

Solid Waste Management Case Study

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Project

Solid Waste Collection, Transfer and Disposal, Sohag City

Introduction

A waste collection service was implemented in a number of low income, densely populated areas in Sohag City. Approximately 70,000 people, or about 40% of the population of Sohag City, now benefit from the new system.

Prior to implementation, a large number of the residents had expressed dissatisfaction with the waste management service. Waste collection was irregular, collection trucks were inadequate and unsuitable for working in narrow streets and the levels of littering had reached alarming levels.

A cost effective waste collection and transfer system was developed by the SEAM Project in collaboration with the Sohag East and West Districts and residents. A fleet of 1.5 ton Micro Trucks proved ideal for collection in the narrow streets. Support was also provided by SEAM to strengthen the local manufacture of a tractor-trailer-container pick up system which was then used for transferring waste from the collection area to the dumpsite.



New Waste Collection System in Operation at Sohag City

Associated problems of waste disposal, vehicle maintenance and accumulated street waste were also addressed. Achieving community participation proved essential in the projects success and ongoing sustainability.

The annualised capital and operating costs for the collection and transfer equipment were LE226,138 (excluding plastic bags). Cost per household is LE1.4 per month.

Which Areas were Covered in Sohag City?

The project was implemented in five areas as follows:

Areas in Sohag City Covered by the New Waste Collection System

		Population	Comments
Sohag West	El-Makhbaz El-Ally	25,000	Residential
	Kessareya	10,000	Commercial and residential
	Ghayeteya	10,000	Commercial and residential
Sohag East	Naga Abou Shagara	15,000	Residential
	El Arqam	10,000	Residential, many hospitals and clinics

The waste collection was introduced into El-Makhabaz El-Ally and Naga Abu Shagara and progressively extended to the other three areas. The phased approach allowed time to train staff and overcome any initial operational difficulties.

How to Involve the Community?

It was recognised from the outset that the efficiency of the system would be dependent upon gaining the involvement and co-operation of the community.

An initial social survey of 945 households was undertaken to get residents views on current problems and on how and when waste should be collected. At the same time the survey was aimed at identifying indicators that could be monitored over time to determine the success of the project (e.g. satisfaction levels, dirtiness of streets) and to gauge peoples views on willingness to pay for an improved service. A follow up survey was undertaken 9 months after the service had been operating. A comparison of the key findings is given below:

Key Findings of Social Survey, Before and After Implementation

	BEFORE July 97	AFTER April 98
Satisfaction with waste service	32%	85%
Collection vehicles seen in the streets	40%	85%
Street sweepers pass in the street	40%	86%
Preferred collection in plastic bags	52%	73%
in bins	7%	NA
Preferred time for morning collection	8-10.00 (50%)	7-9.00 (97%)
Willingness to pay for improved service	70%	59%
Average monthly fee per household	LE1.40	LE1.03

The communitys views were incorporated into the design and operation of the waste system. In addition views were sought from the waste operators on opportunities for improvement as well as preferences for vehicles that could be more easily maintained.

A range of other activities to involve the community and to raise their awareness had been developed as follows:

- ❖ 10 large resident meetings were held to raise awareness on solid waste issues and to discuss operator and community roles in introducing the new system.
- ❖ Workshops were held with other key stakeholders including the Directorates of Health, Social Affairs and Education, religious leaders and the media to encourage their active role in raising community awareness.

- ❖ Focused group discussions were also held with waste workers, residents and key stakeholders.
- ❖ Door to door household visits were undertaken by a local NGO to disseminate waste collection bags, information leaflets and posters that explained the new system.
- ❖ Resident committees were established in the East and West Districts. The committees, comprising around 30 people, meet monthly with District officials to mutually resolve any issues and to stimulate better waste practices among residents.
- ❖ Various competitions were held for the cleanest building, cleanest street, waste collection crew of the month and a childrens art competition. A local musician also wrote a song that is played by the collection crew to alert residents of the collection service.



As Part of Community Awareness Plastic Collection Bags and Information Packs were Distributed to Residents

Developing Efficient Waste Collection and Transfer

Equipment selection and the development of the waste collection system was based on the following:

- ❖ Views expressed by the community in the initial social survey.
- ❖ Views expressed by the two respective Districts and their workers.
- ❖ Equipment that could be easily maneuvered in narrow, winding streets.
- ❖ Simple technology that can be locally maintained.
- ❖ System that is practical and affordable.

In light of the above, a cost effective collection and transfer system was designed and the equipment procured as indicated below.

Collection and Transfer Equipment

Collection Equipment			
Number	Equipment	Total Cost LE	Comments
7	1.5 ton Suzuki Micro Trucks	332,500	These small (1.6 m ³) high tipping trucks are cost effective for primary collection systems where there are short haul distances and narrow streets and where they can discharge directly into larger transfer containers. They are particularly effective with a bag collection system where bags of waste can be thrown into the body. The system is suitable for use with two workers.
21	Handcarts with bins	9,009	Work in tandem with the Suzuki trucks to sweep street waste and collect waste from very narrow passageways. Operated by 1 person and manufactured locally in the Akhmim workshop.
4	Jawa Motorcycles	17,676	For supervisors of the waste teams
110	Uniforms	4,590	Provided to the 50 District workers
2 tons	Plastic bags	23,320	Provided free to residents for the first 4 months so that they become accustomed to dispose their waste in plastic bags. Residents are now re-using plastic grocery bags.
Sub Total		387,095	

<i>Transfer Equipment</i>			
Number	Equipment	Total Cost LE	Comments
21	6 m ³ Containers	71,400	Waste is transferred to containers located in the collection areas, so that Suzuki round-trip transfer distances are ideally less than 1 km. The larger containers allow loads to be bulked up before transfer to the dumpsite. Tractors are cost effective for transporting heavy loads over short haul distances. A tractor-trailer-container pick-up system was developed in association with Mabrouk Engineering of Tanta. The hydraulic trailer/container system is designed for use behind tractors of at least 60 hp and with waste densities of 400-600 kg/m ³ . One tractor was fitted with a front end loader to remove accumulated street waste. Approximately 25 × 6 m ³ loads are transferred daily to the dumpsite, 4 km away.
3	Tractors	116,000	
4	Trailers	52,000	
	Sub Total	239,400	
	TOTAL	626,495	



Suzuki Micro Trucks, Transfer Containers and Hand carts

The new collection system operates on two shifts with the morning shift (7.00 a.m. - 3.00 p.m.) collecting waste in the residential areas. Each truck collects around five loads. A reduced afternoon shift operates with collection principally in the commercial areas (shops and main streets). Residential users of the system put waste in the plastic bags, which are placed on the street in front of their apartment blocks between 7.00 - 9.00 a.m. daily. This minimises the opportunity for waste to be scattered by scavengers and goat herders. Street sweepers also collect waste from narrow passageways and place the collected waste in bin lined handcarts. When full, the bags are tied and left on the street for collection by the Suzuki trucks. Waste collected in the Suzuki is transferred to the 6 m³ containers, which are then hauled by tractor to the dumpsite, 4 km away.



Support was Provided to Develop a Tractor-Trailer-Container System to Transfer Waste

The system is operated by the Sohag East and West Districts and employs over 50 people. Training of waste supervisors and collectors has been an integral part of the project. The Districts have paid all labour and operating costs. There are 11,000 households, which make up 85% of all premises covered by the new service, the remainder being commercial shops, offices, clinics and market stalls.

Clinical waste segregation

Often clinical waste is mixed in with municipal waste and poses health risks to those who may come in contact.

Within the El Arqam District there are four hospitals with the following bed capacity: 1) Chest - 128 beds; 2) Fever - 64 beds; 3) Endemic disease - 20 beds; and 4) Psychiatric - 20 beds. In addition there are two health care units. A system was put in place to segregate the clinical waste with separate containers being provided for sharps, clinical waste and other waste. Clinical waste and sharps are now collected twice a week and transported to a clinical waste incinerator at the Health Directorates laboratory. This has a Hoval incinerator, which was recently installed and incinerates waste at 500 °C in primary combustion and 900 °C in secondary combustion.

Awareness raising workshops were held in each of the hospitals and health clinics to inform staff of the dangers and appropriate procedures for handling clinical waste. This was undertaken in conjunction with the Directorate of Health.

Removing Accumulated Waste

There were many areas, particularly in West Sohag but also in parts of East Sohag, where large heaps of wastes had accumulated on vacant land, between blocks of apartments and even in basements of buildings. These areas had become breeding grounds for insects and rodents and were creating health hazards to residents.

Clean-up campaigns were organised to remove the accumulated street waste, involving District workers and the community and using the tractors fitted with front-end loaders. Once cleaned the area was included in the regular collection service. In addition a major awareness-raising effort was carried out, incorporating home visits, the distribution of stickers and leaflets to all households and the organisation of a clean building contest. Some sites that were cleaned were planted and turned into green areas.



Removing Accumulated Waste, Before and After

Burning Dumpsite What Can be Done?

The dumpsite for Sohag City lies beside Naga El Shamendy, a village of around 6,000 inhabitants situated about 4 km from Sohag City. The site is an old drainage canal that was designated a temporary dumpsite around five years ago.

The dumpsite posed serious health risks due to its deteriorated condition. As there was no real system of managing the waste at the site, garbage was dumped randomly and set on fire. Mounds of burning waste impeded access to the village and schools and the smoke caused many village residents to suffer respiratory problems. Hospital and clinical waste that had been dumped at the site also posed a health risk to children scavenging there.

A survey of village residents and dumpsite scavengers showed the following:

Naga El-Shamendy Village (151 interviewed)

- ❖ 92.1% felt the adjoining dumpsite affected their health.
- ❖ 89.0% indicated they suffered respiratory disease.
- ❖ 57% preferred the dumpsite to be transformed into a public park; 49% would like a building for literacy classes.
- ❖ 95% were willing to look after the area after remediation.

Scavengers (27 interviewed)

- ❖ Average age was 11 years.
- ❖ Average income from the dumpsite was LE1.90 per day.
- ❖ 68% Suffered health problems.
- ❖ 67% Suffered skin infections; and 56% gastro-enteritis.

Remedial action was taken to:

- ❖ Extinguish the fires and introduce controlled tipping.
- ❖ Remove the piles of accumulated waste.
- ❖ Level and top dress the area with 4,000 m³ of soils dredged from the irrigation canals.
- ❖ Transform the area into a public park and football field.

The above actions were done in conjunction with the Governorate, Sohag East and West Districts, and after consulting with residents, teachers and children of the nearby village and schools. 99% of residents surveyed expressed satisfaction with the remediation. 81% indicated that the positive effects were less smoke and odour.

Equipment was provided by the Districts at the dumpsite to maintain the better tipping practices. In addition a gardener has been appointed full time to look after the public garden.



Remediating the Dumpsite and Converting the Area into a Public Park

Upgrading of Maintenance Workshops

The maintenance facilities in the East and West districts of Sohag City were not able to provide the most basic vehicle servicing requirements in an adequate manner. Improving the maintenance facilities was essential to avoid:

- ❖ Poor vehicle utilisation due to excessive downtime.
- ❖ Reduced life expectancy of vehicles and equipment.

An overall plan was developed to upgrade the workshop facilities. Construction undertaken by SEAM included renovations for maintenance rooms, improved facilities for servicing vehicles and the provision of a lube bay.

A stock of spare parts for the Suzukis and sets of workshop tools were provided to both workshops. Preventive maintenance programmes are now in place and vehicle logbooks are kept not only for the Suzukis but also for the other District vehicles.

This work has resulted in:

- ❖ Improved service areas for maintaining vehicles.
- ❖ Construction of workshops and lube bays.
- ❖ Supply of workshop tools and vehicle spare parts.
- ❖ Workshop training and the introduction of preventative maintenance schedules.

Further work is planned by both District workshops including improving tools and spare part storage and paving workshop areas.



Upgrading Maintenance Facilities at District Workshops

What Does the New Collection System Cost?

Capital costs expended on the waste collection and transfer equipment are summarised below.

Capital Costs for Waste Collection and Transfer Equipment.

Item	LE
Suzuki trucks	332,500
Handcarts and bins	9,009
Supervisor motorcycles	17,676
Uniforms	4,590
6 m ³ containers	71,400
Tractors	74,000
Tractor with front end loader	42,000
Trailers	52,000
Miscellaneous tools	4,500
Bins for segregating clinical waste	5,990
Total	613,665

The above costs were met through the SEAM Project. SEAM and the Sohag East and West Districts incurred additional costs on community participatory activities, workshop upgrading, dumpsite remediation and conversion to a public garden and clinical waste segregation.

The Sohag East and West Districts have met all labour, fuel, maintenance and other operating costs, which have been recorded daily since the projects inception. To gain a better understanding of the costs for replicating the scheme a financial analysis was undertaken with capital investments being annualised at 10% real discount rate over 7 years.

The total annualised capital and operating costs are LE226,138. This reduces to LE192,217 for the 11,000 households, which comprise 85% of all premises covered by the service. Cost per household is LE1.4 per month (excluding the cost of plastic bags).

A summary of the financial analysis is as follows:

Replicable Costs for the Solid Waste Collection and Transfer System

Cost Element	LE
Capital costs	613,665
Annual Operating Costs	
Labour (on the basis of 2 shifts)	60,000
Fuel and Lubricants (based on diesel at LE0.40 per litre)	9,408
Maintenance (5% of capital costs)	30,683
Plastic bags (cost is LE4.25 per kg)	69,960
TOTAL Annual Operating Costs, including bags	170,051
TOTAL Annual Operating Costs, excluding bags	100,091
Total Annualised Capital costs (discounted at 10% over 7 years)	126,047
Total annualised capital and operating costs, including bags	296,098
Total annualised capital and operating costs, excluding bags	226,138
85% of annualised capital and operating costs attributable to households (with plastic bags)	251,683
85% of annualised capital and operating costs attributable to households (without plastic bags)	192,217
No of households covered by the service	11,000
Total costs per household per month, including bags	1.9
Total costs per household per month, excluding bags	1.4

The introduction of a user fee to cover the costs of operation is presently under consideration by the Governorate. There is also considerable interest in extending the service to other parts of the city as well as replicating the system in other urban centres.

Is the New Waste System Sustainable?

The waste system implemented was designed to be sustainable in the following ways:

- ❖ Providing suitable equipment appropriate for use in narrow, densely populated areas.
- ❖ Strengthening local technology and local fabrication that is better able to support current operations and future replication.
- ❖ Selecting equipment that can more readily serviced by the local mechanics.
- ❖ Training and improving the capacity of the workers and supervisors.
- ❖ Involving the community throughout all phases of implementation.
- ❖ Delivering a service that satisfies residents as evidenced by the dramatic increase in satisfaction levels, from 32% before to 85% after.
- ❖ In comparison with the costs of running the old system the new system is about 35% cheaper per cubic metre of waste collected.
- ❖ Upgrading maintenance capabilities and introducing preventive maintenance servicing.
- ❖ Sohag East and West Districts have met all operating costs since inception, and have used existing labour.
- ❖ 70% of residents had initially indicated a willingness to pay. Consideration is presently being given to introducing a user fee.
- ❖ Encouraging better law enforcement.

CONTACTS

More information on this project and the SEAM Project, are available from:

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The SEAM Project

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Solid Waste Management

Improving solid waste management had been identified as a high priority in the Governorates of Dakahleya and Sohag. The SEAM project developed a strategic approach to tackle the problem and funded projects that showed tangible benefits of improved waste practices.

Solid Waste Strategies

To address the issue of solid waste management, an assessment of the current waste practices has been undertaken in the Governorates of Dakahleya and Sohag. Information was collected on the type and quantity of waste generated, the present collection, separation, treatment and disposal practices as well as the institutional and social dynamics.

A strategic approach to deal with the solid waste problems was developed and priority issues identified.

Solid Waste Demonstration Projects

Solid waste demonstration projects were undertaken in both Governorates to address priority issues that had been identified in the waste strategies. Four demonstration projects were implemented covering areas of waste collection, transfer and disposal, maintenance, dumpsite remediation, recycling and composting. In all cases solutions were sought that:

- Are practical and affordable.
- Improved the efficiency of previous practices.
- Adapted the most cost effective technology to suit the purpose.
- Strengthened local capacity.
- Developed local manufacturing capability.
- Addressed sustainability issues.
- Involved the community.

As a result of the demonstration projects:

- 23,000 tons of municipal waste are collected each year.
- 45,000 tons of waste each year are recycled and converted to compost rather than being disposed to dumpsites.
- 115,000 people living in four low income urban and rural communities in Sohag and Dakahleya Governorate now benefit from improved waste collection and disposal services.
- Fires extinguished, odour and litter minimised at 2 municipal solid waste dumpsites.