DATA ANALYSIS OF THE SURVEY QUESTIONNAIRE

Sample size-200

Average age and marital status according to sex

Sex	Average Age (years)	Shingle parents (no.)	(%)	Married (no.)	(%)	Other (no.)	Total
Females	27.8	31	15.5	80	40.0	11	122
Males	32.9	17	8.5	57	28.5	4	78
Total		48	24.0	137	68.5	15	200

Usage of Various Containers in Solid Waste Disposal (survey question 8)

Type of Container	No of Respondents	% of total
Paper bag	28	14
Plastic bag	32	16
Plastic bucket	64	32
Metal tin	40	20
Other	36	18
Total	200	100

Major SW Disposal Points (survey question 9)

Disposal Point	No. of Respondents	% of total
Outside the House	10	5
Busia road	7	3.5
Enterprise road	6	3
River (Ngong River)	169	84.5
Other	8	4
Total	200	100

Knowledge of Waste as a factor of Environmental quality (survey question 12)

No. of respondents with knowledge = 186

No. of respondents without the knowledge = 14

Level of Participation in Clean Up Activities (survey question 13)

No. of respondents who have Not participated = 165
No. of respondents who have participated = 35

Main Forms of external Assistance needed from outside to improve SWM (question 14)

Form of Assistance	No. of Respondents
Simple implements & tools	44
Collection of SW by NCC	36
Installation of waste bins	30
Allocating SW disposal point	29
Organized Clean ups	24
Education and awareness	20
Paid cleaners	15

Selected Local ideas to improve cleanliness (question 15)

Action	No. of Repondents
Establish WM groups	43
Dump waste in one area	40
Mobilise communities	27
Education on SWM	16
Availability of NCC trucks	16
Regular Clean ups	14

Perceived problems relating to poor SWM (question 16)

Type of problem	No. of Respondents
Poor sanitation	39
Diseases & vectors	65
(Cholera, typhoid)	
Poor drainage	32
(water & sewerage)	
Bad smell	23
Loss of aesthetic value	18
Narrow corridors	5

5.4.4 Time and Motion Study for the Experimental Collection Work (Summary Records)

3Areas(1/2)

Date	Vehicle No.	Trip	Number of Collection Point	Route	Location	Number of Crew	Moving Distance(m)				Time (minuites)										Idling	Average Collection Time (min/collection point)			Average Transportation Speed(km/hr.)	Daily Average			
							Collection	Trans-portation	Inside the Dump Site	Total	Collection			Trans-portation	Inside the Dump Site			Total								Trips	Distance (m)	Time (min.)	Idling (min.)
											Total	Moving	Loading		Moving	Loading	Total	Moving	Loading	Total		Total	Moving	Loading					
97/12/18	KWX417	1	26		Madaraka	9	3,700	23,300	1,000	28,000	137	26	111	79	7	1	8	112	112	224	0	5.3	1.0	4.3	17.7	1	28,000	224	0
97/12/19	KWX417	1	1		Dandora (I)	9	0	7,000	1,000	8,000	101	0	101	37	9	2	11	46	103	149	0	101.0	0.0	101.0	11.4				
97/12/19	KWX417	2	2		Dandora (I)	9	100	900	1,000	2,000	109	1	108	10	7	1	8	21	109	130	3	54.5	0.5	54.0	5.4				
97/12/19	KWX417	3	2		Dandora (I)	9	200	1,600	200	2,000	117	1	116	9	11	1	12	34	117	151	13	58.5	0.5	58.0	10.7				
97/12/19	KWX417	4	1		Dandora (I)	9	0	300	0	300	0	0	0	6	0	0	0	7	0	7	1	0.0	0.0	0.0	3.0	4	12,300	437	17
97/12/19 Average			**1.5**			**9**	**75**	**3,167**	**733**	**3,075**	**109**	**1**	**108**	**16**	**9**	**1**	**10**	**27**	**110**	**109**	**4**	**71.3**	**0.3**	**71.0**	**7.6**	**4**	**12,300**	**437**	**17**
97/12/22	KWX417	1	26		Madaraka	8					156	31	125	80	9	1	10	120	126	246	0	6.0	1.2	4.8	0.0				
97/12/22	KWX417	2	18		Madaraka	8					198	48	150	99	13	1	14	160	151	311	0	11.0	2.7	8.3	0.0	2		557	0
97/12/22 Average			**22.0**			**8**					**177**	**40**	**138**	**90**	**11**	**1**	**12**	**140**	**139**	**279**	**0**	**8.5**	**1.9**	**6.6**	**0.0**	**2**		**557**	**0**
97/12/23	KWX417	1	1		Kayaba	9					120	0	120	35	7	3	10	42	123	165	0	120.0	0.0	120.0	0.0				
97/12/23	KWX417	2	1		Kayaba	9					145	0	145	65	9	1	10	74	146	220	0	145.0	0.0	145.0	0.0				
97/12/23	KWX417	3	3		Kayaba	9					80	8	72	80	9	1	10	97	73	170	0	26.7	2.7	24.0	0.0	3		555	0
97/12/23 Average			**1.7**			**9**					**115**	**3**	**112**	**60**	**8**	**2**	**10**	**71**	**114**	**185**	**0**	**97.2**	**2.7**	**96.3**	**0.0**	**3**		**555**	**0**
97/12/24	KWX417	1	1		Dandora (I)	9	0	9,000	0	9,000	70	0	70	34	15	1	16	49	71	120	0	70.0	0.0	70.0	15.9				
97/12/24	KWX417	2	1		Dandora (I)	9					133	0	133	7	14	1	15	21	134	155	0	133.0	0.0	133.0	0.0				
97/12/24	KWX417	3	4		Dandora (I)	9	2,800	8,900	0	11,700	172	18	154	47	17	1	18	82	155	237	0	43.0	4.5	38.5	11.4	3	20,700	512	0
97/12/24 Average			**2.0**			**9**	**1,400**	**8,900**	**0**	**10,350**	**125**	**6**	**119**	**29**	**15**	**1**	**16**	**51**	**120**	**171**	**0**	**82.0**	**1.5**	**80.5**	**13.6**	**3**	**20,700**	**512**	**0**
97/12/25	KWX417	1	15		Madaraka	8	0	3,900	24,100	28,000	129	37	92	44	27	2	29	108	91	202	0	8.6	2.5	6.1	5.3				
97/12/25	KWX417	2	12		Madaraka	8	0	4,000	0	4,000	155	48	107	161	13	2	15	222	109	331	0	12.9	4.0	8.9	1.5	2	32,000	533	0
97/12/25 Average			**13.5**			**8**	**0**	**3,950**	**12,050**	**16,000**	**142**	**43**	**100**	**103**	**20**	**2**	**22**	**165**	**102**	**267**	**0**	**10.8**	**3.2**	**7.5**	**3.4**	**2**	**32,000**	**533**	**0**
97/12/26	KWX417	1	2		Dandora (I)	9	1,000	9,000	3,000	13,000	198	5	193	29	17	1	18	51	194	245	0	99.0	2.5	96.5	18.6				
97/12/26	KWX417	2	2		Dandora (I)	9	2,000	1,000	4,000	7,000	154	10	144	6	19	1	20	35	145	180	0	77.0	5.0	72.0	10.0				
97/12/26	KWX417	3	1		Dandora (I)	9	0	9,800	4,200	14,000	44	0	44	58	17	1	18	75	45	120	0	44.0	0.0	44.0	10.1	3	34,000	545	0
97/12/26 Average			**1.7**			**9**	**1,000**	**9,800**	**4,200**	**11,333**	**132**	**5**	**127**	**31**	**18**	**1**	**19**	**54**	**128**	**182**	**0**	**73.3**	**2.5**	**70.8**	**12.9**	**3**	**34,000**	**545**	**0**
97/12/27	KWX417	1	3		Kayaba	8	1,000	3,000	16,000	20,000	230	66	164	27	17	1	18	110	165	275	0	76.7	22.0	54.7	6.7				
97/12/27	KWX417	2	2		Kayaba	8	1,000	22,000	16,000	39,000	115	6	109	87	17	1	18	110	110	220	0	57.5	3.0	54.5	15.2	2	59,000	495	0
97/12/27 Average			**2.5**			**8**	**1,000**	**22,000**	**16,000**	**29,500**	**173**	**36**	**137**	**87**	**17**	**1**	**18**	**110**	**138**	**248**	**0**	**67.1**	**12.5**	**54.6**	**10.9**	**2**	**59,000**	**495**	**0**
97/12/28	KWX417	1	3		Dandora (I)	9	1,600	9,000	3,400	14,000	159	9	150	36	19	1	20	64	151	215	0	53.0	3.0	50.0	15.0				
97/12/28	KWX417	2	2		Dandora (I)	9	3,000	11,000	4,000	18,000	163	10	153	48	19	1	20	77	154	231	0	81.5	5.0	76.5	13.8	2	32,000	446	0
97/12/28 Average			**2.5**			**9**	**2,300**	**11,000**	**4,000**	**16,000**	**161**	**10**	**152**	**42**	**19**	**1**	**20**	**71**	**153**	**223**	**0**	**67.3**	**4.0**	**63.3**	**14.4**	**2**	**32,000**	**446**	**0**
97/12/31	KWX417	1	16		Madaraka	9	1,000	4,000	17,000	22,000	154	36	118	72	19	1	20	127	119	246	0	9.6	2.3	7.4	3.3				
97/12/31	KWX417	2	11		Madaraka	9	2,000	23,000	15,000	40,000	155	21	134	112	17	1	18	150	135	285	0	14.1	1.9	12.2	12.3	2	62,000	531	0

3Areas(1/2)

Date	Vehicle No.	Trip	Number of Collection Point	Route	Location	Number of Crew	Moving Distance (m): Collection	Moving Distance (m): Transportation	Moving Distance (m): To/from Dump Site	Moving Distance (m): Total	[illegible]: Collection: Total	Collection: Moving	Collection: Loading	Transportation	To/from Dump Site: Moving	To/from Dump Site: Loading	To/from Dump Site: Total	Total: Moving	Total: Loading	Total: Total	[illegible]	Average Collection Time per collection point: Total	Moving	Loading	Average Transportation Speed	Daily Average: Trips	Distance	Time	[illegible]
97/12/18	KWX417	1	26		Madaraka	9	3,700	23,300	1,000	28,000	137	26	111	79	7	1	8	112	112	221	0	5.3	1.0	4.3	17.7	1	28,000	221	0
97/12/19	KWX417	1	1		Dandora(b)	9	0	7,000	1,000	8,000	101	0	101	37	9	2	11	16	103	149	0	101.0	0.0	101.0	11.1				
97/12/19	KWX417	2	2		Dandora(b)	9	100	900	1,000	2,000	109	1	108	10	7	1	8	21	109	130	3	54.5	0.5	54.0	5.1				
97/12/19	KWX417	3	2		Dandora(b)	9	200	1,600	200	2,000	117	1	116	9	11	1	12	31	117	151	13	58.5	0.5	58.0	10.7				
97/12/19	KWX417	4	1		Dandora(b)	9	0	300	0	300	0	0	0	6	0	0	0	7	0	7	1	0.0	0.0	0.0	3.0	4	12,300	437	17
97/12/19 Average			**1.5**			**9**	**75**	**3,167**	**733**	**3,075**	**109**	**1**	**108**	**16**	**9**	**1**	**10**	**27**	**110**	**109**	**4**	**71.3**	**0.3**	**71.0**	**7.6**	**4**	**12,300**	**437**	**17**
97/12/22	KWX417	1	26		Madaraka	8					156	31	125	80	9	1	10	120	126	246	0	6.0	1.2	4.8	0.0				
97/12/22	KWX417	2	18		Madaraka	8					198	48	150	99	13	1	14	160	151	311	0	11.0	2.7	8.3	0.0	2		557	0
97/12/22 Average			**22.0**			**8**					**177**	**40**	**138**	**90**	**11**	**1**	**12**	**140**	**139**	**279**	**0**	**8.5**	**1.9**	**6.6**	**0.0**	**2**		**557**	**0**
97/12/23	KWX417	1	1		Kayaba	9					120	0	120	35	7	3	10	12	123	165	0	120.0	0.0	120.0	0.0				
97/12/23	KWX417	2	1		Kayaba	9					115	0	115	65	9	1	10	71	116	220	0	115.0	0.0	115.0	0.0				
97/12/23	KWX417	3	3		Kayaba	9					80	8	72	80	9	1	10	97	73	170	0	26.7	2.7	24.0	0.0	3		555	0
97/12/23 Average			**1.7**			**9**					**115**	**3**	**112**	**60**	**8**	**2**	**10**	**71**	**114**	**185**	**0**	**97.2**	**2.7**	**96.3**	**0.0**	**3**		**555**	**0**
97/12/24	KWX417	1	1		Dandora(b)	9	0	9,000	0	9,000	70	0	70	31	15	1	16	49	71	120	0	70.0	0.0	70.0	15.9				
97/12/24	KWX417	2	1		Dandora(b)	9					133	0	133	7	14	1	15	21	134	155	0	133.0	0.0	133.0	0.0				
97/12/24	KWX417	3	4		Dandora(b)	9	2,800	8,900	0	11,700	172	18	154	17	17	1	18	82	155	237	0	43.0	4.5	38.5	11.4	3	20,700	512	0
97/12/24 Average			**2.0**			**9**	**1,400**	**8,900**	**0**	**10,350**	**125**	**6**	**119**	**29**	**15**	**1**	**16**	**51**	**120**	**171**	**0**	**82.0**	**1.5**	**80.5**	**13.6**	**3**	**20,700**	**512**	**0**
97/12/25	KWX417	1	15		Madaraka	8	0	3,900	24,100	28,000	129	37	92	44	27	2	29	108	91	202	0	8.6	2.5	6.1	5.3				
97/12/25	KWX417	2	12		Madaraka	8	0	4,000	0	4,000	155	48	107	161	13	2	15	222	109	331	0	12.9	4.0	8.9	4.5	2	32,000	533	0
97/12/25 Average			**13.5**			**8**	**0**	**3,950**	**12,050**	**16,000**	**142**	**43**	**100**	**103**	**20**	**2**	**22**	**165**	**102**	**267**	**0**	**10.8**	**3.2**	**7.5**	**3.4**	**2**	**32,000**	**533**	**0**
97/12/26	KWX417	1	2		Dandora(b)	9	1,000	9,000	3,000	13,000	198	5	193	29	17	1	18	51	194	245	0	99.0	2.5	96.5	18.6				
97/12/26	KWX417	2	2		Dandora(b)	9	2,000	1,000	4,000	7,000	154	10	144	6	19	1	20	35	145	180	0	77.0	5.0	72.0	10.0				
97/12/26	KWX417	3	1		Dandora(b)	9	0	9,800	4,200	14,000	44	0	44	58	17	1	18	75	45	120	0	44.0	0.0	44.0	10.1	3	34,000	545	0
97/12/26 Average			**1.7**			**9**	**1,000**	**9,800**	**4,200**	**11,333**	**132**	**5**	**127**	**31**	**18**	**1**	**19**	**54**	**128**	**182**	**0**	**73.3**	**2.5**	**70.8**	**12.9**	**3**	**34,000**	**545**	**0**
97/12/27	KWX417	1	3		Kayaba	8	1,000	3,000	16,000	20,000	230	66	164	27	17	1	18	110	165	275	0	76.7	22.0	54.7	6.7				
97/12/27	KWX417	2	2		Kayaba	8	1,000	22,000	16,000	39,000	115	6	109	87	17	1	18	110	110	220	0	57.5	3.0	54.5	15.2	2	59,000	495	0
97/12/27 Average			**2.5**			**8**	**1,000**	**22,000**	**16,000**	**29,500**	**173**	**36**	**137**	**87**	**17**	**1**	**18**	**110**	**138**	**248**	**0**	**67.1**	**12.5**	**54.6**	**10.9**	**2**	**59,000**	**495**	**0**
97/12/28	KWX417	1	3		Dandora(b)	9	1,600	9,000	3,400	14,000	159	9	150	36	19	1	20	64	151	215	0	53.0	3.0	50.0	15.0				
97/12/28	KWX417	2	2		Dandora(b)	9	3,000	11,000	4,000	18,000	163	10	153	48	19	1	20	77	154	231	0	81.5	5.0	76.5	13.8	2	32,000	416	0
97/12/28 Average			**2.5**			**9**	**2,300**	**11,000**	**4,000**	**16,000**	**161**	**10**	**152**	**42**	**19**	**1**	**20**	**71**	**153**	**223**	**0**	**67.3**	**4.0**	**63.3**	**14.4**	**2**	**32,000**	**416**	**0**
97/12/31	KWX417	1	16		Madaraka	9	1,000	4,000	17,000	22,000	154	36	118	72	19	1	20	127	119	216	0	9.6	2.3	7.4	3.3				
97/12/31	KWX417	2	11		Madaraka	9	2,000	23,000	15,000	40,000	155	21	134	112	17	1	18	150	135	285	0	14.1	1.9	12.2	12.3	2	62,000	531	0

3Areas(2/2)

Date	Vehicle No	Trip	Number of Collection Point	Route	Location	Number of Crew	Moving Distance(m)				Time (minuites)												Average Collection Time (min/collection point)			Average Transportation Speed(km/hr)	Daily Average			
							Collection	Trans-portation	Inside the Dump Site	Total	Collection			Trans-portation	Inside the Dump Site			Total			Idling						Trips	Distance (m)	Time (min.)	Idling (min.)
											Total	Moving	Loading		Moving	Loading	Total	Moving	Loading	Total		Total	Moving	Loading					
97/12/31 Average			**13.5**			**9**	**1,500**	**23,000**	**16,000**	**31,000**	**155**	**29**	**126**	**92**	**18**	**1**	**19**	**139**	**127**	**266**	**0**	**11.9**	**2.1**	**9.8**	**7.8**	**2**	**62,000**	**531**	**0**
98/1/1	KWX417	1	1		Dandora (I)	9	0	0	13,000	13,000	65	0	65	10	8	2	10	18	67	85	0	65.0	0.0	65.0	0.0				
98/1/1	KWX417	2	3		Dandora (I)	9	0	1,000	4,000	5,000	135	2	133	28	9	2	11	39	135	174	0	45.0	0.7	44.3	2.1				
98/1/1	KWX417	3	4		Dandora (I)	9	0	0	6,000	6,000	155	13	142	21	5	5	10	39	147	186	0	38.8	3.3	35.5	0.0	3	24,000	445	0
98/1/1 Average			**2.7**			**9**	**0**	**1,000**	**7,667**	**8,000**	**118**	**5**	**113**	**20**	**7**	**3**	**10**	**32**	**116**	**148**	**0**	**49.6**	**1.3**	**48.3**	**2.1**	**3**	**24,000**	**445**	**0**
98/1/2	KWX417	1	26		Madaraka	9	4,000	4,000	14,000	22,000	227	62	165	58	10	1	11	130	166	296	0	8.7	2.4	6.3	4.1				
98/1/2	KWX417	2	1		Madaraka	9	0	24,000	17,000	41,000	116	0	116	117	11	1	12	128	117	245	0	116.0	0.0	116.0	12.3	2	63,000	541	0
98/1/2 Average			**13.5**			**9**	**2,000**	**24,000**	**15,500**	**31,500**	**172**	**31**	**141**	**88**	**11**	**1**	**12**	**129**	**142**	**271**	**0**	**62.4**	**1.2**	**61.2**	**8.2**	**2**	**63,000**	**541**	**0**
Average			**6.6**			**9**	**1,244**	**12,167**	**1,900**	**15,957**	**139**	**16**	**123**	**53**	**13**	**1**	**15**	**81**	**124**	**201**	**1**	**56.5**	**2.7**	**54.0**	**9.8**	**2.4**	**36,700**	**485**	**1**

3Areas(2/2)

Date	Vehicle No.	Trip	Number of Collection Point	Route	Location	Number of Crew	Moving Distance(m) Collection	Trans portation	Inside the Dump Site	Total	Time Collection Total	Moving	Loading	Trans portation	Inside the Dump Site Moving	Loading	Total	Total Moving	Loading	Total	Idling	Average Collection Time Total	Moving	Loading	Average Transportation Speed	Daily Average Trips	Distance	[illegible]	[illegible]
97/12/31 Average			13.5			9	1,500	23,000	16,000	31,000	155	29	126	92	18	1	19	139	127	266	0	11.9	2.1	9.8	7.8	2	62,000	531	0
98/1/1	KWX417	1	1		Dandora(I)	9	0	0	13,000	13,000	65	0	65	10	8	2	10	18	67	85	0	65.0	0.0	65.0	0.0				
98/1/1	KWX417	2	3		Dandora(I)	9	0	1,000	4,000	5,000	135	2	133	28	9	2	11	39	135	174	0	45.0	0.7	44.3	2.1				
98/1/1	KWX417	3	4		Dandora(I)	9	0	0	6,000	6,000	155	13	142	21	5	5	10	39	147	186	0	38.8	3.3	35.5	0.0	3	24,000	415	0
98/1/1 Average			2.7			9	0	1,000	7,667	8,000	118	5	113	20	7	3	10	32	116	148	0	49.6	1.3	48.3	2.1	3	24,000	415	0
98/1/2	KWX417	1	26		Madaraka	9	4,000	4,000	14,000	22,000	227	62	165	58	10	1	11	130	166	296	0	8.7	2.4	6.3	4.1				
98/1/2	KWX417	2	1		Madaraka	9	0	24,000	17,000	41,000	116	0	116	117	11	1	12	128	117	245	0	116.0	0.0	116.0	12.3	2	63,000	541	0
98/1/2 Average			13.5			9	2,000	24,000	15,500	31,500	172	31	141	88	11	1	12	129	142	271	0	62.4	1.2	61.2	8.2	2	63,000	541	0
Average			6.6			9	1,244	12,167	1,900	15,957	139	16	123	53	13	1	15	81	124	201	1	56.5	2.7	54.0	9.8	2.4	36,700	485	1

Dandora(1/1)

Date	Vehicle No.	Trip	Number of Collection Point	Route	Location	Number of Crew	Moving Distance(m)				Time (minutes)											Average Collection Time (min./collection point)			Average Transportation Speed(km/hr.)	Daily Average			
							Collection	Trans-portation	Inside the Dump Site	Total	Collection			Trans-portation	Inside the Dump Site			Total			Idling					Trips	Distance (m)	Time (min.)	Idling (min.)
											Total	Moving	Loading		Moving	Loading	Total	Moving	Loading	Total		Total	Moving	Loading					
19/12/97	KWX417	1	1			9	0	7,000	1,000	8,000	101	0	101	37	9	2	11	46	103	149	0	101.0	0.0	101.0	11.4				
19/12/97	KWX417	2	2			9	100	900	1,000	2,000	109	1	108	10	7	1	8	21	109	130	3	54.5	0.5	54.0	5.4				
19/12/97	KWX417	3	2			9	200	1,600	200	2,000	117	1	116	9	11	1	12	34	117	151	13	58.5	0.5	58.0	10.7				
19/12/97	KWX417	4	1			9	0	300	0	300	0	0	0	6	0	0	0	7	0	7	1	0.0	0.0	0.0	3.0	4	12,300	437	17
19/12 Average			**2**			**9**	**75**	**2,450**	**733**	**3,075**	**109**	**1**	**108**	**16**	**9**	**1**	**10**	**27**	**110**	**109**	**4**	**71.3**	**0.3**	**71.0**	**7.6**	**4**	**12,300**	**437**	**17**
24/12/97	KWX417	1	1			9	0	9,000	0	9,000	70	0	70	34	15	1	16	49	71	120	0	70.0	0.0	70.0	15.9				
24/12/97	KWX417	2	1			9					133	0	133	7	14	1	15	21	134	155	0	133.0	0.0	133.0	0.0				
24/12/97	KWX417	3	4			9	2,800	8,900	0	11,700	172	18	154	47	17	1	18	82	155	237	0	43.0	4.5	38.5	11.4	3	20,700	512	0
24/12 Average			**2**			**9**	**1,400**	**8,950**	**0**	**10,350**	**125**	**6**	**119**	**29**	**15**	**1**	**16**	**51**	**120**	**171**	**0**	**82.0**	**1.5**	**80.5**	**13.6**	**3**	**20,700**	**512**	**0**
26/12/97	KWX417	1	2			9	1,000	9,000	3,000	13,000	198	5	193	29	17	1	18	51	194	245	0	99.0	2.5	96.5	18.6				
26/12/97	KWX417	2	2			9	2,000	1,000	4,000	7,000	154	10	144	6	19	1	20	35	145	180	0	77.0	5.0	72.0	10.0				
26/12/97	KWX417	3	1			9	0	9,800	4,200	14,000	44	0	44	58	17	1	18	75	45	120	0	44.0	0.0	44.0	10.1	3	34,000	545	0
26/12 Average			**2**			**9**	**1,000**	**6,600**	**3,733**	**11,333**	**132**	**5**	**127**	**31**	**18**	**1**	**19**	**54**	**128**	**182**	**0**	**73.3**	**2.5**	**70.8**	**12.9**	**3**	**34,000**	**545**	**0**
28/12/97	KWX417	1	3			9	1,600	9,000	3,400	14,000	159	9	150	36	19	1	20	64	151	215	0	53.0	3.0	50.0	15.0				
28/12/97	KWX417	2	2			9	3,000	11,000	4,000	18,000	163	10	153	48	19	1	20	77	154	231	0	81.5	5.0	76.5	13.8	2	32,000	446	0
28/12 Average			**3**			**9**	**2,300**	**10,000**	**3,700**	**16,000**	**161**	**10**	**152**	**42**	**19**	**1**	**20**	**71**	**153**	**223**	**0**	**67.3**	**4.0**	**63.3**	**14.4**	**2**	**32,000**	**446**	**0**
1/1/98	KWX417	1	1			9	0	0	13,000	13,000	65	0	65	10	8	2	10	18	67	85	0	65.0	0.0	65.0	0.0				
1/1/98	KWX417	2	3			9	0	1,000	4,000	5,000	135	2	133	28	9	2	11	39	135	174	0	45.0	0.7	44.3	2.1				
1/1/98	KWX417	3	4			9	0	0	6,000	6,000	155	13	142	21	5	5	10	39	147	186	0	38.8	3.3	35.5	0.0	3	24,000	445	0
1/1 Average			**3**			**9**	**0**	**1,000**	**7,667**	**8,000**	**118**	**5**	**113**	**20**	**7**	**3**	**10**	**32**	**116**	**148**	**0**	**49.6**	**1.3**	**48.3**	**2.1**	**3**	**24,000**	**445**	**0**
Average			**2.0**			**9**	**892**	**6,533**	**2,080**	**8,786**	**127**	**5**	**122**	**26**	**13**	**2**	**15**	**44**	**123**	**159**	**1**	**68.8**	**1.8**	**67.0**	**10.6**	**3.0**	**24600**	**477**	**3**

Dandora(1/1)

Date	Vehicle No.	Trip	Number of Collection Point	Route	Location	Number of Crew	Moving Out of Centre: Collection	Moving Out of Centre: Trans-portation	Moving Out of Centre: Inside the Dump Site	Moving Out of Centre: Total	Inside the Dump Site: Collection: Total	Collection: Moving	Collection: Loading	Trans-portation	Inside the Dump Site: Moving	Inside the Dump Site: Loading	Inside the Dump Site: Total	Total: Moving	Total: Loading	Total: Total	Rating	Average Collection Time (hour: collection point): Total	Moving	Loading	Average Transportation Speed (km/hr)	Dump Average: Trips	Distance	Time	Income
19.12.97	KWX417	1	1			9	0	7,000	1,000	8,000	101	0	101	37	9	2	11	16	103	119	0	101.0	0.0	101.0	11.3				
19.12.97	KWX417	2	2			9	100	900	1,000	2,000	109	1	108	10	7	1	8	21	109	130	3	54.5	0.5	54.0	5.4				
19.12.97	KWX417	3	2			9	200	1,600	200	2,000	117	1	116	9	11	1	12	31	117	151	13	58.5	0.5	58.0	10.2				
19.12.97	KWX417	1	1			9	0	300	0	300	0	0	0	6	0	0	0	7	0	7	1	0.0	0.0	0.0	3.0	1	12,300	17	17
19/12 Average			**2**			**9**	**75**	**2,450**	**733**	**3,075**	**109**	**1**	**108**	**16**	**9**	**1**	**10**	**27**	**110**	**109**	**4**	**71.3**	**0.3**	**71.0**	**7.6**	**1**	**12,300**	**437**	**17**
24.12.97	KWX417	1	1			9	0	9,000	0	9,000	70	0	70	34	15	1	16	49	71	120	0	70.0	0.0	70.0	15.9				
24.12.97	KWX417	2	1			9					133	0	133	7	11	1	15	21	134	155	0	133.0	0.0	133.0	0.0				
24.12.97	KWX417	3	1			9	2,800	8,900	0	11,700	172	18	154	17	17	1	18	82	155	237	0	43.0	1.5	38.5	11.4	3	20,700	512	0
24/12 Average			**2**			**9**	**1,400**	**8,950**	**0**	**10,350**	**125**	**6**	**119**	**29**	**15**	**1**	**16**	**51**	**120**	**171**	**0**	**82.0**	**1.5**	**80.5**	**13.6**	**3**	**20,700**	**512**	**0**
26.12.97	KWX417	1	2			9	1,000	9,000	3,000	13,000	198	5	193	29	17	1	18	51	191	215	0	99.0	2.5	96.5	18.6				
26.12.97	KWX417	2	2			9	2,000	1,000	4,000	7,000	154	10	144	6	19	1	20	35	115	180	0	77.0	5.0	72.0	10.0				
26.12.97	KWX417	3	1			9	0	9,800	4,200	14,000	11	0	11	58	17	1	18	75	15	120	0	11.0	0.0	11.0	10.1	3	34,000	515	0
26/12 Average			**2**			**9**	**1,000**	**6,600**	**3,733**	**11,333**	**132**	**5**	**127**	**31**	**18**	**1**	**19**	**54**	**128**	**182**	**0**	**73.3**	**2.5**	**70.8**	**12.9**	**3**	**34,000**	**515**	**0**
28.12.97	KWX417	1	3			9	1,600	9,000	3,400	14,000	159	9	150	36	19	1	20	61	151	215	0	53.0	3.0	50.0	15.0				
28.12.97	KWX417	2	2			9	3,000	11,000	4,000	18,000	163	10	153	18	19	1	20	77	154	231	0	81.5	5.0	76.5	13.8	2	32,000	116	0
28/12 Average			**3**			**9**	**2,300**	**10,000**	**3,700**	**16,000**	**161**	**10**	**152**	**42**	**19**	**1**	**20**	**71**	**153**	**223**	**0**	**67.3**	**4.0**	**63.3**	**14.4**	**2**	**32,000**	**446**	**0**
1.1.98	KWX417	1	1			9	0	0	13,000	13,000	65	0	65	10	8	2	10	18	67	85	0	65.0	0.0	65.0	0.0				
1.1.98	KWX417	2	3			9	0	1,000	4,000	5,000	135	2	133	28	9	2	11	39	135	174	0	15.0	0.7	14.3	2.1				
1.1.98	KWX417	3	1			9	0	0	6,000	6,000	155	13	142	21	5	5	10	39	147	186	0	38.8	3.3	35.5	0.0	3	24,000	415	0
1/1 Average			**3**			**9**	**0**	**1,000**	**7,667**	**8,000**	**118**	**5**	**113**	**20**	**7**	**3**	**10**	**32**	**116**	**148**	**0**	**49.6**	**1.3**	**48.3**	**2.1**	**3**	**24,000**	**445**	**0**
Average			**2.0**			**9**	**892**	**6,533**	**2,080**	**8,786**	**127**	**5**	**122**	**26**	**13**	**2**	**15**	**44**	**123**	**159**	**1**	**68.8**	**1.8**	**67.0**	**10.6**	**3.0**	**24600**	**477**	**3**

Kayaba(1/1)

Date	Vehicle No	Trip	Number of Collection Point	Route	Location	Number of Crew	Moving Distance(m)				Time (minuites)											Average Collection Time (min/collection point)			Average Transportation Speed(km/hr.)	Daily Average			
							Collection	Trans-portation	Inside the Dump Site	Total	Collection			Trans-portation	Inside the Dump Site			Total			Idling					Trips	Distance (m)	Time (min)	Idling (min)
											Total	Moving	Loading		Moving	Loading	Total	Moving	Loading	Total		Total	Moving	Loading					
23/12/97	KWX417	1	1			9					120	0	120	35	7	3	10	42	123	165	0	120.0	0.0	120.0	0.0				
23/12/97	KWX417	2	1			9					145	0	145	65	9	1	10	74	146	220	0	145.0	0.0	145.0	0.0				
23/12/97	KWX417	3	3			9					80	8	72	80	9	1	10	97	73	170	0	26.7	2.7	24.0	0.0	3		555	0
23/12 Average			**1.7**			**9**					**115**	**3**	**112**	**60**	**8**	**2**	**10**	**71**	**114**	**185**	**0**	**97.2**	**2.7**	**96.3**	**0.0**	**3**	**0**	**555**	**0**
27/12/97	KWX417	1	3			8	1,000	3,000	16,000	20,000	230	66	164	27	17	1	18	110	165	275	0	76.7	22.0	54.7	6.7				
27/12/97	KWX417	2	2			8	1,000	22,000	16,000	39,000	115	6	109	87	17	1	18	110	110	220	0	57.5	3.0	54.5	15.2	2	59,000	495	0
24/12 Average			**2.5**			**8**	**1,000**	**22,000**	**16,000**	**29,500**	**173**	**36**	**137**	**87**	**17**	**1**	**18**	**110**	**138**	**248**	**0**	**67.1**	**12.5**	**54.6**	**10.9**	**2**	**59,000**	**495**	**0**
Average			**2.0**			**9**	**1,000**	**22,000**	**16,000**	**29,500**	**138**	**16**	**122**	**67**	**12**	**1**	**13**	**87**	**123**	**210**	**0**	**85**	**9**	**80**	**10.9**	**2.5**	**59,000**	**525**	**0**

Kayaba(1/1)

Date	Vehicle No	Trip	Number of Collection Point	Route	Location	Number of Crew	Moving Destination				Time Inside the Site										Average Operation Time			Average Transportation Speed(km/h)	Trip Average			
							Collection	Transportation	Inside the Dump Site	Total	Collection			Transportation	Inside the Dump Site			Total			Time								
											Total	Moving	Loading		Moving	Loading	Total	Moving	Loading	Total		Total	Moving	Loading		Trips	Distance	Time	Fuel
23.12.97	KWX317	1	1			9					120	0	120	35	7	3	10	42	123	165	0	120.0	0.0	120.0	0.0				
23.12.97	KWX317	2	1			9					115	0	115	65	9	1	10	71	136	220	0	115.0	0.0	115.0	0.0				
23.12.97	KWX317	3	3			9					80	8	72	80	9	1	10	97	73	170	0	26.7	2.7	24.0	0.0	3		555	0
23/12 Average			1.7			9					115	3	112	60	8	2	10	71	114	185	0	97.2	2.7	96.3	0.0	3	0	555	0
27.12.97	KWX317	1	3			8	1,000	3,000	16,000	20,000	230	66	164	27	12	1	18	110	165	275	0	76.7	22.0	54.7	6.7				
27.12.97	KWX317	2	2			8	1,000	22,000	16,000	39,000	115	6	109	87	17	1	18	110	110	220	0	57.5	3.0	54.5	15.2	2	59,000	395	0
24/12 Average			2.5			8	1,000	22,000	16,000	29,500	173	36	137	87	17	1	18	110	138	248	0	67.1	12.5	54.6	10.9	2	59,000	495	0
Average			2.0			9	1,000	22,000	16,000	29,500	138	16	122	67	12	1	13	87	123	210	0	85	9	80	10.9	2.5	59,000	525	0

Madaraka(1/1)

Date	Vehicle No.	Trip	Number of Collection Point	Route	Location	Number of Crew	Moving Distance(m)				Time (minutes)												Average Collection Time (min./collection point)			Average Transportation Speed(km/hr)	Daily Average			
							Collection	Trans-portation	Inside the Dump Site	Total	Collection			Trans-portation	Inside the Dump Site			Total			Idling								Trips	Distance (m)	Time (min.)	Idling (min.)
											Total	Moving	Loading		Moving	Loading	Total	Moving	Loading	Total		Total	Moving	Loading						
18/12/97	KWX417	1	26			9	3,700	23,300	1,000	28,000	137	26	111	79	7	1	8	112	112	224	0	5.3	1.0	4.3	17.7	1	28,000	224	0
22/12/97	KWX417	1	26			8					156	31	125	80	9	1	10	120	126	246	0	6.0	1.2	4.8	0.0				
22/12/97	KWX417	2	18			8					198	48	150	99	13	1	14	160	151	311	0	11.0	2.7	8.3	0.0	2		557	0
22/12 Average			**22.0**			**8**					**177**	**40**	**138**	**90**	**11**	**1**	**12**	**140**	**139**	**279**	**0**	**8.5**	**1.9**	**6.6**	**0.0**	**2**		**557**	**0**
25/12/97	KWX417	1	15			8	0	3,900	24,100	28,000	129	37	92	44	27	2	29	108	94	202	0	8.6	2.5	6.1	5.3				
25/12/97	KWX417	2	12			8	0	4,000	0	4,000	155	48	107	161	13	2	15	222	109	331	0	12.9	4.0	8.9	1.5	2	32,000	533	0
25/12 Average			**13.5**			**8**	**0**	**3,950**	**12,050**	**16,000**	**142**	**43**	**100**	**103**	**20**	**2**	**22**	**165**	**102**	**267**	**0**	**10.8**	**3.2**	**7.5**	**3.4**	**2**	**32,000**	**533**	**0**
31/12/97	KWX417	1	16			9	1,000	4,000	17,000	22,000	154	36	118	72	19	1	20	127	119	246	0	9.6	2.3	7.4	3.3				
31/12/97	KWX417	2	11			9	2,000	23,000	15,000	40,000	155	21	134	112	17	1	18	150	135	285	0	14.1	1.9	12.2	12.3	2	62,000	531	0
31/12 Average			**13.5**			**9**	**1,500**	**13,500**	**16,000**	**31,000**	**155**	**29**	**126**	**92**	**18**	**1**	**19**	**139**	**127**	**266**	**0**	**11.9**	**2.1**	**9.8**	**7.8**	**2**	**62,000**	**531**	**0**
2/1/98	KWX417	1	26			9	4,000	4,000	14,000	22,000	227	62	165	58	10	1	11	130	166	296	0	8.7	2.4	6.3	4.1				
2/1/98	KWX417	2	1			9	0	24,000	17,000	41,000	116	0	116	117	11	1	12	128	117	245	0	116.0	0.0	116.0	12.3	2	63,000	541	0
2/1 Average			**13.5**			**9**	**2,000**	**14,000**	**15,500**	**31,500**	**172**	**31**	**141**	**88**	**11**	**1**	**12**	**129**	**142**	**271**	**0**	**62.4**	**1.2**	**61.2**	**8.2**	**2**	**63,000**	**541**	**0**
Average			**16.8**			**9**	**1,529**	**23,433**	**8,000**	**26,429**	**159**	**34**	**124**	**91**	**14**	**1**	**15**	**140**	**125**	**265**	**0**	**21.4**	**2.0**	**19.4**	**8.1**	**1.8**	**46,250**	**477**	**0**

Madaraka(1/1)

Date	Vehicle No.	Trip	Number of Collection Point	Route	Location	Number of Crew	Moving Distance(m) Collection	Transportation	Inside the Dump Site	Total	Time(minutes) Collection Total	Collection Moving	Collection Loading	Transportation	Inside the Dump Site Moving	Inside the Dump Site Loading	Inside the Dump Site Total	Total Moving	Total Loading	Total Total	Idling	Average Collection Time (min/collection point) Total	Moving	Loading	Average Transportation Speed (km/h)	Daily Average Trips	Distance	Time	[illegible]
18/12/97	KWX417	1	26			9	3,700	23,300	1,000	28,000	137	26	111	79	7	1	8	112	112	224	0	5.3	1.0	4.3	17.7	1	28,000	224	0
22/12/97	KWX417	1	26			8					156	31	125	80	9	1	10	120	126	246	0	6.0	1.2	4.8	0.0				
22/12/97	KWX417	2	18			8					198	48	150	90	13	1	14	160	151	311	0	11.0	2.7	8.3	0.0	2		557	0
22/12 Average			22.0			8					177	40	138	90	11	1	12	140	139	279	0	8.5	1.9	6.6	0.0	2		557	0
25/12/97	KWX417	1	15			8	0	3,900	24,100	28,000	129	37	92	41	27	2	29	108	94	202	0	8.6	2.5	6.1	5.3				
25/12/97	KWX417	2	12			8	0	4,000	0	4,000	155	48	107	161	13	2	15	222	109	331	0	12.9	4.0	8.9	1.5	2	32,000	533	0
25/12 Average			13.5			8	0	3,950	12,050	16,000	142	43	100	103	20	2	22	165	102	267	0	10.8	3.2	7.5	3.4	2	32,000	533	0
31/12/97	KWX417	1	16			9	1,000	4,000	17,000	22,000	154	36	118	72	19	1	20	127	119	246	0	9.6	2.3	7.4	3.3				
31/12/97	KWX417	2	11			9	2,000	23,000	15,000	40,000	155	21	134	112	17	1	18	150	135	285	0	11.1	1.9	12.2	12.3	2	62,000	531	0
31/12 Average			13.5			9	1,500	13,500	16,000	31,000	155	29	126	92	18	1	19	139	127	266	0	11.9	2.1	9.8	7.8	2	62,000	531	0
2/1/98	KWX417	1	26			9	4,000	4,000	14,000	22,000	227	62	165	58	10	1	11	130	166	296	0	8.7	2.4	6.3	4.1				
2/1/98	KWX417	2	1			9	0	21,000	17,000	41,000	116	0	116	117	11	1	12	128	117	245	0	116.0	0.0	116.0	12.3	2	63,000	541	0
2/1 Average			13.5			9	2,000	14,000	15,500	31,500	172	31	141	88	11	1	12	129	142	271	0	62.4	1.2	61.2	8.2	2	63,000	541	0
Average			16.8			9	1,529	23,433	8,000	26,429	159	34	124	91	14	1	15	140	125	265	0	21.4	2.0	19.4	8.1	1.8	46,250	477	0

5.4.5 Time and Motion Study for the Experimental Collection Work (Daily Records)

Time & Motion Study Organization: Trip- 1 Date: 23rd December 1997

Vehicle No. KWX417 Loading Capacity: Researcher's name: Ngugi

No. of Crew: 9 Estimated Volume:

Location		Mileage (km)	Distance (m)	Time	Moving time (min.)	Loading time (min.)	Remarks (route)
Start from workshop	out			7 : 45			Jogoo, Ensaka, Enterprise,
Loading-1	in			8 : 0	15		Enterprise, Lusaka, Jogoo, Rabai
	out			10 : 0		120	Mumias, Outering, Mutarakwa,
							Komorock, John Osogo
Dumping site	in			10 : 20	20		John Osogo, Kiriadi and back
Start dumping				10 : 25	5		
Finish dumping				10 : 28		3	
Dumping site	out			10 : 30	2		
Reach to workshop	in			:			
Total					42	123	Total min.: 165 min.
Collection					0	120	
Transportation					35		
Inside the dumping site					7	3	Dumping time.: 10 min.
Idling time							

Time & Motion Study Organization: Trip- 2 Date: 23rd December 1997

Vehicle No. KWX417 Loading Capacity: Researcher's name: Ngugi

No. of Crew: 9 Estimated Volume:

Location		Mileage (km)	Distance (m)	Time	Moving time (min.)	Loading time (min.)	Remarks (route)
Start from dumping site	out			10 : 30			
Loading-1	in			11 : 10	40		
	out			13 : 35		145	
Dumping site	in			14 : 0	25		
Start dumping				14 : 4	4		
Finish dumping				14 : 5		1	
Dumping site	out			14 : 10	5		
Reach to workshop	in			:			
Total					74	146	Total min.: 220 min.
Collection					0	145	
Transportation					65		
Inside the dumping site					9	1	Dumping time.: 10 min.
Idling time							

Time & Motion Study Organization: Trip- 3 Date: 23rd December 1997

Vehicle No. KWX417 Loading Capacity: Researcher's name: Ngugi

No. of Crew: 9 Estimated Volume:

Location		Mileage (km)	Distance (m)	Time	Moving time (min.)	Loading time (min.)	Remarks (route)
Start from dumping site	out			14 : 10			
Loading-1	in			14 : 40	30		
	out			15 : 7		27	
Loading-2	in			15 : 10	3		
	out			15 : 45		35	
Loading-3	in			15 : 50	5		
	out			16 : 0		10	
Dumping site	in			16 : 25	25		
Start dumping				16 : 30	5		
Finish dumping				16 : 31		1	
Dumping site	out			16 : 35	4		
Reach to workshop	in			17 : 0	25		
Total					97	73	Total min.: 170 min.
Collection					8	72	
Transportation					80		
Inside the dumping site					9	1	Dumping time.: 10 min.
Idling time							

Time & Motion Study Organization: Trip- 1 Date: 27th December 1997

Vehicle No. KWX417 Loading Capacity: Researcher's name: Ngugi

No. of Crew: 8 Estimated Volume:

Location		Mileage (km)	Distance (m)	Time	Moving time (min.)	Loading time (min.)	Remarks (route)
Start from workshop	out	15429		7 : 45			
Loading-1	in	15432	3000	7 : 58	13		
	out	15432	0	9 : 35		97	
Loading-2	in	15433	1000	9 : 38	3		
	out	15433	0	10 : 27		49	
Loading-3	in			11 : 30	63		Garage for writing bettay(?)
	out			11 : 48		18	changig, repairs,
							Kariobangi South
Dumping site	in			12 : 2	14		
Start dumping				12 : 7	5		
Finish dumping				12 : 8		1	
Dumping site	out	15449	16000	12 : 20	12		
Reach to workshop	in			:			
Total			20000		110	165	Total min.: 275 min.
Collection			1000		66	164	
Transportation			3000		27		
Inside the dumping site			16000		17	1	Dumping time.: 18 min.
Idling time							

Time & Motion Study Organization: Trip- 2 Date: 27th December 1997

Vehicle No. KWX417 Loading Capacity: Researcher's name: Ngugi

No. of Crew: 8 Estimated Volume:

Location		Mileage (km)	Distance (m)	Time	Moving time (min.)	Loading time (min.)	Remarks (route)
Start from dumping site	out	15449		12 : 20			
Loading-1	in	15461	12000	12 : 25	5		
	out	15461	0	12 : 47		22	
Loading-2	in	15462	1000	12 : 53	6		
	out	15462	0	14 : 20		87	
Dumping site	in			15 : 12	52		
Start dumping				15 : 17	5		
Finish dumping				15 : 18		1	
Dumping site	out	15478	16000	15 : 30	12		
Reach to workshop	in	15488	10000	16 : 0	30		
Total			39000		110	110	Total min.: 220 min.
Collection			1000		6	109	
Transportation			22000		87		
Inside the dumping site			16000		17	1	Dumping time.: 18 min.
Idling time							

Time & Motion Study Organization: M. Tours Trip- 1 Date: 18th December 1997

Vehicle No. KWX417 Loading Capacity: Researcher's name: Roy Onyango

No. of Crew: 9 Estimated Volume:

Location		Mileage (km)	Distance (m)	Time	Moving time (min.)	Loading time (min.)	Remarks (route)
Start from workshop	out	14931		7 : 42			Jogoo Rd, Lusaka Rd,
Loading-1	in	14937	6000	7 : 55	13		Langata Rd, Olesangale rd
	out	14937	0	8 : 1		6	Note:Loading points one
Loading-2	in	14937	0	8 : 1	0		and two are together.
	out	14937	0	8 : 7		6	
Loading-3	in	14937	0	8 : 8	1		Estate lanes & cubicles
	out	14937.6	600	8 : 16		8	
Loading-4	in	14937.7	100	8 : 17	1		Estate lanes & cubicles
	out	14937.7	0	8 : 25		8	
Loading-5	in	14937.7	0	8 : 25	0		Estate lanes & cubicles
	out	14937.7	0	8 : 29		4	
Loading-6	in	14938	300	8 : 32	3		Estate lanes & cubicles
	out	14938	0	8 : 36		3.5	
Loading-7	in	14938	0	8 : 36	0		Estate lanes & cubicles
	out	14938	0	8 : 39		3.5	
Loading-8	in	14938.3	300	8 : 41	2		Estate lanes & cubicles
	out	14938.3	0	8 : 45		4	
Loading-9	in	14938.3	0	8 : 45	0		Estate lanes & cubicles
	out	14938.3	0	8 : 49		4	
Loading-10	in	14938.5	200	8 : 52	3		Estate lanes & cubicles
	out	14938.5	0	8 : 56		4	
Loading-11	in	14938.5	0	8 : 56	0		Estate lanes & cubicles
	out	14938.5	0	9 : 0		4	
Loading-12	in	14938.7	200	9 : 1	1		Estate lanes & cubicles
	out	14938.7	0	9 : 4		3	
Loading-13	in	14938.7	0	9 : 4	0		Estate lanes & cubicles
	out	14938.7	0	9 : 7		3	
Loading-14	in	14938.9	200	9 : 11	4		Estate lanes & cubicles
	out	14938.9	0	9 : 11		0	
Loading-15	in	14938.9	0	9 : 12	1		Estate lanes & cubicles
	out	14938.9	0	9 : 14		2	
Loading-16	in	14939	100	9 : 15	1		Estate lanes & cubicles
	out	14939	0	9 : 20		5	
Loading-17	in	14939.6	600	9 : 22	2		Garbage poured next to
	out	14939.6	0	9 : 27		5	cubicles (ie outside)
Loading-18	in	14939.6	0	9 : 27	0		Garbage poured next to
	out	14939.6	0	9 : 32		5	cubicles (ie outside)
Loading-19	in	14939.6	0	9 : 33	1		distance form cubicle to
	out	14939.6	0	9 : 37		3.5	refuse vehicles blocked by
Loading-20	in	14939.6	0	9 : 37	0		parked cars hence the
	out	14939.6	0	9 : 40		3.5	Time lapse
Loading-21	in	14940	400	9 : 43	3		
	out	14940	0	9 : 47		4	

Time & Motion Study Organization: M. Tours Trip- 1 Date: 18th December 1997

Vehicle No. KWX417 Loading Capacity: Researcher's name: Roy Onyango

No. of Crew: 9 Estimated Volume:

Location		Mileage (km)	Distance (m)	Time	Moving time (min.)	Loading time (min.)	Remarks (route)
Loading-22	in	14940	0	9 : 47	0		
	out	14940	0	9 : 51		4	
Loading-23	in	14940	0	9 : 52	1		
	out	14940	0	9 : 56		3.5	
Loading-24	in	14940	0	9 : 56	0		
	out	14940	0	9 : 59		3.5	
Loading-25	in	14940.7	700	10 : 1	2		
	out	14940.7	0	10 : 7		5.5	Olesangale Rd, Langata Rd,
Loading-26	in	14940.7	0	10 : 7	0		Lusaka Rd, Jogoo Rd, Rabai
	out	14940.7	0	10 : 12		5.5	Rd, Mumias Rd, Outering Rd
							Komorock Rd, John Osogo
Dumping site	in	14951	10300	10 : 47	35		Rd
Start dumping		14951	0	10 : 51	4		Karindi Rd
Finish dumping		14951	0	10 : 52		1	Karindi Rd
Dumping site	out	14952	1000	10 : 55	3		4mins Idling to take form to
Reach to workshop	in	14959	7000	11 : 26	31		office (booking dumpsite) that
							took 4mins 10:56-11:00am
Total			28000		112	112	Total min.: 224 min.
Collection			3700		26	111	
Transportation			23300		79		
Inside the dumping site			1000		7	1	Dumping time.: 8 min.
Idling time							

Time & Motion Study Organization: Trip- 1 Date: 22nd December 1997

Vehicle No. KWX417 Loading Capacity: Researcher's name: Roy Onyango

No. of Crew: 8 Estimated Volume: 4TONS

Location		Mileage (km)	Distance (m)	Time	Moving time (min.)	Loading time (min.)	Remarks (route)
Start from workshop	out	15143		8 : 3			Speedometer faulty not
Loading-1	in			8 : 39	36		registering Jogoo Rd, Lusaka Rd,
	out			8 : 48		8.5	Langata Rd, Olesangale and
Loading-2	in			8 : 48	0		Estate routes
	out			8 : 56		8.5	
Loading-3	in			8 : 59	3		
	out			9 : 4		5	
Loading-4	in			9 : 5	1		
	out			9 : 12		7	
Loading-5	in			9 : 13	1		
	out			9 : 18		5	
Loading-6	in			9 : 22	4		
	out			9 : 26		4	
Loading-7	in			9 : 26	0		
	out			9 : 30		4	
Loading-8	in			9 : 32	2		
	out			9 : 35		2.5	
Loading-9	in			9 : 35	0		
	out			9 : 37		2.5	
Loading-10	in			9 : 39	2		
	out			9 : 46		7	
Loading-11	in			9 : 47	1		
	out			9 : 51		4	
Loading-12	in			9 : 52	1		
	out			9 : 55		3	
Loading-13	in			9 : 58	3		
	out			10 : 3		5	
Loading-14	in			10 : 3	0		
	out			10 : 8		5	
Loading-15	in			10 : 10	2		
	out			10 : 13		3	
Loading-16	in			10 : 13	0		
	out			10 : 16		3	
Loading-17	in			10 : 18	2		
	out			10 : 25		7	
Loading-18	in			10 : 25	0		
	out			10 : 32		7	
Loading-19	in			10 : 36	4		
	out			10 : 41		4.5	
Loading-20	in			10 : 41	0		
	out			10 : 45		4.5	
Loading-21	in			10 : 46	1		
	out			10 : 53		6.5	

Time & Motion Study Organization: Trip- 1 Date: 22nd December 1997

Vehicle No. KWX417 Loading Capacity: Researcher's name: Roy Onyango

No. of Crew: 8 Estimated Volume: 4TONS

Location		Mileage (km)	Distance (m)	Time	Moving time (min.)	Loading time (min.)	Remarks (route)
Loading-22	in			10 : 53	0		
	out			10 : 59		6.5	
Loading-23	in			11 : 1	2		
	out			11 : 5		3.5	
Loading-24	in			11 : 5	0		
	out			11 : 8		3.5	
Loading-25	in			11 : 10	2		
	out			11 : 13		2.5	
Loading-26	in			11 : 13	0		
	out			11 : 15		2.5	Estate Lanes, Olesangale Rd,
							Langata, Lusaka, Jogoo, Rabai,
							Mumias, Outering, Mutarakwa,
							Komorock, Kenyatta, Muigai
							Traffic jam, lasting 10mins on
							Lusaka Rd, due to rd construction
							near Remand Prison. John Osogo
							Rd, Kirindi Rd, kmorock and
Dumping site	in			11 : 59	44		back.
Start dumping				12 : 4	5		12:11am-12:13am taking form
Finish dumping				12 : 5		1	to booking office
Dumping site	out			12 : 9	4		
Reach to workshop	in			:			
Total					120	126	Total min.: 246 min.
Collection					31	125	
Transportation					80		
Inside the dumping site					9	1	Dumping time.: 10 min.
Idling time							

Time & Motion Study Organization: Trip- 2 Date: 22nd December 1997

Vehicle No. KWX417 Loading Capacity: Researcher's name: Roy Onyango

No. of Crew: 8 Estimated Volume: 4.5TONS

Location		Mileage (km)	Distance (m)	Time	Moving time (min.)	Loading time (min.)	Remarks (route)
Start from dumping site	out			12 : 9			
Loading-1 (45)	in			12 : 50	41		Same route as 1st trip
	out			13 : 4		13.5	
Loading-2 (46)	in			13 : 4	0		Nos in brackests are for
	out			13 : 17		13.5	cubicles
Loading-3 (43)	in			13 : 18	1		
	out			13 : 23		5	
Loading-4 (44)	in			13 : 23	0		
	out			13 : 28		5	
Loading-5 (39)	in			13 : 59	31		
	out			14 : 10		10.5	
Loading-6 (40)	in			14 : 10	0		
	out			14 : 20		10.5	
Loading-7 (38)	in			14 : 25	5		
	out			14 : 40		15	
Loading-8 (39)	in			14 : 41	1		
	out			14 : 49		8	
Loading-9 (36)	in			14 : 53	4		
	out			15 : 2		9	
Loading-10 (35)	in			15 : 2	0		
	out			15 : 11		9	
Loading-11 (34)	in			15 : 13	2		
	out			15 : 19		6	
Loading-12 (33)	in			15 : 19	0		
	out			15 : 25		6	
Loading-13 (32)	in			15 : 26	1		
	out			15 : 36		9.5	
Loading-14 (31)	in			15 : 36	0		
	out			15 : 45		9.5	
Loading-15 (30)	in			15 : 47	2		
	out			15 : 50		3	
Loading-16 (29)	in			15 : 50	0		
	out			15 : 53		3	
Loading-17 (28)	in			15 : 54	1		
	out			16 : 1		7	
Loading-18 (27)	in			16 : 1	0		
	out			16 : 8		7	Estate Lanes, Olesangale,
							Langata, Lusaka, Jogoo,
							Rabai, Mumias, Outering,
							Mutarakwa, Kenyatta,
							Muigai, John Osogo

Time & Motion Study Organization: Trip- 2 Date: 22nd December 1997

Vehicle No. KWX417 Loading Capacity: Researcher's name: Roy Onyango

No. of Crew: 8 Estimated Volume: 4.5TONS

Location	Mileage (km)	Distance (m)	Time	Moving time (min.)	Loading time (min.)	Remarks (route)
Dumping site in			16 : 48	58		John Osogo Rd, Kirindi Rd,
Start dumping			16 : 53	5		Komorock
Finish dumping			16 : 54		1	
Dumping site out			17 : 2	8		The vehicle did not return
Reach to workshop in			:			to workshop
Total				160	151	Total min.: 311 min.
Collection				48	150	
Transportation				99		
Inside the dumping site				13	1	Dumping time.: 14 min.
Idling time						

Time & Motion Study Organization: Trip- 1 Date: 25th December 1997

Vehicle No. KWX417 Loading Capacity: Researcher's name:

No. of Crew: 8 Estimated Volume:

Location		Mileage (km)	Distance (m)	Time	Moving time (min.)	Loading time (min.)	Remarks (route)
Start from workshop	out	15310		7 : 53			
Loading-1	in	15313.9	3900	8 : 1	8		Jogoo Rd-
	out			8 : 20		19	Lusaka Rd-
Loading-2	in			8 : 25	5		Langata Rd-
	out			8 : 30		5	Ole-Sangale-
Loading-3	in			8 : 35	5		
	out			8 : 37		2	
Loading-4	in			8 : 40	3		
	out			8 : 45		5	
Loading-5	in			8 : 47	2		
	out			9 : 2		15	
Loading-6	in			9 : 5	3		
	out			9 : 6		1	
Loading-7	in			9 : 8	2		
	out			9 : 10		2	
Loading-8	in			9 : 12	2		
	out			9 : 14		2	
Loading-9	in			9 : 15	1		
	out			9 : 18		3	
Loading-10	in			9 : 19	1		
	out			9 : 23		4	
Loading-11	in			9 : 26	3		
	out			9 : 30		4	
Loading-12	in			9 : 32	2		
	out			9 : 37		5	
Loading-13	in			9 : 40	3		
	out			9 : 50		10	
Loading-14	in			9 : 53	3		
	out			10 : 0		7	
Loading-15	in			10 : 2	2		
	out			10 : 10		8	Langata, Lusaka, Jogoo,
							Rabai, Mumias, Outering,
Dumping site	in			10 : 46	36		Mutarakwa, Komorock,
Start dumping				11 : 10	24		Osogo, Kirindi
Finish dumping				11 : 12		2	
Dumping site	out	15338	24100	11 : 15	3		
Reach to workshop	in			:			
Total			28000		108	94	Total min.: 202 min.
Collection			0		37	92	
Transportation			3900		44		
Inside the dumping site			24100		27	2	Dumping time.: 29 min.
Idling time							

Time & Motion Study Organization: Trip- 2 Date: 25th December 1997

Vehicle No. KWX417 Loading Capacity: Researcher's name:

No. of Crew: 8 Estimated Volume:

Location		Mileage (km)	Distance (m)	Time	Moving time (min.)	Loading time (min.)	Remarks (route)
Start from dumping site	out	15338		11 : 15			Jogoo, Lusaka, Langata,
Loading-1	in	15342	4000	11 : 52	37		Ole sangale
	out			12 : 31		39	
Loading-2	in			12 : 33	2		
	out			12 : 34		1	
Loading-3	in			12 : 43	9		
	out			12 : 49		6	
Loading-4	in			12 : 52	3		
	out			12 : 58		6	
Loading-5	in			13 : 5	7		
	out			13 : 9		4	
Loading-6	in			13 : 13	4		
	out			13 : 18		5	
Loading-7	in			13 : 20	2		
	out			13 : 23		3	
Loading-8	in			13 : 25	2		
	out			13 : 28		3	
Loading-9	in			13 : 36	8		
	out			13 : 53		17	
Loading-10	in			13 : 58	5		
	out			14 : 4		6	
Loading-11	in			14 : 8	4		
	out			14 : 12		4	
Loading-12	in			14 : 14	2		
	out			14 : 27		13	
Dumping site	in			15 : 20	53		
Start dumping				15 : 24	4		
Finish dumping				15 : 26		2	
Dumping site	out			15 : 35	9		
Reach to workshop	in			16 : 46	71		
Total			4000		222	109	Total min.: 331 min.
Collection			0		48	107	
Transportation			4000		161		
Inside the dumping site			0		13	2	Dumping time.: 15 min.
Idling time							

Time & Motion Study Organization: Trip- 1 Date: 31st December 1997

Vehicle No. KWX417 Loading Capacity: Researcher's name: Ngugi

No. of Crew: 9 Estimated Volume:

Location		Mileage (km)	Distance (m)	Time	Moving time (min.)	Loading time (min.)	Remarks (route)
Start from workshop	out	15574		7 : 55			
Loading-1	in	15578	4000	8 : 10	15		
	out	15578	0	8 : 24		14	
Loading-2	in	15578	0	8 : 26	2		
	out	15578	0	8 : 32		6	
Loading-3	in	15578	0	8 : 35	3		
	out	15578	0	8 : 42		7	
Loading-4	in	15578	0	8 : 43	1		
	out	15578	0	8 : 46		3	
Loading-5	in	15578	0	8 : 48	2		
	out	15578	0	8 : 57		9	
Loading-6	in	15578	0	8 : 58	1		
	out	15578	0	9 : 2		4	
Loading-7	in	15578	0	9 : 10	8		Most of the garbage was
	out	15578	0	9 : 11		1	poured on the floor
Loading-8	in	15578	0	9 : 12	1		
	out	15578	0	9 : 16		4	
Loading-9	in	15578	0	9 : 20	4		
	out	15578	0	9 : 28		8	
Loading-10	in	15578	0	9 : 30	2		
	out	15578	0	9 : 39		9	
Loading-11	in	15578	0	9 : 43	4		
	out	15578	0	9 : 49		6	
Loading-12	in	15579	1000	9 : 50	1		
	out	15579	0	9 : 54		4	
Loading-13	in	15579	0	9 : 55	1		
	out	15579	0	10 : 3		8	
Loading-14	in	15579	0	10 : 6	3		
	out	15579	0	10 : 17		11	
Loading-15	in	15579	0	10 : 18	1		
	out	15579	0	10 : 28		10	
Loading-16	in	15579	0	10 : 30	2		
	out	15579	0	10 : 44		14	
Dumping site	in	15579	0	11 : 25	57		
Start dumping				11 : 34	9		
Finish dumping				11 : 35		1	
Dumping site	out	15596	17000	11 : 45	10		
Reach to workshop	in			:			
Total			22000		127	119	Total min.: 246 min.
Collection			1000		36	118	
Transportation			4000		72		
Inside the dumping site			17000		19	1	Dumping time.: 20 min.
Idling time							

Time & Motion Study Organization: Trip- 2 Date: 31st December 1997

Vehicle No. KWX417 Loading Capacity: Researcher's name: Ngugi

No. of Crew: 9 Estimated Volume:

Location		Mileage (km)	Distance (m)	Time	Moving time (min.)	Loading time (min.)	Remarks (route)
Start from dumping site	out	15596		11 : 45			
Loading-1	in	15609	13000	12 : 20	35		
	out	15609	0	12 : 32		12	
Loading-2	in	15609	0	12 : 33	1		
	out	15609	0	12 : 43		10	
Loading-3	in	15609	0	12 : 45	2		
	out	15609	0	13 : 0		15	
Loading-4	in	15609	0	13 : 1	1		
	out	15609	0	13 : 14		13	
Loading-5	in	15610	1000	13 : 19	5		
	out	15610	0	13 : 30		11	
Loading-6	in	15610	0	13 : 31	1		
	out	15610	0	13 : 38		7	
Loading-7	in	15610	0	13 : 39	1		
	out	15610	0	13 : 54		15	
Loading-8	in	15610	0	13 : 57	3		
	out	15610	0	14 : 8		11	
Loading-9	in	15610	0	14 : 9	1		
	out	15610	0	14 : 20		11	
Loading-10	in	15610	0	14 : 23	3		
	out	15610	0	14 : 32		9	
Loading-11	in	15611	1000	14 : 35	3		
	out	15611	0	14 : 55		20	
Dumping site	in			15 : 37	42		
Start dumping			0	15 : 43	6		
Finish dumping			0	15 : 44		1	
Dumping site	out	15626	15000	15 : 55	11		
Reach to workshop	in	15636	10000	16 : 30	35		
Total			40000		150	135	Total min.: 285 min.
Collection			2000		21	134	
Transportation			23000		112		
Inside the dumping site			15000		17	1	Dumping time.: 18 min.
Idling time							

Time & Motion Study Organization: Trip- 1 Date: 2nd January 1998

Vehicle No. KWX417 Loading Capacity: Researcher's name: Ngugi

No. of Crew: Estimated Volume:

Location		Mileage (km)	Distance (m)	Time	Moving time (min.)	Loading time (min.)	Remarks (route)
Start from workshop	out	15686		7 : 54			
Loading-1	in	15690	4000	8 : 10	16		
	out	15690	0	8 : 23		13	
Loading-2	in	15690	0	8 : 27	4		
	out	15690	0	8 : 30		3	
Loading-3	in	15690	0	8 : 32	2		
	out	15690	0	8 : 38		6	
Loading-4	in	15690	0	8 : 39	1		
	out	15690	0	8 : 42		3	
Loading-5	in	15690	0	8 : 45	3		
	out	15690	0	8 : 51		6	
Loading-6	in	15690	0	8 : 52	1		
	out	15690	0	8 : 59		7	
Loading-7	in	15690	0	9 : 2	3		
	out	15690	0	9 : 12		10	
Loading-8	in	15690	0	9 : 13	1		
	out	15690	0	9 : 22		9	
Loading-9	in	15690	0	9 : 25	3		
	out	15690	0	9 : 32		7	
Loading-10	in	15691	1000	9 : 33	1		
	out	15691	0	9 : 40		7	
Loading-11	in	15691	0	9 : 43	3		
	out	15691	0	9 : 48		5	
Loading-12	in	15691	0	9 : 52	4		
	out	15691	0	9 : 56		4	
Loading-13	in	15691	0	9 : 58	2		
	out	15691	0	10 : 5		7	
Loading-14	in	15691	0	10 : 7	2		
	out	15691	0	10 : 15		8	Up to house block MF26
Loading-15	in	15691	0	10 : 18	3		
	out	15692	1000	10 : 22		4	
Loading-16	in	15692	0	10 : 25	3		
	out	15692	0	10 : 32		7	
Loading-17	in	15692	0	10 : 33	1		
	out	15692	0	10 : 37		4	
Loading-18	in	15692	0	10 : 41	4		
	out	15692	0	10 : 45		4	
Loading-19	in	15692	0	10 : 47	2		
	out	15692	0	10 : 53		6	
Loading-20	in	15692	0	10 : 58	5		
	out	15692	0	11 : 11		13	
Loading-21	in	15692	0	11 : 13	2		
	out	15692	0	11 : 17		4	

Time & Motion Study Organization: Trip- 1 Date: 2nd January 1998

Vehicle No. KWX417 Loading Capacity: Researcher's name: Ngugi

No. of Crew: Estimated Volume:

Location		Mileage (km)	Distance (m)	Time	Moving time (min.)	Loading time (min.)	Remarks (route)
Loading-22	in	15693	1000	11 : 20	3		
	out	15693	0	11 : 27		7	
Loading-23	in	15693	0	11 : 31	4		
	out	15693	0	11 : 35		4	
Loading-24	in	15693	0	11 : 36	1		
	out	15693	0	11 : 40		4	
Loading-25	in	15693	0	11 : 43	3		
	out	15693	0	11 : 45		2	
Loading-26	in	15693	0	11 : 46	1		
	out	15694	1000	11 : 57		11	
Dumping site	in			12 : 39	42		
Start dumping				12 : 44	5		
Finish dumping				12 : 45		1	
Dumping site	out	15708	14000	12 : 50	5		
Reach to workshop	in			:			
Total			22000		130	166	Total min.: 296 min.
Collection			4000		62	165	
Transportation			4000		58		
Inside the dumping site			14000		10	1	Dumping time.: 11 min.
Idling time							

Time & Motion Study Organization: Trip- 2 Date: 2nd January 1998

Vehicle No. KWX417 Loading Capacity: Researcher's name: Ngugi

No. of Crew: 9 Estimated Volume:

Location		Mileage (km)	Distance (m)	Time	Moving time (min.)	Loading time (min.)	Remarks (route)
Start from dumping site	out	15708		12 : 50			
Loading-1	in	15722	14000	13 : 29	39		Old garbage collection on
	out	15722	0	15 : 25		116	MF38
Dumping site	in			16 : 13	48		
Start dumping				16 : 15	2		
Finish dumping				16 : 16		1	
Dumping site	out	15739	17000	16 : 25	9		
Reach to workshop	in	15749	10000	16 : 55	30		
Total			41000		128	117	Total min.: 245 min.
Collection			0		0	116	
Transportation			24000		117		
Inside the dumping site			17000		11	1	Dumping time.: 12 min.
Idling time							

Time & Motion Study Organization: Trip- 1 Date: 19th December 1997

Vehicle No. KWX417 Loading Capacity: Researcher's name: Roy Onyango

No. of Crew: 9 Estimated Volume: 3TON

Location		Mileage (km)	Distance (m)	Time	Moving time (min.)	Loading time (min.)	Remarks (route)
Start from workshop	out	14989		7 : 52			Jogoo Rd, Rabai, Outering,
Loading-1	in	14995	6,000	8 : 21	29		Mutarakwa Rd, Komorock
	out	14995	0	10 : 2		101	Rd, John Osogo, Kirindi Rd
Dumping site	in	14996	1,000	10 : 10	8		John Osogo Rd
Start dumping		14996	0	10 : 16	6		Taking form to report office
Finish dumping		14996	0	10 : 18		2	took from 10:23-10:26
Dumping site	out	14997	1,000	10 : 21	3		3mins
Reach to workshop	in			:			
Total			8,000		46	103	Total min.: 149 min.
Collection			0		0	101	
Transportation			7,000		37		
Inside the dumping site			1,000		9	2	Dumping time.: 11 min.
Idling time							

Time & Motion Study Organization: Trip- 2 Date: 19th December 1997

Vehicle No. KWX417 Loading Capacity: Researcher's name: Roy Onyango

No. of Crew: 9 Estimated Volume: 4TON

Location		Mileage (km)	Distance (m)	Time	Moving time (min.)	Loading time (min.)	Remarks (route)
Start from dumping site	out	14997		10 : 21			Kirindi Rd, John Osogo Rd,
Loading-1	in	14997.7	700	10 : 31	10		Kirindi Rd, John Osogo Rd,
	out	14997.7	0	11 : 19		48	Kirindi Rd, John Osogo Rd,
Loading-2	in	14997.8	100	11 : 20	1		Not finished
	out	14997.8	0	12 : 20		60	Taking form to report office
							took from 10:23-10:26 3mins
Dumping site	in	14998	200	12 : 23	3		Vehicle had developed slow
Start dumping		14998	0	12 : 27	4		puncture took from 12:32-12:43
Finish dumping		14998	0	12 : 28		1	to inflate the tyres = 11mins
Dumping site	out	14999	1,000	12 : 31	3		Took from 12:44-12:46 to take
Reach to workshop	in			:			form to office 2mins
Total			2,000		21	109	Total min.: 130 min.
Collection			100		1	108	
Transportation			900		10		
Inside the dumping site			1,000		7	1	Dumping time.: 8 min.
Idling time					3		

Time & Motion Study Organization: Trip- 3 Date: 19th December 1997

Vehicle No. KWX417 Loading Capacity: Researcher's name: Roy Onyango

No. of Crew: 9 Estimated Volume: 3.8TON

Location		Mileage (km)	Distance (m)	Time	Moving time (min.)	Loading time (min.)	Remarks (route)
Start from dumping site	out	14999		12 : 31			
Loading-1	in	15000	1,000	12 : 50	19		Kirindi Rd, Balance from 2nd trip
	out	15000	0	13 : 40		50	Karindi Rd
Loading-2	in	15000.2	200	13 : 41	1		Vehicle had developed slow
	out	15000.2	0	14 : 47		66	puncture took from 12:32-12:43
							to inflate the tyres = 11mins
							Took from 12:44-12:46 to take
							form to office 2mins
Dumping site	in	15000.8	600	14 : 50	3		John Osogo Rd, Start from
Start dumping				14 : 57	7		petrol station
Finish dumping				14 : 58		1	
Dumping site	out	15001	200	15 : 2	4		
Reach to workshop	in			:			
Total			2,000		34	117	Total min.: 151 min.
Collection			200		1	116	
Transportation			1,600		9		
Inside the dumping site			200		11	1	Dumping time.: 12 min.
Idling time					13		

Time & Motion Study Organization: Trip- 4 Date: 19th December 1997

Vehicle No. KWX417 Loading Capacity: Researcher's name: Roy Onyango

No. of Crew: 9 Estimated Volume:

Location		Mileage (km)	Distance (m)	Time	Moving time (min.)	Loading time (min.)	Remarks (route)
Start from dumping site	out	15001		15 : 2			Kirindi Rd, vehicle developed
Loading-1	in	15001.3	300	15 : 9	7		puncture - work suspended
	out			:			
							15:04-15:05 1min Taking for to
							record office
Dumping site	in			:	0		
Start dumping			0	:	0		
Finish dumping			0	:		0	
Dumping site	out		0	:	0		
Reach to workshop	in			:			
Total			300		7	0	Total min.: 7 min.
Collection			0		0	0	
Transportation			300		6		
Inside the dumping site			0		0	0	Dumping time.: min.
Idling time					1		

Time & Motion Study Organization: Trip- 1 Date: 24th December 1997

Vehicle No. KWX417 Loading Capacity: Researcher's name: Roy Onyango

No. of Crew: 9 Estimated Volume:

Location		Mileage (km)	Distance (m)	Time	Moving time (min.)	Loading time (min.)	Remarks (route)
Start from workshop	out	15268		8 : 0			Speedmeter not working
Loading-1	in	15277	9000	8 : 27	27		Komorock, Kirindi,
	out	15277	0	9 : 37		70	John Osogo, John Osogo,
							Kirindi
Dumping site	in			9 : 44	7		
Start dumping				9 : 48	4		
Finish dumping				9 : 49		1	
Dumping site	out			10 : 0	11		
Reach to workshop	in			:			
Total			9000		49	71	Total min.: 120 min.
Collection			0		0	70	
Transportation			9000		34		
Inside the dumping site			0		15	1	Dumping time.: 16 min.
Idling time							

Time & Motion Study Organization: Trip- 2 Date: 24th December 1997

Vehicle No. KWX417 Loading Capacity: Researcher's name: Ngugi

No. of Crew: 9 Estimated Volume:

Location		Mileage (km)	Distance (m)	Time	Moving time (min.)	Loading time (min.)	Remarks (route)
Start from dumping site	out			10 : 0			
Loading-1	in	15281		10 : 4	4		Kirindi, John Osogo
	out	15281		12 : 17		133	
Dumping site	in			12 : 20	3		
Start dumping				12 : 24	4		
Finish dumping				12 : 25		1	
Dumping site	out			12 : 35	10		
Reach to workshop	in			:			
Total					21	134	Total min.: 155 min.
Collection					0	133	
Transportation					7		
Inside the dumping site					14	1	Dumping time.: 15 min.
Idling time							

Time & Motion Study Organization: Trip- 3 Date: 24th December 1997

Vehicle No. KWX417 Loading Capacity: Researcher's name: Ngugi

No. of Crew: 9 Estimated Volume:

Location		Mileage (km)	Distance (m)	Time	Moving time (min.)	Loading time (min.)	Remarks (route)
Start from dumping site	out			12 : 35			Hiside Estate to Mutarakwa,
Loading-1	in	15284		12 : 38	3		Komorock station
	out	15284	0	13 : 27		49	
Loading-2	in	15284.5	500	13 : 30	3		
	out	15284.5	500	14 : 27		57	
Loading-3	in	15284.9	400	14 : 32	5		
	out	15284.9	400	15 : 2		30	
Loading-4	in	15285.4	500	15 : 12	10		
	out	15285.4	500	15 : 30		18	
Dumping site	in			15 : 37	7		John Osogo, Kirindi,
Start dumping				15 : 45	8		Komorock, Mutarakwa ,
Finish dumping				15 : 46		1	Rabai, Jogoo, Back
Dumping site	out			15 : 55	9		
Reach to workshop	in	15294.3	8900	16 : 32	37		
Total			11700		82	155	Total min.: 237 min.
Collection			2800		18	154	
Transportation			8900		47		
Inside the dumping site			0		17	1	Dumping time.: 18 min.
Idling time							

Time & Motion Study Organization: Trip- 1 Date: 26th December 1997

Vehicle No. KWX417 Loading Capacity: Researcher's name: Ngugi

No. of Crew: 9 Estimated Volume:

Location		Mileage (km)	Distance (m)	Time	Moving time (min.)	Loading time (min.)	Remarks (route)
Start from workshop	out	15376		7 : 45			Waited for rain to stop untill
Loading-1	in	15385	9000	8 : 10	25		8:38
	out	15385	0	10 : 0		110	Weather was very rainy and
Loading-2	in	15386	1000	10 : 5	5		wet
	out	15386	0	11 : 28		83	All collected from the ground
Dumping site	in			11 : 32	4		
Start dumping				11 : 37	5		
Finish dumping				11 : 38		1	
Dumping site	out	15389	3000	11 : 50	12		
Reach to workshop	in			:			
Total			13000		51	194	Total min.: 245 min.
Collection			1000		5	193	
Transportation			9000		29		
Inside the dumping site			3000		17	1	Dumping time.: 18 min.
Idling time							

Time & Motion Study Organization: Trip- 2 Date: 26th December 1997

Vehicle No. KWX417 Loading Capacity: Researcher's name: Ngugi

No. of Crew: 9 Estimated Volume:

Location		Mileage (km)	Distance (m)	Time	Moving time (min.)	Loading time (min.)	Remarks (route)
Start from dumping site	out	15389		11 : 50			
Loading-1	in	15390	1000	11 : 53	3		collected from the ground
	out	15390	0	12 : 8		15	
Loading-2	in	15391	1000	12 : 18	10		collected from the plastic
	out	15392	1000	14 : 27		129	paper bags
							Garbage collected from house
							to house
Dumping site	in			14 : 30	3		
Start dumping				14 : 38	8		
Finish dumping				14 : 39		1	
Dumping site	out	15396	4000	14 : 50	11		
Reach to workshop	in			:			
Total			7000		35	145	Total min.: 180 min.
Collection			2000		10	144	
Transportation			1000		6		
Inside the dumping site			4000		19	1	Dumping time.: 20 min.
Idling time							

Time & Motion Study Organization: Trip- 3 Date: 26th December 1997

Vehicle No. KWX417 Loading Capacity: Researcher's name: Ngugi

No. of Crew: 9 Estimated Volume:

Location		Mileage (km)	Distance (m)	Time	Moving time (min.)	Loading time (min.)	Remarks (route)
Start from dumping site	out	15396		14 : 50			
Loading-1	in	15396.8	800	14 : 53	3		most people we using the
	out	15396.8	0	15 : 37		44	plastic bags
Dumping site	in			16 : 2	25		
Start dumping				16 : 8	6		
Finish dumping				16 : 9		1	
Dumping site	out	15401	4200	16 : 20	11		
Reach to workshop	in	15410	9000	16 : 50	30		
Total			14000		75	45	Total min.: 120 min.
Collection			0		0	44	
Transportation			9800		58		
Inside the dumping site			4200		17	1	Dumping time.: 18 min.
Idling time							

Time & Motion Study Organization: Trip- 1 Date: 28th December 1997

Vehicle No. KWX417 Loading Capacity: Researcher's name: Ngugi

No. of Crew: 9 Estimated Volume: 3TON

Location		Mileage (km)	Distance (m)	Time	Moving time (min.)	Loading time (min.)	Remarks (route)
Start from workshop	out	15506		7 : 45			
Loading-1	in	15515	9,000	8 : 13	28		
	out	15515	0	9 : 5		52	
Loading-2	in	15516	1,000	9 : 8	3		
	out	15516	0	10 : 16		68	
Loading-3	in	15516.6	600	10 : 22	6		
	out	15516.6	0	10 : 52		30	
Dumping site	in			11 : 0	8		
Start dumping				11 : 6	6		
Finish dumping				11 : 7		1	
Dumping site	out	15520	3,400	11 : 20	13		
Reach to workshop	in			:			
Total			14,000		64	151	Total min.: 215 min.
Collection			1,600		9	150	
Transportation			9,000		36		
Inside the dumping site			3,400		19	1	Dumping time.: 20 min.
Idling time							

Time & Motion Study Organization: Trip- 2 Date: 28th December 1997

Vehicle No. KWX417 Loading Capacity: Researcher's name: Ngugi

No. of Crew: 9 Estimated Volume:

Location		Mileage (km)	Distance (m)	Time	Moving time (min.)	Loading time (min.)	Remarks (route)
Start from dumping site	out	15520		11 : 20			
Loading-1	in	15521	1000	11 : 25	5		
	out	15523	2000	13 : 32		127	
Loading-2	in	15524	1000	13 : 42	10		
	out	15524	0	14 : 8		26	
Dumping site	in			14 : 15	43		
Start dumping				14 : 22	7		
Finish dumping				14 : 23		1	
Dumping site	out	15528	4000	14 : 35	12		
Reach to workshop	in	15538	10000	15 : 30			
Total			18000		77	154	Total min.: 231 min.
Collection			3000		10	153	
Transportation			11000		48		
Inside the dumping site			4000		19	1	Dumping time.: 20 min.
Idling time							

Time & Motion Study Organization: Trip- 1 Date: 1st January 1998

Vehicle No. KWX417 Loading Capacity: Researcher's name: Njenga

No. of Crew: 9 Estimated Volume:

Location		Mileage (km)	Distance (m)	Time	Moving time (min.)	Loading time (min.)	Remarks (route)
Start from workshop	out	15651		:			Jogoo, Rabai, Mumias, South,
Loading-1	in			9 : 10			Mumias, Mutarakwa
	out			10 : 15		65	
Dumping site	in			10 : 25	10		
Start dumping				10 : 30	5		
Finish dumping				10 : 32		2	
Dumping site	out	15664	13000	10 : 35	3		
Reach to workshop	in			:			
Total			13000		18	67	Total min.: 85 min.
Collection			0		0	65	
Transportation			0		10		
Inside the dumping site			13000		8	2	Dumping time.: 10 min.
Idling time							

Time & Motion Study Organization: Trip- 2 Date: 1st January 1998

Vehicle No. KWX417 Loading Capacity: Researcher's name: Njenga

No. of Crew: 9 Estimated Volume:

Location		Mileage (km)	Distance (m)	Time	Moving time (min.)	Loading time (min.)	Remarks (route)
Start from dumping site	out	15664		10 : 35			
Loading-1	in	15665	1000	10 : 50	15		
	out			11 : 57		67	
Loading-2	in			11 : 58	1		
	out			12 : 3		5	
Loading-3	in			12 : 4	1		
	out			13 : 5		61	
Dumping site	in			13 : 18	13		
Start dumping				13 : 20	2		
Finish dumping				13 : 22		2	
Dumping site	out	15669	4000	13 : 29	7		
Reach to workshop	in			:			
Total			5000		39	135	Total min.: 174 min.
Collection			0		2	133	
Transportation			1000		28		
Inside the dumping site			4000		9	2	Dumping time.: 11 min.
Idling time							

Time & Motion Study Organization: Trip- 3 Date: 1st January 1998

Vehicle No. KWX417 Loading Capacity: Researcher's name: Njenga

No. of Crew: 9 Estimated Volume:

Location		Mileage (km)	Distance (m)	Time	Moving time (min.)	Loading time (min.)	Remarks (route)
Start from dumping site	out	15669		13 : 29			
Loading-1	in			13 : 32	3		
	out			13 : 59		27	
Loading-2	in			14 : 1	2		
	out			15 : 4		63	
Loading-3	in			15 : 10	6		
	out			15 : 30		20	
Loading-4	in			15 : 35	5		
	out			16 : 7		32	
Dumping site	in			16 : 15	8		
Start dumping				16 : 17	2		
Finish dumping				16 : 22		5	
Dumping site	out	15675	6000	16 : 25	3		
Reach to workshop	in			16 : 35	10		
Total			6000		39	147	Total min.: 186 min.
Collection			0		13	142	
Transportation			0		21		
Inside the dumping site			6000		5	5	Dumping time.: 10 min.
Idling time							

5.4.6 Summary of the Daily Operation of the Experimental Collection Work

Summary of the Daily Operation of the Experimental Collection Work

Date	Day	Vehicl No.	Mileage (km)			Fuel (l)		Fuel consumption	Time (hr.)			Collection Area	No.of trip	Tipping time				Remarks
			Start	Close	Difference	Diesel	Oil		Out	In	Difference			1st	2nd	3rd	4th	
8/12/97	Mon	KWX 417	14199	14246	47	15	0	3.13	8:15	16:25	8:10	MADARAKA	2	11:45	15:15			No mechanical problems.
9/12/97	Tue	KWX 417	14255	14290	35	21	0.5	1.67	8:00	16:30	8:30	DANDORA (I)	3	11:15	13:35	16:05		Work was well done.
10/12/97	Wed	KWX 417	14305	14377	72	36	0	2.00	8:25	17:20	8:55	KAYABA	3	10:30	13:40	16:50		We managed three loads but the loader were too much exhausted and got late in the evening.
11/12/97	THu	KWX 417	14386	14435	49	27	0	1.81	8:00	17:00	9:00	MADARAKA	2	12:35	16:50			Most of the Cubicles were full of the old refuse e g No.3,12,13,17,18,19,20, 25,26,41,42,39,40,38,37,33,34,31,32,30,29,28,27,and No.14.
12/12/97	Fri	KWX 417	14440	14452	12	16	0	0.75	8:00	16:30	8:30	DANDORA(Eastern)	3	11:10	13:20	16:10		We manage to cleare most of the garbage near the river although there is still more to be collected.
13/12/97	Sat	KWX 417	14456	14508	52	23	0	2.26	8:00	17:00	9:00	KAYABA(Southern)	2	11:15	15:40			The operation was Oky for we cleaned Busia road,inside Kaiyaba villge and also the ones inside Dandora estate.
14/12/97	Sun	KWX 417	14614	14678	64	37	0	1.73	7:45	17:00	9:15	MADARAKA(Western)	2	10:55	15:20			-
15/12/97	Mon	KWX 417	14687	14759	72	37	0.25	1.95	8:00	17:00	9:00	MADARAKA(Western)	2	11:20	15:20			We collected up to Cubicle No.1
16/12/97	Tue	KWX 417	14764	14791	27	21	0	1.29	7:45	17:00	9:15	DANDORA	3	11:05	13:55	16:00		Cleaner in Dandora should be educated on our operations not to play out our Pegs.
17/12/97	Wed	KWX 417	14867	14924	57	38	0.25	1.50	7:40	16:30	8:50	KAYABA(Southern)	3	10:15	13:10	16:05		-
18/12/97	Thu	KWX 417	14931	14989	58	34	0	1.71	7:42	17:00	9:18	MADARAKA(Western)	2	11:00	15:45			Most of the Cubicles from 27 to 46 and still having the old refuse.
19/12/97	Fri	KWX 417	14989	15015	26	17	0	1.53	7:52	16:00	8:08	DANDORA	4	10:25	12:50	15:05	15:45	The loaders complained that the work is too much for them.
20/12/97	Sat	KWX 417	15023	15105	82	41	0.25	2.00	7:40	18:00	10:20	KAYABA	3	10:40	15:15	17:35		-
21/12/97	Sun	KWX 417	15112	15136	24	22	0	1.09	7:40	16:00	8:20	DANDORA	3	9:40	11:50	17:50		-
22/12/97	Mon	KWX 417	15143	15211	68	34	-	2.00	8:03	17:30	9:27	MADARAKA(Western)	2	12:15	17:05			-
23/12/97	Tue	KWX 417	15183	15261	78	38	0	2.05	7:45	17:40	9:55	KAYABA	3	10:30	15:10	16:35		Speedometer fixed and also also the strter.
24/12/97	Wed	KWX 417	15268	15294	26	18	0.25	1.44	8:00	16:32	8:32	DANDORA (I)	3	10:00	12:35	15:55		-
25/12/97	Thu	KWX 417	15310	15361	51	16	0	3.19	7:45	16:45	9:00	MADARAKA	2	11:15	15:30			Garbage deposition average (50-80)
26/12/97	Fri	KWX 417	15376	15410	34	15	0	2.27	7:45	16:50	9:05	DANDORA (I)	3	11:50	14:50	16:20		The weather was too wet and we had to collect some garbage from the ground.
27/12/97	Sat	KWX 417	15429	-		-	-	-	7:45	16:00	8:15	KAYABA	2	11:20	15:30			There was not much garbage for most people have gone up country for christmass holidays.
28/12/97	Sun	KWX 417	15506	15538	32	18	0	1.78	7:45	15:30	7:45	DANDORA (I)	2	11:20	14:35			There was not much garbage in that area.
31/12/97	Wed	KWX 417	15574	15636	62	47	0	1.32	7:55	16:30	8:35	MADARAKA	2	11:45	15:55			-
1/1/98	Thu	KWX 417	15651	15675	24	10	0.5	2.40	7:45	17:00	9:15	DANDORA	3	10:45	13:25	16:30		Deliverance of waste in paper bags average.
2/1/98	Fri	KWX 417	15696	15749	53	34	0	1.56	7:54	16:55	9:01	MADARAKA	2	12:50	16:25			We collected are load of old garbage and on of old on block MF 38.
3/1/98	Sat	KWX 417	15765	15849	84	47	0	1.79	8:06	17:30	9:24	KAYABA	3	11:00	13:50	17:00		The work load was too much for the loaders although the finished collecting all the points.
4/1/98	Sun	KWX 417	15866	15909	43	26	0	1.65	7:45	16:30	8:45	DANDORA (I)	3	10:00	13:00	15:35		-
5/1/98	Mon	KWX 417	15916	15973	57	37	0	1.54	8:00	17:40	9:40	MADARAKA	2	12:10	17:10			The work load was not much,we collected one near and filled with the old for second trip.
6/1/98	Tue	KWX 417	15989	16013	24	24	0	1.00	7:45	16:00	8:15	DANDORA (I)	2	14:10	15:20			There was not much work load today therefor we finish a bit early and also went round the Estate door to door.
7/1/98	Wed	KWX 417	16027	16077	50	39	0.25	1.28	7:45	17:00	9:15	KAYABA	2	11:30	15:55			The cleaning was okay.
Ave.					48.7	28.1	0.08	1.73	7:52	16:47	8:55		2.5	11:15	14:45	16:23		

	Fuel Ave. (l/day)	Fuel Consumption (km/l)	Ave. Operation Time (hr./day)	No. of trip Ave.
MADARAKA	31.8	1.83	9:03	2.0
DANDORA (I)	18.9	1.48	8:34	2.9
KAYABA	37.4	1.85	9:07	2.6

▨ :Operation with plastic bags

□ :Operation without plastic bags

Summary of the Daily Operation of the Experimental Collection Work

Date	Day	Vehicl No.	Mileage (km)			Fuel (l)		Fuel consumption	Time (hr.)			Collection Area	No.of trip	Tipping time				Remarks
			Start	Close	Difference	Diesel	Oil		Out	In	Difference			1st	2nd	3rd	4th	
8/12/97	Mon	KWX 417	14199	14246	47	15	0	3.13	8:15	16:25	8:10	MADARAKA	2	11:45	15:15			No mechanical problems.
9/12/97	Tue	KWX 417	14255	14290	35	21	0.5	1.67	8:00	16:30	8:30	DANDORA (I)	3	11:15	13:35	16:05		Work was well done.
10/12/97	Wed	KWX 417	14305	14377	72	36	0	2.00	8:25	17:20	8:55	KAYABA	3	10:30	13:40	16:50		We managed three loads but the loader were too much exhausted and got late in the evening
11/12/97	Thu	KWX 417	14386	14435	49	27	0	1.81	8:00	17:00	9:00	MADARAKA	2	12:35	16:50			Most of the Cubicles were full of the old refuse e.g No's 13,14,15,18,19,20, 25,26,41,42,39,40,38,37,33,34,35,30,29,28,27 and No's 43
12/12/97	Fri	KWX 417	14440	14452	12	16	0	0.75	8:00	16:30	8:30	DANDORA (Eastern)	3	11:10	13:20	16:10		We manage to cleare most of the garbage near the river although there is still more to be collected
13/12/97	Sat	KWX 417	14456	14508	52	23	0	2.26	8:00	17:00	9:00	KAYABA(Southern)	2	11:15	15:40			The operation was Oky for we cleaned Bisita roadaside Kayaba village and also the ones inside Dandora estate
14/12/97	Sun	KWX 417	14614	14678	64	37	0	1.73	7:45	17:00	9:15	MADARAKA(Western)	2	10.55	15:20			-
15/12/97	Mon	KWX 417	14687	14759	72	37	0.25	1.95	8:00	17:00	9:00	MADARAKA(Western)	2	11:20	15:20			We collected up to Cubicle No.1
16/12/97	Tue	KWX 417	14764	14791	27	21	0	1.29	7:45	17:00	9:15	DANDORA	3	11:05	13:55	16:00		Cleaner it. Dandora should be educated on our operations not to play out our Pegs.
17/12/97	Wed	KWX 417	14867	14924	57	38	0.25	1.50	7:40	16:30	8:50	KAYABA(Southern)	3	10:15	13:10	16:05		-
18/12/97	Thu	KWX 417	14931	14989	58	34	0	1.71	7:42	17:00	9:18	MADARAKA(Western)	2	11:00	15:45			Most of the Cubicles from 27 to 46 and still having the old refuse
19/12/97	Fri	KWX 417	14989	15015	26	17	0	1.53	7:52	16:00	8:08	DANDORA	4	10:25	12:50	15:05	15:45	The loaders complained that the work is too much for them.
20/12/97	Sat	KWX 417	15023	15105	82	41	0.25	2.00	7:40	18:00	10:20	KAYABA	3	10:40	15:15	17:35		-
21/12/97	Sun	KWX 417	15112	15136	24	22	0	1.09	7:40	16:00	8:20	DANDORA	3	9:40	11:50	17:50		-
22/12/97	Mon	KWX 417	15143	15211	68	31	-	2.00	8:03	17:30	9:27	MADARAKA(Western)	2	12:15	17:05			-
23/12/97	Tue	KWX 417	15183	15261	78	38	0	2.05	7:45	17:40	9:55	KAYABA	3	10.30	15:10	16:35		Speedometer fixed and also also the sitter.
24/12/97	Wed	KWX 417	15268	15294	26	18	0.25	1.44	8:00	16:32	8:32	DANDORA (I)	3	10:00	12:35	15:55		-
25/12/97	Thu	KWX 417	15310	15361	51	16	0	3.19	7:45	16:45	9:00	MADARAKA	2	11:15	15:30			Garbage deposition average (50-80)
26/12/97	Fri	KWX 417	15376	15410	34	15	0	2.27	7:45	16:50	9:05	DANDORA (I)	3	11:50	14:50	16:20		The weather was too wet and we had to collect some garbage from the ground
27/12/97	Sat	KWX 417	15429	-		-	-	-	7:45	16:00	8:15	KAYABA	2	11:20	15:30			There was not much garbage for most people have gone up country for christmass holidays.
28/12/97	Sun	KWX 417	15506	15538	32	18	0	1.78	7:45	15:30	7:45	DANDORA (I)	2	11:20	14:35			There was not much garbage in that area.
31/12/97	Wed	KWX 417	15574	15636	62	47	0	1.32	7:55	16:30	8:35	MADARAKA	2	11:45	15:55			-
1/1/98	Thu	KWX 417	15651	15675	24	10	0.5	2.40	7:45	17:00	9:15	DANDORA	3	10:45	13:25	16:30		Deliverance of waste in paper bags average.
2/1/98	Fri	KWX 417	15696	15749	53	34	0	1.56	7:54	16:55	9:01	MADARAKA	2	12:50	16:25			We collected are load of old garbage and on of old on block MF 38.
3/1/98	Sat	KWX 417	15765	15849	81	47	0	1.79	8:06	17:30	9:24	KAYABA	3	11.00	13:50	17.00		The work load was too much for the loaders although the finished collecting all the pegas.
4/1/98	Sun	KWX 417	15866	15909	43	26	0	1.65	7:45	16:30	8:45	DANDORA (I)	3	10.00	13:00	15:35		-
5/1/98	Mon	KWX 417	15916	15973	57	37	0	1.54	8:00	17:40	9:40	MADARAKA	2	12:10	17:10			The work load was not much,we collected one near and filled with the old for second trip.
6/1/98	Tue	KWX 417	15989	16013	24	24	0	1.00	7:45	16:00	8:15	DANDORA (I)	2	14:10	15:20			There was not much work load today therefor we finish a bit early and also went round the Estate door to door.
7/1/98	Wed	KWX 417	16027	16077	50	39	0.25	1.28	7:45	17:00	9:15	KAYABA	2	11:30	15:55			The cleaning was okay.
Ave.					48.7	28.1	0.08	1.73	7:52	16:47	8:55		2.5	11:15	14:45	16:23		

	Fuel Ave. (l/day)	Fuel Consumption (km/l)	Ave. Operation Time (hr./day)	No. of trip Ave.
MADARAKA	31.8	1.83	9:03	2.0
DANDORA (I)	18.9	1.48	8:34	2.9
KAYABA	37.4	1.85	9:07	2.6

□:Operation with plastic bags

□:Operation without plastic bags

5.5

CALCULATION RESULTS OF THE WASTE AMOUNT TO BE COLLECTED

The Amount of Waste to be Collected by NCC and Private
(One Final Disposal Site without Transfer Station; 100% Collection)

Unit: ton/day

No.	Location	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008
A1	Makadara	42	43	44	45	46	47	48	49	50	51	52	53
	Kaloleni/Makongeni	3	3	3	4	4	4	4	4	4	5	5	5
	Maringo/Mibotela	16	16	16	17	17	17	17	18	18	18	19	19
	Bahati	19	20	20	21	21	21	22	22	22	23	23	23
	Pumwani	7	8	8	8	8	9	9	10	10	11	12	13
	Eastleigh	72	73	75	76	78	80	82	84	87	89	91	94
	Kamukunji	22	23	23	23	25	25	26	27	28	28	29	30
Total		181	186	189	194	199	203	208	214	219	225	231	237
A2	Viwanda	16	17	17	17	18	18	18	19	19	20	20	21
	Mugumoini	74	77	81	85	90	96	102	109	117	124	133	142
Total		90	94	98	102	108	114	120	128	136	144	153	163
A3	Kibera/Woodley	32	33	34	35	38	40	42	45	48	51	54	58
	Waithaka	27	29	31	33	36	38	41	44	48	51	55	59
	Kangemi	71	76	81	87	93	100	107	115	124	133	143	153
	Riruta	35	38	41	43	47	50	54	58	62	67	72	77
	Kawangware	26	28	29	31	34	36	38	41	44	47	51	54
	Mutuini	24	26	27	29	32	34	37	39	42	46	49	53
Total		215	230	243	258	280	298	319	342	368	395	424	454
A4	Mathare	33	33	34	35	36	36	36	37	38	39	39	40
	Kahara	56	61	67	72	77	82	87	93	99	106	113	120
	Roysambu	56	58	61	63	67	72	76	81	87	93	99	105
Total		145	152	162	170	180	190	199	211	224	238	251	265
A5	Embakasi	92	98	105	113	121	129	139	149	160	172	184	198
	Njiru	202	223	244	267	287	309	332	363	385	415	447	481
	Dandora	26	27	29	31	33	35	37	40	42	45	48	51
	Kariobangi	21	23	24	25	27	28	30	31	33	35	37	39
	Kasarani (Ruaraka)	65	69	73	77	81	85	89	94	99	105	111	118
Total		406	440	475	513	549	586	627	677	719	772	827	887
A-Total		1037	1102	1167	1237	1316	1391	1473	1572	1666	1774	1886	2006

No.	Location	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008
B1	Starehe	125	129	134	138	145	152	159	167	174	183	192	202
B2	Ngara	38	39	40	41	43	46	49	52	55	58	62	66
B3	Kenyatta/Golf Course	13	13	13	14	15	16	17	18	19	20	21	22
B4	Parklands (excl.Muthaiga)	120	126	133	139	148	158	168	180	192	205	219	234
B5	Kilimani	34	35	35	36	39	41	44	47	50	53	57	61
B6	Muthaiga	14	16	17	19	20	21	23	24	26	28	30	31
B7	Karen/Langata	47	52	56	61	66	71	76	82	88	95	102	110
B-Total		391	410	428	448	476	505	536	570	604	642	683	726
PSI collection ratio						11%	10%	10%	11%	11%	19%	19%	21%
Grand Total (A+B)*		1426	1509	1595	1684	1785	1893	2009	2141	2269	2413	2566	2730
Total PSI collection ratio		20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%
Total amount by all PSI			302	319	337	357	379	402	428	454	483	513	546
Total amount by reduction			0	8	17	27	38	50	64	79	97	115	137
Total amount by NCC			1207	1268	1330	1401	1477	1557	1649	1736	1834	1937	2048

Note: *Grand total is not necessarily equal to total of "A" and "B" due to rounding.

*Highlighted areas above indicate target waste amount by contracted private collectors.

The Amount of Waste to be Collected by NCC and Private
(Two Final Disposal Sites with Transfer Station; 100% Collection)

Unit: ton/day

No.	Location	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008
A1	Makadara	42	43	44	45	46	47	48	49	50	51	52	53
	Kaloleni/Makongeni	3	3	3	4	4	4	4	4	4	5	5	5
	Maringo/Mbotela	16	16	16	17	17	17	17	18	18	18	19	19
	Bahati	19	20	20	21	21	21	22	22	22	23	23	23
	Pumwani	7	8	8	8	8	9	9	10	10	11	12	13
	Eastleigh	72	73	75	76	78	80	82	84	87	89	91	94
	Kamukunji	22	23	23	23	25	25	26	27	28	28	29	30
Total		181	186	189	194	199	203	208	214	219	225	231	237
A2	Viwanda	16	17	17	17	18	18	18	19	19	20	20	21
	Mugumoini	74	77	81	85	90	96	102	109	117	124	133	142
Total		90	94	98	102	108	114	120	128	136	144	153	163
A3	Kibera/Woodley	32	33	34	35	38	40	42	45	48	51	54	58
	Waithaka	27	29	31	33	36	38	41	44	48	51	55	59
	Kangemi	71	76	81	87	93	100	107	115	124	133	143	153
	Riruta	35	38	41	43	47	50	54	58	62	67	72	77
	Kawangware	26	28	29	31	34	36	38	41	44	47	51	54
	Mutuini	24	26	27	29	32	34	37	39	42	46	49	53
Total		215	230	243	258	280	298	319	342	368	395	424	454
A4	Mathare	33	33	34	35	36	36	36	37	38	39	39	40
	Kahara	56	61	67	72	77	82	87	93	99	106	113	120
	Roysambu	56	58	61	63	67	72	76	81	87	93	99	105
Total		145	152	162	170	180	190	199	211	224	238	251	265
A5	Embakasi	92	98	105	113	121	129	139	149	160	172	184	198
	Njiru	202	223	244	267	287	309	332	363	385	415	447	481
	Dandora	26	27	29	31	33	35	37	40	42	45	48	51
	Kariobangi	21	23	24	25	27	28	30	31	33	35	37	39
	Kasarani (Ruaraka)	65	69	73	77	81	85	89	94	99	105	111	118
Total		406	440	475	513	549	586	627	677	719	772	827	887
A-Total		1037	1102	1167	1237	1316	1391	1473	1572	1666	1774	1886	2006

No.	Location	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008
B1	Starehe	125	129	134	138	145	152	159	167	174	183	192	202
B2	Ngara	38	39	40	41	43	46	49	52	55	58	62	66
B3	Kenyatta/Golf Course	13	13	13	14	15	16	17	18	19	20	21	22
B4	Parklands (excl.Muthaiga)	120	126	133	139	148	158	168	180	192	205	219	234
B5	Kilimani	34	35	35	36	39	41	44	47	50	53	57	61
B6	Muthaiga	14	16	17	19	20	21	23	24	26	28	30	31
B7	Karen/Langata	47	52	56	61	66	71	76	82	88	95	102	110
B-Total		391	410	428	448	476	505	536	570	604	642	683	726
PSI collection ratio						11%	10%	10%	11%	11%	19%	19%	21%
Grand Total (A+B)*		1426	1509	1595	1684	1785	1893	2009	2141	2269	2413	2566	2730
Total PSI collection ratio		20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%
Total amount by all PSI			302	319	337	357	379	402	428	454	483	513	546
Total amount by reduction			0	8	17	27	38	50	64	79	97	115	137
Total amount by NCC			1207	1268	1330	1401	1477	1557	1649	1736	1834	1937	2048
Ruai Total		732	778	826	877	928	979	1034	1102	1162	1235	1309	1389
Ngong Forest Total		694	731	769	807	857	914	975	1039	1107	1178	1257	1341
Total PSI collection ratio		20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%
Total amount by all PSI			302	319	337	357	379	402	428	454	483	513	546
Total PSI for Ruai			156	165	175	186	196	207	220	232	247	262	278
Total PSI for Ngong			146	154	161	171	183	195	208	221	236	251	268
Total amount by reduction			0	8	17	27	38	50	64	79	97	115	137
Total reduction for Ruai			0	4	9	14	20	26	33	41	49	59	69
Total reduction for Ngong			0	4	8	13	18	24	31	39	47	57	67
Total amount by NCC			1207	1268	1330	1401	1477	1557	1649	1736	1834	1937	2048
Total NCC for Ruai			622	657	693	728	764	801	849	889	939	988	1042
Total NCC for Ngong			585	611	638	673	713	756	800	847	895	949	1006

Note: *Grand total is not necessarily equal to total of "A" and "B" due to rounding.

Rual Only (Inirect transport - Collection ratio: 100%)

Year	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008
Total amount for collection		1207	1268	1330	1401	1477	1557	1649	1736	1834	1937	2048
Amount for direct trans.		622	657	693	728	764	801	849	889	939	988	1042
Amount for indirect trans.		585	611	638	673	713	756	800	847	895	949	1006
Total amount from T/S (t/d)		731	765	799	844	896	951	1008	1068	1131	1200	1274
Direct trans.												
Collection by containers (t/d)		311	328	346	364	382	401	424	444	469	494	521
Collection by side loaders (t/d)		187	197	208	219	229	240	255	267	282	296	313
Collection by tippers (t/d)		124	131	139	146	153	160	170	178	188	198	208
Indirect trans.												
Collection by containers (t/d)		292	306	319	336	356	378	400	423	448	475	503
Collection by side loaders (t/d)		175	183	191	202	214	227	240	254	269	285	302
Collection by tippers (t/d)		117	122	128	135	143	151	160	169	179	190	201
Required No. of cont. trucks		82	86	91	96	101	106	112	118	125	132	139
Required No. of side loaders		40	42	44	46	49	51	54	57	60	64	67
Required No. of tippers		19	20	21	22	23	24	26	27	28	30	32
Required No. of trailer trucks		23	24	25	27	28	30	32	34	36	38	40
Required No. of containers		1853	1947	2042	2151	2267	2390	2531	2665	2815	2974	3143
Required No. of wheel loaders		19	20	21	22	23	24	26	27	28	30	32
Required No. of sprinklers		3	3	3	4	4	4	4	4	5	5	5
Required No. of inspection cars		22	22	22	22	22	22	22	22	22	22	22
Required No. of tow trucks		1	1	1	1	1	1	2	2	2	2	2
Required No. of parking lots		6	6	6	6	6	6	6	6	6	6	6
Required No. of drivers		212	221	231	242	253	265	279	292	307	322	339
Required No. of loaders		413	433	454	478	505	533	564	595	629	665	703
Required No. of sweepers		1239	1300	1361	1435	1514	1599	1693	1785	1886	1995	2110
Required No. of supervisors		182	191	200	211	222	233	247	260	274	289	306
Required No. of headman		83	87	91	96	101	107	113	119	126	133	141

Ruai Only (Inirect transport - Collection ratio: 60-80-100%)

Year	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008
Total amount for collection		604	630	657	687	719	753	1220	1282	1351	1424	2048
Amount for direct trans.		311	326	342	357	372	388	628	657	692	726	1042
Amount for indirect trans.		292	304	315	330	347	366	592	625	660	698	1006
Total amount from T/S (t/d)		439	458	476	501	530	561	800	847	895	949	1274
Direct trans.												
Collection by containers (t/d)		156	163	171	179	186	194	314	328	346	363	521
Collection by side loaders (t/d)		93	98	103	107	112	116	188	197	207	218	313
Collection by tippers (t/d)		62	65	68	71	74	78	126	131	138	145	208
Indirect trans.												
Collection by containers (t/d)		146	152	157	165	174	183	296	313	330	349	503
Collection by side loaders (t/d)		88	91	94	99	104	110	178	188	198	209	302
Collection by tippers (t/d)		58	61	63	66	69	73	118	125	132	140	201
Required No. of cont. trucks		41	43	45	47	49	51	83	87	92	97	139
Required No. of side loaders		20	21	22	23	24	25	40	42	45	47	67
Required No. of tippers		9	10	10	11	11	12	19	20	21	22	32
Required No. of trailer trucks		14	15	15	16	17	18	25	27	28	30	40
Required No. of containers		927	967	1008	1055	1104	1156	1873	1968	2074	2186	3143
Required No. of wheel loaders		9	10	10	11	11	12	19	20	21	22	32
Required No. of sprinklers		2	2	2	2	2	2	3	3	3	4	5
Required No. of inspection cars		22	22	22	22	22	22	22	22	22	22	22
Required No. of tow trucks		1	1	1	1	1	1	2	2	2	2	2
Required No. of parking lots		6	6	6	6	6	6	6	6	6	6	6
Required No. of drivers		120	124	128	133	137	143	214	223	233	244	339
Required No. of loaders		206	215	224	235	246	258	418	439	463	489	703
Required No. of sweepers		619	646	672	704	738	774	1253	1318	1390	1466	2110
Required No. of supervisors		92	96	100	104	109	114	183	192	203	213	306
Required No. of headman		41	43	45	47	49	52	84	88	93	98	141

Ruai Only (Inirect transport - Collection ratio: 40-50-60%)

Year	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008
Total amount for collection		302	311	320	330	341	352	578	601	627	654	956
Amount for direct trans.		156	161	167	172	176	181	298	308	321	334	486
Amount for indirect trans.		146	150	153	159	165	171	281	293	306	321	469
Total amount from T/S (t/d)		168	172	175	181	187	193	303	315	328	343	491
Direct trans.												
Collection by containers (t/d)		78	81	83	86	88	90	149	154	161	167	243
Collection by side loaders (t/d)		47	48	50	52	53	54	89	92	96	100	146
Collection by tippers (t/d)		31	32	33	34	35	36	60	62	64	67	97
Indirect trans.												
Collection by containers (t/d)		73	75	77	79	82	85	140	147	153	160	235
Collection by side loaders (t/d)		44	45	46	48	49	51	84	88	92	96	141
Collection by tippers (t/d)		29	30	31	32	33	34	56	59	61	64	94
Required No. of cont. trucks		21	21	22	23	23	24	39	41	43	44	65
Required No. of side loaders		10	10	11	11	11	12	19	20	21	22	31
Required No. of tippers		5	5	5	5	5	5	9	9	10	10	15
Required No. of trailer trucks		5	5	6	6	6	6	10	10	10	11	16
Required No. of containers		463	477	491	507	523	540	887	923	963	1004	1467
Required No. of wheel loaders		5	5	5	5	5	5	9	9	10	10	15
Required No. of sprinklers		1	1	1	1	1	1	1	2	2	2	2
Required No. of inspection cars		22	22	22	22	22	22	22	22	22	22	22
Required No. of tow trucks		1	1	1	1	1	1	2	2	2	2	2
Required No. of parking lots		6	6	6	6	6	6	6	6	6	6	6
Required No. of drivers		74	75	77	78	80	81	116	119	123	127	173
Required No. of loaders		103	106	109	113	116	120	198	206	215	225	328
Required No. of sweepers		310	319	327	338	349	361	594	618	645	674	984
Required No. of supervisors		47	48	50	51	53	54	88	91	95	99	144
Required No. of headman		21	21	22	23	23	24	40	41	43	45	66

Ruai Only (Direct transport 1998-2003, Indirect transport 2004-2008, Collection ratio: 60-80-100%)

Year	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008
Total amount for collection		604	630	657	687	719	753	1220	1282	1351	1424	2018
Amount for direct trans.		604	630	657	687	719	753	628	657	692	726	1042
Amount for indirect trans.		0	0	0	0	0	0	592	625	660	698	1006
Total amount from T/S (t/d)		0	0	0	0	0	0	800	847	895	949	1274
Direct trans.												
Collection by containers (t/d)		302	315	328	344	360	377	314	328	346	363	521
Collection by side loaders (t/d)		181	189	197	206	216	226	188	197	207	218	313
Collection by tippers (t/d)		121	126	131	137	144	151	126	131	138	145	208
Indirect trans.												
Collection by containers (t/d)		0	0	0	0	0	0	296	313	330	349	503
Collection by side loaders (t/d)		0	0	0	0	0	0	178	188	198	209	302
Collection by tippers (t/d)		0	0	0	0	0	0	118	125	132	140	201
Required No. of cont. trucks		49	51	53	56	58	61	83	87	92	97	139
Required No. of side loaders		25	26	27	29	30	31	40	42	45	47	67
Required No. of tippers		11	12	12	13	13	14	19	20	21	22	32
Required No. of trailer trucks		0	0	0	0	0	0	25	27	28	30	40
Required No. of containers		927	967	1008	1055	1104	1156	1873	1968	2074	2186	3143
Required No. of wheel loaders		11	12	12	13	13	14	19	20	21	22	32
Required No. of sprinklers		2	2	2	2	2	2	3	3	3	4	5
Required No. of inspection cars		22	22	22	22	22	22	22	22	22	22	22
Required No. of tow trucks		1	1	1	1	1	1	2	2	2	2	2
Required No. of parking lots		6	6	6	6	6	6	6	6	6	6	6
Required No. of drivers		138	143	148	154	160	166	214	223	233	244	339
Required No. of loaders		255	267	277	298	309	322	418	439	463	489	703
Required No. of sweepers		765	801	831	894	927	966	1253	1318	1390	1466	2110
Required No. of supervisors		111	115	120	126	131	138	183	192	203	213	306
Required No. of headman		51	53	55	60	62	64	84	88	93	98	141

Ruai Only (Direct transport 1998-2003, Indirect transport 2004-2008, Collection ratio: 40-50-60%)

Year	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008
Total amount for collection		302	311	320	330	341	352	578	601	627	654	956
Amount for direct trans.		302	311	320	330	341	352	298	308	321	334	486
Amount for indirect trans.		0	0	0	0	0	0	281	293	306	321	469
Total amount from T/S (t/d)		0	0	0	0	0	0	303	315	328	343	491
Direct trans.												
Collection by containers (t/d)		151	156	160	165	170	176	149	154	161	167	243
Collection by side loaders (t/d)		91	93	96	99	102	105	89	92	96	100	146
Collection by tippers (t/d)		60	62	64	66	68	70	60	62	64	67	97
Indirect trans.												
Collection by containers (t/d)		0	0	0	0	0	0	140	147	153	160	235
Collection by side loaders (t/d)		0	0	0	0	0	0	84	88	92	96	141
Collection by tippers (t/d)		0	0	0	0	0	0	56	59	61	64	94
Required No. of cont. trucks		25	25	26	27	28	29	39	41	43	44	65
Required No. of side loaders		13	13	13	14	14	15	19	20	21	22	31
Required No. of tippers		6	6	6	6	6	7	9	9	10	10	15
Required No. of trailer trucks		0	0	0	0	0	0	10	10	10	11	16
Required No. of containers		463	477	491	507	523	540	887	923	963	1004	1467
Required No. of wheel loaders		6	6	6	6	6	7	9	9	10	10	15
Required No. of sprinklers		1	1	1	1	1	1	1	2	2	2	2
Required No. of inspection cars		22	22	22	22	22	22	22	22	22	22	22
Required No. of tow trucks		1	1	1	1	1	1	2	2	2	2	2
Required No. of parking lots		6	6	6	6	6	6	6	6	6	6	6
Required No. of drivers		83	85	86	88	90	92	116	119	123	127	173
Required No. of loaders		128	132	135	143	146	150	198	206	215	225	328
Required No. of sweepers		384	396	405	429	438	450	594	618	645	674	984
Required No. of supervisors		56	58	60	61	63	65	88	91	95	99	144
Required No. of headman		26	26	27	29	29	30	40	41	43	45	66

DATA BOOK 6

ENVIRONMENTAL CONSIDERATIONS

6.1
ENVIRONMENTAL QUALITY OF NAIROBI CITY

6.1.1 Private Companies Disposing Wastes at Dandora Disposal Site (1985)

6.1.2 Existing Laws Relevant to Environment in Kenya

Table 6.1-1 Private Companies Disposing Wastes at Dandora Disposal Site(1985)

1. BAT(Kenya Ltd.)-Waste paper and tobacco.
2. East African Industries-Waste wrapping paper for toilet soaps.
   Oil wastes
3. Kamiti Tanners- Tannery wastes
4. ABM-(Battery Manufactures) Waste Batter shells, waste paper
5. Firestone- Rubber waste and paper.
6. Insteel- (manufactures of galvanized iron sheets and nails)
7. Kenya Engineering-saw dust and wood sharing
8. Car & General-Rubber wastes
9. Implala Glass mart-broken glass
10. Panplastics - polyurethane wastes
11. General Printers - Waste paper
12. Silent night - saw dust, wastes from mattresses
13. Elephant Soap Factory-Charcoal & Ashes
14. NAS- Food wastes
15. Wood products - saw dust & pieces of timber
16. General Motors - waste paper, timber, plastic, etc.
17. Marshall E.A. Ltd. - Motor vehicle workshop wastes.
18. Nalin Investment - plastic pipes manufactures (waste pipes)
19. Crescent Investments - waste carbon papers
20. Madhupaper - waste paper
21. Kenya paper - waste paper
22. Mopper plastic - waste plastic materials
23. Wacco builders - debris
24. Elliots - waste bread and wrapping paper
25. Standard confectioners - waste bread and wrapping paper
26. Mother's choice - waste bread and wrapping paper
27. East A. Oxygen-Waste chalk
28. Avon Rubber-Rubber wastes
29. Pearl Dry Cleaners-Laundry wastes
30. Mecco - furniture manufacturers - timber and saw dust
31. Chai Ltd. - waste plastic and tea
32. Notco - waste paper
33. Kenya oil- Sunoil seed husks
34. Susana products - waste beauty products (tins, etc)
35. Cocacola - broken bottles
36. Power & lighting - waste paper, tree cuttings
37. Post Office - waste paper and tree cuttings
38. C.M.C.-Motor vehicle workshop wastes
39. Achilles - waste foods
40. Ceramic - waste ceramics
41. Hiltong hotel - food wastes
42. Mawani - battery shells
43. Kenya Inland container - terminal waste paper and cardboard

Source: Proyect of Waste Management in the towns of
Nairobi, Mombasa, Nakuro, Kisumu and Eldoret
Year 1985

Table 6.1-2 Existing Laws Relevant to Environment in Kenya

Conservation Laws	Chapter
The Water Act	372
The Agriculture Act	318
The Forest Act	385
The Land Planning Act	303
The Fish Industry Act	324
The Local Government Act	265
The Town Planning Act	134
The Lakes and Rivers Act	409
The Government Fisheries Protection Act	379
The Kerio Valley Development Authority Act	441
The Lake Basin Development Authority Act	442
The Tana and Athi Rivers Development Authori	443
The Wildlife Conservation and Management Act	376
The Grass Fires Act	327
Pollution Control Laws	
The Water Act	372
The Public Health Act	242
The Factories Act	514
The Food, Drugs and Chemical Substances Act	254
The Pharmacy and Poisons Act	244
The Use of Poisonous Substances Act	247
The Cattle Cleansing Act	319
The Fertilizers and Animal Foodstuffs Act	345
The Agricultural Produce (Export) Act	319
The Pests Control Products Act	346
The Radiation Act	245
The Traffic Act	403
The Penal Code	63
The Merchant Shipping Act	389
The Kenya Bureau of Standards Act	496

6.1.3 Photographs

HIGH INCOME AREA

Langata	Spring Valley
	
Open space used as dumping site and for recycling	Storage points of bins. Note the presence of scavenger. Regular collecby private sector
Loresho	**Kitusuri**
	
Bins storage in front of the house. Regular collection is provided by NCC	Every resident manage their waste individually

MIDDLE INCOME AREA

Ngara East 1	Ngara East 2
	
Open space used as dumping site	Open dumping site along the road side. Note the population coexisting with the waste. Down to this place can be found Nairobi River
Ngara East 3	**Madaraka East 1**
	
Kariokor market waste, mainly chicken waste with bad odour. Presence of flies and many people around	Open container full of waste. No regular collection is provided

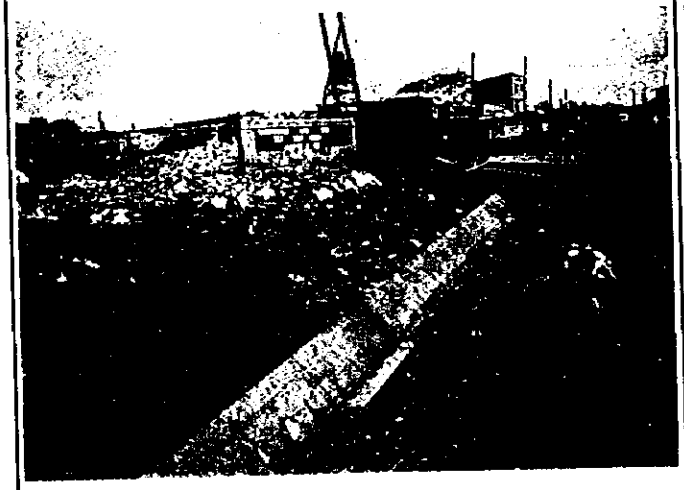
MIDDLE INCOME AREA

Madaraka East 2	Ngumo
	
Waste cubicle for storage. No regular collection is provided. Flies and smell are very common in the place	Open dumping site on the road. Note the presence of scavengers and how is worsened the view of the place
Uhuru	**Kahawa West**
	
Open space left for a park. Actually act as open dumping site. No only residents but also private trucks dispose of here the waste	Open dumping site on the road. Note the presence of animals and people living with the waste

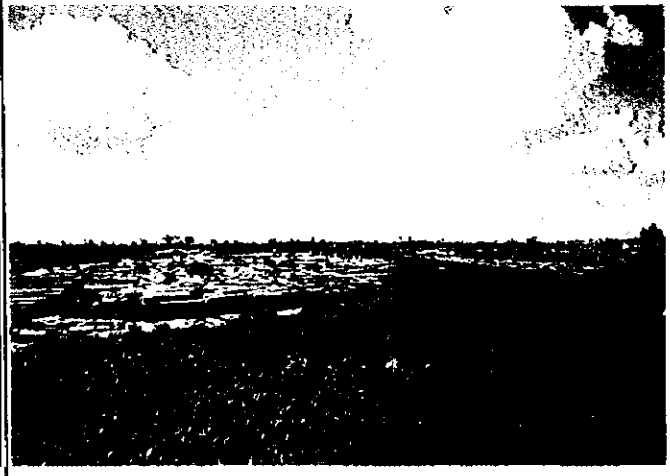
LOW INCOME AREA

East Leigh 1	East Leigh 2
	
Open dumping site along the road. Note the presence of may pedestrian. The open channels used for the drainage are completed blocked by the waste	Open dumping site on the road. Note how is worsened the view of the place
Kariobangi 1	**Kariobangi 2**
	
Open dumping site along the road. Note how road is blocked by waste	Open space used as recycling place. Smell characteristic could be noted due to the fermentation

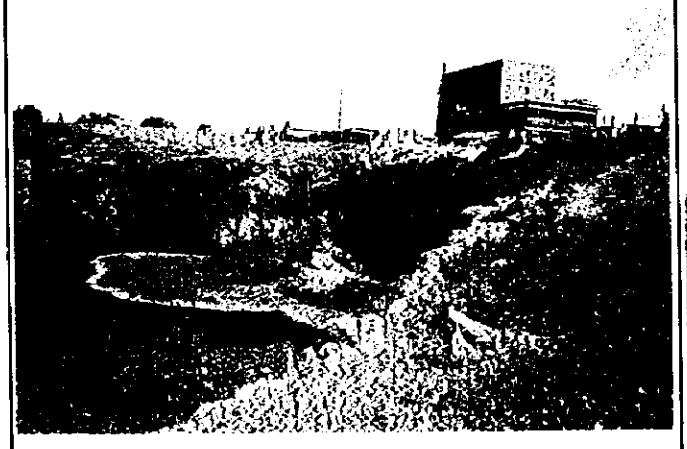
LOW INCOME AREA

Dandora 1	Dandora 2
	
Open dumping site along the road. Drainage channel often is blocked by waste. Bad odour and smoke and presence of flies is the daily panorama of the place	Open dumping site along the road side. Flies, smoke and smell are the major complaint of the people living next to the site
Kawangware 1	**Kawangware 2**
	
Open container for waste storage. Animals eating the waste is very common in the place	This child intended to discharge the waste into the drainage channel but he couldn't because the woman has ordered him to take the waste to the dumping site

SLUMS AREA

Kibera 1	Kibera 2
	
Open dumping site along the road side. Residents from the slum bring here their waste	Overview of the slum near to Nairobi dam
Mathare South 1	**Mathare South 2**
	
Open space used as open dumping site. Animals and people live with the waste	Overview of the slum

SLUMS AREA (cont.)

Kayaba 1	Kayaba 2
	
Open dumping site along the road side. Residents from the slum bring here their waste	Entrance to the slum
Korogocho 1	**Korogocho 2**
	
Open dumping site along the road side and next to a abandoned quarry in which finally waste are disposed of polluting water which is used by some residents. Waste is brought to this place by slum's residents	Inside the slum, the scattering of waste and sewage are very common

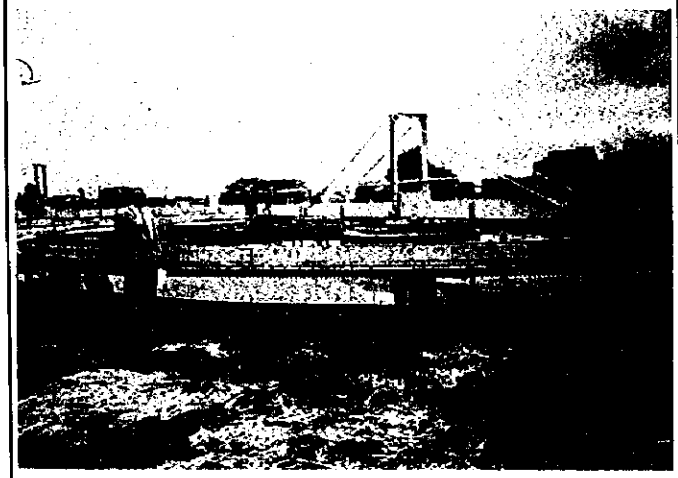
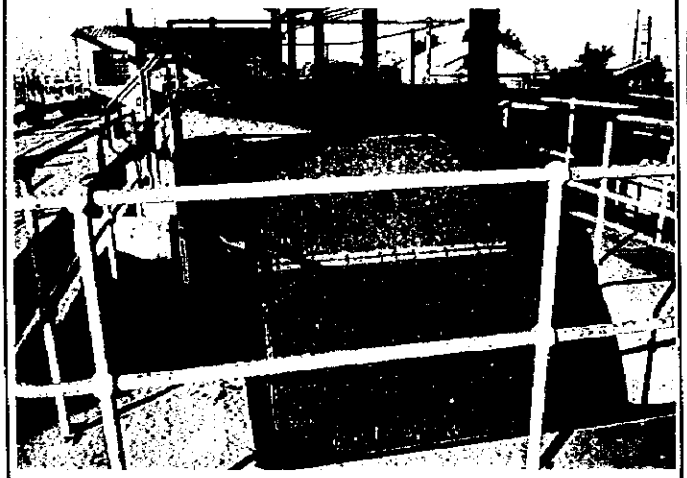
OTHERS

Dandora Disposal Site 1	Dandora Disposal Site 2
	
The burning method is very common in Dandora refuse tip as a way of reducing the amount of waste dumped there	This picture shows the discharge of waste before reaching the disposal site. This common practice permits the scattering of waste outside of the disposal site
Oxics Gospel Church (informal primary school)	Jamhuri Forest
	
This is one of the schools located next to the disposal site	While surveying it was observed that illegal dumping into the forest is also practiced by residents and industrial sector

SAMPLING ON MAJORS RIVERS OF NAIROBI CITY FOR WATER QUALITY ANALYSIS

1	2
	
Affluent of Nairobi River on James Gichuru Road	Measurement of water quality
2	4
	
Affluent of Ngong River	Nairobi River on Outer Ring Road

SEWAGE TREATMENT FACILITIES

Sewage Treatment Plan at Kariobangi 1	Sewage Treatment Plan at Kariobangi 2
	
Tank for sedimentation	Drying beds for sludge
Sewage Treatment Plant at Dandora Estate 1	**Sewage Treatment Plant at Dandora Estate 2**
	
Inlet works	Stabilisation Lagoons