# NEED ANALYSIS OF WASTE TRANSPORTER FLEET IN PATI DISTRICT

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## ABSTRACT

Transportation of waste to carry waste from the transfer location or from the source of the waste directly to the Final Disposal Site (TPA). In Pati Regency there is a buildup of waste from shops, trades, and markets. The purpose of this study is to determine the waste transportation system, determine the needs of the waste transportation fleet, and determine the need for the number of waste transportation fleets in 2031. The method used is Stationary Container System (SCS) is used to analyze the waste transportation fleet, Waste Generation Prediction is used to predict volume population waste generation in 2031. There are currently 18 waste transport vehicles in Pati Regency, for dump trucks with a capacity of 8 m for 2 rites/ day, for arm roll trucks with a capacity of 6 m, which is 9 units. Garbage transport vehicles needed by Pati Regency in ideal conditions with the volume of waste generated 662.09 tons/day are 86 units for dump trucks with a capacity of 8 m for 3 rites/day and 26 units of arm roll trucks with a capacity of 6 m for 3 ritations/day. Meanwhile, the need for waste transportation vehicles in 2031 with an estimated waste generation of 714.87 tons/day is 104 units of dump trucks measuring 8m for 3 rites/day and 41 units of arm roll trucks for 3 rites/day measuring 6m³ and garbage carts/rickshaws in 2031 based on prediction required 661 units.

## INTRODUCTION

Garbage is leftover material, both materials that are no longer used (used goods) as well as materials that have taken their main parts, from an economic point of view, waste is waste material that is worthless and from an environmental perspective, waste is waste material that is not useful and causes many pollution problems and disruption to environmental sustainability (Nigiana et al., 2015; Sunarsih, 2014)

According to the Environmental Dictionary in Basriyanta (2007), waste is material that has no value or is not valuable for ordinary or special use in production or use; goods damaged or defective during manufacture or excess or discarded materials. Many more experts propose other limitations, but in general they contain the principles of the existence of an object or solid substance or material, directly/indirectly related to human activity, materials/objects that are not used, are not liked and disposed of in ways that are acceptable (need good management) (Pratiwi, 2019).

Garbage is an object or item that is thrown away because it is no longer used (Priatna et al., 2020). Waste is a crucial problem for humans, this is because waste has many negative impacts (Plaza & Lambertucci, 2017). Among the many impacts, waste is very detrimental to the health of the surrounding community (Ayen et al., 2016), because one particular type of waste can cause various diseases. Garbage can reduce the beauty or aesthetic value of a city.

The rapid population growth in Pati Regency, in addition to bringing benefits with the growth and development of the district to become a center of economic, industrial, social and cultural activities, also has the consequence of a decline in environmental quality, one of which is the waste problem. Pati Regency is one

of the regencies located in Central Java province. Pati Regency is directly adjacent to Jepara Regency and the Java Sea to the north, Grobogan Regency and Blora Regency to the south, Kudus Regency and Jepara Regency to the west, and Rembang Regency to the east (Tryasmara et al., 2017).
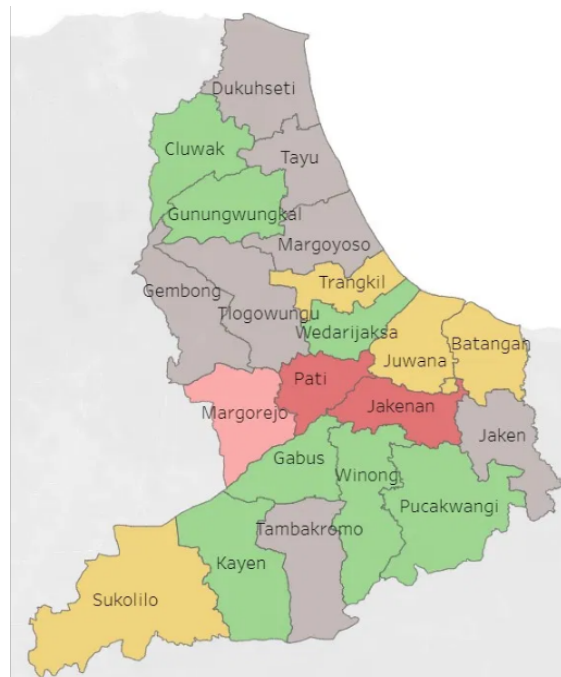


**Figure 1. Map of Pati Regency**

The area of Pati Regency in 2021 is 1,503.68 km². The monograph condition of Pati Regency consists of 21 sub-districts with a population of 1,349,172 people and a density of 2,451 people/km² (Lestari, 2022).

Increasing growth in line with higher consumptive lifestyles is certainly accompanied by an increase in waste production (Syafrini et al., 2012). In big cities, waste always creates complex problems that need to be solved (Alfian & Phelia, 2021). This is because waste greatly impacts environmental and health problems. Garbage that is disposed of in the open air can carry various bacteria and germs, causing various kinds of diseases or health problems to the surrounding community.

Delay in transporting waste can lead to disasters such as floods (Sohn, 2006). Indeed, during the rainy season, waste is often carried away by water and into ditches or drainage systems (As-Siddiqi et al., 2017). As a result, this waste can clog the drainage system, preventing the drainage from functioning properly and flooding the roads (Yunianta & Setiadji, 2022). Until now, whenever it rains, the road in Pati Regency that is often flooded during the rainy season is Jalan Raya Pati-Juwana. Entering the rainy and stormy season, everyone must care about the environment, especially urban areas and the environment outside the city of Pati by disposing of trash in its place.

However, this is not accompanied by the provision of equal facilities and infrastructure by the government, so that the services provided are less than optimal and have an impact on reducing environmental quality, especially in urban waste transportation and at landfills. To overcome this problem, the government's role is needed which is supported by the concern of the community itself.

Based on the problems above, it can be seen from the rapid growth rate with a large volume of waste and there are still frequent delays in transporting waste to the TPA. The aims of the research are: (1) knowing the causes of delays in waste transportation in Pati Regency, (2) knowing the garbage transportation system, garbage collection patterns, and the current needs of the garbage collection fleet in Pati Regency, (3) knowing the number of needs for the garbage collection fleet in accordance with the volume of waste generated in Pati Regency up to 2031.

**METHODS**

A research is said to be systematic, organized and can run effectively, efficiently and on target, a research method is needed which includes the process of planning and conducting research. The implementation of the research is adjusted to the research objectives and includes procedures for completion so that each part and has a sequential relationship with one another, thus it is hoped that a good final result will get the maximum value. The study used quantitative research (Creswell & Creswell, 2017).

Location This research was conducted in Pati Regency. The regency is located in Central Java, with the northern boundaries bordering Jepara Regency and the Java Sea, to the south by Grobogan Regency and Blora Regency, to the west by Kudus Regency and Jepara Regency, to the east by Rembang Regency. The area of Pati Regency is 1,503.68 km$^2$.

## Research Procedures

The outline of the working procedure of this research includes:
1. Determination of research objectives, namely:
   a) Knowing the transportation system and pattern of waste collection in Pati Regency.
   b) Analyzing the needs of the garbage collection fleet in Pati Regency.
   c) Knowing the need for a garbage collection fleet according to the volume of waste generated in Pati Regency until 2031.
2. Determination of research locations, namely only in Pati Regency.
3. The method used is:
   a) The Characteristic Method of the Garbage Transportation Fleet Pattern is used to determine the transportation system and waste collection patterns.
   b) The Stationary Container System (SCS) method is used to analyze the waste transport fleet,
   c) The Waste Generation Prediction Method is used to predict the volume of population waste generation in 2031.

## Data collection

1. Primary data
   The primary data input for the purposes of this research is the amount of waste generation and the volume of waste, the time it takes to transport waste (per day), the number and types of vehicles transporting waste from TPS to TPA.
2. Secondary Data
   Secondary data was obtained from the Pati Regency Environmental Service, the Central Bureau of Statistics, including demographic data for Pati Regency, Pati Regency population data, TPS service route data, number of temporary waste disposal locations.

## RESULTS
### Number of Garbage Transport Vehicles in Pati Regency

Garbage transport operations in Pati Regency are carried out by the Environment Agency. The available waste infrastructure is 18 units of dump trucks, 12 units of pick-up cars, 9 units of arm roll cars, 93 units of containers, 106 units of trash carts. The waste transported to TPA is household waste, offices, schools and public facilities (markets, shops and terminals).

### Garbage Transportation Services

The percentage of existing waste transportation system services can be seen in the following table:

**Table 1. Service Percentage**

| Year | Waste Volume (m$^3$) | Garbage Transport (m$^3$) | Percentages |
|------|----------------------|---------------------------|-------------|
| 2019 | 969,241 | 135,589 | 10.55 |
| 2020 | 315,488 | 140,160 | 42.20 |
| 2021 | 319031.27 | 140,525 | 44.05 |

Source: Department of the Environment of Pati Regency

**Population Projection of Pati Regency**

In calculating the projected population of Pati Regency, the geometric equation method is used, with the formula: Pn = Po (1 + r) n

Where:
Pn = Total population in year n
Po = The initial population n
t  = Projection time period
r  = % population growth each year

**Table 2. Population Data for Pati Regency**

| Year | Number of People |
|------|------------------|
| 2019 | 1,259,590 |
| 2020 | 1,324,172 |
| 2021 | 1,349,172 |

Source: BPS Pati Regency

*Finding Average Population Growth*

The steps to calculate the projected population growth are as follows:

a) Finding r (average number of inhabitants)
   P2019 = 1,259,590
   P2021 = 1,349,172
   Constant = 1
   t = 3
   r = (1,349,172)1/3-1
   _____
       1,259,590
   = 0.0229 = 2.29 %

   The percentage increase in the average population is used to predict the population from 2022 to 2031.
b) Looking for predictions of the population until 2031
   P2022 = P2021 (1+r) 1
         = 1,349,172 (1 + 0.0229) 1
         = 1,380,068
   P2023 = P2021 (1+r) 2
         = 1,349,172 (1 + 0.0229) 2
         = 1,411,671
   P2024 = P2021 (1+r) 3
         = 1,349,172 (1 + 0.0229) 3
         = 1,443,998

The next calculation of the population up to 2031 can be written in the table.

**Table 3. Rejected population growth in Pati Regency**

| No | year | Number of People |
|----|------|------------------|
| 1 | 2022 | 1,380,068 |
| 2 | 2023 | 1,411,671 |
| 3 | 2024 | 1,443,998 |
| 4 | 2025 | 1,477,066 |

| No | year | Number of People |
|----|------|------------------|
| 5 | 2026 | 1,510,891 |
| 6 | 2027 | 1,545,490 |
| 7 | 2028 | 1,580,882 |
| 8 | 2029 | 1,617,084 |
| 9 | 2030 | 1,654,115 |
| 10 | 2031 | 1,691,995 |

Source: data processing

**Table 4. Population Projection for Each District in Pati Regency in 2031**

| Number | Regency | Year: 2021 | Year: 2031 |
|--------|---------|------------|------------|
| 1. | Sukolilo | 93.156 | 116.826 |
| 2. | Kayen | 80.644 | 101.135 |
| 3. | Tambakromo | 57.101 | 76.610 |
| 4. | Winong | 65.142 | 81.894 |
| 5. | Pucakwangi | 48.585 | 61.272 |
| 6. | Jaken | 46.850 | 58.754 |
| 7. | Batangan | 45.396 | 56.931 |
| 8. | Juwana | 96.748 | 121.331 |
| 9. | Jakenan | 48.705 | 61.080 |
| 10. | Pati | 111.027 | 139.238 |
| 11. | Gabus | 63.749 | 79.947 |
| 12. | Margorejo | 64.411 | 79.523 |
| 13. | Gembong | 48.353 | 60.639 |
| 14. | Tlogowungu | 55.554 | 69.670 |
| 15. | Wedarijaksa | 64.775 | 81.234 |
| 16. | Trangkil | 64.182 | 80.490 |
| 17. | Margoyoso | 75.272 | 94.398 |
| 18. | Gunungwungkal | 38.703 | 48.537 |
| 19. | Cluwak | 48.310 | 60.585 |
| 20. | Tayu | 71.075 | 89.135 |
| 21. | Dukuhseti | 62.161 | 77.956 |

Source: data processing

**Prediction of Waste Generation in Pati Regency in 2031**

To predict waste generation in 2031 in Pati Regency, we need the growth rate of the industrial sector, the growth rate of the agricultural sector, the rate of increase in per capita income and the current population growth rate.

**Table 5. Total Waste Generation in Pati Regency**

| Number | Year | Waste generation (m3/ day) | Waste generation (m3/ year) |
|--------|------|----------------------------|------------------------------|
| 1 | 2019 | 501.32 | 182.981.65 |
| 2 | 2020 | 654.96 | 239.060.58 |
| 3 | 2021 | 662.09 | 241.664.31 |

Source: Pati's Regency Environmental Services

The formula used in predicting waste generation (SNI 3242-2008):

$$Qn = Qt \,(1 + Cs)$$

$$Cs = \frac{(1+(Ci+Cp+Cqn)/3)}{1+p}$$

Notes
Qn = waste generation in the following n-year
Qt = waste generation in the early calculation
Cs = City development
Ci = Industrial sector growth rate
Cp = Agriculture sector growth rate

Cqn = Per capita income sector growth rate
P = population growth rate

**Table 6. Growth Rate in 2021 Pati Regency**

| | | |
|---|---|---|
| Industrial sector growth rate | Ci | 3.42% |
| Agriculture sector growth rate | Cp | -0.20% |
| population growth rate | P | 2.29% |
| Per capita income sector growth | Cqn | 3.38% |

Source: Pati's Regency Statirics

$$Cs = \frac{(1+(Ci+Cp+Cqn)/3)}{1+p}$$
$$= \frac{(1+(3.42+(-0.20)+3.38)/3)}{1+2.29}$$
$$= \frac{2.54}{3,29}$$
$$= 0.77 \%$$

Waste generation in the early year (Qexisting) = 662.09 tons/day

$Qn = Qt (1+ Cs)^5$

$Q2026 = 662.09 (1+0.0077)^5$
　　　　= 262.47 tons/day
$Q2031 = 662.09 (1+0.0077) 10$
　　　　= 280.81 tons/day

Calculation of predictions for the amount of waste generation in Pati Regency can be written in table 7.

**Table 7. Results of Waste Generation Prediction Calculations**

| Year | Waste Generation (tons/day) | Waste Generation (tonnes/year) |
|---|---|---|
| 2022 | 667.18 | 243520.7 |
| 2023 | 672.32 | 245396.8 |
| 2024 | 677.50 | 247287.5 |
| 2025 | 682.71 | 249189.15 |
| 2026 | 687.97 | 251109.05 |
| 2027 | 693.27 | 253043.55 |
| 2028 | 698.61 | 254992.65 |
| 2029 | 703.99 | 256956.35 |
| 2030 | 709.41 | 258934.65 |
| 2031 | 714.87 | 260927.55 |

Source: Data processing

Increase in the amount of waste from 2021-2031
= 260,927 – 241,664 = 19,263 tons/year
Percentage of waste = (260,927 – 241,664) / 241,664 x 100% = 7 %

It is known from Table 8, that the increase in the amount of waste generation from 2021 to 2031 is 19,263 tonnes/year, with a percentage of 7%.
If field observations are not yet available due to a lack or lack of accurate data, based on SNI 3242-2008, then to calculate the amount of waste generation, the following waste generation figures can be used:
1. Medium municipal waste generation unit = 2.75 – 3.25 liters/person/day = 0.7 - 0.8 kg/person/day.
2. Small municipal waste generation unit = 2.5 – 2.75 liters/person/day = 0.625 - 0.7 kg/person/day.
　　　The waste generation of a resident in Pati Regency is assumed to be 0.8 kg/day, because Pati Regency is in a medium-sized city with a population of 1,349,172 people and is classified as a medium-sized city based on SNI 3242-2008. Then the waste generation in Sukolilo District is 93,156 people multiplied by 0.8 kg/person/day, which is 74,524.8 kg/day or 74.5248 tons/day.

**Prediction of waste generation in each sub-district in Pati district in 2021**

**Table 8. Results of Prediction of Waste Generation Predictions in each sub-district in Pati district in 2021**

| Number | Regency | Population in 2021 | Waste generation Ton/ Day/ People |
|--------|---------|--------------------|-----------------------------------|
| 1. | Sukolilo | 93.156 | 74 |
| 2. | Kayen | 80.644 | 64 |
| 3. | Tambakromo | 57.101 | 45 |
| 4. | Winong | 65.142 | 52 |
| 5. | Pucakwangi | 48.585 | 39 |
| 6. | Jaken | 46.850 | 37 |
| 7. | Batangan | 45.396 | 36 |
| 8. | Juwana | 96.748 | 77 |
| 9. | Jakenan | 48.705 | 38 |
| 10. | Pati | 111.027 | 88 |
| 11. | Gabus | 63.749 | 50 |
| 12. | Margorejo | 64.411 | 50 |
| 13. | Gembong | 48.353 | 38 |
| 14. | Tlogowungu | 55.554 | 44 |
| 15. | Wedarijaksa | 64.775 | 51 |
| 16. | Trangkil | 64.182 | 51 |
| 17. | Margoyoso | 75.272 | 60 |
| 18. | Gunungwungkal | 38.703 | 30 |
| 19. | Cluwak | 48.310 | 38 |
| 20. | Tayu | 71.075 | 56 |
| 21. | Dukuhseti | 62.161 | 49 |

Source: data processing

**Prediction of waste generation in each sub-district in Pati district in 2031**

**Table 9. The results of calculating the prediction of waste generation in each sub-district in Pati district in 2031**

| Number | Regency | Population in 2031 | Waste generation Ton/ Day/ People |
|--------|---------|--------------------|-----------------------------------|
| 1. | Sukolilo | 116.826 | 93 |
| 2. | Kayen | 101.135 | 81 |
| 3. | Tambakromo | 76.610 | 57 |
| 4. | Winong | 81.894 | 65 |
| 5. | Pucakwangi | 61.272 | 49 |
| 6. | Jaken | 58.754 | 47 |
| 7. | Batangan | 56.931 | 46 |
| 8. | Juwana | 121.331 | 97 |
| 9. | Jakenan | 61.080 | 49 |
| 10. | Pati | 139.238 | 111 |
| 11. | Gabus | 79.947 | 64 |
| 12. | Margorejo | 79.523 | 64 |
| 13. | Gembong | 60.639 | 49 |
| 14. | Tlogowungu | 69.670 | 56 |
| 15. | Wedarijaksa | 81.234 | 65 |
| 16. | Trangkil | 80.490 | 64 |
| 17. | Margoyoso | 94.398 | 76 |
| 18. | Gunungwungkal | 48.537 | 39 |
| 19. | Cluwak | 60.585 | 48 |
| 20. | Tayu | 89.135 | 71 |
| 21. | Dukuhseti | 77.956 | 62 |

Source: data processing

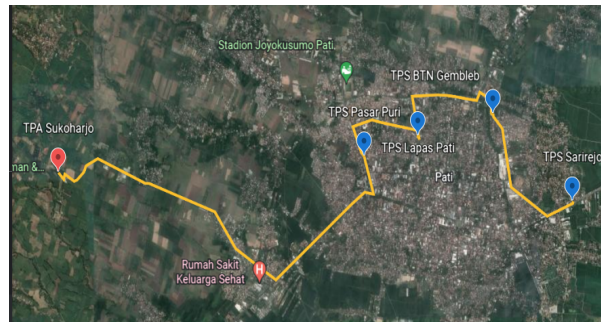### Analysis by Service Route in Pati Regency



**Figure 1. Route 1 Pati District**

**Table 10. Service Routes 1**

| Number | Vehicle registration plate | Route | Garbage collection service time | Distance of TPS to TPA (km) | Time on location |
|--------|---------------------------|-------|--------------------------------|----------------------------|------------------|
| 1 | K 9588 H | TPS Pasar Puri | 07.30 | 5.9 | 0.41 |
|   |          | TPS Lapas |      | 7.3 | 0.25 |
|   |          | TPS BTN Gembleb |  | 9.1 | 0.33 |
|   |          | TPS Sarirejo |    | 10  | 0.28 |

### Analysis of the needs of vehicles with the SCS system is

1. To calculate the transit time from TPS or to TPA, the following formula is used: 0.21 0.066 0.066 0.083
   TSCS = (PSCS + S + a + bx )

   Pscs (time needed to load trash from the first location to the last location) = 1.677
   - b) The time required for loading and unloading (S) = 0.167 hours/trip
   - c) Continuously constant load empirical (a) = 0.068 hour/rit
   - d) Constant load empirical (b) = 0.037 hours/km
   - e) Mileage (x) = 8.85 km/rit
   - f) TCS = (1.677 + 0.167 + 0.068 + (0.037 x 8.85))
   - g) TSCS = 2,239 hours/trip

   So the time per TSCS circuit is 2,239 hours/trip

2. To calculate the rotation in one day, the following formula is used

   Nd = H (1 − w) − (t1+t2) /THCS

   = 8 (1-0.1) − (0.066)/2.239

   Then the number of trips in one day (Nd) = 3 trips/day

3. The time required per day for the SCS system is calculated by the following formula

   $$Hscs = \frac{(t1 + t2) + Nd\ (Tscs)}{(1-w)}$$

   - a) Time from the pool to the starting point of the waste source (t1) = 0.066 hours

   - b) Time from the last source of waste to the pool (t2) = 0.16 hours

   - c) Off route factor (w) = 0.1 (assumption)

   - d) Hscs $\frac{(0.066+0.16)+3\ (2.239)}{(1-0,1)}$

   - e) Hscs = 7.71 Hours

   So the working hours for one day of the SCS (H) system are 7.71 hours for 3 repetitions/day.

**Table 11. Comparison of Transportation Ritation Results between Existing Conditions and Dump Truck Vehicle Calculation Results**

| Number | Vehicle registration plate | Existing value | Calculating value |
|---|---|---|---|
| 1. | K 9588 H | 2 | 3 |
| 2. | K 9587 BH | 2 | 2 |
| 3. | K 8009 XA | 1 | 2 |
| 4. | K 9531 AA | 2 | 4 |
| 5. | K 9563 SA | 2 | 3 |
| 6. | K 9549 SA | 1 | 2 |
| 7. | K 9596 WA | 1 | 2 |
| 8. | K 8039 XA | 2 | 4 |
| 9. | K 9544 SA | 3 | 4 |
| 10. | K 9565 VA | 1 | 2 |
| 11. | K 9568 VA | 1 | 2 |
| 12. | K 9532 AA | 2 | 3 |

**The Need for a Garbage Transport Fleet in Pati Regency**

The amount of waste produced per day in Pati Regency according to the Sanitation Service is 662.09 tons. The pattern of garbage collection in Pati Regency is an indirect individual pattern. This pattern is carried out by collecting waste from waste sources and then transporting it by garbage carts/rickshaws then collecting it at communal trash bins and then transporting it to the TPA. The need for waste transport equipment in Pati Regency according to the analysis is:

1. The need for garbage carts /rickshaws with a capacity of 1m3

   Based on SNI 3242 of 2008 for 1 unit of garbage cart/rickshaw with a capacity of 1m3 has a service capacity of 640 people. Pati Regency in 2021 has a population of 1,349,172 people, so it takes 2 trips x 1 m3 / 2 times a day, so 527 units of garbage carts/rickshaws are needed for garbage collection.

2. The need for a dump truck with a capacity of 8m³ has a carrying capacity of 3.2 tons

   Dump trucks distributed for each sub-district with an average of 3 repetitions according to the results of the count. The total amount of waste generation that can be transported is Pati District 7 units of trucks x 3.2 tons x 3 repetitions = 67.2 tons.

3. The need for an arm roll truck with a capacity of 6 m³ has a carrying capacity of 2.4 tons

   The need for arm roll trucks is the total waste generation in Pati sub-district in 2021 minus the waste generation transported by dump trucks, which is 88 tons minus 67.2 tons (30% of total waste generation) is 20.8 tons. Then it takes 2 units of arm roll trucks with 3 trips to transport the container to the TPA.

**Table 12. Results of analysis of the 2021 garbage transportation fleet**

| Number | Regency | Cart | Dump Truck | Arm Roll Truck |
|---|---|---|---|---|
| 1. | Sukolilo | 36 | 6 | 2 |
| 2. | Kayen | 32 | 5 | 2 |
| 3. | Tambakromo | 22 | 4 | 1 |
| 4. | Winong | 25 | 4 | 1 |
| 5. | Pucakwangi | 19 | 3 | 1 |
| 6. | Jaken | 18 | 3 | 1 |
| 7. | Batangan | 18 | 3 | 1 |
| 8. | Juwana | 38 | 6 | 2 |
| 9. | Jakenan | 19 | 3 | 1 |
| 10. | Pati | 43 | 7 | 2 |
| 11. | Gabus | 25 | 4 | 1 |
| 12. | Margorejo | 25 | 4 | 1 |
| 13. | Gembong | 19 | 3 | 1 |
| 14. | Tlogowungu | 22 | 4 | 1 |
| 15. | Wedarijaksa | 25 | 4 | 1 |
| 16. | Trangkil | 25 | 4 | 1 |
| 17. | Margoyoso | 29 | 5 | 1 |
| 18. | Gunungwungkal | 15 | 3 | 1 |
| 19. | Cluwak | 19 | 3 | 1 |

| Number | Regency | Cart | Dump Truck | Arm Roll Truck |
|---|---|---|---|---|
| 20. | Tayu | 28 | 4 | 2 |
| 21. | Dukuhseti | 24 | 4 | 1 |
| | Total | 527 | 86 | 26 |

**Table 13. Comparison of the Number of Garbage Conveyors in Existing Conditions and Calculation Analysis Results**

| Transportation | Total | |
|---|---|---|
| | Existing condition | Analysis results |
| Cart | 106 | 527 |
| Dump truck | 18 | 86 |
| Arm roll truck | 9 | 26 |

**The Need for Garbage Transport Equipment in Pati Regency in 2031**

The total waste generation in 2031 is 714.87 tonnes/day and one day's operating hours are 8 hours. The need for waste transport equipment in Pati Regency in 2031 is:

1. The need for garbage carts/rickshaws with a capacity of 1m$^3$

   Based on SNI 3242 of 2008 for 1 unit of garbage cart/rickshaw with a capacity of 1m3 has a service capacity of 640 people. Pati Regency in 2031 with a predicted population growth of 2.29% has a population of 1,691,995 people, 661 units of garbage carts / tricycles are needed for garbage collection.

2. The need for a dump truck with a capacity of 8m³ has a carrying capacity of 3.2 tons

   Dump trucksdistributed for each sub-district with an average of 3 repetitions according to the results of the count. The total amount of waste generation that can be transported is Pati District 8 trucks x 3.2 tons x 3 repetitions = 76.8 tons.

3. The need for an arm roll truck with a capacity of 6m³ has a carrying capacity of 2.4 tons

   The need for arm roll trucks is the total waste generation in Pati sub-district in 2031 minus the waste generation transported by dump trucks, which is 111 tons minus 76.8 tons is 34.2 tons. Then it takes 4 units of arm roll trucks with 3 trips to transport the container to the TPA.

Results of the Analysis of the Needs of the Garbage Transport Fleet in each sub-district in Pati district in 2031.

**Table 14. Results of the 2031 garbage fleet analysis**

| Number | Regency | Cart | Dump Truck | Arm Roll Truck |
|---|---|---|---|---|
| 1. | Sukolilo | 46 | 7 | 3 |
| 2. | Kayen | 40 | 6 | 3 |
| 3. | Tambakromo | 28 | 4 | 2 |
| 4. | Winong | 32 | 5 | 2 |
| 5. | Pucakwangi | 24 | 4 | 1 |
| 6. | Jaken | 23 | 4 | 1 |
| 7. | Batangan | 22 | 4 | 1 |
| 8. | Juwana | 47 | 7 | 4 |
| 9. | Jakenan | 24 | 4 | 1 |
| 10. | Pati | 54 | 8 | 4 |
| 11. | Gabus | 31 | 5 | 2 |
| 12. | Margorejo | 31 | 5 | 2 |
| 13. | Gembong | 24 | 4 | 1 |
| 14. | Tlogowungu | 27 | 4 | 2 |
| 15. | Wedarijaksa | 32 | 5 | 2 |
| 16. | Trangkil | 31 | 5 | 2 |
| 17. | Margoyoso | 37 | 6 | 2 |
| 18. | Gunungwungkal | 19 | 3 | 1 |
| 19. | Cluwak | 24 | 4 | 1 |
| 20. | Tayu | 35 | 5 | 3 |
| 21. | Dukuhseti | 30 | 5 | 1 |
| | Total | 661 | 104 | 41 |

**Table 15. Comparison of the Number of Garbage Conveyors in 2021 & 2033**

| Transportation | Total | |
|---|---|---|
| | Year 2021 | Year 2031 |
| Cart | 527 | 661 |
| Dump truck | 86 | 104 |
| Arm roll truck | 26 | 41 |

From table 15 in 2031 there will be several changes compared to 2021, for dump trucks there will be an addition of 18 units, for arm roll trucks there will be an addition of 15 units, while the addition of carts/ rickshaws will be 134 units.

## CONCLUSION

Based on the results of the Analysis of Garbage Transportation in Pati Regency, the following conclusions can be drawn are: (1) delays in transporting garbage in Pati Regency were caused by a lack of garbage transport fleets in Pati Regency, (2) waste processing in Pati Regency, namely organic waste is processed into compost and briquettes. Meanwhile, wet waste such as leftover food is collected in one container so that it can be used by chicken and duck farmers. For waste types of cardboard and plastic, used mineral water is sold back to used goods collectors, (3) the most suitable transportation system and waste collection pattern for the Pati Regency area using the SCS (Stationary Container System) method is a garbage container system with an indirect individual pattern, namely by collecting garbage carts from the waste source and then collecting it in a garbage container or TPS (temporary disposal site) before being taken to the TPA (final disposal site), (4) there are currently 18 waste transport vehicles in Pati Regency for dump trucks with a capacity of 8m³, for arm roll trucks with a capacity of 6m³, namely 9 units each. The waste transport vehicles needed by Pati Regency in 2021 with a volume of waste produced of 662.09 tonnes/day are 86 units of dump trucks with a capacity of 8m³ and 26 units of arm roll trucks with a capacity of 6 m³. The number of garbage carts/rickshaws in the existing condition of Pati Regency is 527 units, and (5) the need for waste transport vehicles in 2031 with an estimated waste generation of 714.07 tonnes/day is 104 units of 8m³ dump trucks and 41 units of 6m³ arm roll trucks. Garbage carts/rickshaws in 2031 based on predictions will require 661 units.

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