2.21	243.0		7.8
4. Katugastota	2	3	2	3	2	0	1	2	3	3	8	6	6	5	4	4	3	4	5	3	5	4	6	5	4	5	2	4	5	4	8	121						121	121	2.21	267.8		8.6	
5. Aruppola	1	0	2	2	1	0	2	1	1	2	2	2	2	1	2	2	2	0	2	1	0	2	1	0	2	1	0	1	2	0	2	4	40	424					40	40	2.21	88.5	944.6	2.9
Central Market	4	4	2	5	2	0	1	3	4	4	3	4	4	4	4	3	4	6	4	3	2	3	2	5	7	7	4	6	4	2	7	117	117					117	117	2.47	289.4	289.4	9.3	
IDPX	3	0	0	1	0	0	0	0	4	3	2	3	2	0	0	0	0	0	0	0	2	1	0	0	0	0	0	0	0	0	0	21						21	21	1.89	39.7		1.3	
IDPO	0	0	4	4	0	0	0	0	0	1	1	0	2	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	15	36					15	15	1.89	28.4	68.1	0.9	
Tobacco Co	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1						1	1	2.47	2.5		0.1	
Le Kandyan Hotel	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	2	2						2	2	1.23	2.5		0.1
Private	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3					0	0	2.21	0.0	4.9	0.0	
Sub-total	24	24	27	34	16	2	11	19	20	35	38	34	37	32	27	24	25	32	27	21	33	25	22	34	27	33	23	30	24	17	35	812	812					812		2020.3	2020.3	65.2		
Conservancy (bkts)	6	6	7	7	6	0	7	6	3	4	4	6	6	5	6	6	5	6	5	5	6	6	7	6	5	6	6	7	6	0	7	168	168					168	0.015	2.5	2.5	0.1		
Total KM SW trips	25	25	28	35	17	2	12	20	21	36	39	35	38	33	28	25	26	33	28	22	34	26	23	35	28	34	24	31	25	17	36	841	841					841		2022.8	2022.8	65.3		
Outside KMC																																												
Harispattuwa P.S.	1	0	1	1	0																																							

Dimensions:

1. KMC compactor:

0.585 m

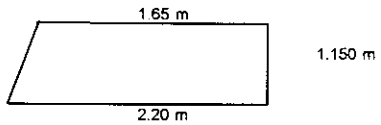


Width = 1.70 m
 Area = 2.25 m²
 Vol = 3.82 m³
 Density = 608 kg/m³, from weighbridge data
 Tonnage = 2.32 T

Measured at KMC workshop based on internal dimensions on 19 June 2002

2. Care Kleen compactors

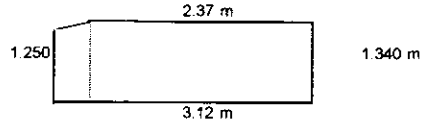
Small (227-3146)



Width = 1.72 m
 Area = 2.21 m²
 Vol = 3.81 m³
 Density = 608 kg/m³, from weighbridge data
 Tonnage = 2.32 T

Measured at Care Kleen office based on internal dimensions in July 2002

Large (226-9026)



Width = 2.00 m
 Area = 4.15 m²
 Vol = 8.29 m³
 Density = 501 kg/m³, from weighbridge data
 Tonnage = 4.16 T

2. KMC compactor data

	Care Kleen Large	Care Kleen Small	KMC Comp'r	Katugast Comp'r
T/load	4.16	2.32	2.32	2.0
Fill factor	100	100	100	100
KMC	5.4	3.4	5.4	2

Calculated from actual internal measurements, except for Katugastota compactor - KMC figure assumed correct
 Estimated by Peter, Landfill Manager
 Tonnages per load used by KMC

7. Proportion of gully sucker loads brought by small and large gully suckers

GS	No	GS Capacity (L)	Trips (No/d)	Avg trips (No/d)	Avg vol (L/d)	Vol/trip (L/trip)
Small	1	3500	2 - 3	2.5	8750	
Large	2	7000	3 - 4	3.5	24500	
Total	3			6	33250	5542

8. Esala Perahera data

	LC	SC	4WT	Sum
Aug 1-5	17	0	23	40
Aug 6-12	17	7	50	74
Aug 13-19	21	15	56	92
Aug 20-26	26	16	36	78
Aug 27-31	15	10	25	50

9. General notes:

1. Daily sheet data generally considered more accurate than monthly trip summary data - hence any discrepancies resolved by adjusting monthly 4WT total to give same total no of trips as daily data except where indicated otherwise.
2. Bata shoe company is located outside of Kandy municipal limits at Ambattane.
3. Conservancy data relates to number of buckets per load. 0 indicates no trip; non-zero number indicates 1 trip with stated no of buckets (usually 6-8)
4. Private vehicles assumed same tonnage as KMC tractor
5. Before July 2001, only the total trips was counted without the no of different compactor and tractor trips being specified separately. Separate recording (i.e. additional monthly summary sheet) began in Jul 2001 (when Mr Dissanayake took over management).

Summary data - No of loads

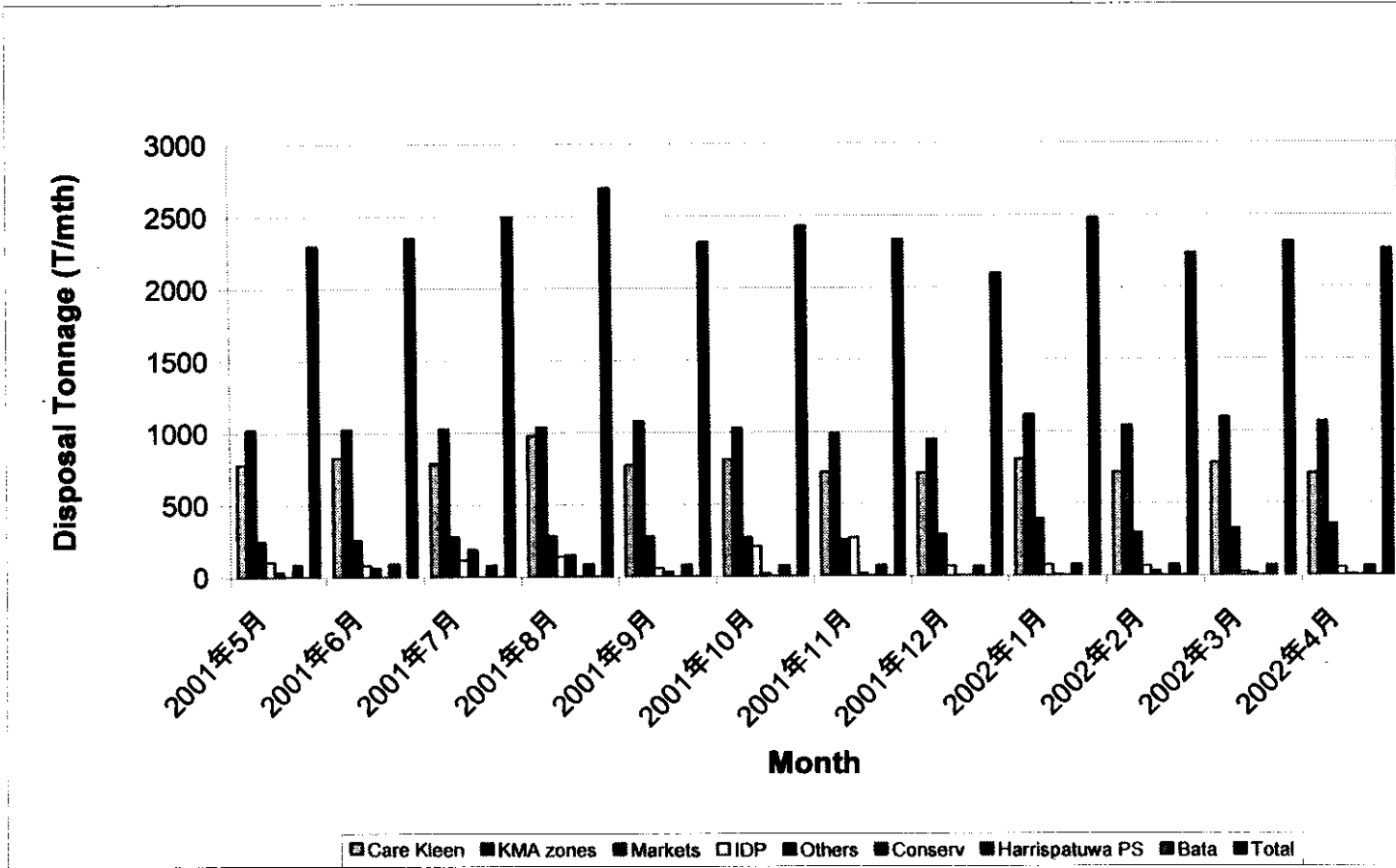
	Area	Vehicle	May-01	Jun-01	Jul-01	Aug-01	Sep-01	Oct-01	Nov-01	Dec-01	Jan-02	Feb-02	Mar-02	Apr-02	Sum	Mth avg	Daily avg
Inside Kandy Municipal area (KMA)	Care Kleen	Tractor	135	70	119	190	114	116	119	101	139	141	133	105	1482	124	4.1
		Sm. Comp'r	73	107	114	48	70	31	60	44	59	92	67	39	804	67	2.2
		Lg. Comp'r	67	98	55	96	79	109	69	87	79	37	71	85	932	78	2.6
	KMA zones	Tractor	400	399	297	317	426.5	322	304	367	440	418	433	424	4548	379	12.5
		Sm. Comp'r	59	60	77	60	58	60	60	57	60	49	58	55	713	59	2.0
		Katu Comp'r	0	0	96	98	0	89	88	0	0	0	0	0	371	31	1.0
	Markets	Tractors	101	104	113	115	113	110	103	117	159	120	130	144	1429	119	3.9
	IDP	Tractors	57	44	63	75	32	112	141	36	39	36	14	30	679	57	1.9
	Others	Tractors	21	30	87	49	17	10	10	3	5	13	8	4	257	21	0.7
	Sub-total		913	912	1021	1048	909.5	959	954	812	980	906	914	886	11215	935	30.7
Conserv	Buckets	184	141	157	187	155	179	179	168	194	152	193	172	2061	172	5.6	
Total		940	934	1045	1077	936.5	989	984	841	1011	931	945	913	11547	962	31.6	
Outside KMA	Harrispatuwa PS	Tractors	40	42	38	41	38	34	34	30	35	34	32	29	427	36	1.2
	Bata	Tractors	5	1	4	6	4	4	4	5	1	5	0	2	41	3	0.1
Total to landfill	No	985	977	1087	1124	978.5	1027	1022	876	1047	970	977	944	12015	1001	32.9	
Liquid wastes	Gully sucker		131	166	133	130	91	104	119	110	132	130	115	109	1470	123	4.0
Daily avg	All KMA loads	No	30.3	31.1	33.7	34.7	31.2	31.9	32.8	27.1	32.6	33.3	30.5	30.4	31.6		
	KMA + other	No	31.8	32.6	35.1	36.3	32.6	33.1	34.1	28.3	33.8	34.6	31.5	31.5	32.9		
	Gully sucker	No	4.2	5.5	4.3	4.2	3.0	3.4	4.0	3.5	4.3	4.6	3.7	3.6	4.0		
No of days	days	31	30	31	31	30	31	30	31	31	28	31	30	365			

Notes:

1. Conservancy tractor data is for no of buckets, not loads; actual loads obtained from difference between total and sub-total

Summary Data - Tonnages

	Area	Units	May-01	Jun-01	Jul-01	Aug-01	Sep-01	Oct-01	Nov-01	Dec-01	Jan-02	Feb-02	Mar-02	Apr-02	Sum	Mth avg	Daily avg	
Inside Kandy Municipal area (KMA)	Care Kleen	T	781.3	828.1	786.8	980.0	772.3	811.6	720.0	713.2	808.7	715.5	779.1	703.2	9400.0	783.3	25.8	
	KMA zones	T	1022.3	1022.4	1028.2	1036.9	1078.6	1030.0	988.2	944.6	1113.2	1038.9	1093.0	1066.1	12462.5	1038.5	34.1	
	Markets	T	249.8	257.3	279.5	284.5	279.5	272.1	254.8	289.4	393.3	296.8	321.6	356.2	3534.8	294.6	9.7	
	IDP	T	107.8	83.2	119.2	141.9	60.5	211.8	266.7	68.1	73.8	68.1	26.5	56.7	1284.2	107.0	3.5	
	Others	T	39.2	63.9	191.5	151.6	36.0	20.7	20.4	4.9	8.6	30.7	16.1	7.4	591.1	49.3	1.6	
	Sub-total	T	2200.5	2254.9	2405.2	2594.9	2227.0	2346.3	2250.0	2020.3	2397.6	2150.0	2236.3	2189.7	27272.6	2272.7	74.7	
	Conserv	T	2.8	2.1	2.4	2.8	2.3	2.7	2.7	2.5	2.9	2.3	2.9	2.6	30.9	2.6	0.1	
	Total	T	2203.2	2257.0	2407.5	2597.7	2229.4	2349.0	2252.7	2022.8	2400.5	2152.3	2239.2	2192.3	27303.5	2275.3	74.8	
	Outside KMA	Harrispatuwa PS	T	88.5	93.0	84.1	90.7	84.1	75.3	75.3	66.4	77.5	75.3	70.8	64.2	945.1	78.8	2.6
		Bata	T	3.6	0.7	2.9	4.3	2.9	2.9	2.9	3.6	0.7	3.6	0.0	1.4	29.5	2.5	0.1
Total	T	2295.4	2350.6	2494.5	2692.7	2316.3	2427.1	2330.8	2092.8	2478.7	2231.1	2310.0	2257.9	28278.1	2356.5	77.5		
Liquid wastes	m3		726.0	919.9	737.0	720.4	504.3	576.3	659.5	609.6	731.5	720.4	637.3	604.0	8146.3	678.9	22.3	
Daily avg	All KMA	T/d	71.1	75.2	77.7	83.8	74.3	75.8	75.1	65.3	77.4	76.9	72.2	73.1	74.8			
	KMA + other	T/d	74.0	78.4	80.5	86.9	77.2	78.3	77.7	67.5	80.0	79.7	74.5	75.3	77.5			
	Gully sucker	m3/d	23.4	30.7	23.8	23.2	16.8	18.6	22.0	19.7	23.6	25.7	20.6	20.1	22.3			
No of days	days	31	30	31	31	30	31	30	31	31	28	31	30	365				



A. General Notes

Kandy MC

1. SWM Staff Salary + allowance costs

Item	Salary	Allowance	Total	Adopted
Driver	4350	2200	6550	6,550
Labourer	3850	2200	6050	6,050

Notes:

- a. Basic salary data from KMC paysheets gives average salary of 3,847Rs/mth from 103 workers - say 3850 Rs/mth
- b. Collection worker survey gave average salary of 5,121 Rs/mth, including allowances, or 2,921 Rs/mth basic salary - this is too low.
- c. Use paysheet figure and add 500 Rs/mth to driver's salary as per Matale + 2,200 Rs/mth allowance to get adopted values above.

2. Calculating tyre replacement costs for different vehicles

(KMC gave overall costs; individual costs calculated from other data)

From KMC SWM data, they spend 371050 Rs/yr for 15 4WT/trailers & 1 Comp'r, 3 gully suckers & 1 pickup

- a. 4WT/trailer have 4 sm tyres @ 1500 ea & 2 lg tyres @ 4000 ea, replaced every 1 yrs = 14000 Rs/yr x 15 veh = 210000 Rs/yr
 - b. Compactors tyre replacement cost is ~ 27000 (Abans) - 45000 (CMC) giving average of 36000 Rs/yr - increased slightly to: 38760 Rs/yr
 - c. Gully suckers - assume same as compactors = 38760 Rs/yr x 3 vehicles = 116280 Rs/yr
 - d. Pickup has 4 small tyres @ 1500 ea, replaced every 1 yrs = 6000 Rs/yr
- Tyre costs based on Galle MC data, but assuming tractor tyres replaced more often than in Galle due to hilly terrain and greater distance to landfill Sum = 371040 Rs/yr
- Compactor tyre cost adjusted so as to give same total as KMC's total tyre cost - slightly greater than average of Abans and CMC data (36000)
- This sum is close enough to above value and the shaded figures have been adopted for cost calculations

3. Calculating repair and maintenance cost for different vehicles

(KMC gave overall costs; individual costs calculated from other data)

From KMC data, they spend 965060 Rs/yr for 15 4WT/trailers & 1 Comp'r, 3 gully suckers & 1 pickup

- a. In Galle, 4WT R&M cost = 24000 Rs/yr + trailer = 20000 Rs/yr x 15 vehicles x 1.125 factor due to hilly conditions in Kandy = 742500 Rs/yr
 - This is equivalent to: 49500 Rs/4WT.yr
 - b. Compactors R&M cost = 48000 (Abans) to 322,000 (CMC) Rs/yr; assume R&M cost close to Abans as KMC driver looks after it well = 50740 Rs/yr
 - c. Assume gully sucker R&M same as compactors = 50740 x 3 vehicles = 152220 Rs/yr
 - d. Assume pickup R&M cost = 40 % of 4WT cost = 9600 Rs/yr
- assumed this sum does not include bulldozer maintenance costs, as bulldozer has only been used for short time. Sum = 955060
- This sum is close enough to above value and the shaded figures have been adopted for cost calculations

4. KMC Budget equipment items listed below (but equipment costs calculated based on data given by KMC for different vehicles, rather than this data).

- Uniforms 2002 budget cost = 90000 for 330 labourers = 273 Rs/labourer.yr
- Mamoti and ekel brooms 2002 budget cost = 400000 for 330 labourers = 1212 Rs/labourer.yr

5. Blue shaded data indicates data given to JICA Study Team by KMC SWM/Workshop staff.

B. Collection vehicle unit costs - existing situation

Handcart (HC) Item	Unit	Unit Rate	Qty	Cost (Rs/yr)	Source & Notes
Labourers	Rs/mth	6050	24	145200	See general notes No1; no of lab'rs/HC = 2 (KMC said 2-3 - see note 4 for 3 case)
Protective equipment (gloves, etc)	Rs/yr	1675	1	1675	See note 1
Tyres, tubes	Rs/yr	2000	1	2000	Estimate based on 2 sm tyres @ 1500 Rs ea with 1.5 yr life
Handcart repair, maintenance	Rs/yr	2000	1	2000	KMC Handcart project estimate
Insurance	Rs/yr	0	1	0	
Rev Licence	Rs/yr	0	1	0	
Depreciation	Rs/yr	2125	1	2125	See note 2
Total O&M Costs per HC	Rs/yr			153000	per HC
Avg no of trips per HC per d	trips/d			3.2	from Katugastota zone survey information (13 HCs @ 41 trips/d according to supervisor)
Avg amount collected/HC/yr	T/yr			114	See note 3 - total tonnage divided by 13 HCs in Katugastota zone
Unit HC O&M cost	Rs/T			1342	= total O&M costs/HC tonnage per yr (actual data)

Notes:

1. Staff protective equipment based on KMC data and current prices:

a. Gloves	2 labourers/HC x	0 sets/yr @	40 Rs ea =	0 Rs/yr	No gloves (KMC)
b. Uniforms	2 labourers/HC x		0 Rs/yr =	0 Rs/yr	No uniforms (KMC), although in budget
c. Mamoti (hoes)	1 mamoti/HC x	0.5 sets/yr @	350 Rs ea =	175 Rs/yr	KMC: 1 mamoti/HC (2yr life)
d. Ekel brooms	2 labourers/HC x	12 sets/yr @	35 Rs ea =	840 Rs/yr	KMC: 1 ekel broom/labourer (1mth life)
e. Baskets	1 basket/HC x	12 sets/yr @	55 Rs ea =	660 Rs/yr	KMC: 1 basket/HC (1mth life); 40-70 Rs
Total labourer protective equipment costs				1675 Rs/yr	

2. Handcart capital cost = 8500 with estimated life of 4 yrs (3-5yrs)

Straight line depreciation gives 2125 Rs/yr

3. Total Katugastota HC waste collection in 12 mths = 3.2 trips/d x 13 HCs x 0.12 T/load x 26 days/mth x 12 mths/yr gives a total of 1482 T/yr, c.f. 2997 T/yr from tractor and compactor data for Katugastota zone or HCs do 49 % of total tonnage -

this is considered reasonable as this area has a lot of bins which people will discharge into directly.

(According to KMC data, there are 19 HCs working in Katugastota, but Sup'r said only 13 HCs. If the larger no is used, unit cost = 1962 Rs/yr)

4. If no of labourers = 3 costs increase from 153000 as above + extra labour of 72600 + extra brooms of 420 gives total cost of 226020 Rs/yr or 1963 Rs/T

Four wheel tractor (4WT)+trailer Item	Unit	Unit Rate	Qty	Cost (Rs/yr)	Source & Notes
Driver costs	Rs/mth	6550	12	78600	See general notes No1
Labourer costs	Rs/mth	6050	48	290400	See general notes No1; no of labourers/4WT = 4
Protective equipment (gloves, etc.)	Rs/yr	1328	1	1328	See note 1
Diesel	Rs/mth	6871	12	82448	KMC SWM diesel records, see note 2
Oil	Rs/mth	149	12	1792	KMC SWM staff estimate, see note 3
Tyres and tubes	Rs/yr	14000	1	14000	See general notes No2 - estimated tyres cost based on KMC & Galle data
4WT & trailer repair/maintenance	Rs/yr	49500	1	49500	See general notes No3 - estimated R&M cost based on KMC & Galle data
Insurance	Rs/yr	3730	1	3730	KMC: 3730 for 4WT & 18610 for trailer divided by 15 vehicles
Registration/licence	Rs/yr	360	1	360	KMC: 2700 for 4WT & 2700 for trailer divided by 15 vehicles
Depreciation	Rs/yr	53707	1	53707	See note 4
Total O&M costs per tractor	Rs/yr			575864	per 4WT
Avg no of trips per 4WT per d	trips/d			1.7	
Avg 4WT waste T/yr	T/yr	n/a		10065	Using May 2001 - April 2002 data
Avg No of 4WTs in operation	No			8.67	9 tractors for 8 mths of yr and 8 for 4mths (zones 1B-5)
Avg waste T/yr per 4WT	T/yr			1161	See note 5
Unit 4WT O&M cost	Rs/T			498	= total O&M costs/4WT tonnage per yr (actual data)

Notes:

1. Staff protective equipment based on KMC data and current prices:

a. Gloves	4 labourers/4WT x	4 sets/yr @	40 Rs ea =	640 Rs/yr	KMC supplies gloves; assumed 4 sets/yr
b. Gumboots	0 labourer/crew x	2 sets/yr @	600 Rs ea =	0 Rs/yr	No labourers given gumboots (KMC)
c. Uniforms	4 labourers/4WT x		0 Rs/yr =	0 Rs/yr	No uniforms (KMC), although in budget
d. Shovels	2 shovels/4WT x	0.5 sets/yr @	225 Rs ea =	225 Rs/yr	KMC: 2 shovels per 4WT (2yr life)
e. Mamoti (hoes)	1 mamoti/4WT x	0.5 sets/yr @	350 Rs/yr =	175 Rs/yr	KMC: 1 mamoti per 4WT (2yr life)
f. Forks	2 forks/4WT x	0.5 sets/yr @	287.5 Rs ea =	288 Rs/yr	KMC: 2 forks per 4WT (2yr life)

Total labourer protective equipment costs

1328 Rs/yr

2. Diesel consumption =

3357 L/mth for

15 4WT @

30.7 Rs/L =

6871 Rs/4WT.mth

3. Oil consumption =

16 L/mth for

15 4WT @

140 Rs/L =

149 Rs/4WT.mth

4. Four wheel tractor capital cost =

883200 Rs with

17.5 yr lifetime (15-20yrs) - capital cost based on average of 9 most recent tractors

4WT trailer cost =

132000 Rs with

9 yr lifetime (8-10yrs) - average capital cost of 11 trailers for which cost data was available

Straight line depreciation over lifetime of tractor =

39040 and trailer =

14667 =

53707 Rs/yr

5. KMC tractors made

4548 trips from May 2001 - Apr 2002 @

2.21 T/load =

10065 T/yr

Annual no of trips equates to

1.7 avg trips/d based on

26 working days/mth &

8.67 4WTs in operation

Compactor Item	Unit	Unit Rate	Qty	Cost (Rs/yr)	Source & Notes
Driver costs	Rs/mth	7050	12	84600	Based on tractor driver salary increased by 500 Rs/mth (see General notes No1)
Labourer costs	Rs/mth	6050	48	290400	See general notes No1; no of labourers/comp'r = 4
Staff equipment (gloves, etc.)	Rs/yr	3568	1	3568	See note 1
Diesel	Rs/mth	24867	12	298404	KMC SWM diesel records, see note 2
Oil	Rs/mth	700	12	8400	KMC SWM staff estimate - see note 3
Tyres and tubes	Rs/yr	38760	1	38760	See general notes No2 - estimated R&M cost based on KMC, Abans and CMC data
Repair/maintenance	Rs/yr	50740	1	50740	See general notes No3 - estimated R&M cost based on KMC & Abans data
Insurance	Rs/yr	52718	1	52718	KMC records
Registration/licence	Rs/yr	2800	1	2800	KMC records
Depreciation	Rs/yr	340000	1	340000	See note 4
Total O&M costs per comp'r	Rs/yr			1170390	per compactor
Avg no of trips per comp'r per d	trips/d			2.3	
Avg comp'r waste T/yr	T/yr			1655	Using May 2001 - April 2002 data; see note 5
Unit comp'r O&M cost	Rs/T			707	= total O&M costs/comp'r tonnage per yr (actual data)

Notes:

1. Staff protective equipment based on KMC data and current prices:

a. Gloves	4 labourers x	4 sets/yr @	40 Rs ea =	640 Rs/yr	KMC supplies gloves; assumed 4 sets/yr
b. Gumboots	0 labourer/crew x	2 sets/yr @	600 Rs ea =	0 Rs/yr	No labourers given gumboots (KMC)
c. Uniforms	4 labourers x		0 Rs/yr =	0 Rs/yr	No uniforms (KMC), but in budget
d. Baskets	4 labourers x	12 sets/yr @	55 Rs ea =	2640 Rs/yr	KMC: 4 baskets per vehicle (1mth life)
e. Forks	2 forks/vehicle x	0.5 sets/yr @	287.5 Rs ea =	288 Rs/yr	KMC: 2 forks/vehicle (2yrs life)
Total staff equipment costs				3568 Rs/yr	

2. Diesel consumption = 810 L/mth for 1 comp'r @ 30.7 Rs/L = 24867 Rs/mth

3. Oil consumption = 6 L/mth for 1 comp'r @ 140 Rs/L = 700 Rs/mth

4. Compactor capital cost = 400000 Rs with 12 yr lifetime - increased from KMC estimate of 8-10yrs as compactor is still in good condition after 8yrs operation

Straight line depreciation over lifetime of compactor = 340000 Rs/yr

5. KMC compactor made 713 trips from May 2001 - Apr 2002 @ 2.32 T/load = 1655 T/yr

Annual no of trips equates to 2.3 avg trips/d based on 26 working days/mth & 1 compactor in operation

Kandy: Other Collection And Transportation Data

Collection routes and problem areas were mapped for each zone, with the assistance of the Mechanical Engineer, PHIs, Supervisors, drivers and labourers (worker collection survey). Generally, this mapping involved identifying the roads within the city that are provided with a tractor/compactor or handcart garbage collection service, the locations of collection points and the frequency of collection. A detailed analysis was undertaken for Zone 4, where the actual routes followed by handcarts and tractors was mapped. This appendix contains more detailed information on garbage collection/transportation, including details of specific problems identified in each zone.

Example Of Daily Record Sheet (Gohagoda landfill site)

Date: 4 June 2002

Area	Vehicle Registration	Time In – Time out
Zone 1A (Care Kleen)	227-3146	10:20 – 10:30 am
	49-4917	12:40 – 12:50 pm
	227-3146	1:10 – 1:20 pm
	49-4917	3:45 – 3:50 pm
	49-4917	5:50 – 6:00 pm
	227-3146	8:10 – 8:20 pm
	227-3146	10:30 pm
	49-4917	11:20 - 11:30 pm
	227-3146	2:00 – 2:10 am
Zone 1B (Deiyanewela)	37-7171	10:20 – 10:40 pm
	49-8898	10:40 – 10:40 pm
	49-8898	12:40 – 12:45 pm
	37-7171	2:10 – 2:15 pm
	49-8898	3:10 – 3:20 pm
Zone 2 (Mahaiyawa)	49-8598	10:35 - 10:40 am
	270-1208	10:50 – 11:00 am
	37-8593	2:00 – 2:10 pm
	270-1208	2:15 – 2:25 pm
Zone 3 (Peradeniya)	47-2904	10:25 – 10:30 pm
	37-5165	10:35 – 10:40 pm
	37-5165	1:55 – 2:00 pm
	47-2904	2:20 – 2:30 pm
Zone 4 (Katugastota)	270-1207	9:30 – 9:40 am
	270-1207	10:20 – 10:30 am
	270-1207	12:10 – 12:15 pm
	270-1207	1:20 – 1:25 pm
	37-8577	9:15 – 9:25 am
	37-8577	11:15 – 11:25 am
	37-8577	1:25 – 1:35 pm
	WID 227 3743	11:05 – 11:10 am
Zone 5 (Aruppola)	49-4626	10:05 – 10:10 am
	49-4625	10:30 – 10:35 am
	49-4626	1:35 – 1:40 pm
	49-4625	2:00 – 2:10 pm
Kandy Central Market	37-8181	9:40 – 9:50 am
	37-8181	11:30 – 11:40 am
	37-8181	1:05 – 1:10 pm
Mennikumbura Market	49-4624	9:45 – 9:55 am
	49-4624	1:50 – 2:00 pm
Gully sucker/conservancy	GI-2578	8:40 - 8:50 am
	49-4578	10:05 – 11:00 am
	GI-2578	11:50 – 12:00 am
	GI-2578	3:00 – 3:10 pm
IDP	37-1528	10:50 – 11:00 am
	37-1528	12:55 – 1:00 pm
Harispattuwa		11:50 – 12:00
		1:10 – 1:20 pm

Time And Motion Studies

Zone 2 : Mahaiyawa

Vehicle : KMC Tractor

Date: August 2001

Time		Location	Load time (min)	Comments
Arr	Dep			
8:15	8:17	Adahanamaluwa Rd, near RDA temporary dump	2	
8:20	8:30	Sumangala Rd (8:24 – junction in front of Sumangala College)	10	
8:31	8:32	Apex class	1	
8:32	8:33	Near Ayurvedic	1	
8:34		After 100m		Before Asgiriya Cooperative
8:40	8:41	From Asgiriya junction to Bahirawakanda Rd	1	
8:42	8:43	Bahirawakanda Rd – after 50m	1	
8:44	8:45	Bahirawakanda Rd – after 100m	1	
8:45	8:47	Veediya Bandara Lane junction	2	
8:47	8:48	Bahirawakanda – Topaz junction (Bahirawakanda lane)	1	
8:48	8:49	Near Anniwatte Community Hall	1	
8:50	8:52	Anniwatte – before Galkanda junction	2	
8:53	8:54	From Galkanda junction, 100m along	1	
8:55	8:56	Near Circle Rd, 100m along	1	
8:57	9:08	After tunnel, Deveni Rajasinghe Rd, first bin	11	
9:10	9:12	Near Kalutharakade, 50m down	2	
9:15	9:16	Near Kalutharakade, 100m down	1	
9:20	9:25	Rosmid junction	5	Turnaround
9:26	9:38	Riverdale junction bin	12	
9:45	9:55	Riverdale hotel bin	10	End of first collection round; time taken = 1h 40min
9:55	10:27	Travel to Gohagoda		32min travel; 8 min at landfill
10:35	10:47	Return from Gohagoda		12min travel
10:47	10:55	RDA near Asgiriya	8	Start of second collection round
10:55	10:57	Ground side junction	2	Departure time estimated (not stated)
11:00	11:20	Asgiriya Bodiya junction bin	20	
11:27	11:30	Bahirawakanda Rd	3	
11:32	11:42	Bahirawakanda junction bin (near Bo tree)	10	
11:45	11:55	Bahirawakanda lane (Dr Millagoda)	10	
11:57	12:05	Topaz junction	8	
12:08	12:11	Topaz hotel bin	3	
12:12	12:25	Upper bin	13	
12:35	12:50	Topaz – Pushpadana School Rd	15	
12:55	13:05	Bin near Kadurata Broadcasting Corporation	10	
13:06	13:07	Pushpadana school bin	1	Departure time estimated (not stated); end of second collection round; time taken = ~2h 20min

Loading time = 169min; Total time = 292 min; loading time = 58% of total time

Zone 3 : Peradeniya
Vehicle : KMC Compactor

Date: 23 August 2001

Time		Location	Load time (min)	Comments
Arr	Dep			
	7:15	Leave Workshop		
7:25	7:30	Suduhumpola Office		Four labourers
7:32	7:38	Peradeniya Rd, in front of Girls High School; bin near Wasantha Stores	6	Start of 1 st round – collect some households' garbage from Pronoto Rd
7:40	7:44	Hindu Centre bin	4	
7:45	7:47	South Depot bin	2	
7:48	7:52	In front of Regal	4	
7:54	7:55	In front of Dharmawickrama School	1	New bin needed
7:56	7:57	In front of Piasso Garden Rd	1	
7:58	7:59	Near Estate Development Board	1	
8:01	8:09	Suwasewana bin	8	
8:11	8:15	Mulgampola bin, in front of J.M.W.	4	
8:17	8:21	Bin in front of Mulgampola National	4	
8:24	8:35	Heerassagala Rd, William Gopallawa Rd, Royal Supermarket bin	11	New bin needed
8:39	8:40	Close to Water Board	1	
8:45	8:47	Rajawatha Cooperative	2	
8:49	8:50	In front of Peradeniya Hospital	1	
8:50	8:53	Peradeniya Resthouse	3	
8:54	9:00	In front of Peradeniya Botannical Garden bin	6	
9:02	9:04	Old Galaha Rd, external exam section	2	
9:05	9:06	Peoples Bank	1	
9:13	9:23	Bin near Sarasaviyana Railway station	10	
9:25	9:35	Tea break	10	
9:37	9:40	Petroleum bin	3	
9:41	9:44	Beginning of Sarasaviyana Railway station rd	3	Return from Peradeniya
10:02	10:03	Mahanama School, Gatambe	1	
10:06	10:09	Near Hemachandra Jewellery bin	3	
10:10	10:13	PS Petrol shed	3	
10:15	10:16	In front of Colombo Commercial company	1	End of 1 st round; time taken = 3h 1min
10:18	10:35	Travel to Gohagoda		17min travel via Gannonuwa; 10min at landfill
10:45	11:05	Return from Gohagoda – Katugastota – Peradeniya Rd – Girls High School		20min travel
11:07	11:09	Near South Depot	2	Start of 2 nd round
11:10	11:11	Hameedia	1	
11:12	11:24	Swarnamali bin	12	
11:25	11:27	Swarnamali school	2	
11:28	11:35	Piyazo Garden	7	
11:38	11:46	Danasiri Supermarket bin	8	
11:47	12:06	Mugampola Isuru bin I	19	(2 nd time today)
12:08	12:18	In front of Mugampola National bin	10	
12:19	12:28	Kingswood bin	9	
12:31	12:37	Hemachandra bin	6	
12:42	12:50	In front of Botannical Garden bin	8	
12:53	13:30	Peradeniya Hospital bin and canteen	37	End of 2 nd round; time taken = 2h 23min

Loading time = 217min; total time = 375min; loading time = 58% of total time

Garbage Collection Routes Problems and Constraints

Zone	Description	Problems/Constraints
1A	Central city area (mainly commercial)	<ol style="list-style-type: none"> 1. Heavily congested area (people and traffic) during daytime making garbage collection and transportation difficult. 1. Includes many large waste generators (e.g. Bogambara prison, Sacred Tooth Temple, Ceybank House, Goodshed Bus stand, Second Singha Regiment Quarters, Queens Hotel). 2. Garbage collection is difficult around Bogambara Prison on Pola days. 3. Garbage collection in Attupattiya (shanty/slum area) is very difficult (narrow streets, steps, illegal kiosks blocking access). 4. Simonwatta and Baldiwatta include narrow streets with some steps. Access for garbage collection is difficult. 5. Some small traders improperly discharge of their garbage, ignoring bins/trailers located close by (e.g. Torrington Rd).
1B	Deiyannewela: Around Kandy Lake (flat) and to the south and east (hilly to very hilly)	<ol style="list-style-type: none"> 6. Most of this zone is hilly to very hilly. 7. Difficult to clean drainage around the Lake. 8. Large number of institutions (schools, temples, hospitals) and some hotels. 9. Most of Ampitiya is not provided with a garbage collection service, due to the steepness of the roads in this area (main reason) and as most properties have large gardens and can dispose of their own garbage on site. 10. Deiyannewela housing scheme – poor public cooperation, difficult access.
2	Mahaiyawa: Along the Mahaweli Ganga and inland hilly to very hilly areas.	<ol style="list-style-type: none"> 11. Hilly through the middle of this zone. 12. Very poor public cooperation in Mahaiyawa (low income area). Residents tend to discharge their garbage into drains, while human excrement is commonly discharged in plastic bags for garbage collection due to a shortage of public toilets in the area. Children also commonly play in the streets, creating a hazard for tractor drivers. 13. Sharp corner difficult to negotiate with tractor/trailer. 14. Steep areas with very narrow, often unsealed streets and low population density. Garbage collection is by handcart and baskets. 15. Large amounts of garden waste are discharged by residents for collection – at least 2T/wk. 16. Handcarts have to travel long distances in places between community collection points (concrete bins).

Zone	Description	Problems/Constraints
3	Peradeniya: Along either side of Peradeniya Rd, extending to the Mahaweli Ganga and Peradeniya University in the west/south.	17. Southern section of George E de Silva Mw comprises a gravel road with steps at the end down to Peradeniya Rd. 18. Western end of Primrose Rd comprises steps. 19. Most of Mulgampola is not provided with a garbage collection service as it is a very steep, low population density area where most houses have large gardens. 20. RDA are responsible for William Gopalluwa Rd from near the Peradeniya Rd junction to near the Heerassagala Rd junction. 21. Peradeniya University is responsible for garbage collection along Sri Amarawansa Rd, near the Faculty of Dental Sciences. 22. Gangawatta Korale PS is responsible for garbage collection along 2-3 roads leading out of the city (Hantane Rd, rd past cemetery, Augusta Estate Rd). 23. Garden and some construction waste is dumped by KMC in this area, off the side of the road. 24. The Botannical Gardens at Peradeniya are responsible for garbage collection and disposal within their grounds. 25. Peradeniya University is responsible for garbage collection and disposal within its grounds. 26. Some housing schemes on southern side of William Gopalluwa Rd, with narrow roads and some steps where garbage collection is difficult (e.g. Kamatha Rd, Polwatta).
4	Katugastota: Katugastota Rd from Wewelpitiya, Katugastota township and along the northern section of the Mahaweli Ganga	27. Mixed residential and commercial area; mainly flat. 28. Some steep roads (Burket lane, Galagedara Lane, Mapanawathura)
5	Arrupola: Eastern side of city, bordered by Mahaweli Ganga.	29. Garbage collection is difficult in the Uplands Housing scheme. 30. Many monkeys along Dharmasoka Mw, making collection difficult as they scatter garbage discharged to the community collection points (concrete bins). 31. Uyanawatte: footpath with some steps - labourers collect from houses in area using plastic bags. 32. Some steps along this road. 33. Residents are asked to bring their garbage to Dharmashoka Mw for collection. 34. A lack of community bins in some areas, meaning handcarts must travel a long way before discharging their load. 35. Ceylon Tobacco Co. looks after garbage collection in this area round their factory.

Zone IV : Katugastota -- Collection Route Analysis

Veh- icle	Collection Route	Collection area	Dist. (km)
H1	S: Matala Rd/Madawela Rd jn → Madawela Rd (hospital, Post office) → Railway station (F1) or Jambughapitiya near PWD Officers Quarters (F2) (alternating days) (2-3 loads/d @ 0.9-1.5km/trip)	Residential, commercial and institutional, including Katugastota District Hospital, Post Office and railway station, some government offices and Training Centre.	1.8 – 4.5
H2	S1: Matala Rd/Madawela Rd jn → Matala Rd → Galwatta HS → CP (F1)	Residential and commercial.	0.46
	S2: Galwatta HS CP → north-east along un-named road → Madawela Rd → hospital trailer CP (F2)		0.56
H3	S: Matala Rd/Madawela Rd jn → Ranawana Rd → TA → Madawela Rd → Burket Ln (steep) → CP (TA) → Madawela Rd → Gohagoda Rd → CP near city limits (F) (4-5 loads/d @ 1.0km/trip)	Katugastota commercial area; some residential.	4.0 – 5.0
H4	S: Katugastota Bridge → Galagedara Rd → Kondadeniya Rd jn (TA) → Galagedara Rd → Gohagoda Rd → CP near city limits (F) (3-4 loads/d @0.6km/trip)	Katugastota commercial area; some residential; Sri Ruhula school.	1.8 – 2.4
H5	S: Kondadeniya jn → Galagedara Rd → Galagedara Ln (steep; every 2 nd day) → TA → Galagedara Rd → Sri Rajasingharamaya (every 2 nd day) → TA → Galagedara Rd → bin by city limits (F) (~3 loads/d @ 1.0-1.4 km/trip)	Residential and commercial.	3.0 – 4.2
IDP	S: Galagedara Ln → Galagedara Rd → Gohagoda Rd → CP near city limits (F) (every 2 weeks)		0.80
T1	S1: Jambughapitiya → Madawela Rd → Railway station (every 2 nd day) → Madawela Rd → Matala Rd → Galwatta HS → CP near Education Office (+ Matala Rd → CP by Police Station (TA) → Matala Rd → CP by Education Office (every 2 nd day)) (F1)	Residential, commercial and institutional; collects H1 + H2 garbage and empties KMC trailer parked by hospital every 2 nd day.	1.9 (+1.4)
	S2: CP near Education Office → Matala Rd → Madawela Rd → Galagedara Rd → CP near city limits (TA) → Galagedara Rd → Gohagoda Rd → CP near city limits (F2)	Mainly residential and commercial; collects H3, H4 + H5 garbage.	3.1
	S3: St Anthonys CP → Katugastota Rd → bridge → Gohagoda Rd → CP near city limits (F3)	Residential and commercial; collects part of H9 garbage.	0.75
H6	S1: Kandy Rd jn → Srimath Kuda Ratwatta (SKR) Mw → small lane (every 2 nd day) → TA → SKR Mw → Samagi Ln (every 2 nd day) → CP (F1)	Mainly residential.	0.80 (+0.20)
	S2: Samagi Ln CP → Samagi Ln → SKR Mw → Bakery Ln (every 2 nd day) → Wattarantenna Jn (TA) → SKR Mw → small lane (every 2 nd day) → TA → SKR Mw → Kovari Ln CP (F2)		1.4 (+0.5)
	S3: Kovari Ln CP → Kovari Ln (every 2 nd day) → Wattarantenna Jn (TA) → SKR Mw → Kosmi Mw → Cosmi Gardens CP (F3)		0.7 (+0.4)
	S4: Cosmi Gardens HS (loop) back to CP (F4) (every 2 nd day) (F4)		0.20
H7	S1: Katugastota Rd jn → Wattarantenna Mw → Samagi Ln CP (F1)	Mainly residential.	0.44
	S2: Samagi Ln CP → Wattarantenna Mw → CP near Bakery Ln (F2)		0.21
	S3: CP near Bakery Ln → Wattarantenna Mw → Cosmi Gardens CP (F3)		0.50

Veh- icle	Collection Route	Collection area	Dist. (km)
H8	S: Mapanawathura CP → Mapanawathura Rd → Samagi Ln CP (F) (2-3 loads/d @1.1km/trip)	Mainly residential.	2.2 – 3.3
H9	S1: Katugastota bridge → Katugastota Rd → St Anthony's CP (F1)	Residential and commercial.	0.40
	S2: St Anthony's Rd CP → Katugastota Rd → CP (F2)		1.4
	S3: CP → Katugastota Rd → zone boundary (TA) → CP (F3)		0.63
H10	S1: Mawamada Jn → CP near small lane (F1)	Mainly residential.	0.70
	S2: CP → Mawamada Rd → unnamed lane (RHS) → TA → Mawamada Rd → Bobby Ln → CP → 1 st and 2 nd lanes (every 2 nd day) (F2)		0.56 (+0.1)
	S3: Bobby Ln CP → Mawamada Rd → School Mw jn → School CP (F3)		0.44
H11	S1: Nittawela Jn → Nittawela Rd → Sportsground (TA) → CP (F1)	Mainly residential.	1.0
	S2: CP → Nittawella HS loop → CP (F2)		0.25
H12	S1: CTC jn → Nagaha Ela (south) → Mawamada Rd → School CP (F1)	Mainly residential.	0.40
	S2: CTC jn → Nagaha Ela (north) → CP (F2)		0.15
	S3: CP → Nagaha Ela (north) → CP (F3)		0.50
	S4: Adamsa Niwarsa jn → Nagaha Ela (south) → CP (F4)		0.10
H13	S1: Katugastota Rd jn → Siyabalagastenna Rd → CP near church (F1)	Mainly residential; some commercial, including Mahaweli Reach Hotel) and institutional (temple, convent).	0.12
	S2: CP near church → Siyabalagastenna Rd → small lanes (RHS, every 2 nd day) → CP (F2)		0.18 (+0.30)
	S3: CP → Siyabalagastenna Rd → Temple CP (F3)		0.15
	S4: Temple CP → Siyabalagastenna Mw (Mahaweli Reach hotel, convent) → Railway crossing (TA) → CP near Mahaweli Reach Hotel (F4)		0.10
T2	S1: Kandy Rd jn → SKR Mw → Kosmi Mw → Wattarantenna Mw → Samagi Ln CP (F1)	Mainly residential; collects H6 + H7 garbage	1.5
	S2: Samagi Ln bin → Wattarantenna Mw → Mapanawathura Rd → CP (TA) → Katugastota Rd (towards city) → CP (TA) → Dr CDL Mw (every second day) → Katugastota Rd → Silverin (every 2 nd day) → Nittawela Mw → CP (TA) → Katugastota Rd → Siyabalagastenna Mw (temple, Mahaweli Reach Hotel, convent) → railway crossing (F2)	Residential, commercial (e.g. Mahaweli Reach Hotel) and institutional (temple, school, Carmelite convent); collects H8, H9 (majority), H11 + H13 garbage.	5.1 (+1.2)
	S3: Katugastota Rd jn → Mawamada Rd → Bobby Ln → CP (TA) → Mawamada Rd → Nagaha Ela → Adarsa Nivarsa Mw → Wallamulla → Adarsa Nivarsa HS (TA) → Adarsa Nivarsa Mw → Nagaha Ela → Mawamada Rd → Siyabalagastenna Mw (F3).	Mainly residential; collects H10 + H12 garbage.	3.4

Notes: H = handcart, HS = housing scheme, jn = junction, T = tractor, TA = turn around; All handcarts have two labourers except H11. Distance in brackets indicates additional distance every second day.

**jica**