P-ISSN: 2618-0723
E-ISSN: 2618-0731

NAAS Rating (2026): 5.04
www.extensionjournal.com

International Journal of Agriculture Extension and Social Development

Volume 9; Issue 1; January 2026; Page No. 101-103

Received: 24-10-2025
Accepted: 30-11-2025

Indexed Journal
Peer Reviewed Journal

Cost comparison of materials for development of flow regulation and control unit

[1]Chitte Karishma, [2]B Krishna Rao, [3]A Mani, [3]B Hari Babu and [3]V Srinivas Rao

[1]Dr. NTR, College of Agricultural Engineering, Bapatla, Andhra Pradesh, India

[2]ICAR-Indian Institute of Soil & Water Conservation, RC, Ballari, Karnataka, India

[3]Acharya NG Ranga Agricultural University, LAM, Guntur, Andhra Pradesh, India

DOI: https://www.doi.org/10.33545/26180723.2026.v9.i1b.2885

Corresponding Author: B Krishna Rao

Abstract

Flow control Structures that remain in place for more than one irrigation season are considered permanent. The control structures moved from one place to another place during every irrigation are installed for one season as considered as temporary. Temporary structures are required on most irrigated farms, but permanent structures normally permit better water control with less labour. The cost of temporary and permanent irrigation control structures can often be reduced by combining two or more structures wherever possible. These are like checks, drops, divisors, turnouts or combined with various combinations. In this to develop control unit FRP, HDPE, PVC, PP, MS, GI was used, different costs to develop modules are base material cost, preparation cost, welding labour cost, filler material cost, Gases cost was considered from this observed that cost of development of modules with PP is less.

Keywords: Cost, control unit, develop, fabrication, materials

Introduction

In order to effectively irrigate the agricultural lands, the irrigation system requires operator to control water and measurement of water at various points of the irrigation system. The operator should apply water to the lands in required quantity with non-erosive velocities with minimum consumption of labour. On the farm, water control is achieved with help of structures in open channel. These convey water from main canal or lateral head gate, natural stream, or other source to its destination on the field. These structures may require controlling channel flow when unlined ditches are used. Water control structures regulate water levels, dissipate energy, accurate distribution and deliver water at desired rate to fields. Flow control Structures that remain in place for more than one irrigation season are considered permanent. The control structures moved from one place to another place during every irrigation are installed for one season as considered as temporary. Temporary structures are required on most irrigated farms, but permanent structures normally permit better water control with less labour. The cost of temporary and permanent irrigation control structures can often be reduced by combining two or more structures wherever possible. These are like checks, drops, divisors, turnouts or combined with various combinations.

Wooden control structures have been widely used in the USA over the previous century. These are replaced by concrete and metal after wards Control Structures made with durable materials are recommended for permanent installations. Many commercial purpose control structures are being manufactured with precast concrete and modular or component type metal structures. These permanent type control structures are efficient, much useful and well adapted to farmer's field installation. Effective water control structures on the fields also obtained by using improved rubber devices and plastic.

Polymers are the basis for numerous synthetic and organic materials, such as plastics, rubber, thermoplastic elastomers, adhesives, foams, paints, and sealants. In recent years the use of polymers and plastics has been expanded in several applications. Polymers offer a plethora of uses due to their low cost, high specificity, and versatility (Singh, 2020) [5]. Products made with plastics are frequently thin, tough, strong, and flexible, low cost and easy to handle and construct. Keeping these considerations in view, the present study was conducted to test the various properties of most commonly available plastic materials for construction of flow measuring devices, flow control structure.

Materials and Methods

Flow regulation and control unit is a device used to control the water flow discharge in the fields. These units are developed with different materials and different costs involved in the fabrication of units.

Different costs of fabrication of flow regulation and control unit

To develop modules cost comparison of Different available materials like FRP, HDPE, PVC, PP, MS and GI was compared based on fabrication of units, three units of discharges 7.5,10,15 lit/sec were developed using FRP, HDPE, PVC, PP, MS and GI.

By calculating the cost of each step in the developing process, the cost of the fabrication process was estimated (Kumar *et al*., 2011) [2]. The whole fabrication cost was divided accordingly.

Base material cost

This is the expense incurred for acquiring (including customs duties), transporting, handling, storing, testing, and bringing all the necessary materials at the site of erection, in the appropriate sequence, quality, and quantity, ready to be prepared for welding.

Preparation cost

Each metal piece's cost for cutting and dimensioning was correctly accounted for and added to the overall job cost. Preparing for the setup, aligning, and measuring gaps and distances are routine operations: the use of well-designed fixtures and measuring tools

Welding labour cost

According to factors such as experience, talent, adaptability, and other factors, welders are typically paid an hourly wage for their work. The amount of time a welder spends actually welding is known as the operator or operational factor. In the welding business, operating factor values typically range from 30 to 50%. Good practice advises aiming for high quality on the first try in order to save needless processes like repair, rework, and re-inspection, which raise expenses without offering any benefit or advantage to the firm. Machining, cleaning, and material cutting are all included in this cost.

Filler metal price

Working with the proper filler metal size directly affects the welding cost. Increased current density is possible with smaller electrodes, which may have an impact on penetration. A larger size allows for working with a higher current, which results in more metal being deposited in a given amount of time. Deposition efficiency is the ratio of the actual weight of filler metal used per unit length to the theoretical weight (volume multiplied by density) of the joint material needed per unit length. The easiest way to determine this is to use raw data, or to make an assumption based on prior knowledge. The weight of filler metal used per hour may be calculated if we know the weight of filler metal required to weld one unit of length (meter or foot) of the specified joint and the number of unit lengths welded in one hour. The Welding-Cost of Welding is calculated by multiplying the Weld Deposition Rate by the price of filler metal per unit weight.

Gases cost

Only when auxiliary gases are really used in the process does this expense become relevant. In this instance, the hourly consumption rate is used to calculate the cost of gas per hour (including welding and non-welding hours when flow is nil). weight we obtain cost of filler metal during welding eat within an hour

Fabrication of modules

Materials surface needs to be cleaned first. If an any dirt, dust, or other debris that may be there and could obstruct the welding procedure. Material surface should next be roughened using fine-grit sandpaper. This will give the material surface a rough texture, which will improve the bonding of the weld.

Preheating the material components is the last step of the preparation procedure. This will make the materials more malleable and workable, which will improve the efficiency and effectiveness of the welding operation. After preparing the material surface, it's time to assemble the components. The hardest and most important step if you want to guarantee a robust joint is this one. The material components should first be precisely aligned and clamped. By doing this, it will be made sure that the components are in the right positions and won't shift during the welding procedure.

Results and Discussion

Cost comparisons of developing control units with different materials

Different material costs comparisons for developing flow regulation and control unit are showed in Fig.1-3.

Fig.1 shows that different costs to develop 7.5 lit/sec module with different materials base material cost of FRP is 1125, HDPE 510, PVC 750, PP 450, MS 540 and GI is 750 Rs, preparation cost of FRP is 300, HDPE 300, PVC 350, PP 300, MS 400, GI 400 Rs, welding labour cost of FRP is 700, HDPE 700, PVC 700, PP 700, MS 800, GI 800 Rs, filler metal cost of FRP is 200, HDPE 200, PVC 200, PP 200, MS 150, GI 150 Rs, gases cost of FRP is 130, HDPE 110, PVC 130, PP 120, MS 200, GI 200 Rs. Total cost of FRP is 2455, HDPE 1820, PVC 2130, PP 1770, MS 2090, GI 2300 Rs.

Fig.2 shows that different costs to develop 10.0 lit/sec module with different materials base material cost of FRP is 1125, HDPE 510, PVC 750, PP 450, MS 540 and GI is 750 Rs, preparation cost of FRP is 400, HDPE 400,PVC 450,PP 400,MS 500,GI 500 Rs, welding labour cost of FRP is 700, HDPE 700, PVC 700, PP 700, MS 800, GI 800 Rs, filler metal cost of FRP is 250, HDPE 250, PVC 250, PP 250, MS 200, GI 200 Rs, gases cost of FRP is 150, HDPE 150, PVC 130, PP 140, MS 220, GI 220.Total cost of FRP is 2625, HDPE 1990, PVC 2300, PP 1940, MS 2260, GI 2470 Rs.

Fig.3 shows that different costs to develop 15.0 lit/sec module with different materials base material cost of FRP is 1125, HDPE 510, PVC 750, PP 450, MS 540 and GI is 750 Rs, preparation cost of FRP is 400, HDPE 400, PVC 450, PP 400, MS 500, GI 500 Rs, welding labour cost of FRP is 700, HDPE 700, PVC 700, PP 700, MS 800, GI 800 Rs, filler metal cost of FRP is 300, HDPE 300, PVC 300,PP 300, MS 250, GI 250 Rs, gases cost of FRP is 150, HDPE 150, PVC 130, PP 140, MS 220, GI 220 Rs. Total cost of FRP is 2675, HDPE 2040, PVC 2350, PP 1990, MS 2310, GI 2520 Rs.

From Fig.1,2,3 observed that total cost to develop 7.5 lit/sec PP module is 1770 which is less followed by HDPE 1820, MS 2090, PVC 2130, GI 2300, FRP 2455 Rs. Total cost of 10.0 lit/sec is PP 1940 less followed by HDPE 1990, MS 2260, PVC 2300, GI 2470, FRP 2625 Rs. Total cost of 15.0 lit/sec is PP 1990 less followed by HDPE 2040, MS 2310, PVC 2350, GI 2520, FRP 2675 Rs.

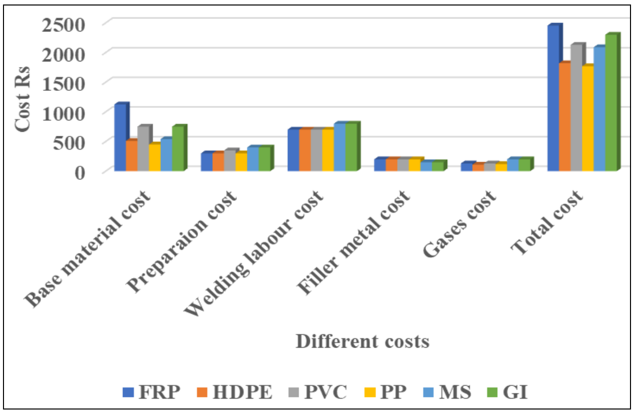

Fig 1: Development cost comparisons for 7.5 lit/sec module

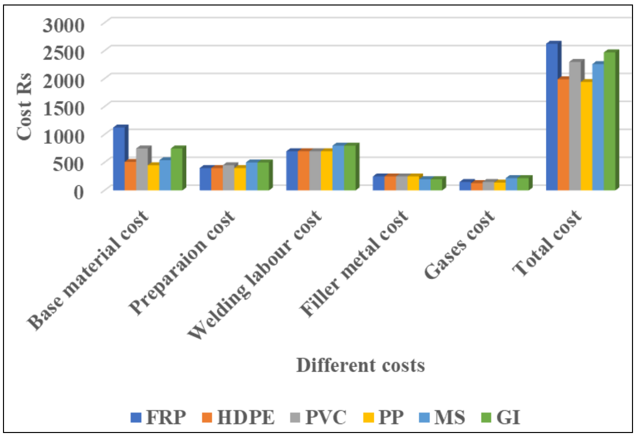

Fig 2: Development cost comparisons for 10.0 lit/sec module

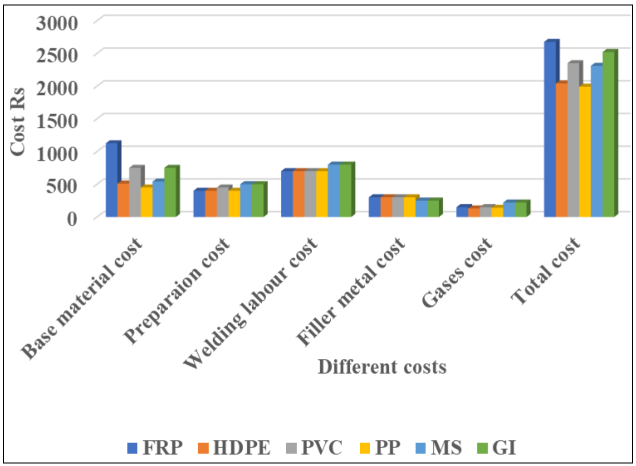

Fig 3: Development cost comparisons of 15.0 lit/sec module

Conclusion

Cost comparisons of development of flow regulation and control unit with FRP, HDPE, PVC, PP, MS and GI, total cost of PP for development of 7.5 lit/sec, 10 lit/sec,15 lit/sec modules were less. So, PP is used for the development of flow regulation and control unit.

Future scope

There is clear evidence that the PP will continue to be the preferred option for numerous strengthening different flow control devices in field channels in the coming years due to the lower cost of fabrication which farmers offer.

Acknowledgement

I would like to extend my profound regards and deep sense of gratitude to all authors for their prudent guidance, encouragement and constructive suggestions all through the investigation and preparation of this manuscript

References

1. Jarmai K, Farkas J. Fabrication cost of steel and aluminium structures. In: Eurosteel 2014 proceedings; 2014. p. 1-6.
2. Kumar S, Anand S. Estimation and comparison of welding cost of MIG and MAG process on mild steel. In: Proceedings of the national conference on recent advances in manufacturing engineering and technology; 2011. p. 55-59.
3. Mallah HD, Hayawi AA. Laboratory study of flow characteristics through three baffle sluice gates. Al-Rafidain Eng J. 2019;24(1):1-9.
4. Mishra PK, Larsen P, Satyanarayana T. Development of low-discharge baffle-sluice modules. J Irrig Drain Eng. 1990;116:444-453.
5. Singh DP. Research in polymeric materials: current status and future potential. In: National conference on advances in applied sciences and mathematics (NCASM-20); 2020; Rajpura, India.