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Financing Of Municipal Solid Waste **In The City Of Manado** Teddy Takaendengan 1), Tri Padi 2), Emenda Sembiring 3), Enri Damanhuri 4) 1) Post Graduate Program in Environmental Engineering FTSL, ITB Indonesia, Civil Departement, Manado State Polytechnic, Indonesia 2), 3), 4) **Faculty of Civil and Environmental Engineering (FTSL)** , ITB Indonesia e-mail: tchtakaendengan@yahoo.com ABSTRACT Basically human life will produce waste, which if not managed properly will cause new problems. To speed up the process of waste disposal to a place that has been planned, it means the waste transport plays an important role.

The **transport waste was done by vehicles consisting of many types of vehicles, namely 20 units of arm-roll, 20 units of dump-trucks, 10 units of small pick-up trucks, 3 units of wooden box trucks and 2 units of iron box truck.** Calculation of the cost of transporting waste is by knowing the volume of waste. Factors affecting the volume of this waste is **ritasi number, density, weekdays.** For operational costs, factors that influence is the number of vehicle crew (driver + garbage workers).

Fuel **consumption in a year can be calculated from the distance traveled per ritasi (km / rit), vehicle fuel consumption (km/l) and the prevailing fuel prices.** The research result shows that the costs for the transport vehicle Arm Roll truck, is Rp. 55,362 / ton of garbage, Dump Truck, is Rp. 112,574 / ton of garbage, Trucks Cash Iron / wood, is Rp. 159,085 / ton of garbage, to vehicles Car Pick-up, the total cost is Rp. 107,523 / ton of garbage Keywords: transport of waste, **the cost of transporting waste** 1 Introduction Total Population of Indonesia with a high growth rate resulted in increasing the volume of the trash can.

During this most people still look garbage as the remaining goods which cannot profit,

not as resources that need to be used. The paradigm of waste management that relies on final disposal was time abandoned and replaced by a new paradigm of waste management. Waste management system condition in Indonesia with total population increases and **the level of public** consumption increased, resulted in waste volume increases, this condition causes garbage must be managed well so that it does not cause problems. Based on Act 32/2005 concerning Local Government, stated that the problem of waste becomes the responsibility of the district and are required to hold the handling of waste including the Sanitize processing more adequate, and to certain conditions TPA is also a regional required implemented. Many of the problems faced in the waste management in each district or city is the availability of land for the processing of the end of the trash (TPA).

Most areas in Indonesia does not have enough land to TPA, and if the land is available usually have the distance far enough from the city. The provision of land for temporary **disposal sites (TPS) located in** the path of the waste transportation is also very difficult, because of limited land and funds. The cost required for the transport system will be even greater accompanied by their levies burdening waste management system.

Recycling system that is not optimal for example, it has not been socialized program 3R (reduce, reuse and recycle), so that solid waste reduction of waste sources has not been done completely. No or lack of treatment facilities or Intermediate Transfer Facilities (ITF) resulted in **the volume of waste** that goes into landfill TPS and to be quite a lot. Under Law 32/2005 on Local Government, stated that the problem of waste is the responsibility of the area and is obligated to implement handling per sampah including final processing (TPA) more adequately, and to certain regional landfill conditions also must be implemented. According to the Law **of the Republic of Indonesia** No.

18 of 2008 on waste management, in particular Chapter VIII on cooperation and partnership, article 26 of the inter-regional cooperation, paragraph 1 and paragraph 2 states that "Local governments may establish cooperation among local governments in carrying out waste management. (2) The cooperation referred to in paragraph (1) can be realized **in the form of** cooperation and / or creation of a joint venture waste management. " Garbage quantity varies between 2.5-3.0 liters **per person per day** in line with the activities of industrial society (Damanhuri, 2010). Standards set by the Ministry of Public The work regarding the amount of waste generated, can be seen in Table 1.

Amount of Waste generation is based on an urban scale Waste Transportation Operations In planning for a transportation system that is efficient and effective, the operation of transporting waste (Damanhuri 2010) should pay attention to the following

limitations: • ing tanspoatn oe rtshot possible and with the least possible obstacles. • ing nvence it/ ulage as much as possible. • ing rrt letarfue efficient. • t ake ntowok ime possible by increasing the amount of work load as much as possible by increasing the amount of workload / ritasi carriage.

2 Material and methods The method used in this research is to analyze waste transportation fee of 4 types of vehicles that will be counted. The first step is to collect data from the operational costs of the four vehicles. Primary data were obtained from field observation, and secondary data comes from and Sanitation Department (DKP) as well as an official document of the relevant government agencies. The calculation of the cost of transporting waste for every type of transport vehicle is by knowing the volume of waste. Factors affecting the volume of this waste is ritasi number, density, weekdays.

From the data obtained tesebut volume of waste transported per year. For operational costs, factors that influence is the number of vehicle crew (driver + garbage workers). The use of fuel in a year can be calculated from the distance traveled per ritasi (km/ritasi), vehicle fuel consumption (km/l) and the prevailing fuel prices. Vehicle maintenance costs can vary depending on the age and type of vehicle. The replacement of the tires of the vehicle in accordance with the standards of around 40-50 thousand km, spare parts and oil lubricants can being estimated cost per year.

The price of the vehicle, age use very influential in calculating the depreciation of the vehicle. From the data, analyzed so get investment cost unit and the unit of the cost of the vehicle transporting trash can. Next, the data obtained validated. After the data is valid, data is inserted in the calculation to get the cost of transportation of rubbish in the unit of Rp/tons of waste. After get the cost of various types of transport vehicles and waste compared to search for the cost of transporting waste is most effective and efficient.

3 Result and conclusion Research areas Manado city has a population of 414 116 inhabitants and an area of the city of Manado is 157,24 Km², with a population density reaches 2,665 people / km² (Manado in Figures 2014, 2014) Figure 1. Layout of the city of Manado Waste Transporter vehicle Based on the data obtained from the field, Manado City served by various types of transport vehicles waste namely 20 units of arm-roll, 20 units of dump-trucks, 10 units of small pick-up trucks, 3 units of wooden box trucks and 2 units of iron box truck. Each vehicle has ritasi as much as 2 ritasi/day. The volume of waste that can be transported each day is as much as 560 m³. The volume of waste.

From analysis, it was found the average volume and average weight of waste that goes

to landfill in the city of Manado is: average weight: 225 ton / day or an average volume of 560 m³ / day (see figure 2 and figure 3. below). Figure 3. Graph of the average volume of waste / day

The calculation of the cost of transporting waste waste transportation cost calculations for all types of vehicles can be seen in table 1. The calculation of the cost of transporting waste below.

No	Types of Vehicle	Unit	Arm Roll	Truck	Dump Truck	box trucks	small pick-up trucks
1	volume of waste collected	tons/year	2,592	1,296	432	432	2
2	operational costs	Rp/year	42,000,000	78,000,000	78,000,000	54,000,000	3
3	fuel costs	Rp/ year	31,500,000	20,097,000	2,835,000	3,780,000	4
4	Maintenance costs	Rp/ year	20,000,000	20,000,000	20,000,000	10,000,000	5
5	Total Cost of operational	Rp/ year	93,500,000	118,097,000	100,835,000	67,780,000	6
6	Unit Cost of operational	Rp/tons	36,072	91,124	233,414	156,898	7
7	Price Vehicle	Rp/unit	391,000,000	278,000,000	300,000,000	100,000,000	8
8	Investment cost unit	Rp/tons	15,084	21,450	69,444	23,148	9
9	Unit Cost Total	Rp/tons	51,157	112,574	302,858	180,046	

Figure 2. Graph of the average weight of waste / day Table 1.

The Calculation Of The Cost Of Transporting Waste The conclusion From the results of the calculation is obtained that the waste transporter vehicle type of Arm Rolls, most cheap amounting to Rp 51,157/tonnes of waste. The cost is small compared with the other transporter vehicle type is not necessarily the most efficient, because they still have to pay attention to other technical factors such as the location of the placement of the; containers; which requires a wide enough. Type of vehicle for other transporters such as dump trucks, iron/wood box truck that although the cost of the larger, will but open opportunities for employee / workers trash can.

In the selection or determination of the type of vehicles should be observed in many ways / aspect, for it then Manado city government must be wise in making decisions.

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