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Distribution mapping of Open Defecation (OD) houses in East Surabaya based on Geographic Information System (GIS)

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Abstract. The purpose of this study is to know and locate the distribution of open defecation houses in East Surabaya of Surabaya City, Indonesia. Both of secondary and primary data are required for this research, the secondary data consist of the number of OD houses in East Surabaya and basic map of Surabaya City. Primary data consist of field survey OD houses of legal and illegal status. Mapping is conducted with mapping software based on geographical information system. The result of this research proves that there are 1.083 OD houses in East Surabaya and it is equally distributed throughout East Surabaya. The most OD sub-district (Kelurahan) is Gubeng with approximately 319 houses while the least is Kelurahan Tambaksari with 23 houses.

1. Background

Surabaya City has 31 districts, 164 sub-districts, and 63 units of health centers. It is a metropolis city in East Java Province with high population growth. This population growth has impacts on facilities, infrastructure, and service which needs increment. According to Surabaya Government [1], sanitation access service in Surabaya has achieved 86.74% of total area. There are still many sub-districts that has not achieved Open Defecation Free (ODF) criteria yet. Achieving ODF is sometimes a complicated issue since there are some obstacles in building healthy Water Closet (WC). Most of Surabaya citizens believe that they are not participating in OD, but somehow they are not aware whether the WC channel they are using flows directly to drainage/river instead of it flows into septic tanks [2].

Mayor of Surabaya responded those issues above by publishing form letter about achievement acceleration regarding ODF declaration. According to Form Letter from Mayor of Surabaya No. 443/310/436.6.3/2015, one of the points inside the letter is target to actualize clean, healthy environment, and ODF sub-district immediately as also mentioned by Soedjono *et.al.* [3]. Open defecation has real impact, such as environment contamination that can arouse some diseases. Some diseases caused by open defecation are typhoid, parathyroid disease, diarrhea, dysentery, and several other infectious diseases. Open defecation can also cause damage on environmental aesthetics [4]. In In 2017, Mayor of Surabaya published mayor form letter containing septic tank and Wastewater Treatment Plant (WWTP) manufacture acceleration advisories in Surabaya. The form letter is published and addressed to all Surabaya citizen and Office of Public Housing and Residential Areas, Cipta Karya and Spatial Planning (Dinas Perumahan Rakyat dan Kawasan pemukiman, Cipta Karya dan Tata Ruang) for helping Surabaya citizen in fecal waste treatment or communal septic tank and communal WWTP manufacture.

East Surabaya becomes the location object in this research because based on data from Surabaya Public Health Office, area with the highest OD number is East Surabaya. The number of OD in East Surabaya has reach more than 2800 householders (HH). This high number of OD in East Surabaya is



not relevant with high number growth and development in East Surabaya. Lack of sanitation access has become one of the factor that cause high OD number in East Surabaya.

2. Methods

Tools used in this research are stationeries, printer, PC, Google Earth software, GIS software, Microsoft Office software, and Global Positioning System (GPS).

Materials used in this research are base map of Surabaya, A4 and A3 sized paper, printer tint, location map with OD citizen in East Surabaya year 2016, and any other supporting literatures.

Primary data was collected in East Surabaya by doing observation or survey and mapping with GIS software. This survey would plot sampling locations. Survey location determination is being plotted in every sub-districts. The number of samples are determined by statistic formulation or solving methods as follows:

$$n = \frac{N}{1 + Ne^2} \quad (1)$$

Explanation:

n = Number of sample

N = Number of population

E = Tolerance limit

After doing the calculation with slovin method, the following step is arranging coordination with health center sanitarian in relevant sub-district to judge the location for research object. Coordinates are then determined to plot each location spots for mapping. Those coordinates are obtained during survey by doing ground check using GPS.

The secondary data was collected in relevant agencies. The secondary data, which was collected from Surabaya City Health Office, and base map of Surabaya that was collected from office of Public Housing and Resettlement Areas, Cipta Karya and Spatial Planning of Surabaya (Dinas Perumahan Rakyat dan Kawasan pemukiman, Cipta Karya dan Tata Ruang Kota Surabaya).

The collected data was being analyzed and used as base data for mapping. This mapping was conducted using GIS software to help the identification of area with OD number.

3. Results and discussions

East Surabaya consists of 41 sub-districts from 7 districts, such as Gunung Anyar District, Rungkut District, Sukolilo District, Tenggilis Mejoyo District, Mulyorejo District, Tambaksari District, and Gubeng District. East Surabaya is one of area in Surabaya which still has OD behavior. According to Surabaya Public Health Office, East Surabaya has the highest number of OD, with total 3118 householders (HH), for both householders living in legal and illegal land.

Table 1. Observation recap results.

No.	Districts	Number of OD
1	Gunung Anyar	238 HH
2	Rungkut	153 HH
3	Sukolilo	30 HH
4	Gubeng	319 HH
5	Tenggilis Mejoyo	168 HH
6	Mulyorejo	149 HH
7	Tambaksari	23 HH
Total		1080

Number of OD data in East Surabaya then observed directly to the citizens. Direct observation was aimed to do the re-checking on existing data change. Observation was conducted on 7 districts in East Surabaya. Open defecation observation was focused on citizens who lived in legal area or private property. The number of total OD in East Surabaya based on field observation can be seen in Table 1.

Based on observation result in Table 1, the highest number of OD in East Surabaya has reach 1080 householders (HH). Open defecation distribution is prevalent to 7 districts in East Surabaya. The highest number of OD is in Gubeng District with 319 householders, and lowest number of OD is in Tambaksari District with 23 householders. The following is a distribution map of OD in East Surabaya.

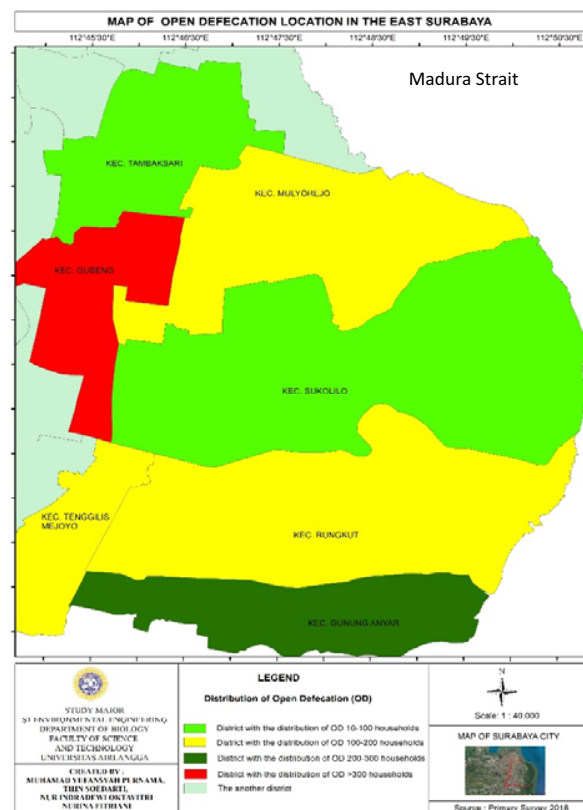


Figure 1. The distribution map of OD in East Surabaya

Based on the figure 1, in red area is the highest of OD's number in Gubeng District. In dark green area, is the second highest of OD's number Gunung Anyar District. The yellow area, is the second lowest of OD's number in Tenggilis Mejoyo, Rungkut and Mulyorejo District. The last for the lowest OD's number in light green area is Sukolilo and Tambaksari District.

4. Conclusion

Based on this research, it is concluded that the number of OD houses on legal land in East Surabaya are 1080 units. Those number of OD houses overspread in 7 sub-districts. Highest number of OD is in Gubeng District with 319 houses and lowest number of OD is in Tambaksari District with 23 houses.

References

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