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Solid Waste Landfill Site Selection; Konya City Sample[#]

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A R T I C L E I N F O	A B S T R A C T
	In developing countries, consumption habits have changed with the increase in population, the development of technology and industrialization. For this reason, good management of the increase in the amount of solid waste by municipalities is very important for the health and sustainability of nature. The location of the facility to be established is important for the regular storage and efficient disposal of solid wastes. Site selection of landfill facilities in the 'Site Management and Operation Guide for Landfill Facilities' published by the General Directorate of Environmental Management; The ratio of the volume to the area, the distance to the buildings, the wind direction, the external view (landscape), the effect on the traffic on the side, the profit from the finished facility, and the effect on the water are evaluated under the sub-headings. With the 'Konya Solid Waste Management Project', 'Aslım Sanitary Landfill', which was used until 2017, was closed. Instead, the 'Konya Solid Waste Landfill Site', which was established in a different region to meet the need, was put into operation. In the study to be carried out in this context; Both fields were evaluated according to the specified criteria and compared with each other using the Analytical Hierarchy Method. As a result, it is aimed that the success rate of the location selection of the new solid waste storage area will be revealed and it will be a base for similar studies to be done in the future.

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Introduction

With the rapidly increasing population in the world, settlement in cities has increased due to migration from villages to cities. Increasing industrial activities with the developing technology are changing the consumption amount and habits day by day. With this situation, consumption has increased and the amount of waste generated has inevitably increased. Waste; It is any substance that has been used, is not wanted to be used anymore, and may create a negative situation for the environment (Yüceil, 1997). The amount of solid waste and what it consists of are related to the economic situation and cultural level of the people, along with the season in the region where it comes out (Karakaya, 2019).

It is nearly impossible to eliminate all types of waste, but they can be managed using environmentally sustainable practices (Rahman et al., 2008). More than one way or method is followed for the collection of waste and how it will be evaluated. At this stage, where the waste is collected from or what type it is also gains importance. Therefore, it is necessary to follow a correct hierarchy when managing waste. Solid waste storage facilities are used to ensure that all these processes are efficient and economical. Landfills will be the most effective option for reducing and recycling the environmental impact of waste (Cherubini et al., 2008).

The good management of the increase in the amount of solid waste by the municipalities is a necessary issue for the health and sustainability of the nature in which they live together with the living things. The collection of such wastes requires more systematic work beyond the garbage collection of local municipalities. The harm caused by these wastes to the environment has led to the need for their recycling or storage. Studies to be carried out on solid wastes; is to establish multi-faceted systems such as the collection, transportation, evaluation and elimination of wastes. The ultimate purpose of the established systems is to ensure that the resulting wastes cause the least damage to the environment and economy (Meriç and Kayranlı, 2003).

In our country, many waste types and solid waste management are followed in accordance with the Environmental Law No. 2872 and international standards. In this process, in order to comply with EU environmental studies; Plans such as Planning of High Cost Environmental Investments (EHCIP), National Environmental Integrated Adaptation Strategy, Solid Waste Master Plan, Waste Management Action Plan, National Recycling Strategy Document and Action Plan have been prepared (Korucu, 2019). Regular solid waste storage facilities are the areas that provide the separation and disposal of solid wastes, which have been used most widely in many countries for many years (Komilis et al., 1999). Studies in landfills for the recovery and recycling of wastes, which are an integral part of solid waste management, consist of many complex physical and biochemical stages.

Location Selection

Due to the ever-increasing population and urbanization, the areas deemed suitable for solid waste storage are insufficient and have begun to remain in the development pattern of the city (Güngör and Dilek, 2006).

There are issues to be considered in the selection of solid waste storage areas. The first of these is the distance from the settlements specified in the regulation on the regular storage of wastes. According to the regulation, the distance of the facility border to the settlements must be at least 1 km for the 1st class facilities and at least 250 meters for the 2nd and 3rd class facilities (Anonymous, 2014). In fact, it is stated that the surroundings up to 1.6 km from the solid waste landfills are directly affected (Ham, 1993). Determining the location of a healthy landfill and determining the best disposal method according to the type of waste requires a comprehensive evaluation process (Al-Jarrah and Abu-Qdais, 2006). In addition, in the location selection of the landfill facility;

- Whether the facility affects air transportation security,
- Dominant wind direction,
- Distance from forest and afforestation areas and areas under protection for special purposes such as the protection of wildlife and vegetation,
- Groundwater resources, water level, flow directions, surface water basins and precipitation amount in the region,
- Topographic, geomorphological, geological, geotechnical and hydrogeological condition of the area,
- The risk of landslide, avalanche, erosion, flood and high earthquake in the region,
- Natural or cultural heritage situation should be taken into account (Rushbrook and Pugh, 1999)

Table.1 Evaluation Criteria for Landfill Site Selection and Significance Levels (Anonymous, 2014)

Ratio of volume to area	7
Distance to structures	20
Wind direction	7
Appearance (landscape)	7
Effect on adjacent traffic	13
Earnings from the finished plant	13
Effect on water	33

In the study to be carried out in this context; Aslım Sanitary Landfill, which was used until 2017 with the 'Konya Solid Waste Management Project', was closed. Instead, the 'Konya Solid Waste Storage Area', which was put into operation in order to meet the need in Kaşınhanı region, was built. By using the Analytical Hierarchy Method, they were compared with each other and evaluated according to the specified criteria. As a result, the success rate of the new solid waste landfill site selection will be revealed and it is aimed to be a base for similar studies to be done later.

Material and Method

This work; It covers the analysis of the general priorities of the solid waste storage facility location selection criteria, which are given in the Regular Solid Waste Storage Guide of the Ministry of Environment and Urbanization, on the Aslım Solid Waste Storage Area and Konya Solid Waste Regular Landfill in the city of Konya, with the AHP method. The purpose of choosing the AHP method; It is one of the most suitable methods as it enables the comparison of both facilities according to these criteria. A survey was conducted in an easy and understandable language for 97 (Population: 2,000,000, 10% margin of error, calculated according to 95% confidence level) city dwellers who were informed about the facilities. Then, the survey data were entered into the system and the priority vectors of the determined criteria were calculated by pairwise comparisons. General priority matrices were found by resynthesis of the obtained priority vectors. The data obtained as a result of the survey were analyzed with the Microsoft Excel software of the Office 2021 program.

Analytical Hierarchy Process (AHP)

The basis of this mathematical theory developed by Saaty is the selection by pairwise comparisons. Due to its simple and easy-to-understand structure, the AHP method is a very popular method in the literature for determining criterion weights in multi-criteria decision-making problems. AHP is a fundamental approach to decision making. It is designed to select the best from a number of alternatives evaluated according to various criteria. In this process; The decision maker applies simple pairwise comparison decisions used to compare simple options and develop overall priorities (Saaty and Vargas, 2012).

Findings

Aslım Solid Waste Landfill

Aslım Solid Waste Storage Area, which is located in Aslım locality, 7 kilometers from Konya city center and has an area of 55 hectares; It has hosted solid wastes collected from Meram, Selçuklu and Karatay districts of the city for more than 35 years (Anonymous, 2022).

The smell of the facility, which is close to the city center and in the prevailing wind direction; It is known that it disturbs a large part of the city, especially the immediate surroundings. In addition, the garbage storage function was terminated in 2017, as it filled the carrying capacity. The power generation facility in the region continued to produce electricity from garbage until it completed its

economic life, produced 20,294,011 kilowatts in 2019, 11,981,713 kilowatts in 2020, and was closed at the end of 2021 because the amount of gas in the facility decreased (Anonymous, 2020).

Konya Solid Waste Landfill

The area established in Kaşınhanı region covers an area of 1 million 700 thousand square meters. Since its establishment, more than 1,455 tons of solid waste has been disposed of on average daily (Anonymous, 2020).

Wastes from Karatay, Selçuklu, Meram and Çumra Districts are stored in the Konya Solid Waste Landfill Site located in Kaşınhanı location, and a Methane Gas Power Generation Facility with a 10.92 megawatt/hour electrical energy generation capacity has been established in the field. The newly established Methane Gas Power Generation Facility was put into operation as of October 2018. A total of 55,650,607,00 kilowatts of electricity was produced in 2019 (Anonymous, 2020).

Binary Comparison Data

Table 2. Priority vectors of landfills for each criterion

	Aslım Landfill Site	Konya Solid Waste Landfill
Ratio of volume to area	0.299849	0.700151
Distance to structures	0.097414	0.902586
Wind direction	0.084277	0.915723
Appearance (landscape)	0.226366	0.773634
Effect on adjacent traffic	0.047853	0.952147
Earnings from the finished plant	0.374126	0.625874
Effect on water	0.297431	0.702569

Table 3. General Priority Vectors

	General Priority	Percent (%)
Aslım Landfill Site	0.125187	12.52
Konya Solid Waste Landfill	0.874813	87.48

Conclusion

According to the multiple comparison analyzes made, it was concluded that Aslım Sanitary Landfill had 12.52% priorities and Konya Solid Waste Sanitary Landfill had 87.48% priorities. This shows that the location selection made according to the determined criteria is a successful choice for the residents of the city.

In addition to this analysis, spatial and land use suitability analyzes of the area planned to be used in the site selection decision process of the sanitary landfills should be made, the factors affecting the site selection should be evaluated according to the planned area, alternative areas should be evaluated by considering environmental, cultural and social factors. First of all, a sustainable location should be chosen in terms of environmental, economic and technical aspects.

Public participation in the landfill site selection decision process; Increasing the possibility of public approval for final plans, providing decision makers and a different perspective on the criteria, information and problems considered in the decision process,

It is a very important step in terms of paving the way for the reduction of the negative impact on the settlements and communities that are likely to be affected, making choices by foreseeing possible criticisms, improving the skills of decision makers to be sensitive to problems, encouraging the public to think about their own role as waste producers and to be conscious.

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