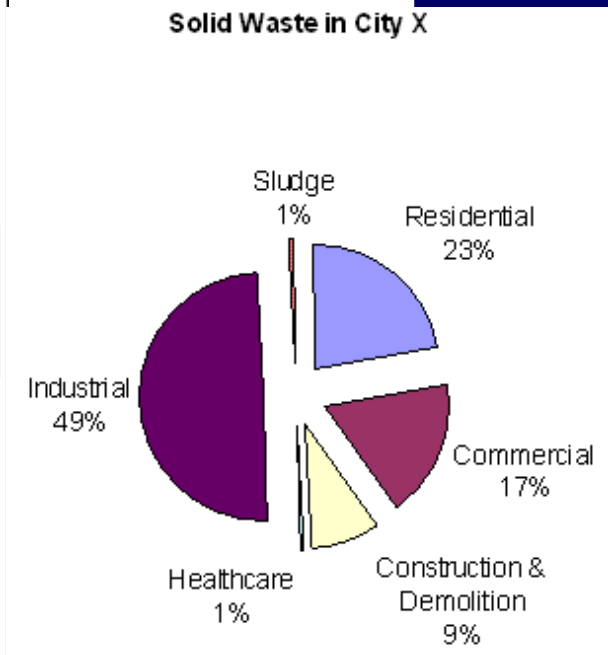
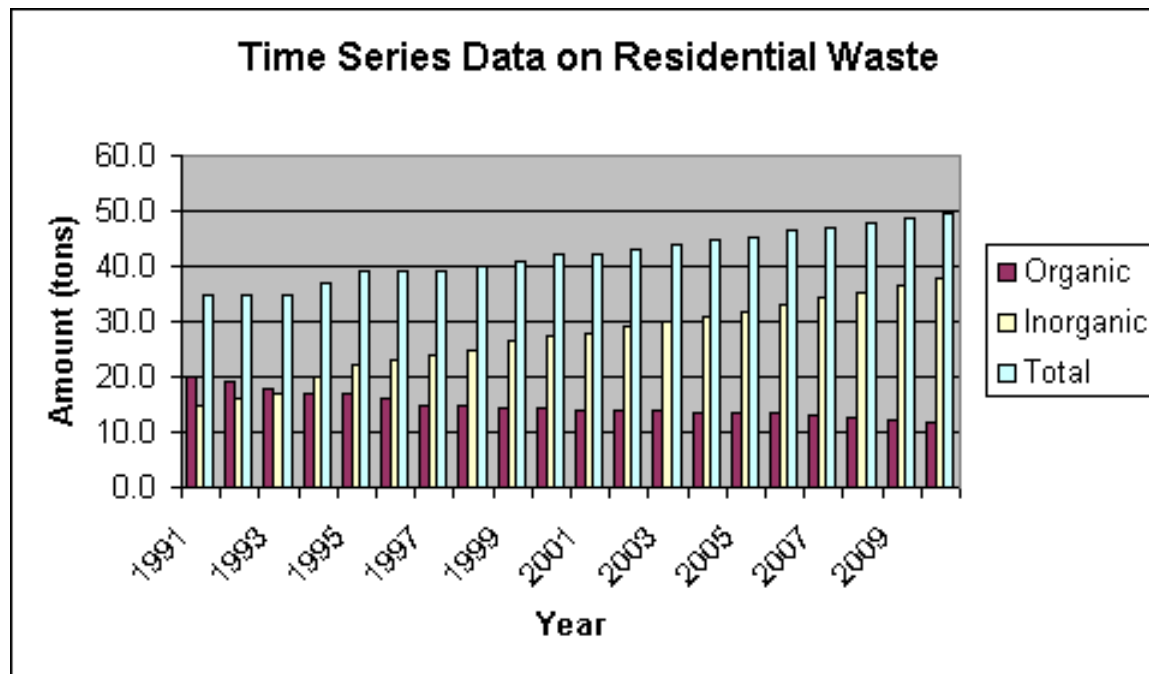


Mapping Solid Waste – III

Data Analysis & Presentation



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Presentation Outline

- ❖ Hypothetical example of City X
- ❖ Data presentation in tables
- ❖ Data presentation in graphs



MSW Data Collection for City X

❖ List of materials

Based on historical data and pilot survey:

Food waste, paper, cardboard, plastics, textiles, rubber, leather, yard wastes, wood, glass, metal, dirt and ash.

❖ Data requirements

For integrated solid waste management, C.L. 70%

Number of samples is 27 from Table 3.1

❖ Site Selection

Waste collection vehicles at final disposal site

Assigning numbers to each vehicle or each trip (20 trips/day)

Selecting 3 samples per day (Total 9 days for 27 samples)



Waste Quantification

Daily Samples		
Day	Samples	Tonnage per sample
1	1	2
1	2	2
1	3	3
2	4	4
2	5	2
2	6	1
3	7	2
3	8	2
3	9	3
4	10	2
4	11	3
4	12	1
5	13	2
5	14	2
5	15	3
6	16	3
6	17	2
6	18	2
7	19	1
7	20	2
7	21	3
8	22	2
8	23	3
8	24	1
9	25	2
9	26	4
9	27	2

Aggregated Data		
Day	Tonnage per 3 samples	Total (Daily)
1	7	46.7
2	7	46.7
3	7	46.7
4	6	40.0
5	7	46.7
6	7	46.7
7	6	40.0
8	6	40.0
9	8	53.3
	61	406.7
	Average (Daily)	45.2



Raw & dry weight & MC

Component	Raw Weight (tons)	Moisture Content MC (%)	Dry Weight (tons)
Food Wastes	4.1	70.0	1.2
Paper	15.4	5.9	14.5
Cardboard	2.7	5.0	2.6
Plastics	3.2	1.4	3.2
Textiles	0.9	10.0	0.8
Rubber	0.2	0.0	0.2
Leather	0.2	20.0	0.2
Yard wastes	8.4	64.9	2.9
Wood	0.9	20.0	0.7
Inorganic	9.1	3.0	8.8
<i>Total</i>	45.2		35.1



Historical / Laboratory Data on Composition

Component	Percent by weight (dry basis)					
	Carbon	Hydrogen	Oxygen	Nitrogen	Sulfur	Ash
Food wastes	48.0	6.4	37.6	2.6	0.4	5.0
Paper	43.5	6.0	44.0	0.3	0.2	6.0
Cardboard	44.0	5.9	44.6	0.3	0.2	5.0
Plastics	60.0	7.2	22.8			10.0
Textiles	55.0	6.6	31.2	4.6	0.2	2.5
Rubber	78.0	10.0		2.0		10.0
Leather	60.0	8.0	11.6	10.0	0.4	10.0
Yard wastes	47.8	6.0	38.0	3.4	0.3	4.5
Wood	49.5	6.0	42.7	0.2	0.1	1.5
Glass	0.5	0.1	0.4	0.1		98.9
Metals	4.5	0.6	4.3	0.1		90.5



Composition Analysis for Raw Waste

Food Waste: Dry weight = $4.08 - (4.08 \times 0.7) = 1.2$ ton; C = $1.2 \times 0.48 = 0.6$ ton

Component	Wet Weight tons	Dry Weight tons	Composition					
			C	H	O	N	S	Ash
Food Waste	4.1	1.2	0.6	0.1	0.5	0.0	0.0	0.1
Paper	15.4	14.5	6.3	0.9	6.4	0.0	0.0	0.9
Cardboard	2.7	2.6	1.1	0.2	1.2	0.0	0.0	0.1
Plastic	3.2	3.1	1.9	0.2	0.7	0.0	0.0	0.3
Textiles	0.9	0.8	0.4	0.1	0.3	0.0	0.0	0.0
Rubber	0.2	0.2	0.2	0.0	0.0	0.0	0.0	0.0
Leather	0.2	0.2	0.1	0.0	0.0	0.0	0.0	0.0
Yard Wastes	8.4	2.9	1.4	0.2	1.1	0.1	0.0	0.1
Wood	0.9	0.7	0.4	0.0	0.3	0.0	0.0	0.0
TOTAL	36.1	26.4	12.4	1.6	10.4	0.2	0.1	1.6



Calorific Analysis for Raw Waste

$$CV_{\text{raw}} = ((1 - MC) \times (CV_{\text{upper}} - (2241 \times H)) - 2441 \times MC)$$

CV = calorific value ('raw' is real 'as delivered' value, 'upper' is value for dried material) in kJ/kg CV upper is taken from the literature

MC = % moisture content (Table 3.4) H = % Hydrogen content (Table 3.5)

* Vaporization enthalpy of water (2441 kJ/kg at 25°C)

	CV raw	CV upper	Hydrogen (H)	Moisture Content (MC)
	Kj/kg	Kj/kg	(%)	(%)
Food	3809	19800	6.4	70
Paper	14905	17330	6	6
Cardboard	16383	18670	5.9	5
Plastics	37020	39000	7.2	1
Textiles	13553	16780	6.6	10
Rubber	41803	44000	10	0
Yard Wastes	3832	16800	6	65
Wood	14961	20630	6	20



Data Presentation in Tables

- ❖ Solid waste from all the sectors
- ❖ Quantification & composition for each sector (component based)
- ❖ Aggregated data on waste components from all the sectors
- ❖ Time-series data and projections



Overall Solid Waste Generation

Sector	Estimated Ratio (%)	Estimated tonnage (per day)	
		Non-Hazardous	Hazardous
Residential	22.6	45.2	0.0
Commercial	17.4	34.8	0.0
Construction & Demolition	9.0	16.0	1.0
Healthcare	0.5	1.0	1.0
Industrial	50.0	70.0	30.0
Sludge	0.5	0.0	1.0
Total		167	33



Composition of Residential Waste

Component	Wet Weight	Dry Weight	Composition							
	kg	kg	MC	CV	C	H	O	N	S	Ash
Food Waste	4.1	1.2	70	3809	0.6	0.1	0.5	0.0	0.0	0.1
Paper	15.4	14.5	6	14905	6.3	0.9	6.4	0.0	0.0	0.9
Cardboard	2.7	2.6	5	16383	1.1	0.2	1.2	0.0	0.0	0.1
Plastic	3.2	3.1	1	37020	1.9	0.2	0.7	0.0	0.0	0.3
Textiles	0.9	0.8	10	13553	0.4	0.1	0.3	0.0	0.0	0.0
Rubber	0.2	0.2	0	41803	0.2	0.0	0.0	0.0	0.0	0.0
Leather	0.2	0.2	20		0.1	0.0	0.0	0.0	0.0	0.0
Yard Wastes	8.4	2.9	65	3832	1.4	0.2	1.1	0.1	0.0	0.1
Wood	0.9	0.7	20	14961	0.4	0.0	0.3	0.0	0.0	0.0
Glass	4.0	4.0								
Metals	5.1	5.1								



Aggregated Data on Waste Components from All Sectors

Components	Residential	Commercial	Construction	Industrial	Health Care	Total
Food Waste	4.1	5.2	0.0	2.0	0.3	11.6
Paper	15.4	5.0	0.2	7.0	0.1	27.7
Cardboard	2.7	3.0	1.0	9.0	0.0	15.7
Plastic	3.2	3.3	1.0	10.0	0.1	17.6
Textiles	0.9	1.2	0.0	5.0	0.2	7.3
Rubber	0.2	1.0	1.0	5.0	0.1	7.3
Leather	0.2	1.0	1.0	5.0	0.1	7.3
Yard Wastes	8.4	4.0	1.0	5.0	0.1	18.5
Wood	0.9	2.0	4.0	5.0	0.0	11.9
Glass	4.0	4.0	2.0	7.0	0.0	17.0
Metals	5.1	5.1	3.0	10.0	0.0	23.2
Hazardous	0.0	0.0	1.0	30.0	1.0	32.0
Total	45.2	34.8	15.2	100.0	2.0	197.2



Time-series Data and Projections

Year	Residential			Year	Residential		
	Organic	Inorganic	Total		Organic	Inorganic	Total
1991	20.0	15.0	35.0	2001	14.0	28.0	42.0
1992	19.0	16.0	35.0	2002	14.0	29.0	43.0
1993	18.0	17.0	35.0	2003	13.8	30.0	43.8
1994	17.0	20.0	37.0	2004	13.6	31.0	44.6
1995	17.0	22.0	39.0	2005	13.4	31.8	45.2
1996	16.0	23.0	39.0	2006	13.4	33.0	46.4
1997	15.0	24.0	39.0	2007	12.9	34.2	47.1
1998	15.0	25.0	40.0	2008	12.5	35.4	47.9
1999	14.5	26.5	41.0	2009	12.0	36.6	48.6
2000	14.5	27.5	42.0	2010	11.6	37.8	49.4

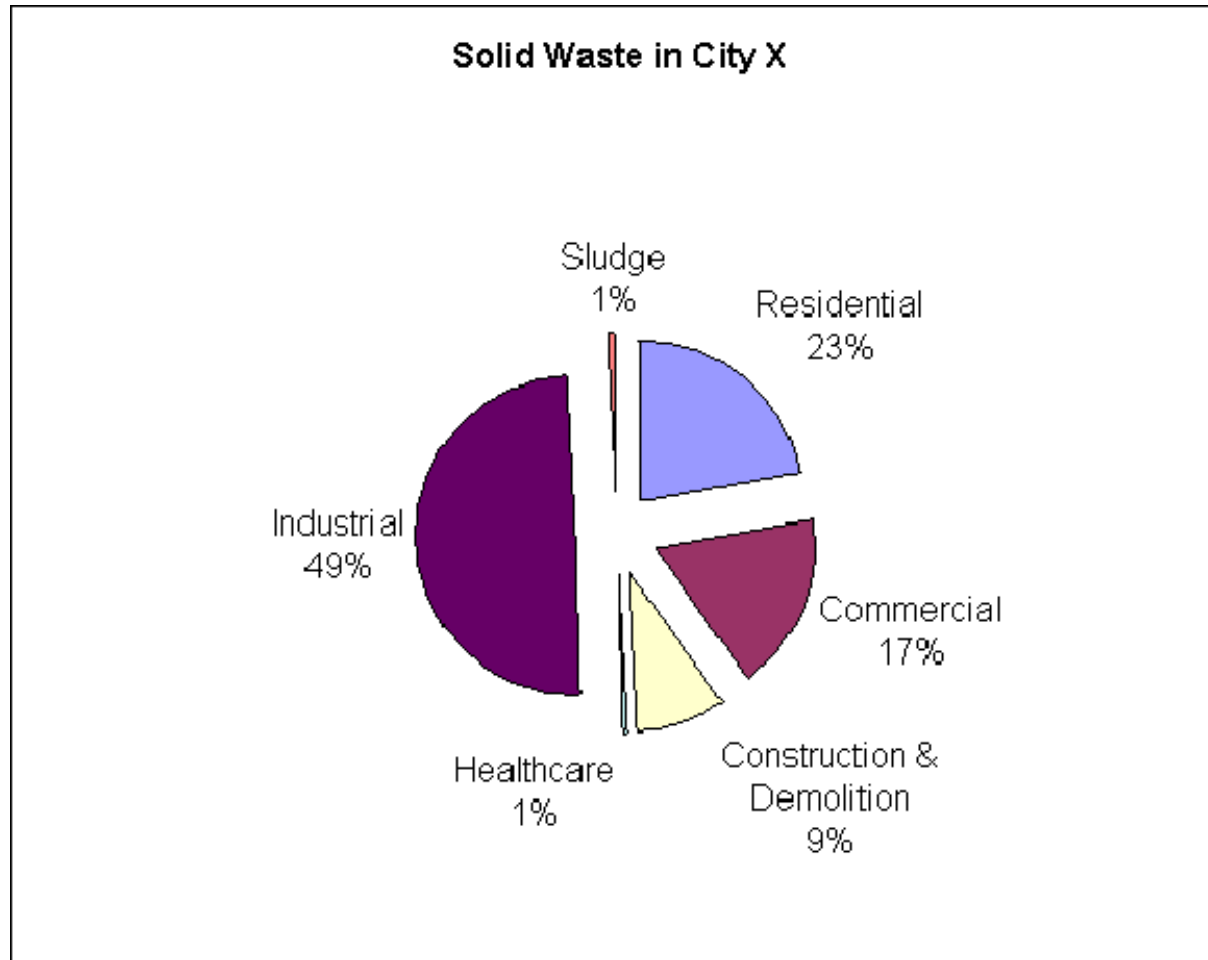


Data Presentation in Graphs

- ❖ Pie charts for solid waste comparison from all the sectors, and for waste components from each sector or a waste component from all the sectors (proportion)
- ❖ Bar and column charts for indication values for different sectors and different sectors
- ❖ XY or line charts for time-series data and projections



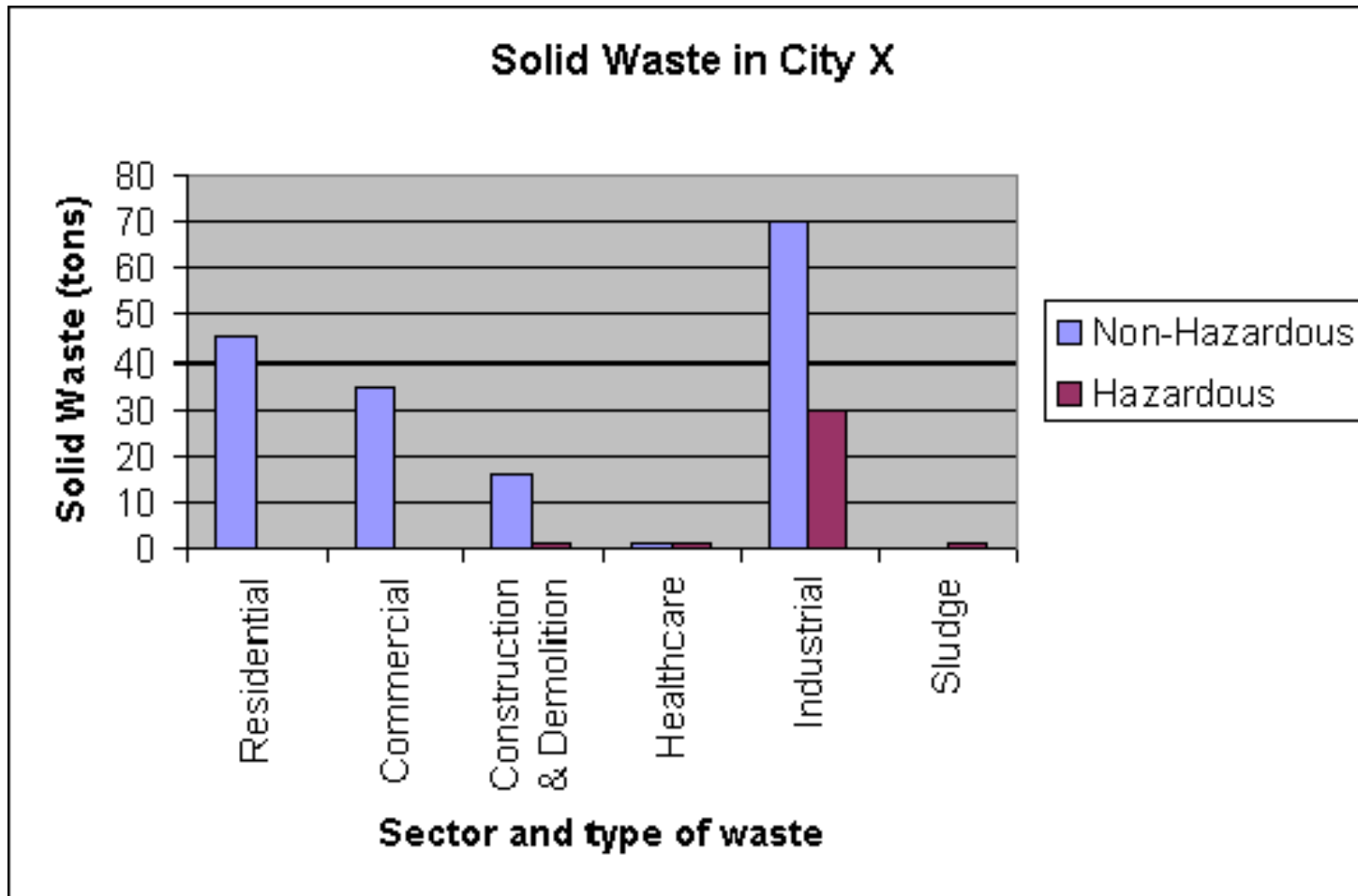
Pie Charts for Comparisons Sector-wide



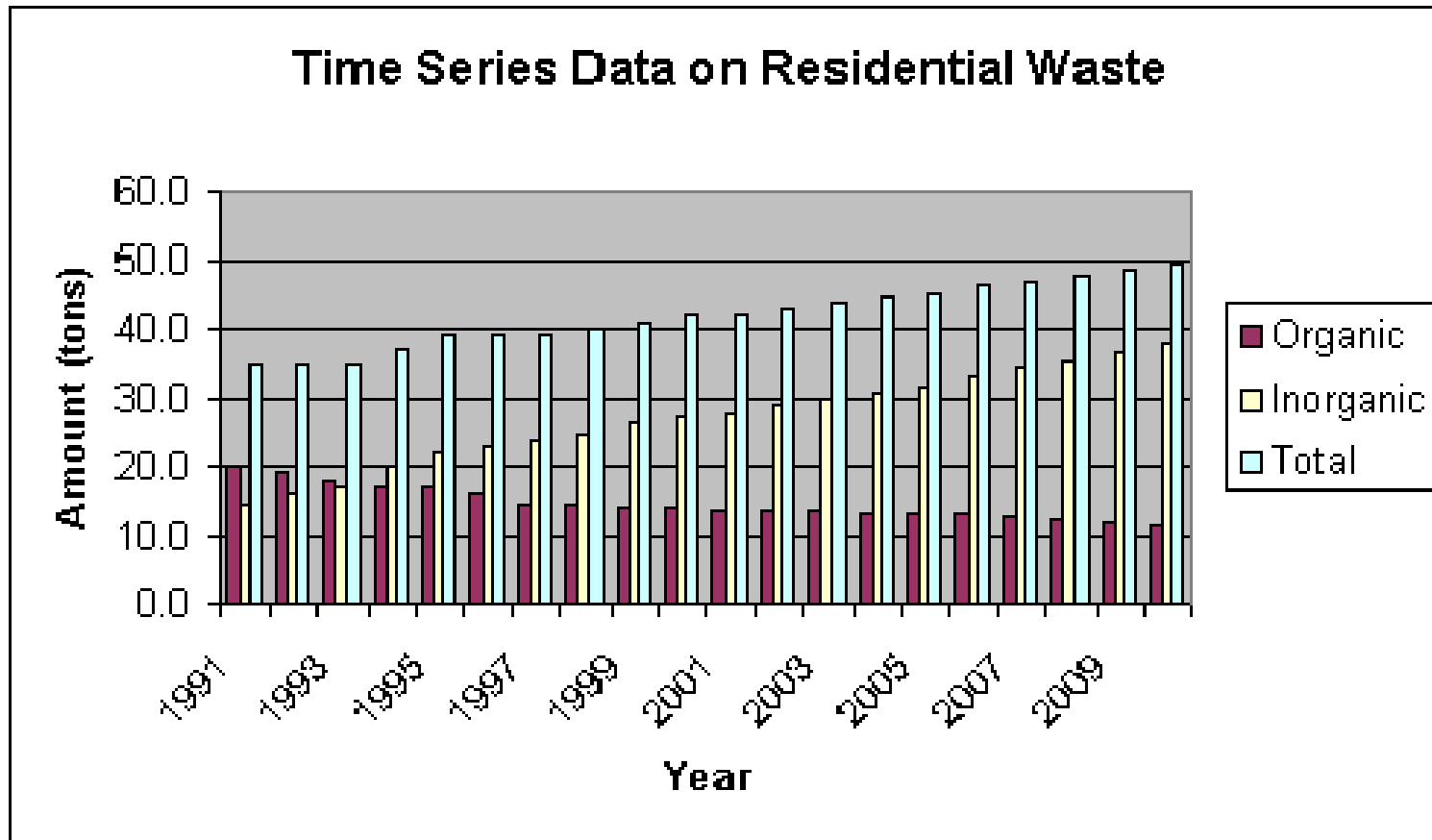
Pie Charts for Comparisons Component-based (proportion)



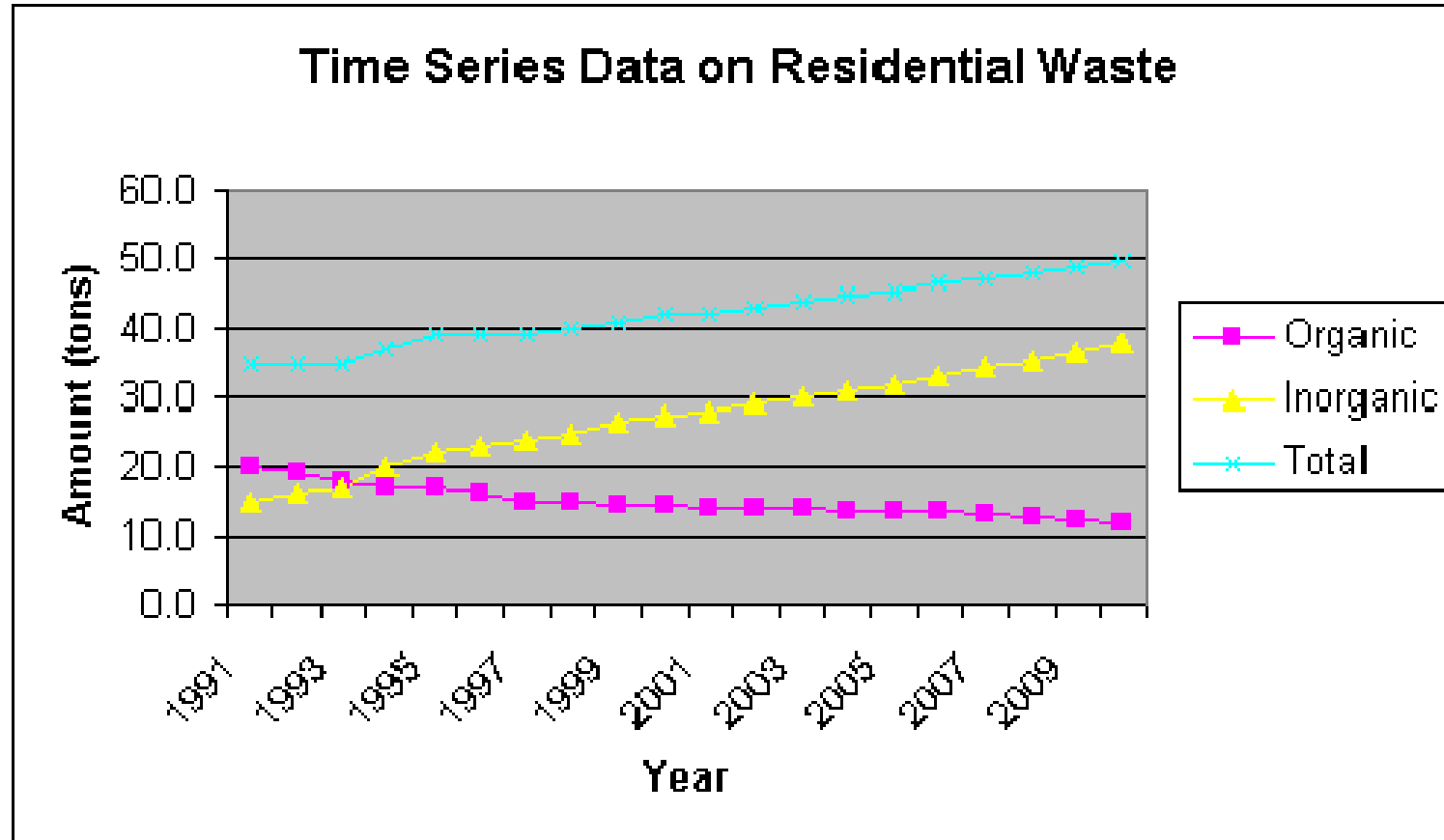
Column Charts for Comparisons Component-based (values)



Column Charts for Time-series Data and Projections



Line Charts for Time-series Data and Projections





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Thank You...

