

**SOLID WASTE
STREAM ANALYSIS
FOR THE
MUNICIPALITY OF
ZLATOGRAD**

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SOLID WASTE STREAM ANALYSIS FOR THE MUNICIPALITY OF ZLATOGRAD

INTRODUCTION

Effective management of municipal solid waste (MSW) and the choice of a local strategy for integrated management requires that a city identify all major factors influencing the region, i.e., to specify its geopolitical boundaries

The quality and morphologic composition of the MSW stream are among the primary factors to consider when planning for MSW management. Each municipality has its own peculiarities, so decisions for its future have to account for these characteristics

Why is it necessary to examine the waste stream generated within the municipality, to measure its quantity (in cubic meters or tons) as well as its morphological composition? Because it

- Determines the capacity requirements for future facilities
- Provides an opportunity to determine the residual storage volume for waste disposal in existing open dump areas or sanitary landfills
- Determines the materials that could be recycled, reused and reclaimed
- Determines the required number of containers for waste collection and temporary waste storage, and the capacity of waste transportation vehicles
- Provides information to the potential buyers of waste regarding the quantity and type of recyclable materials in the waste

Municipal solid waste is measured most often by weight, but can be measured by volume too. Volume measurement is an important factor in designing sanitary landfills and composting facilities or determining the capacity and number of transportation vehicles necessary

All future plans for waste management, reduction of waste generation or estimation of recyclable materials are based on waste measurement by weight (ton, kilogram)

Seasonal changes affect MSW in terms of quantity and type. For example, one and the same volume of waste will weigh more during the winter or rainy months than during the summer

Proper and reliable determination of MSW characteristics by the municipality takes a significant commitment of time and resources. However, the more data and details collected, the better the information base for effective waste management will be. In order to select the best alternative, first it is necessary to establish the type and quantity of individual waste components

It is important to bear in mind that waste flows sometimes differ between individual districts of one and the same settlement. This is especially important in comparing urban with rural areas.

Periodical waste sample taking (at least once every 5 years) will make it possible to verify the composition study results and will reflect precisely any changes that may have occurred with time.

CURRENT SITUATION

Municipality of Zlatograd - A Profile

The Municipality of Zlatograd is located in Southern Bulgaria and its southern border runs along the border of the Republic of Bulgaria with Greece. From an administrative point of view, it falls within the Plovdiv region and the former district of Smolyan (Chart 1).

The Municipality of Zlatograd includes the town of Zlatograd and the villages of Startzevo, Erma River, Alamovtzi, Fabrika, Dolen, Kushia and Strashimir.

Table 1 shows the size of the population and its recent trends.

Table 1
Population Trends of the Municipality of Zlatograd

Year	Population	Change	Percent	Births	Deaths	Immigration	Emigration
1993	15,690	+83	0.5	167	118	240	183
1994	15,737	+25	0.16	162	123	149	119
1995	15,720	+26	0.16	162	146	259	249
1996 (Q1)	15,725	-16	-0.1	26	33	51	39
1996 (Q2)	15,736	+11	0.07	39	33	69	42

In May 1996, the population of the town of Zlatograd was 8,978.

A list of the primary businesses within municipal boundaries include a major branch of a regional mining conglomerate, a textile factory, a plant producing automobile parts, a plant for metal cutting machine tools (PMCMT), tobacco processing facilities, a sewing company and a number of retail businesses.



Regional Climate

In terms of climate, the region belongs to the Continental Mediterranean climatic area, South Bulgarian climatic sub-area, Eastern Rodope low mountainous climatic area

According to data from the Zlatograd meteorological station, the annual average air temperature is 10.8° C, with average temperature highs of 20.6° C in July and average lows of 0.8° C in January, which describes a moderately warm summer and a comparatively mild winter. The extreme values of the annual average maximum and minimum temperatures are 17.1° C and 4.9° C respectively, with a maximum monthly average temperature of 28.9° C in August and a minimum monthly average temperature of 3.9° C below zero in January.

The annual average of relative air humidity is 75 percent, peaking in November at 85 percent. The number of days with relative air humidity of 30 percent or less is 13.0, while there are 62.4 days with relative air humidity of 80 percent or more. This shows favourable growth conditions for forest and grass vegetation in the region.

Annual precipitation amount for the climatic area of the landfill is 650 millimeters, which is considerably lower than the actual amount for the area of Zlatograd. According to data from the Zlatograd station, it is 78 millimeters, and the maximum monthly average in November and December is 43 millimeters and the minimum monthly average in August is 18 millimeters.

MSW Management in Bulgaria

Waste management in Bulgaria is not regulated by any single law¹. This is the main reason for the inefficient state policy regarding waste reduction, reclamation, treatment and disposal.

The Ministry of Environment has developed a draft Waste Act. It was discussed and approved by the Council of Ministers and submitted to Parliament. The Waste Draft Act establishes the competent bodies and their regulatory and supervisory authorities with regards to MSW generation and treatment activities. The competent bodies as described in the draft act are:

- Municipal Administrations (MA)
- Regional Environmental Protection Inspectorates (REPI)
- Hygienic Epidemiological Inspectorates (HEI)
- Ministry of Environment (MOE)

¹ As of May 1997

However the legislation remains an act, and the legislative approval procedure is not time limited. The lack of a legal framework prevents the implementation of any economic or administrative measures for waste minimization or reduction. Current activities include feasibility studies for such measures, persuasion and education.

Despite the lack of appropriate legislation, the Council of Ministers did enact a decree No 153 on the collection, transportation, treatment and disposal of hazardous waste on August 6, 1993.

Waste Management Tools

No legal act discusses the management of activities connected with the generation, storage, collection, transportation, treatment and disposal of solid waste. Article 20 of the Local Government and Local Administration Act (SG No 77 of 1991) defines the Municipal Council as the lead body in determining local government policies, including public utilities management and environmental protection policies. The responsibilities involved, and the supervision of this regional policy, however, are not explicitly stated in Bulgarian legislation.

Public works in settlements and other community services are treated by the Territorial, Urban and Rural Development Act (TURDA). This Act, however, does not mention MSW as an element of community services. In the Rules for Implementation of the Territorial Urban and Rural Development Act (SG No 62 of 1973), solid waste is treated as "an element of protecting the urban environment and making it more healthy for habitation."

Article 200 states "Solid waste cleaning activity in human settlements aims at creating and maintaining a high standard of sanitary culture. This activity includes collection, removal, treatment, reclamation and disposal of solid waste."

Article 201 specifies

- Collection and removal of solid waste is to be done with modern technical equipment, in compliance with sanitary requirements, and ensuring that citizens are not disturbed.
- Distances between solid waste treatment sites and populated areas are set in compliance with the adopted technology while abiding with the established zoning requirements for sanitary protection.



- (Amended - SG No 48 of 1985) These sites are constructed, located and operated on the basis of project plans approved by the Chairman of the District People Council's Executive Committee, or an official appointed by him. Projects should include measures for
 - Protection of ground and underground natural resources, and
 - Land reclamation of the respective sites and their incorporation into the surrounding environment
- Industrial solid waste treatment is implemented on the basis of approved projects. The projects also include measures for the reuse of solid waste

Issues relating to hazardous waste treatment are regulated comprehensively in Decree No 153 of the Council of Ministers

Art 8 states "Hazardous waste treatment is accomplished by individuals and legal entities possessing permits therefor"

Art 9 states that the costs for waste collection, transportation, and treatment are at the expense of the parties which generate the said waste

Arts 10, 11, 12, 13, 14 require waste generators to declare waste composition and quantity, storage and collection details, and these activities are obligatory for all generators of hazardous waste

Arts 21 - 27 deal with waste processing and treatment

Arts 33 - 38 regulate the controls over hazardous waste treatment activities

The Ministry of Environment forbids or suspends activities connected with treatment of hazardous waste resulting in environmental damage or pollution

It is necessary, however, to learn from other countries' experience and to develop specific standards for certain hazardous wastes such as worked oils, sludge from water treatment plants, organic solvents, car batteries, mercury lamps, etc which are listed in the hazardous waste catalogues in the attachment to the Decree

For waste in particular, the Environmental Protection Act of 1991 sets out only the obligations connected with environmental impact assessments, issuing of waste treatment instructions, the responsibilities of municipal authorities, and regulates issues of restrictive import and transit transportation regime of waste and hazardous substances

Current MSW Management Practices in the Municipality of Zlatograd

MSW collection is carried out by three special vehicles two of them carry Meva bins with a capacity of 110 liters, and another carries removable containers with a capacity of 4.25 cubic meters²

At present, the waste collecting service at the Municipality transports MSW from the city of Zlatograd and all the villages (population as shown below)

Town of Zlatograd	8,978 residents
Villages	5,898 residents
Total population	14,878 residents

Seven hundred and thirty-five people do not receive waste collection services. These are residents of small hamlets and separate houses within the Municipality.

Transportation is provided according to a time schedule for the whole Municipality of Zlatograd developed by the technical manager Minka Kehayova. Her long experience at the sanitation department has provided her with a great deal of expertise as can be seen in the final product. Mr. Pete Jenkins, the USAID/LGI consultant, also provided invaluable advice on structuring the transportation schedule.

The location of the various types of waste collection vessels in the city of Zlatograd is shown in Chart 2. Sixty removable containers with a capacity of 4.25 cubic meters and 426 Meva bins are used in the city. One hundred and thirty-eight are transported by GAS-531A (Picture 2) and 288 by Skoda-Beaver (Picture 1).

In the village of Startzevo, there are 8 containers and 170 Meva bins.

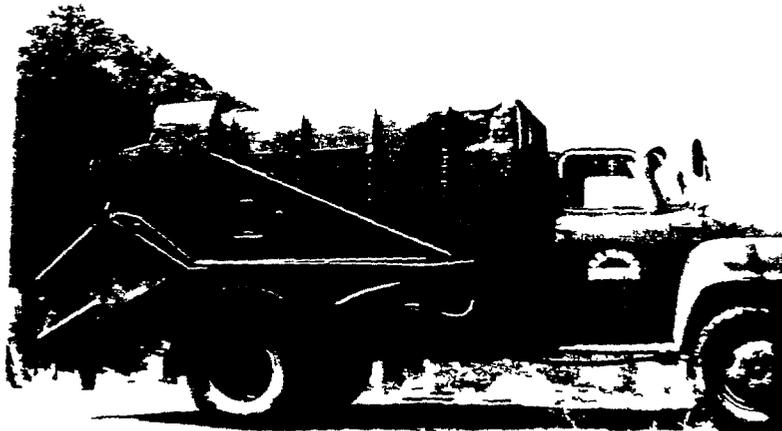
Solid waste is collected 5 days a week, Monday through Friday. If all vehicles are operational, 6 containers are transported with a container carrier to the landfill of Zlatograd, which is located at about 6.5 kilometers away (Picture 3). The other trucks, with volumes of 12.0 and 6.0 cubic meters, respectively, make two runs daily.

Sanitation office staff includes technical manager Minka Kehayova, 6 trash collectors, 3 drivers and 5 part-time (hired under Municipal Ordinance No 1 of 1 Aug 1996).

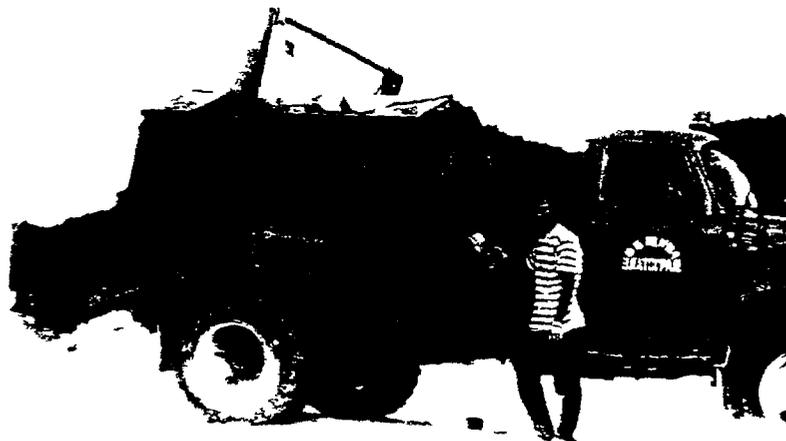
² See pictures 1, 2, and 3



Picture 1



Picture 2



Picture 3

THE MSW SAMPLE TAKING PROCEDURE

MSW composition from the municipalities is heterogeneous and highly variable. Its precise and thorough examination is extremely difficult. It is necessary to determine the average content of large quantities of heterogeneous waste.

In order to obtain precise data during the study, it is necessary to examine the MSW in a differentiated manner taking into account the place of origin:

- Rural regions,
- Residential regions, and
- Commercial regions

After identifying the typical regions for sample taking, it is necessary to specify the type of transport vehicle or container, level of filling.

The Solid Waste Stream Analysis was conducted at the municipal landfill for a period of several weeks following the procedures detailed and illustrated below.

The waste was dumped from the transport vehicle onto a levelled platform (Picture 4). The dumped waste was thoroughly mixed (Picture 5) and levelled in thin layers (250 - 300 millimeters) on the hard smooth surface in the shape of a circle. The circle was divided into four, and the waste from the two opposite segments were discarded. The remaining parts were joined and mixed once again. Then they were spread again in the shape of a circle and levelled out. This procedure was repeated until an average sample of about 25 - 40 (up to 50) kilograms is left depending on the waste quantity. The initial weight of the average sample is then established (Picture 6).

The sack of waste was emptied onto a plastic folio sheet and separated by manual sorting in the following groups: plastics, paper, metals, domestic (food, garden and other organic wastes), leather, rubber and textile, ceramics, construction waste, rocks, ash etc.

Every single waste group was stored in an individual paper sack and weighed. The individual waste components were calculated as a percentage of the total weight and are shown in Table 2.

Table 2
Municipality of Zlatograd Morphologic Composition of Waste Based on Collected Data

Region of Collection	Total Sample Weight	Glass		Plastics		Paper		Metals		Domestic Garden etc		Leather rubber textile		Ceramics construction etc	
		kg	%	kg	%	kg	%	kg	%	kg	%	kg	%	kg	%
		1 Residential area	36.7	1.7	4.6	0.9	2.45	1.5	4.09	0.5	1.36	4.2	11.44	2.4	6.54
2 Residential area low rise	37.2	1.9	5.11	3.2	8.6	5.4	14.52	0.9	2.42	5.1	13.71	2.8	7.53	17.9	49.12
3 Residential area low rise	29.9	2.3	7.69	1.7	5.69	2.4	8.03	3.1	10.37	4.3	14.38	1.5	5.02	14.6	48.83
4 Erma River rural area	29.3	1.8	6.1	2.1	7.2	3.3	11.26	1.7	5.8	3.7	12.63	1.9	6.5	14.8	50.51
5 Residential area and retail sites	43.5	2.6	5.98	1.8	4.14	4.1	9.42	2.5	5.75	5.9	13.56	3.1	7.13	23.5	54.02
6 Startzevo rural area	36.8	8.4	22.83	1.2	3.26	2.9	7.88	5.8	15.76	12.50	33.97	1.4	3.8	4.6	12.5
7 Textile factory Industrial	24.5	1.7	6.94	0.5	2.04	2.2	8.98	7.5	30.61	1.7	6.94	5.8	23.67	5.1	20.82
8 Orecheto commercial area	31.1	6.4	20.58	4.1	13.18	2.2	7.07	6.0	19.29	1.0	3.22	1.4	4.5	10.0	32.15
9 Startzevo rural area	46.7	5.1	10.92	6.4	13.7	5.5	11.78	1.6	3.43	16.3	34.9	3.1	6.64	8.7	18.63
10 Residential area low rise	65.1	9.1	13.98	5.2	7.99	6.5	9.98	4.3	6.6	5.3	8.14	10.1	15.52	24.6	37.79
11 Pandeva kashta commercial area	28.4	3.8	13.38	2.8	9.86	4.9	17.25	2.2	7.75	11.3	39.79	0.9	3.17	2.5	8.8
12 Startzevo rural area	46.7	5.1	10.92	6.4	13.7	5.5	11.78	1.6	3.43	16.3	34.9	3.1	6.64	8.7	18.63
13 residential area low rise	57.9	8.9	15.37	5.6	9.67	6.9	11.92	6.0	10.36	9.8	16.93	5.2	8.98	15.5	26.77
14 Shopping center + apartment blocks	32.7	7.2	22.02	3.6	11.01	3.4	10.4	0.6	1.83	4.8	14.68	4.3	13.15	8.8	26.91
15 Average value for the Municipality	"		11.51		7.25		10.00		9.22		16.85		8.37		36.8



Table 3
Morphological Composition of Waste by Regions in Percentage by Weight

Region	Glass	Plastics	Paper	Metals	Residential, garden and other organic waste	Leather rubber, textile	Ceramics construction waste, etc
Residential areas	9 35	6 88	9 71	6 22	12 92	8 72	46 20
Commercial areas	15 49	9 55	11 04	8 65	17 82	6 98	30 47
Startzevo rural area	15 00	6 96	9 17	10 41	28 11	5 84	24 51
Erma River	6 10	7 20	11 26	5 80	12 63	6 50	50 51

Note The morphologic composition from Erma River is obtained from a single measurement

Table 4
Waste Quality Indicators - Average Values in Percentage by Weight

Region	Flammable (%)	Inflammable (%)
Residential areas	38 23	61 77
Commercial areas	45 39	54 61
Rural areas	50 08	49 92
Average value for the Municipality	42 47	57 53

Table 5
Recyclable Municipal Waste - Average Values in Percentage by Weight

Region	Glass	Plastics	Paper	Metals	Residential, garden and other organic waste
Residential areas	9 35	6 88	9 71	6 22	12 92
Commercial areas	15 49	9 55	11 04	8 65	17 82
Startzevo - rural area	15 00	6 96	9 17	10 41	28 11
Industrial areas	6 94	2 04	9 98	30 61	6 94
Average value for the Municipality	11 51	7 25	10 00	9 22	16 85



QUANTITATIVE STUDY OF MUNICIPAL SOLID WASTE

To study MSW quantitatively, it is necessary to measure (weigh) all waste collected by collection vehicles for a period of at least seven days. Data obtained from these measurements is presented in Table No 6. During the interview with the technical manager M. Kehayova and the truck drivers, it was found that waste is collected and transported to the landfill by a Skoda - Beaver and GAS-53 IÄ without being compacted (Picture 4), although by design data a Beaver's volume is 1.1 cubic meters and that of a GAS-53 IÄ is 1.7 - 3.0 cubic meters. This is due to the normal wear-and-tear effect as a result of exploitation. The waste which is transported with changeable containers type 77 KBO with a capacity of 4.25 cubic meters is also not being compacted.

Since there is no scales at the landfill to weigh the arriving trucks, the weighing was done on scales in the city before transporting the waste to the landfill.

The MSW quantitative study data are given in Table No 6. The transport devices tares are

Skoda Beaver	9,700 kilograms
GAS-53 IÄ	4,100 kilograms
Container carrier	4,200 kilograms

Table 6
Detailed Quantitative Results of Waste Stream Analysis

Time Period	Waste collection region	Transport device type	Waste and transport weight (kg)	Waste net weight (kg)	Volume weight (tons/m ³)
Day 1	V. Levski Str. Barte Subdivision	GAS-53 IÄ	5,900	1,800	0.393
	Balete 1/2	"	6,500	2,400	0.390
	City of Zlatograd a full tour	Beaver	12,300	2,600	0.390
Day 2	V. Tamovo	GAS-53 IÄ	6,600	2,500	0.406
	Hr. Botev, Balete ½	"	6,300	2,200	0.358
	* BI 200, Miniorska Str	Container carrier	6,000	1,800	0.450
	* - -		5,200	1,000	0.313
	New bl. Gorubso	"	5,100	900	0.281
	Svatev	"	5,100	900	0.281

Table 6
Detailed Quantitative Results of Waste Stream Analysis (Continued)

Time Period	Waste collection region	Transport device type	Waste and transport weight (kg)	Waste net weight (kg)	Volume weight (tons/m ³)
*	Village Erma River	"	6,400	2,000	0 518
*	Belovidovo	"	5,900	1,700	0 532
*	Tabahana, Trakia, Ahrda	Beaver	13,600	3,900	0 325
Day 3	Village of Startzevo	GAS-53 A	6,300	2 200	0 358
*	An Kirakov Str, B Zlatev, Byalo More	"	6,300	2,200	0 358
*	Village of Startzevo		4,800	600	0 158
*	Orehche	"	5,000	800	0 200
*	Tzarkvata	"	5,000	800	0 250
	The Mehana below the High School	"	4,900	700	0 219
*	Textile Factory	"	4,700	500	0 156
	State Automobile Enterprise	"		1,800	0 563
	Hr Botev	Beaver	12,100	2,400	0 200
Day 4	Village of Startzevo	GAS-53 A	6,600	2,500	0 406
	"	"	6,100	2,000	0 325
	"		5,300	1,100	0 344
	The Mehana	"	5,100	900	0 281
	High School	"	4,900	700	0 218
	Trading Center	"	5,200	1 000	0 313
	Livestock Market	"	4 800	600	0 188
	City of Zlatograd - full tour	Beaver	13,600	3,900	0 325
Day 5	Zlatograd (G Patnik, Izgr)	GAS-53 A	5,300	1,200	0 195
	Zlatograd (Rohzen, Rakovski)	"	5,100	1,000	0 163
	High School		5,000	8,000	0 250

Table 6
Detailed Quantitative Results of Waste Stream Analysis (Continued)

Time Period	Waste collection region	Transport device type	Waste and transport weight (kg)	Waste net weight (kg)	Volume weight (tons/m ³)
	High School	"	5,000	8,000	0 250
	Yugoustrem	'	5,200	1,000	0 313
	Dragomirov	'	5,100	900	0 281
	Bartze	"	5 200	1,000	0 313
	Behind the Printing House	"	5,300	1,100	0 344
	City of Zlatograd - full tour	Beaver	13,400	3,700	0 308
Weekly Total			Σ=	60,000	G_{avg} = 0 306
Day 6	V Levski, Bartze Subdivision	GAS-531A	6,100	2,000	0 325
	The Market Place		5,000	800	0 250
	The Hospital	"	5 100	900	0 281
	In front of the hospital	'	5 200	1,000	0 313
	Krassi Chetchiev	"	5 000	800	0 250
	Village of Dolen	'	5,300	1,100	0 344
	Byalata Kashta	"	5,200	1,000	0 313
	Zlatograd (the market place, Trakia, Gorubso - main)	Beaver	13,000	3,300	0 275
Day 7	Veliko Tamovo	GAS-531A	6,100	2,000	0 325
	Hr Botev	"	5,500	1,400	0 228
	Bar "Diana"	"	5,200	1,000	0 313
	Behind the Post Office	'	5 300	1,100	0 344
	Berovidovo	"	5,600	1,400	0 438
	Behind the Printing House	"	5,400	1,200	0 375
	Behind the Printing House		5 000	800	0 250
	Ushevi		5,100	900	0 281



Table 6
Detailed Quantitative Results of Waste Stream Analysis (Continued)

Time Period	Waste collection region	Transport device type	Waste and transport weight (kg)	Waste net weight (kg)	Volume weight (tons/m ³)
Day 8	Zlatograd	Beaver	13,000	3,300	0.275
	Village of Startzevo	GAS-53 A	5,400	1,300	0.211
			5,100	1,000	0.163
	Village of Startzevo	Container carrier	5,100	900	0.280
	Diulgerova Co		5,000	800	0.250
	Kad vrts		4,900	700	0.218
	Orehcheto		5,000	800	0.250
	Boyadjiev		4,800	600	0.188
Day 9	Zlatograd - circumference	Beaver	13,000	3,300	0.275
	Village of Startzevo	GAS-53 A	5,800	1,700	0.276
	"	"	5,300	1,200	0.195
	Village of Startzevo	Container carrier	4,800	600	0.188
	Opposite the substation	"	5,000	800	0.250
	Ring furnace	"	4,900	700	0.218
	"	"	5,200	1,000	0.313
	"	"	5,000	800	0.250
Day 10	Council storehouse	"	5,400	1,200	0.375
	Zlatograd	Bobre	12,600	2,900	0.242
	G Patnik, Rozhen Str etc	GAS-53 A	5,300	1,400	0.228
	in the ground		5,200	1,100	0.179
	Village of Dolen	Container carrier	4,700	500	0.156
	Imperial	"	4,900	700	0.218
	Baleshe	"	4,900	700	0.218
BI 7	"	5,000	800	0.250	



Table 6
Detailed Quantitative Results of Waste Stream Analysis (Continued)

Time Period	Waste collection region	Transport device type	Waste and transport weight (kg)	Waste net weight (kg)	Volume weight (tons/m ³)
	Zlatograd	Bobre	12,100	2,400	0 200
Weekly Total			Σ =	52,800	G_{avg} = 0 261
Day 11	V Levski, Bartze	GAS-531A	5,500	1 400	0 228
	V Tamovo, Hr Botev		4 400	300	-
	Textile factory apt block	Container carrier	4,900	700	0 218
	Behind the Council	"	5,000	800	0 200
	Bl 3	"	5,600	1,400	0 438
	bl 4,5,6	'	5,300	1,100	0 344
	Dormushev		5,000	800	0 250
	Balkanbank	"	5,100	900	0 281
	The Boarding House	"	4,900	700	0 218
	Zlatograd - full tour	Beaver	12,600	2,900	0 242
Day 12	Zlatograd	GAS-531A	5,600	1,500	0 244
	"	"	5 500	1,400	0 228
	Òhe Market Place	Container carrier	4,750	500	0 156
	Belovidovo	"	4 800	600	
	Bl 200	"	5,100	900	0 257
	Svatev	"	5,000	800	0 250
	New block of Gorubso	'	4,900	700	0 218
	Village of Erma River	'	4,800	600	0 188
	Zlatograd	Beaver	12,000	2,900	0 242
Day 13	Village of Startzevo	GAS-531A	5,800	1,700	0 276
	"	"	5,200	1,100	0 179
	Village of Startzevo (sewing shop in the proximity)	Container carrier	5,000	800	0 250
	The Mehana		4,900	700	0 218
	The Church	"	4,700	500	0 156

Table 6
Detailed Quantitative Results of Waste Stream Analysis (Continued)

Time Period	Waste collection region	Transport device type	Waste and transport weight (kg)	Waste net weight (kg)	Volume weight (tons/m ³)
	Trading Center	"	5,200	1,000	0 250
	Livestock Market	'	4,900	700	0 218
	Zlatograd - circumference	Beaver	13,400	3,700	0 308
Day 14	Zlatograd	GAS-53\A	5,400	1,300	0 211
	"	"	5,100	1 000	0 163
	One Park	Container carrier	4,900	700	0 176
	lv	'	5,000	800	0 200
	Zlatograd - circumference	Beaver	13,100	3 400	0 283
Weekly Total			Σ=	47,700	$\gamma_{ave} = 0.233$
Day 15	Zlatograd	GAS-53\A	5,600	1,500	0 244
Day 16	Village of Startzevo	"	5,400	1,300	0 260
	Bulgana Blvd	Container carrier	5 500	1,300	0 371
	St Stambolov (Pandeva House)	"	5 100	900	0 235
Day 17*	Pliska Str - residential area	"	4,600	400	0 200
	Trading Center	"	5,500	1,300	0 306
Day 18	Zlatograd 164 bins type "Meva"	Beaver	14,800	4,450	0 371
*	Village of Startzevo (55 bins type "Meva")	GAS-53\A	5,900	1 800	0 300
Day 19 *	Zlatograd full tour (42 bins)	"	5,200	1,100	0 183
Day 20 *	Village of Startzevo (63 bins)	"	5,400	1,300	0 217



Table 6
Detailed Quantitative Results of Waste Stream Analysis (Continued)

Time Period	Waste collection region	Transport device type	Waste and transport weight (kg)	Waste net weight (kg)	Volume weight (tons/m ³)
Day 21 *	Zlatograd full tour (78 bins)	"	5,250	1,150	0 192

Note All rows marked with an asterisk indicate that the waste was transported to the sanitary landfill in the presence of the research team and the deposit volume was measured under team supervision For all remaining measurements assumptions for the filling volume have been made for Beaver - 12 cubic meters, for GAS-531A 6 15 cubic meters and for the container - 3 2 cubic meters The team established these values after numerous visits to the landfill and observation of the transported containers The assumed volume provides the results for value of the weight by volume close to the vehicles personally examined or to those examined by the municipal sanitation team

Table 7
Municipality of Zlatograd Average Waste Quantities and Weight by Volume

Time Period	GAS-531A		Container carrier		Skoda-Beaver		Village of Startzevo		Total for the Municipality of Zlatograd	
	kg	γ	kg	γ	kg	γ	kg	γ	kg	γ
Week 1	20,100	0 327	23,400	0 379	16,500	0 212	8,400	0 318	60,000	0 306
Week 2	14,500	0 236	23,600	0 302	14,700	0 245	6,700	0 219	52,800	0 261
Week 3	12 600	0 204	19,700	0 238	15,400	0 257	7 400	0 216	47,700	0 233
Week 4	-	0 252	-	0 278	-	-	-	0 260	-	0 269
Week 5	-	0 223	-	-	-	0 371	-	0 259	-	0 253
Average		0 248		0 299		0 271	7 500	0 254	53,500	0 264



Picture 4



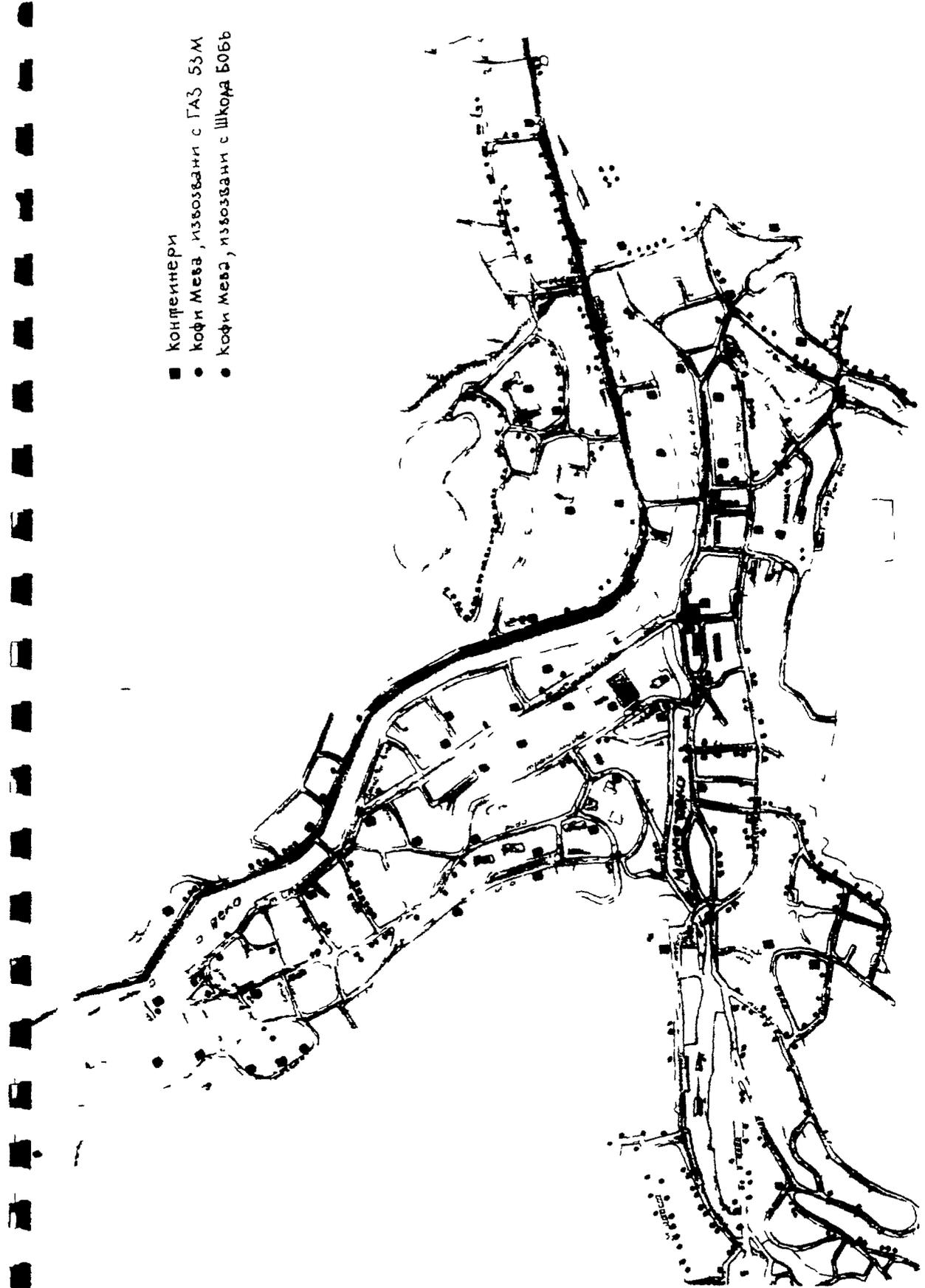
Picture 5



Picture 6



- контеинери
- кофи меча, извозвани с ГАЗ 53М
- кофи меча, извозвани с Шкода Б0Б6



PROJECTED QUANTITIES OF RESIDENTIAL SOLID WASTE

The projected estimate given in Table 8 can be made on the basis of quantitative measurement of MSW transported from the municipality of Zlatograd

Since the measurement was made during a period when MSW usually has less weight by volume, the team projects an increase in the year's total waste weight with 5 percent

Table 8
Annual Waste Generation - Per Capita

Studied region	Annual Quantity of RSW tons/year	Weight by Volume tons/m ³	kg/capita/year	kg/capita/year
Total for the municipality of Zlatograd	2 782	0 264	186 98	0 51
<i>5% increase</i>	<i>2,921</i>	<i>0 277</i>	<i>196 34</i>	<i>0 54</i>
Village of Startzevo	390	0 254	140 64	0 38
<i>5% increase</i>	<i>409 5</i>	<i>0 267</i>	<i>147 67</i>	<i>0 40</i>

Note The village of Startzevo has a population of 2,773

Table 9
Average Values of Projected Annual Waste by Category

Studied region	Glass (tons/yr)	Plastics (tons/yr)	Paper (tons/yr)	Metals (tons/yr)	Domestic garden (tons/yr)	Leather, rubber, textile (tons/yr)	Ceramics, construction waste (tons/yr)
Total for the municipality of Zlatograd	320 20	201 69	278 2	256 50	468 76	232 85	1,023 77
Village of Startzevo	58 5	27 14	35 76	40 60	109 63	22 78	95 59



Table 10
Projected Annual Waste Generation By Flammability

Studied Region	Flammable tons/year	Inflammable tons/year
Total for the municipality of Zlatograd	1 240 55	1,541 45
Village of Startzevo	195 31	194 69

Expected MSW Quantities for the Municipality of Zlatograd

Since the world waste management practice does not know of a case in which 100 percent of the MSW content can be recycled, the figures that can have a real practical value for the Municipality and help it develop the future MSW management plan are given in Table 11

Table 11
Adjusted Annual Projections of Recyclable Waste

Studied Region	Glass tons/year	Plastics tons/year	Paper tons/year	Metals tons/year
Total for the municipality of Zlatograd	160	100	140	125
Village of Startzevo	29	13	17	20

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