

PAPER • OPEN ACCESS

## The effect of channel roughness to the flow velocity (Case Study: secondary channel of the Saddang irrigation area, Pinrang Regency)

To cite this article: S G H Syamsuddin *et al* 2020 *IOP Conf. Ser.: Earth Environ. Sci.* **419** 012142

View the [article online](#) for updates and enhancements.

# The effect of channel roughness to the flow velocity (Case Study: secondary channel of the Saddang irrigation area, Pinrang Regency)

S G H Syamsuddin<sup>1</sup>, F Maricar<sup>2</sup> and R T Lopa<sup>2</sup>

<sup>1</sup>Departement of Civil Engineering, Faculty of Engineering, Hasanuddin University, Makassar, Indonesia

E-mail: gatokhasansyamsuddin@gmail.com

**Abstract.** The channel roughness phenomenon can result in changes in flow velocity. The research is aimed to analyze the magnitude of the speed of the flow that is made out of some roughness channels are different. Research is carried out in line Secondary Regional Irrigation Alitta village Bentenge Subdistrict Paleteang district Pinrang. Channels that are reviewed are the channel secondary which is made of some roughness channel are different by opening the doors as deep as 20 cm, 30 cm, and 40 cm. The results of the study indicate that happens changes the speed of each roughness channel. It is caused by the difference in the roughness of each channel and the sedimentation of each channel.

## 1. Introduction

Water flowing in channels in free conditions is water flowing in open channels and in contact with free air. The entire flow of the entry in the system channel is open in design to flow by gravity. Open channels can be divided into two types, namely artificial and natural channels. Channel open that encountered both in irrigation technical, semi- technical and non prigmatis. The phenomenon rudeness on a channel that is different can result in changes to the Acceleration one of them in result by the friction of the material making up the channel are different.

In the channels that exist in the district Pinrang consists of 4 types of material making up the channel that is different from that channel from the pair of stone, Channels of Lining Concret, Channels of Precast Concrete, and channels of the country. Because the research is intended to analyze the magnitude of the speed of the flow that made some of the roughness of each channel that took the study a case in Channel Secondary Regional Irrigation Saddang, Pinrang.

## 2. Materials and methods

The material and methods of the research are using the following figure.



Figure 1. FL-03 Current Meter

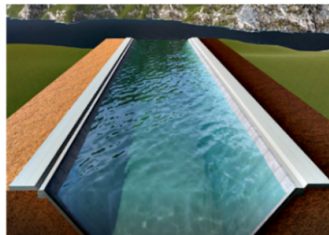


Figure 2. Simulation in Field



Figure 3. Data retrieval process

### 2.1. Location research

The location of this research was carried out in the secondary channel of the Saddang Irrigation Area, Pinrang Regency.

### 2.2. Flow Velocity measurement methods

To obtain the data as an ingredient primary in the study of this, then used three methods of collection of data, namely:

- Studies Library, to obtain the data secondary to read a number of books, articles - articles of scientific as the foundation of the theory in towards perfection research this.
- Collection of data of secondary that consists of:
  - Interview with the water user community regarding the flow rate on the channel.
  - Collection of Maps of the Saddang Irrigation Area.
  - The collection scheme is a network of irrigation Regional Irrigation Saddang
  - Data discharge canal irrigation Secondary Regional Irrigation Saddang Year 2013-2018
- Primary data collection is carried out through field surveys to observe field conditions in detail about the condition of the Saddang Irrigation Area channe. Measurement Flow velocity on the secondary channel uses a Current Meter measuring instrument.
- The procedure of measurement by using the Current meters, are as follow:
  - Determine measurement points on channels
  - Measuring the input and output length on the channel you want to review.
  - Measuring the width of the channel section.
  - Pulling the rope on the cross section of the channel to determine the channel and edge of the channel.
  - Dividing point point of measurement that will be in review.
  - Current meters in pairs on a pole measuring (static) with a depth of 0.2h, 0.6h and 0.8h, then pole measuring inserted into the water up to the pedestal pole measuring located at the base line with the propeller facing the direction of flow (flow of water)
  - Taking the data speed of the flow at the point that in the review using the Current meters.

### 2.3. Data calculation method

#### 2.3.1. Flow discharge

Water discharge is the size of the amount of the volume of water that can pass in a place or can be at capacity in a place every one unit of time. Flow discharge (Q) in a cross section can be expressed in the equation [2]:

$$Q = A \cdot V \quad (1)$$

Description:

Q = Debit flow (m<sup>3</sup>/s)

V = Speed Flow (m/s)

A = Section Area (m<sup>2</sup>)

To get the results in the form of discharge flow, then the required formula - a formula commonly are used in the discussion of the hydraulics of the channel open [3].

- Wet Cross- sectional Area (A)

$$A = b \cdot y \quad (2)$$

Description:

A = Area of Section (m<sup>2</sup>)

b = width of the cross section (m)

y = depth of the cross section (m)

- Wet circumference (P)

$$P = b + 2y \quad (3)$$

Description:

P = Wet circumference (m)

b = width of the cross section (m)

y = Flow Depth (m)

- Hydraulic Fingers (R)

$$R = \frac{A}{P} \tag{4}$$

Description [4]:  
 R = Hydraulic Fingers (m)  
 A = Section Area (m<sup>2</sup>)  
 P = Wet Roving (m)

2.3.2. Average Flow Speed

$$V = \frac{Q}{A} \tag{5}$$

Description [5]:  
 V = Speed Flow (m/s)  
 Q = Debit flow (m<sup>3</sup>/s)  
 A = Section Area (m<sup>2</sup>/s)

2.3.3. Channel Roughness

Manning (N) Coefficient of Roughness [4]:

$$N = \frac{1}{v} \cdot R^{2/3} \cdot S^{1/2} \tag{6}$$

Description:

V = Average Speed (m/s)  
 R = Hydraulic Fingers (A / P)  
 S = Channel Slope (%)  
 N = Resistance / roughness factor  
 A = Wet area of cross section (m<sup>2</sup>)  
 P = Wet Roving (m)  
 Source: [6], [7]

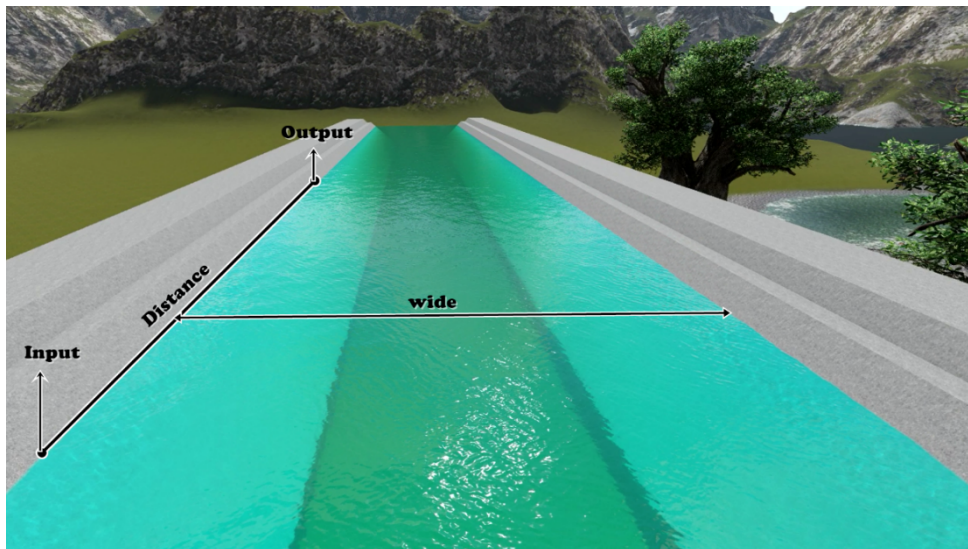
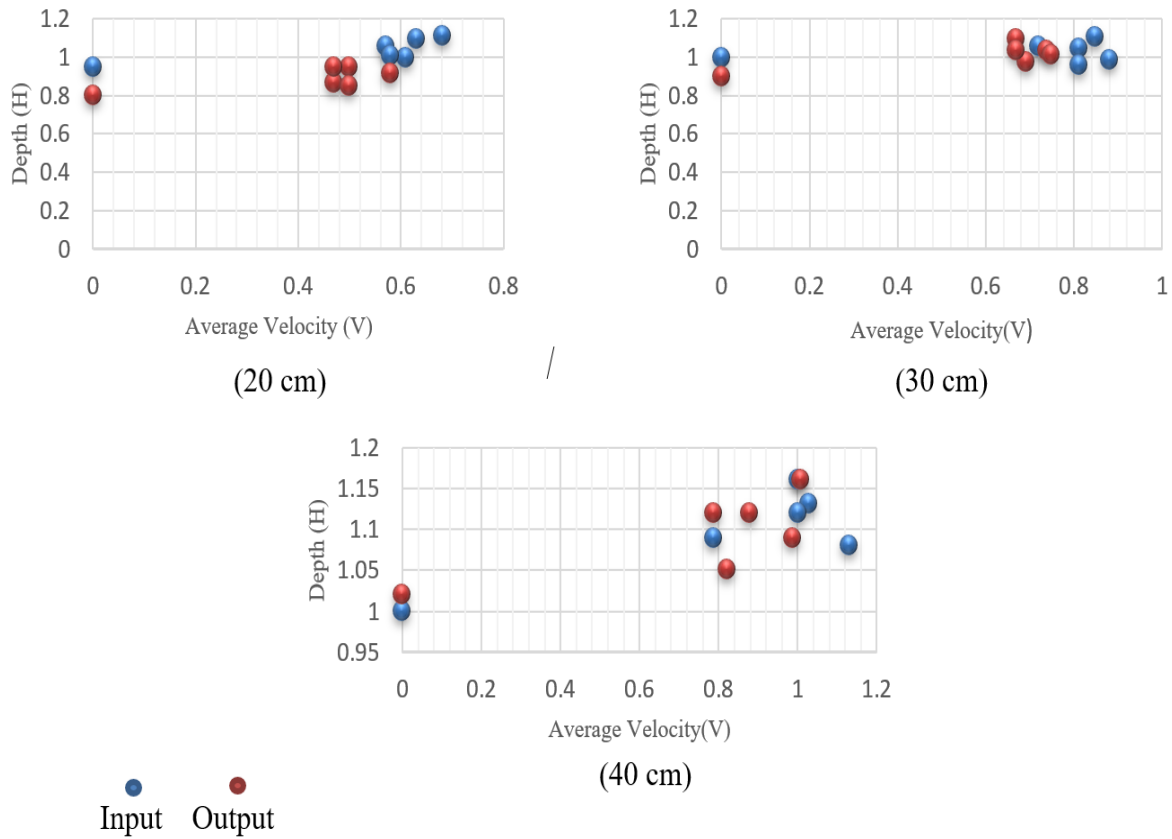


Figure 4. Data simulation in the field.

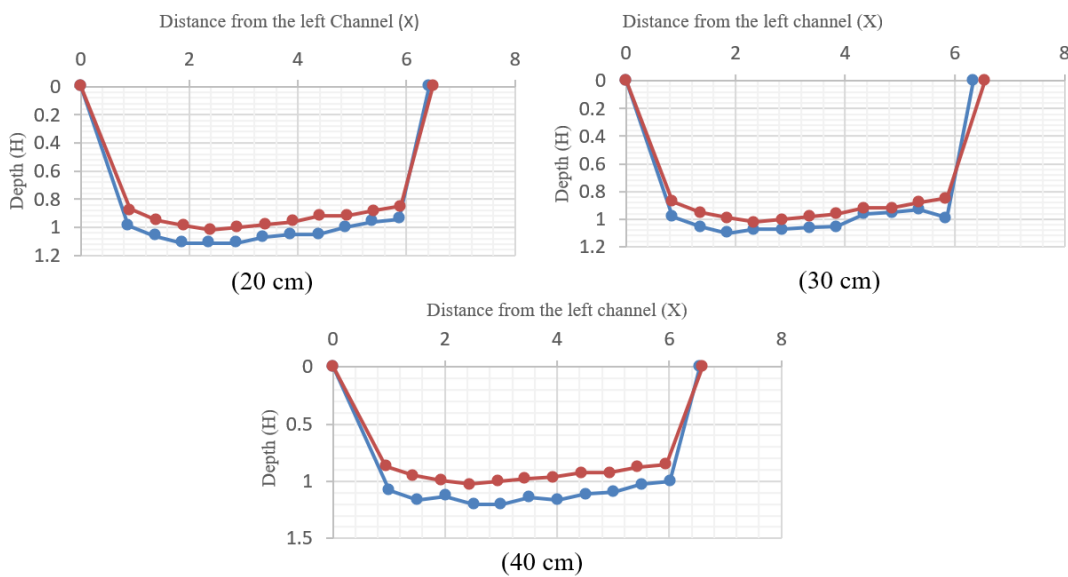
**3. Result and discussion**

*3.1. Result stone pair*

The result stone pair is shown on the following figures.

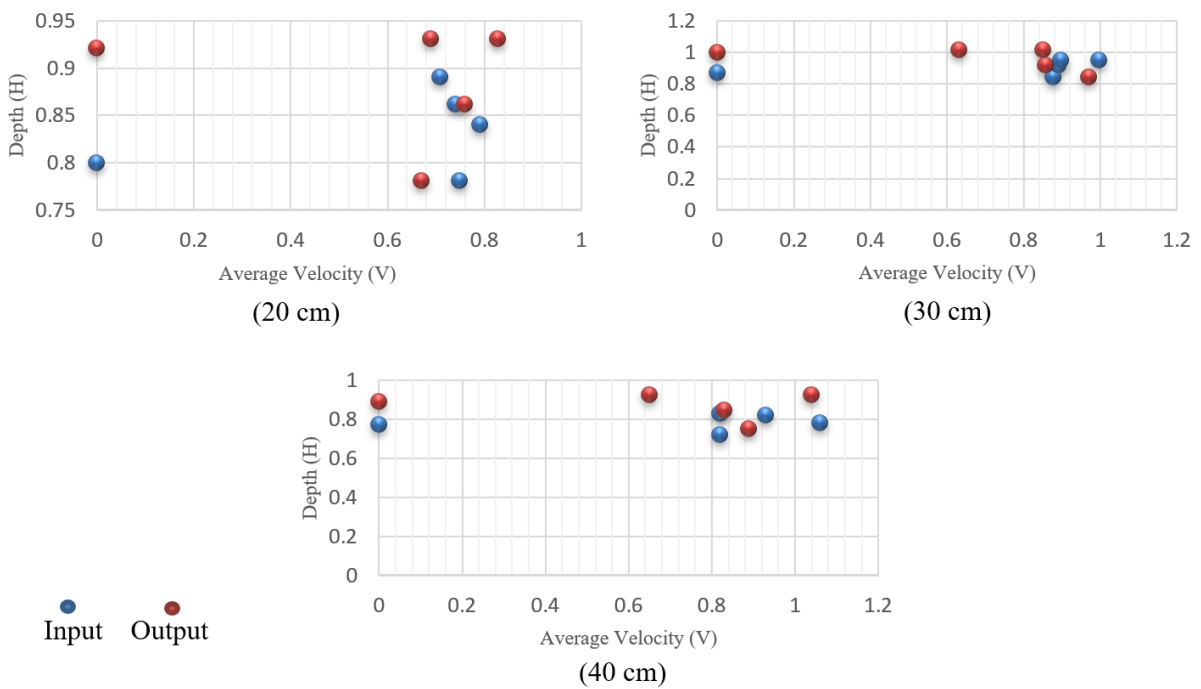


**Figure 5.** shows the relationship between V and H with each door opening on the stone pair channel. In figure 5 shows that the fastest flow velocity is at the 40 cm door opening in Input Channel.

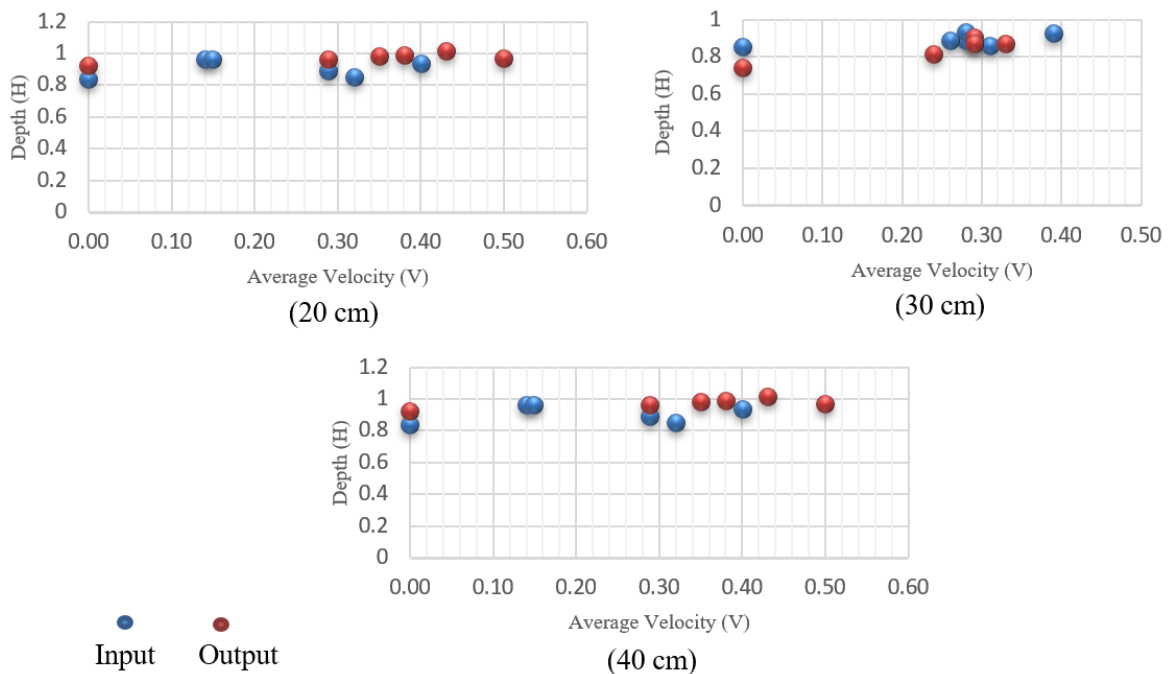


**Figure 6.** Channel transverse profile in stone pair channel.

3.2. Result concrete lining

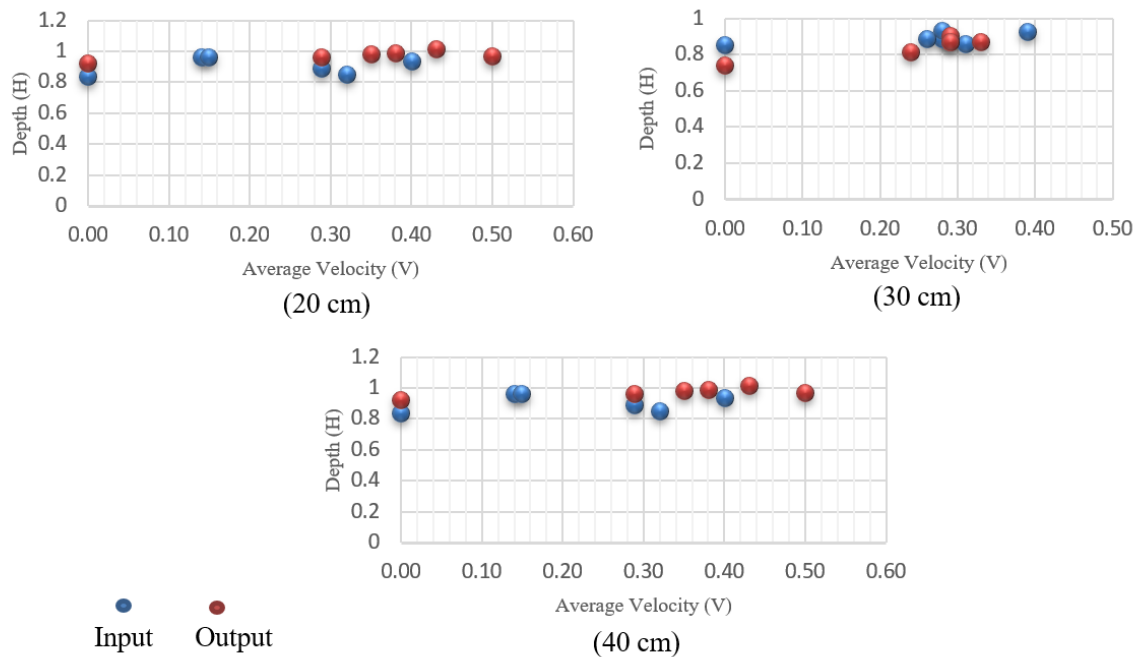


**Figure 7.** The relationship between V and H with each door opening on the Concrete Lining channel.



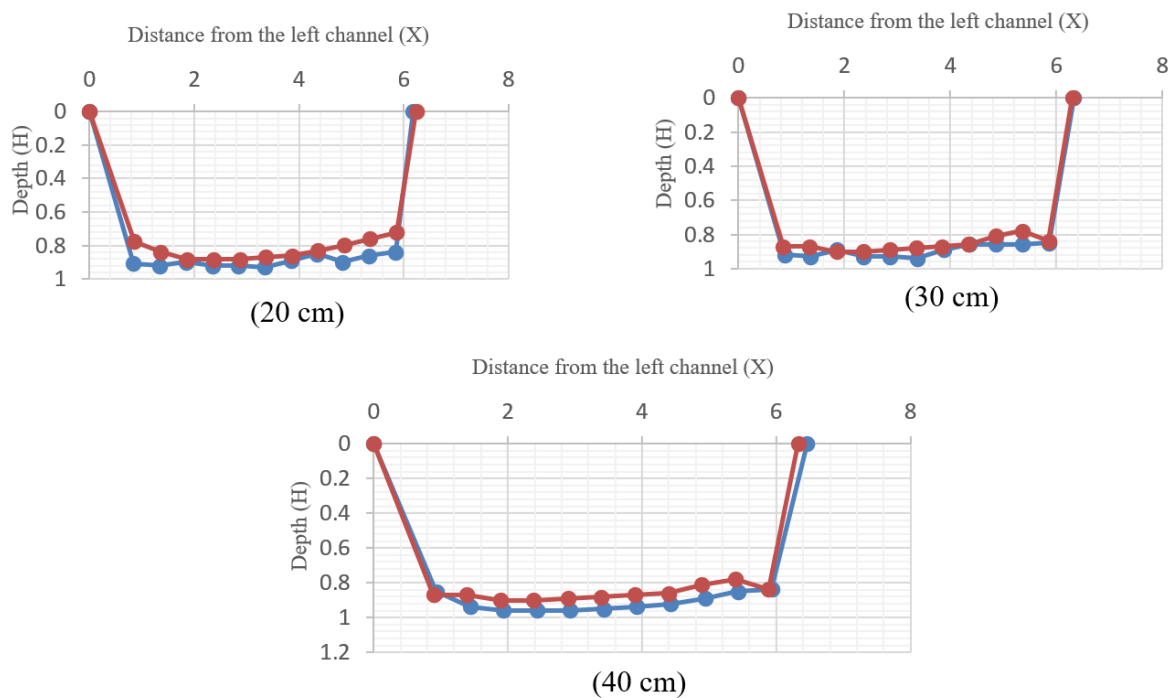
**Figure 8.** The relationship between V and H with each door opening on the Concrete Lining channel.

3.3. Result Concrete Precast



**Figure 9.** The relationship between V and H with each door opening on the Concrete Precast channel

Figure 9 shows that the fastest flow velocity is at the 40 cm door opening in the output channel.



**Figure 10.** Channel transverse profile in Concrete Precast channel

3.4. Result Soil Channel

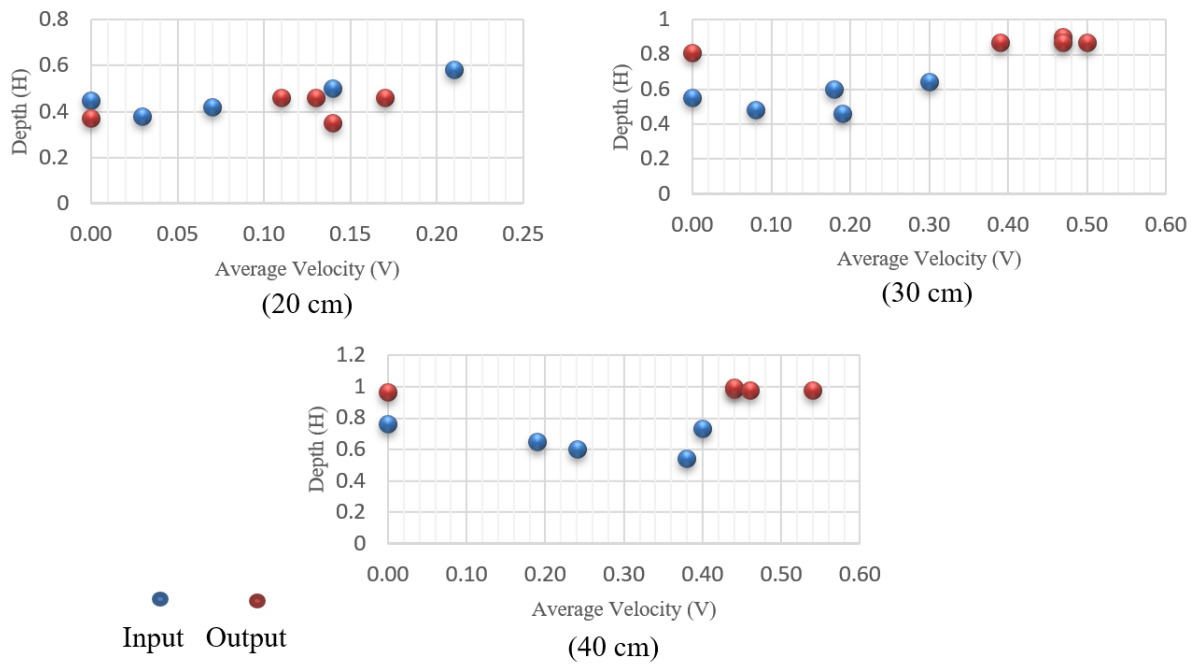


Figure 11. The relationship between V and H with each door opening on the Concrete Precast channel.

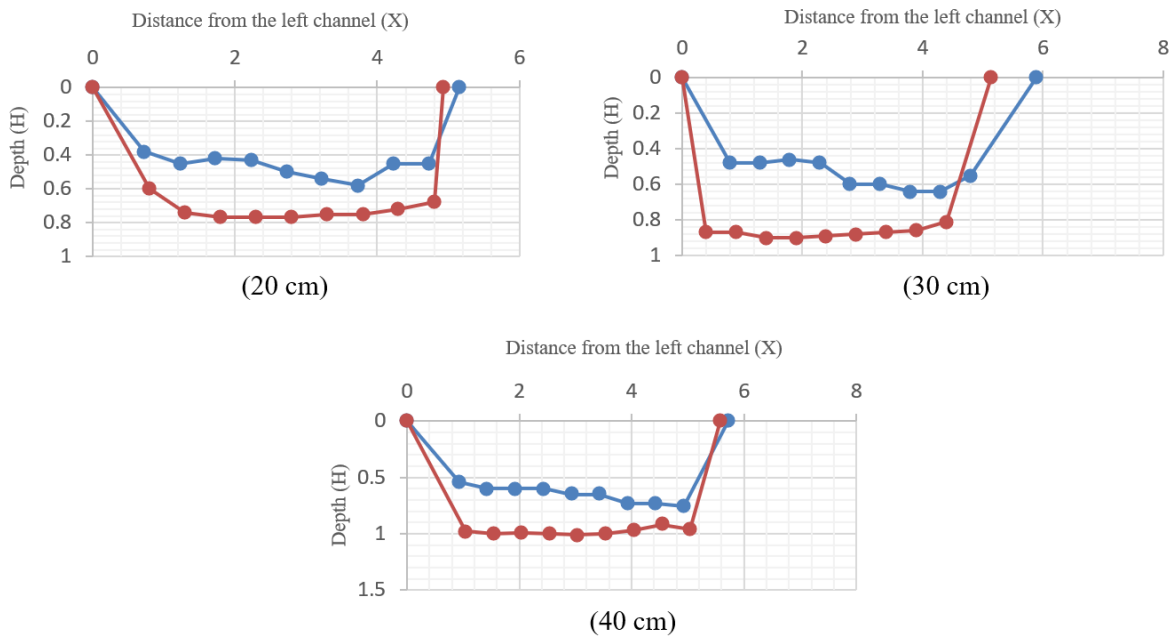


Figure 12. Channel transverse profile in Concrete Precast channel

In table 1 we can see the results of the N real field in each type of channel roughness at the study site. in each channel roughness it is found that roughness and the presence of sedimentation also affect the speed of each channel type, used the desired line. If an author has additional information to appear as a footnote, such as a permanent address or to indicate that they are the corresponding author, the footnote should be entered after the surname.

#### 4. Conclusion

- in the research conducted obtained the results of the type of channel that has the highest speed is the input channel on the stone pair channel at the door opening 40 cm.
- in the research conducted obtained channel roughness results on each type of channel that produces real N values in the field.
- in the research conducted it was found that the cross-sectional area and sedimentation of the channel also affect the flow velocity.

#### References

- [1] Bazak N N 1999 Irrigation Engineering Tata McGraw-Hill *Publishing Company Limited*, New Delhi
- [2] Harianja, J. A, and Gunawan, S 2007 Tinjauan energi spesifik akibat penyempitan pada saluran terbuka 30–46
- [3] Hansen, V. E., O.W. Israelsen, dan Stringham 1992 *Dasar-Dasar Praktek Irigasi* Erlangg, Jakarta
- [4] Indonesia, S. N andNasional, B. S 2015 *Tata cara pengukuran debit aliran sungai dan saluran terbuka menggunakan alat ukur arus dan pelampung*
- [5] Kartasapoetra, A.G. dan M. Sutedjo 1994 *Teknologi pengairan dan pertanian irigasi*
- [6] Nurmi, O Haridjaja S Arsyad dan S Yahya 2009 Perubahan Sifat Fisik Tanah Sebagai Respon Perlakuan Konservasi Vegetatif Pada Pertanaman Kakao. *Forum Pascasarjana* **32**
- [7] Pahlevi, H and Adlin Harahap L 2014 Kajian Nilai Kekasaran Dan Konstanta Beberapa Kondisi Saluran Tersier Pada Jaringan Irigasi Namu Sira Sira Desa Namu Ukur Utara Kecamatan Sei Bingai Kabupaten Langkat. *Keteknikan Pertanian J.Rekayasa Pangan Dan Pert* **4** 131–138