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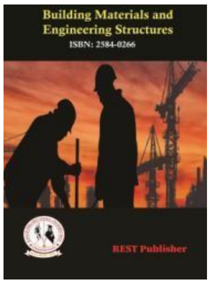

Material Comparative Design of Penstock Pipe for Hydroelectric Pumped Storage Station Using MOORA Method

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Abstract. *Steel would be the only substance utilised for high head pencils; however, the necessary steel strength needs to be specified. Fibreglass, plastic, practical, wire-wound wood staves, banded wood staves, and mild steel can all be utilised for lower heads. A penstock can be made, at least in part, from almost any form of pipe. White polypropylene PVC, which comes in a variety of temperature ratings, and "poly pipe" (also known as black polyethylene, PE, or higher-density polyethylene, or HDPE), which is also readily accessible, are the two most popular varieties. Typical drainpipe has a thin wall and is not pressure-rated. Penstocks, which are substantial pipes or canals, pump water from the hydropower basin to the machines within the actual power station. The penstock, which is normally made of steel, allows fluids at high tension to pass through it. Describe a penstock. units. The changeover pieces are 7.5 metres wide, while penstock pipes are 80 metres long and ten metres broad. At the dam site, 14 portions will be soldered together to form each penstock. alternative: YS (Mpa), L(year), T(mm). Evaluation Preference: PVC, HDPE, GRP, MS. From the results, it can be observed that HDPE and is ranked top, whereas GRP received is ranked last.*

Keywords: *PVC, Penstock, GRP, MS*

1. INTRODUCTION

The main part of a hydroelectric plant that transforms the force of falling water into spinning shaft power is a turbines. Two site parameters, the head and flow available, play a major role in determining which turbine is best suited for a given hydro site. Different types of turbines, such as Pelton wheels, cross flow generators, The report discusses the installation of a micro hydroelectric power station in a destroyed saw mill's infrastructure, which involves re-engineering the site. The power station will use a pipeline to generate hydraulic power for the generator. The report estimates the amount of hydraulic power that will be available to the generator. A significant amount of construction and engineering work has already been done, including repairing rerouting the lower pipeline segment, constructing a bridge, and replacing an outdated pipeline section. The pipeline used to transport water to the power plant is the subject of the paper. Two types of turbines will be used in the power station: pumps as turbines and standard reaction turbines. A penstock is a pipeline used to supply water to a power station. In this instance, the penstock transports water from a creek to the power plant 4 miles below the surface. The penstock has two potential routes: the old route, which follows the creek directly to the charred mill complex before zigzagging beneath the undermines to reach the turbine house; and the new route, which joins the old pipeline shortly before the mill intricate and travels directly across a bridge to reach the generator house. The containers in the pipeline are virtually all functioning, and both network routes are split into two halves to avoid a dead spot in the central area that cannot deflect away from the incoming jet of water. The bucket's admission into the jet is smoother because to the cutaway on the lower lip of the buckets, which allows the next bucket to advance before breaking off the jet. A smaller runner can be employed for a given flow when there are two more jets, which speeds up rotation while maintaining the necessary power. The new governor is designed to have 2 seconds is the minimal amount of time for servomotor closure after 100% opening. Even though the new governor's operating rate was confirmed by laboratories testing, those tests were conducted without taking into account the moment of force that flowing water exerts on the wicket gates and the influence of the moveable parts of the guide wheel's inertia. neglecting external loads on the servomotor piston.

2. METHODOLOGY

Multi-objective optimization techniques, such as the MOORA method introduced by Brauers, can be helpful in selecting the best option from a set of alternatives. This method considers multiple objectives and ranks or selects alternatives based on their effectiveness in meeting those objectives. The MOORA method satisfies the first six conditions of optimization and partially satisfies the seventh condition by using two different methods. It also has the advantage of being computationally efficient and can be easily implemented in MS Excel. Fuzzy AHP and Fuzzy MOORA methods have been used by industrial engineers to analyze data obtained from questionnaires and select the best option based on their preferences and relative importance of attributes. The ranking of alternatives and attributes depend on the decision makers' preferences. The literature on penstock failures in hydropower plants is limited, making it challenging to learn from past failures and improve the operational security of such plants. Bonin's 1960 paper describing damage to a water turbine in the Okinawa Power Station caused by alpenstock failure is a rare exception in the advantages of micro-hydro-electric power plants over other renewable energy technologies. Micro-hydro-electric power plants offer high efficiency, high-capacity factors, and a slow rate of change in output power. They also have maximum output power in winter and are more appropriate for small communities compared to larger hydro-electric power plants. Properly designed micro-hydro-electric power plants can generate maximum power output with minimal environmental disruption and can coexist with the native ecology. A suitable site selection and appropriate design of power generation systems, including the selection of the turbine, generator, and power transmission line components, are crucial in achieving this. Micro-hydro-electric power plants use either impulse or reaction turbines to convert potential energy in the water into mechanical energy in the turbine, and the proper selection of these components is essential for optimal performance.

3. RESULT AND DISCUSSION

TABLE 1. Penstock Material Selection

	YS (Mpa)	L(year)	T(mm)
PVC	0.109	0.096	0.14
HDPE	0.084	0.11	0.039
GRP	0.069	0.0836	0.153
MS	0.117	0.0954	0.121

Table 1 shows that alternative: YS (Mpa), L(year), T(mm). Evaluation Preference: PVC, HDPE, GRP, MS.

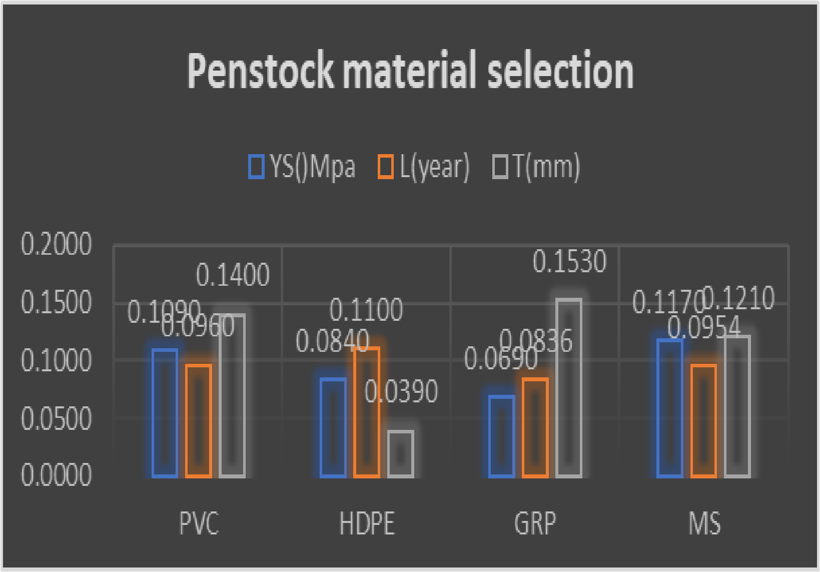

FIGURE 1. Penstock material selection

Figure 1 shows that alternative: YS (Mpa), L(year), T(mm). Evaluation Preference: PVC, HDPE, GRP, MS.

TABLE 2. Normalized Data

Normalized Data		
YS()Mpa	L(year)	T(mm)
0.5637	0.4964	0.5755
0.4344	0.5687	0.1603

0.3569	0.4322	0.629
0.6051	0.4933	0.4974

$$X_{n1} = \frac{x1}{\sqrt{((x1)^2 + (x2)^2 + (x3)^2 \ldots)}} \quad (1).$$

Table 2 shows the various Normalized Data YS (Mpa), L(year), T(mm). Normalized value is obtained by using the formula (1).

TABLE 3. Weight

Weight		
0.25	0.25	0.25
0.25	0.25	0.25
0.25	0.25	0.25
0.25	0.25	0.25

$$X_{wnormal1} = X_{n1} \times w_1 (2).$$

Table 3 shows the Weight ages used for the analysis. We had taken same weights for all the parameters for the analysis. All weight value same 0.25.

TABLE 4. Weighted normalized decision matrix

Weighted normalized decision matrix		
0.1409	0.1241	0.1439
0.1086	0.1422	0.0401
0.0892	0.1081	0.1572
0.1513	0.1233	0.1244

Table 4 shows the weighted normalized decision matrix YS (Mpa), L(year), T(mm). the weighted default result is calculated using the matrix formula (2).

TABLE 5. Assessment value

	Assesment value
PVC	0.1211
HDPE	0.2107
GRP	0.04
MS	0.1502

$$\text{Assesmentvalue} = \sum X_{wn1} + X_{wn2} - X_{wn3} \quad (3).$$

Table 5 shows the Assessment value. Assessment value for PVC = 0.1211, HDPE = 0.2107, GRP = 0.04, MS = 0.1502, Insect layer = 0.091.

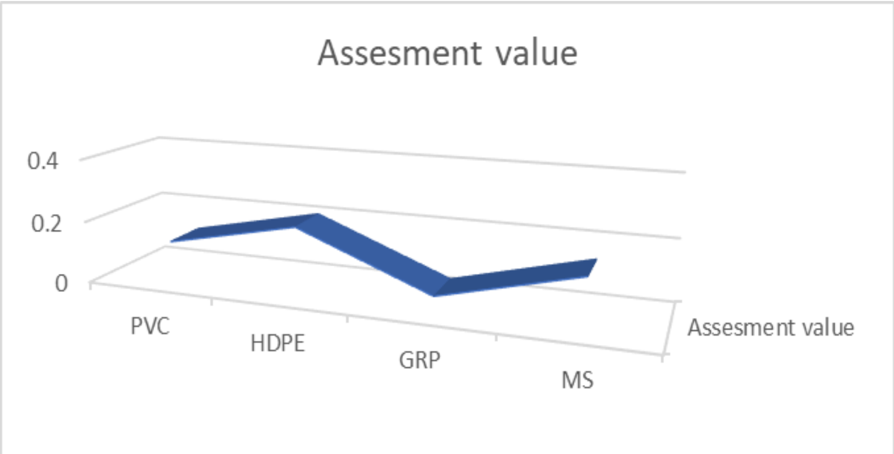

FIGURE 2. Assessment value

Figure 2 shows that Assessment value PVC = 0.1211, HDPE = 0.2107, GRP = 0.04, MS = 0.1502, Insect layer = 0.091.

TABLE 6. Rank

	Rank
PVC	3
HDPE	1
GRP	4
MS	2

Table 6 shows the graphical view of the PVC is in 3rd rank, the HDPE is in 1st, the GRP 4th, MS is in 2nd rank.

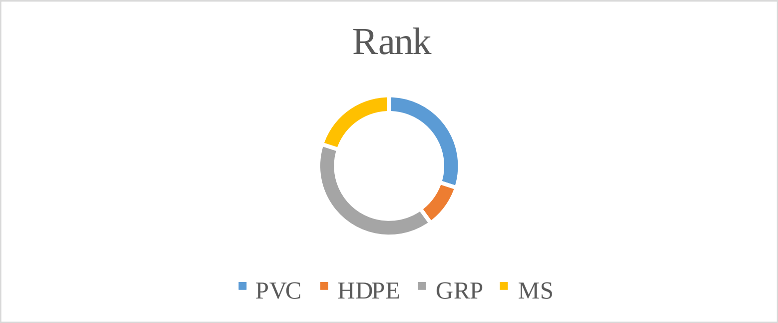

FIGURE 3. Rank

From the results shown in Figure 3, it can be seen that HDPE and is ranked top, while GRP is ranked last.

4. CONCLUSION

The competitiveness of a company is greatly influenced by how it evaluates and selects market segments. This process involves multiple criteria and can be challenging to navigate, especially in an uncertain environment. To address this, we have developed an extension of the an approach to multi-criteria decision-making is the fuzzy CODAS method. The attractiveness of alternatives has been assessed using fuzzy proportional Geometric and fuzzy weighed Hamming kilometres, and the crisp CODAS approach has been expanded using trapezoidal fuzzy numbers. A multi-criteria market segment appraisal and selection challenge was tackled using our suggested methodology. as an example.

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