

## **Effect of Floating Bridges on Velocity Distribution**

**Mohamed M. Ibrahim<sup>1</sup>, Mohamed A. Hassan<sup>1</sup> and Adnan D. Ghanim<sup>1\*</sup>**

<sup>1</sup>*Department of Civil, Faculty of Engineering at Shoubra, Banha University, P.O.Box 11629, Shoubra, Egypt.*

### **Authors' contributions**

*This work was carried out in collaboration between all authors. All authors read and approved the final manuscript.*

### **Article Information**

DOI: 10.9734/JERR/2018/v3i416882

#### Editor(s):

(1) Dr. Guang Yih Sheu, Associate Professor, Chang-Jung Christian University, Taiwan.

#### Reviewers:

(1) J. Dario Aristizabal-Ochoa, National University of Colombia, USA.

(2) Ujwalkumar D. Patil, University of Guam, Guam.

Complete Peer review History: <http://www.sdiarticle3.com/review-history/46475>

**Received 13 November 2018**

**Accepted 30 January 2019**

**Published 07 February 2019**

**Original Research Article**

### **ABSTRACT**

To ensure the stability of the bottom under the floating bridges according to the worst conditions, our study aims to determine the height and width and bearing the floating bridge to ensure the safety of origin with a high security factor. Our study determines the amount of damage under the floating bridge to be treated by a treatment method. We have used a practical model for a water channel and standard dimensions cut by the floating bridge connecting the two ends of the channel and when studying the erosion under the floating bridges and the possibility of maintaining the floating bridges without damage to the structure and perimeter of the bridge (bridge width, maximum load, bridge height, water depth in the channel with a factor Security This study examines the effect of floating bridges on the bottom by designing a model of a channel with a floating bridge and selecting a variable earth and sand floor. We conducted one hundred and sixty-eight experiments to examine the five variables (water depth in the channel, bridge width, loads on the bridge, soil type) Bottom, flow). We observed the effect of these five variables on topography of the bottom of the floating bridge. Experiments were conducted without a bridge and we observed erosion after laying the bridge, we noticed the erosion and sediment that occurred before and below and after the floating bridge and the effect of the bridge on it. We observed the type of positive and inverse relations between the variables mentioned. We took the loads on the bridge, the width of the bridge, the depth of the water and the drainage with a safety factor, as well as ensuring that the appearance of the channel and maintain the geometry of the channel. We put

\*Corresponding author: Email: [adnanalghanam2016@gmail.com](mailto:adnanalghanam2016@gmail.com);

floating loads on the floating bridge to see a load. We used several models to view the floating bridge and made the water depth in the channel change more than once. We also made three different discharges. Finally, we used two types of soil and we recorded the durability and the worst conditions. The effect discharge, by (100% .64%, 45%) The velocity in the sandy soil changes (100%, 42%,38%) and the velocity in clay soil changes (100%,59%,41%) As well as change the width of the bridge by (100%, 85%,71%)velocity changes by (80%,82%,100%) for sandy soil and the ratio of clay soil to (90%,95%,100%) As well as weight change by (100% ,83%,66%)the rate of velocity in the sandy soil to (100%,78%,61%) also change the velocity in clay soils to (100%,68%,62%) as well as depth change (100%,87%,75%)The speed in the sandy soil changes to (50%,75%,100%) and also changes in clay soils by (71%,78%,100%) Thus, we have a knowledge of the rates of change and the effect of each variable on velocity. Therefore, we can draw up a plan to address erosion and sedimentation in the watercourse. Moreover, identify the expected challenges of (overload, flooding, deterioration, foot and aging as well as the structural strength of the bridge gradually decreasing with the foot.

*Keywords: Floating bridges; erosion; bridge response; interceptor dikes; clay and sand soils.*

## 1. INTRODUCTION

Water is life The requirements of life and the need of man (urbanization and population growth and the increase of many and the requirements of life) pushed to create a relationship between the seas and rivers on the part of human life on the other hand, the human thought to develop the state and life and address these problems has been the creation of human bridges on the valleys and rivers according to the possibility and need for it [1]. Some of them have fallen over the course of days, making people think about the causes and causes and treat them or find alternatives. It is necessary to study the erosion below and in the front and back of the floating bridge, which is formed on the valleys and rivers, especially in the river silt and water-resistant areas [2]. Erosion occurs at the bottom of the river and in the direction of the water stream. Because of the energy carried by the water cause the erosion and erosion of the floor of the floating bridges, which poses a danger to the future of those bridges. In addition, that the subject of our study will address erosion below, before, and after the floating bridges causes and problems and ways to solve these problems and address them [3]. The Europeans used these bridges in the Second World War. The retreating forces blew up bridges built on valleys and rivers. Egyptian military engineering used floating bridges in the October 1973 war, which facilitated the crossing of Egyptian forces to the Suez Canal and the destruction of the Barlev line. Iraqi military engineering used this type of bridge in the battles of the liberation of FAO in 1988 from the hands of the Iranian forces [4]. In addition, the hawks of Iraqi military engineering used this type of bridge in 2017 in the liberation battles of

Mosul, Sharqat, Qayyarah, Hawija and Hit. In the United States, they have been used as permanent bridges in places where the water is so deep that its costs are high [5]. Or with soft foundations, forcing them to use floating bridges. In this study, we will investigate erosion and deposition under floating bridges we compared the results without the bridge to note the difference in the results and we know the effect of the floating bridge on topography of the bottom [6]. the development of effective solutions to maintain the form of watercourse and the worst conditions, especially the season of floods and rain or human intervention while ensuring stability bridges [7]. The study of the facts of the previous period and the comprehensive understanding and natural disasters After studying the properties And the specifications of the facility which is connected to the floating bridge to record changes and maintain the facilities according to the most difficult conditions. The man used the floating bridges about 4000 years ago. Floating bridges have several types depending on the type of rivers and valleys to cross. Fixed floating bridges and the separate floating bridges are the main types of floating bridges [8]. It is known as a floating structure or semi-submersible structure and the floating structure has a small depth compared to its width and is suitable for quiet waters near the coast The semi-submersible structures are columns mounted on floats and because of the ballast compartment they are suitable for large lengths and are not affected by high waves The author presented [9] analytical models of floating bridges under moving loads and studied. Dynamic response with hydrodynamic effect coefficients for different depths of water [10]. Two basic approaches to floating structure, namely

frequency and time, and floating bridge, which are exposed to different loads such as waves and wind, as well as dead and live loads, should be considered [11]. Seif Waino [12] studied the analysis of separate floating bridges that are primarily subject to wave bearing. The effect of damping is examined on predicting the time of the weak axis curvature [13]. Many of the authors assigned loads of floating bridges to four types Bridges are affected by main loads, secondary loads, live loads, dead loads, wind loads, earthquakes, earth pressure, temperature and hydraulic pressure. Bridges are affected by tidal waves and are affected by tsunamis and snowstorms [14].

For floating bridge, ropes or ropes must be secured to ensure horizontal rigidity sufficient to withstand the horizontal load of wind, waves and current [15]. The installation of columns in deep water is very expensive considering both design and operation. The curved bridge concept, which suggests the need for additional stiffness from the marina due to arc work, is withdrawn. In contrast to the straight bridge that resists load by beam movement, transverse loads are enabled by carrying the arc in the curved bridge design. The main objective of this study was to study the effect of floating bridges on bottom topography by determining the effect of water depth in the channel, discharge, Bridge, floating bridge view, bottom soil type, fixing problems and finding real solutions to all problems that occur on the floating bridge.

## 2. DIMENSIONAL ANALYSIS

This study examined the effect of floating bridges on bottom topography. Moreover, their effect on the flow velocity of the channels and specifically the specific study area. (15L / 18-11L / 18) and the effect of the five variables on flow velocity, erosion and sedimentation in this project (drainage, floating bridge width, canal water depth, floating load on floating bridge, soil type). Represented by the following abbreviations The discharge from the pumps to the channel = Q The velocity of water flow in the channel = V Water depth in the channel = Yt Loads on Floating Bridge = W Wb = floating bridge width Show channel = b Measurement tank size = V Time = t Line (A1, A2, A3, A4, A5, A6, A7, A8). These are the measurement points of speed, erosion, precipitation and parallel to the channel. Line (A1, B1, C1, D1, E1, F1) speed, erosion and sedimentation points.

## 3. METHODS AND MATERIALS

Experiments were carried out on the study of erosion under floating bridges in Block Al-Ghannam plant in the village of Asdira Sfli, in the area of the left coast - Sharqat district - Salah al-Din province in the great Republic of Iraq. The concrete channel was constructed with a mixture of (4, 2, 1) cement: sand: gravel for the floors and the walls were constructed with a distance of (20 \* 20 \* 40) cm for the block. The walls were cemented with cement (3: 1) On a fine channel clip The dimensions of the channel were. (5). We have used five pumps with different additives to obtain three discharges (110,70,50) l / s and have been placed on the first channel with a distance of (70) \* 50 \* 40 cm. (70 \* 50 \* 40) cm containing the flakes to dissipate the energy and to regulate the flow and the Hadar and the cage of the iron regulation is through (2L / 18) of the channel and thus ensure that the water is flowing in the channel. The depth of the channel is (50) cm from the beginning of the channel to (11 L / 18) and at (11L / 18) to (15L / 18) the depth of the channel (75) cm and at (15L / 18) cm The study area is at (11L / 18) from the beginning of the channel and the study area ends at (15L / 18) and the floating bridge center is at (13L / 18) From the first channel and the gate at the end of the channel to control the water depth in the channel, we will use three depths of the gate (12,14,16) cm The purpose of this project is to know the effect of the floating bridge on erosion and sedimentation under bridges And the effect of (discharge and loads on the bridge of all types and width of the bridge and the depth of water in the channel and the type of bottom soil) and the identification of negatives and positives and the search for treatment methods Ie, finding effective and studied solutions to the problems occurring under floating bridges. We used bridges with a width of 50,60,70 cm We also put weights on the floating bridge, so we chose (20,25,30) kg We also used two types of soil (clay and sand). By changing one of the variables and stabilizing the rest, we get results with different differences to find out the worst conditions and deal with them This study will confirm the collection of the parameters and one change in each experiment, so that the total number of experiments in this study (3 \* 3 \* 3 \* 3 \* 2) experiment, as well as six experiments without the floating bridge and two types of soil. Thus, the total number of experiments (168) was an experiment. We will study the change relative change between discharge, velocity, loads, velocity, floating bridge width, velocity and water depth of the

channel and velocity and both types of soil as can be listed in Table 1.

Study the effect of the soil type, its resistance and its impact on the treatments used in the experiment. It is necessary to identify the descriptions and specifications of the soil used in the experiments in Table 2.

The load test carried on the floating bridge as in Fig. 1.

### 3.1 Justifications of Parameters Assumptions

In our practical experiments, we encountered several obstacles, foremost of which is the knowledge of the discharge volume of each pump and the installation of the discharge required throughout the experiment. The water falling in the channel needs a hydration to dissipate the energy. It also requires a full-flowing iron cage to regulate the flow and obtain

regular flow at the beginning of the channel. We experienced the installation of the gate level and the movement of the gate on the fixed level and we were able to install the back gate to obtain a fixed depth (12,14,16) cm. We also suffered from the problem of cutting the cork with the required dimensions to design the bridge on the canal. The biggest obstacle was after putting the weight on the floating bridge in fixing the floating bridge on the waterway and ensuring its movement despite being subjected to great pressure by the running water in the canal. We noticed that the soils used on the bottom mud soil was more stable than sand soils and work impediments counting the end of each experiment we do the soil brushes and work to settle and clean the watercourse and add materials if needed And the changing of the gate and the loads and the bridge width and type of soil was the process of control of these variables is very difficult, which necessitated to work with caution and focus on each variable to ensure the completion of work on time.

**Table 1. Range of variables used in the experiments**

Parameter	Symbol	Value	Range		Units
			From	To	
Discharge	Q	50, 70, 110	50	110	l/s
Velocity	V				m/s
Width of bridge	Wb	50,60,70	50	70	cm
Weight of bridge	W	20,25,30	20	30	kg
Tail gate water depth	yt	12,14,16	12	16	cm
Bed material	Sand	2, 0.42, 0.074	2	0.074	mm
	Clay	0.002-0.001	0.002	0.001	mm

**Table 2. Characteristics of bed materials**

Bed material no.	<2	2-0.074	0.074-0.002	>0.002	mm
1	0.1	0.75	0.1	0.05	
2	0.04	0.11	0.20	0.685	



**Fig. 1. Loads on the floating bridge**

The present investigation has some parameter presumptions as a basic examination focused on gate measurements, discharge, and gate water depth, gate height. In its effect on flow in a channel, a bridge abutment may be likened to a short contraction, such as indicated in Fig. 2 for flow through a simple orifice. Two flow features are directly evident in the flow field through a contraction:

1. Flow contraction; and
2. The generation and shedding of large-scale turbulence structures from the boundaries of the contraction.

The protection against the erosion and the floating bridge can take many ways, one of them used in this work as in Fig. 3.



Fig. 2. Flow through a bridge opening



Fig. 3. Cooling pools and flow regulation

## 4. TEST PROCEDURE

### 4.1 Run Duration

After the processing of the channel and the ground floor of the study area with sandy soil and make it perfectly flat, we made the water depth in the channel through the back gate (12) cm. The pumps were running water flow in the channel

smoothly and without a floating bridge, and we used three discharges (50,70,110) L / tha We continued to change the flow velocity and changes that occur due to erosion due to water flow and observed the flow stability 90% after 1:30 hours We repeated the same process, but this time with clay soil and observed it more stable than the sandy soil and settled more than 90% after 1:30 hours so the number of experiments without a floating bridge is (6). In the same circumstances, but with a floating bridge width (50,60,70) cm and loads mounted on this bridge weights (20,25,30) kg The water depth in the channel is variable (12,14,16) cm We noticed that the velocity stabilized at 90% at a time of 2 hours so the test time was 3 hours in Fig. 4.

### 4.2 Run Procedure

Temporary interceptor dikes, which are temporary erosion control measures intended to reduce runoff velocity and divert water off the construction right of way, shall be installed following grading operations as shown in the beginning of the plan view in Fig. 4 of the experimental figure within the first three meters of the floating bridge [16]. Within three stages, the interceptor dikes are installed on all disturbed areas as necessary to avoid excessive erosion as can be seen in Fig. 5.

Without a bridge a preparation of the bottom of the study area with sandy soil of specific specifications have a settled to make the back gate (12) cm and fill the pumps with different discharge for each experiment (50,70,110) l/s. Following the process of erosion and speed with time and after two hours the speed is almost constant and we chose the time of three hours of testing and recording readings This is without a bridge three trials of sandy soil and we repeated the same experiments for clay soil., the experiments without a bridge had their number (6) experience. The second phase: - With a floating bridge We install the rear gate at the desired height and then fill the channel with water. When the channel is full and the water flows from the rear gate of the known depth, turn off the pumps and put the bridge in place and load the required loads and then fix the floating bridge on both sides of the channel and the required height. Pumps and according to our need for drainage. If the maximum discharge, the five pumps are operated to give us (110) l/s or if the discharge average (70) l/s. Operate the two large pumps. If the discharge is less than (50) l/s, fill a large pump and a small one to obtain



calculated discharges. The flow of water from the ground reservoir to the channel and from there to the ground reservoir and through the back gate of the channel and according to our experiments is the height of the gate (16,14,12) cm and with the start of the flow began erosion and sedimentation and especially under the floating bridge and after a quarter of an hour movement. After another quarter of an hour, we observed the continuous erosion and repeat the same process for every quarter of an hour. After two hours, however, we noticed a significant decrease in erosion. The decrease continued until it was no more than 3 hours and therefore we chose 3 hours. In order to follow water movement, erosion and sedimentation below the floating bridge, we have identified the points required to take the erosion and sedimentation readings. After each experiment we take the readings with the same purity, six lines parallel to

channel (A, B, C, D, E, F). The channel four of them before the bridge center and four of them after the center of the bridge. At the end of each experiment we take readings of erosion and sedimentation in a table to represent the changes in the bottom because of the impact of the floating bridge. We also take the speed at the first quarter of an hour and with specific points in the study area. Six parallel lines of the channel and eight vertical lines on the channel and repeat the same process for several times until we note that the readings after two hours and a half and three hours are almost equal that the bottom soil stabilized and the speed is almost constant. After three hours we take the last reading of the speed and then extinguish the pumps and open the discharge gate. Background and take the readings for erosion and sedimentation at the specified points and repeat the same process in each experiment with the five variables.

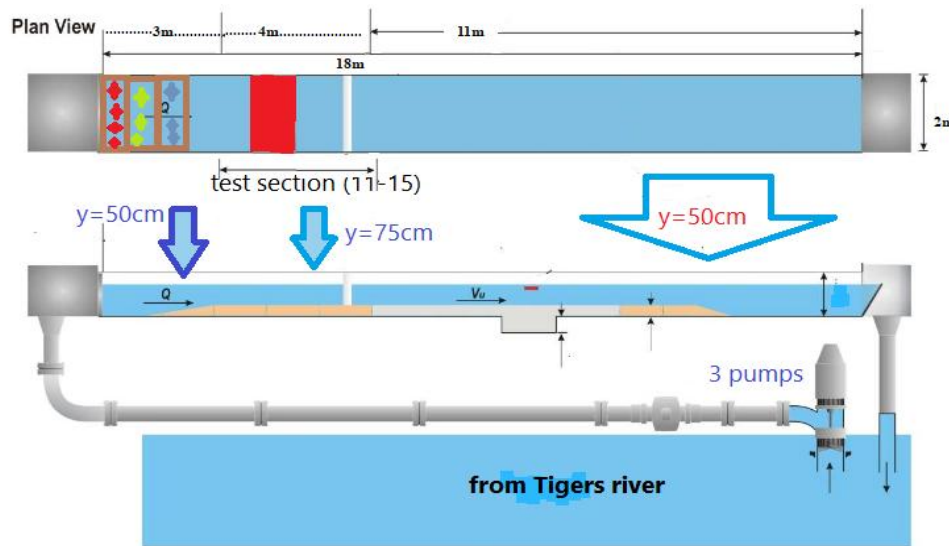


Fig. 4. The plan view of the proposed experiment



Fig. 5. Interceptor dike to control the erosion

### 5. MODEL RUNS

The first stage:- Without a floating bridge and the number of experiments (6) three experiments of sandy soil and three clay soil according to the same conditions, ie the depth of water (12) cm and discharge (50,70,110) liters / tha. The second phase:- The number of experiments (162) experiment with a floating bridge and we took five variables to study the speed in the study area before and after the floating bridge. We took three discharges (50,70,110) l/s, three water depths (12,14,16) cm, three loads on the floating bridge (20,25,30) kg, three bridges width (50, 60,70) cm, (Sand and clay), select one variable and we will fix all four remaining variables and follow the time for each experiment by reading the velocity in the study area and the dimensions of the study area (0.7 × 4) m as shown in Fig. 6. The area of study (11/18) and ending (15/18) is divided into 48 points to verify the effect of speed in sandy soils or mud. Thus, the total number of experiments in this research is (6 + 162) one hundred and sixty-eight experiences.

### 6. RESULTS AND DISCUSSION

The bridge is located at (13L/18 ) in the middle of the study area between (11L / 18 -15L / 18)The length of the bridge shall be the width of the waterway (70) cm We conduct a preliminary inspection on a bridge with a width of (90,80,70,60,50,40 )cm The canal is covered with water and the floating bridge is placed at a width of 40 cm in its place and weights are placed (5-10-15-20-25-30-35-40-45) kg We record with each weight the size of the submersible from the bridge In the same way we use a bridge width (50-60-70-80-90) cm We record each time weight with the submersible part In the end, we work out the diagram and explain the relationship between the submersible part of the floating bridge and the weight on the bridge. We got the chart below. To show the relationship between weight and submersible with floating bridge width change Fig. 7. Draft height on the (40-50-60-70-80-90) cm pontoon width.

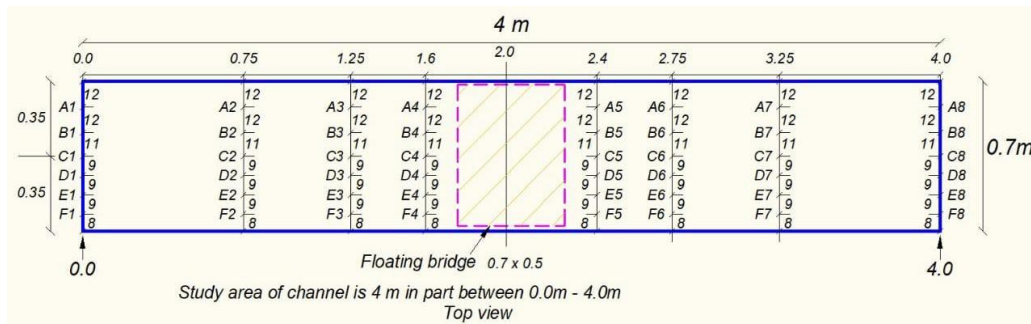


Fig. 6. Speed points in both vertical and parallel directions of the channel

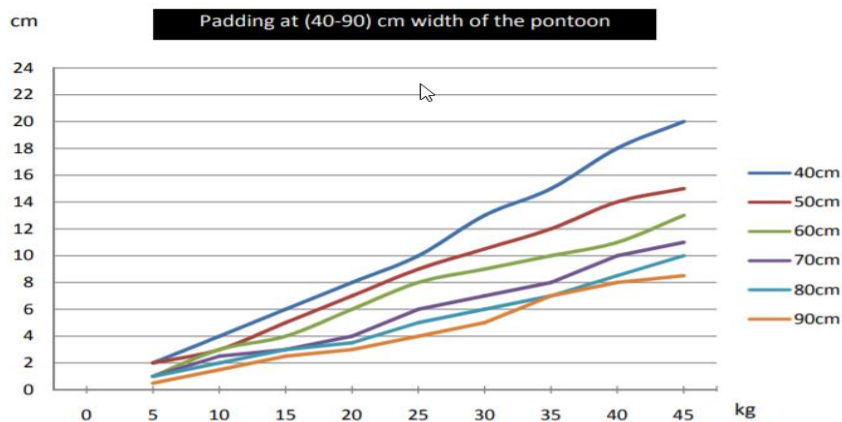


Fig. 7. The draft or pedding pontoon when (5-45) kg weight subjected on the floating bridge of (40-50-60-70-80-90) cm

Through the results, curves and contrast between weights, we selected the bridges with a width of (50, 60, 70) cm for use in our experiments. The bridges were neglected with a width of (40, 80, 90) cm with a width of 90 cm and a bridge with a width of 40 cm as in Fig. 8.

The construction of the floating bridge is shown in Fig. 9.

The weight test of the floating bridge carried out as in Fig. 10.

Measurement of discharge by volume divided by time represents the simplest method of measurement of discharge and the time required to fill a container of a known size [17] through

which to know the discharge of each pump. Water is pumped from the pump by tube to the container, and the filling time is measured by a stopwatch. The tank capacity is (5000) liters and the filling time is calculated accurately. To obtain the real discharge of the pump, the size was divided on the fill time of the tank to obtain discharge. This process was repeated with each pump to see the discharge. Pump no. 1 contains diameter (3). It took 161.3 seconds to fill the tank. For release, the following equation was applied  $Q = V / t = 5000 / 161.3 = 31 \text{ l / s}$  We repeat the same process for each pump. The volumetric method was used to measure the discharge of each of the five pumps according to  $Q$  (size / time). The discharge of the pumps is illustrated in Fig. 11.

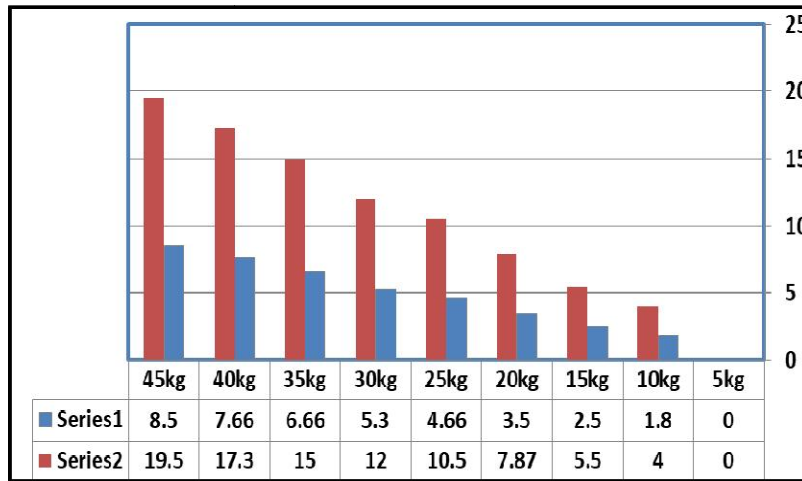


Fig. 8. Max (red) and min (blue) pedding at 40 cm and 90 cm pontoon width



Fig. 9. The Floating Bridge construction





Fig. 10. Weight on the Floating Bridge test

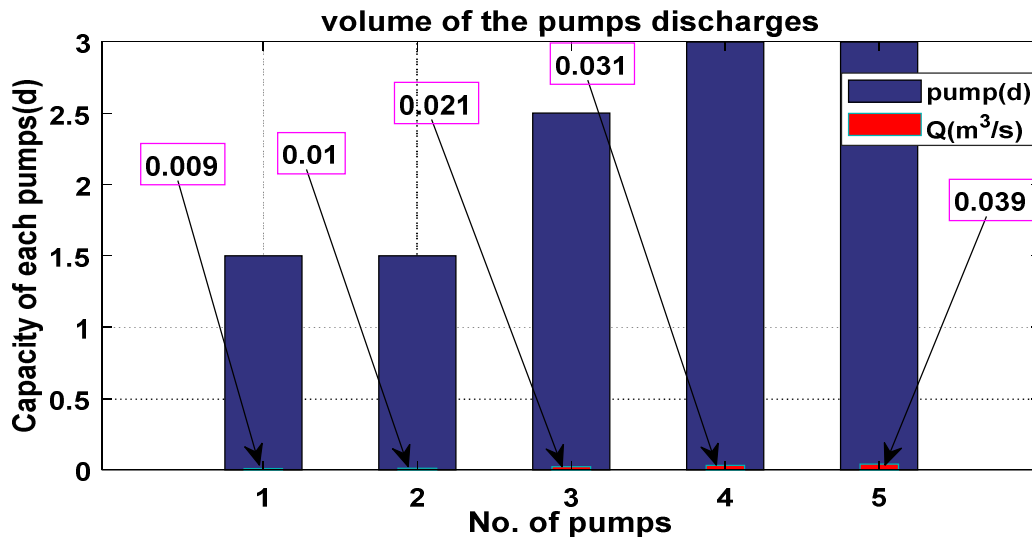


Fig. 11. Volumetric capacity of the pumps

### 6.1 Influence Existence of the Floating Bridges

Speed vent Subsequent curves show velocity in two types of soil and their effect on the same conditions. In accordance with these conditions, the flow velocity of the channel is shown in the curves and at the six checkpoints, at six vertical points on the channel and also at eight parallel points of the channel In forty-eight points check the speed and repeat the same conditions and the same process but the bottom soil is mud and get curved at each line of the parallel lines of the channel as well as the same discharge and in a channel at a depth of 12 cm sand soil and

without a bridge we get a curve shows the difference between the presence of floating bridge Aida as in The following curves: appear in the (Figs. 12, 13, 14, 15, 16, 17).

In our observation of the results obtained, there is a variation in velocity from one place to another in the same channel. We chose the intermediate point, which represents the highest and most affected results, a point. C. If we address the external influences on the point, we have dealt with the problem in the most affected place. Line C represents the sample used for all trials And (c) represent the center of the channel and most affected by the run through it.

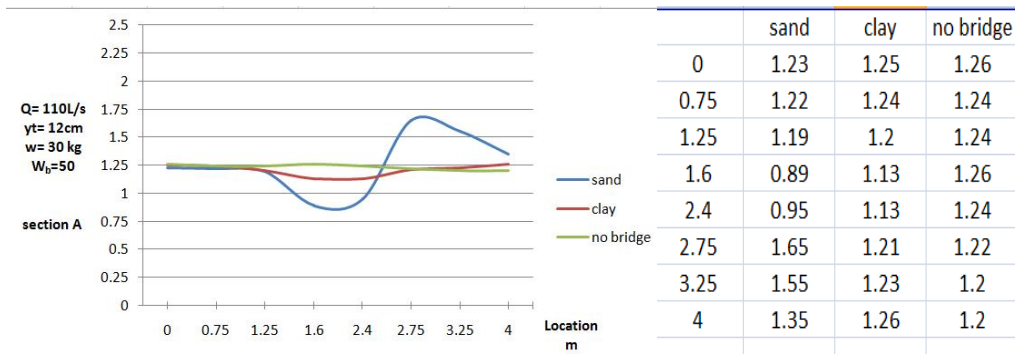


Fig. 12. Effect of flow velocity by changing soil type

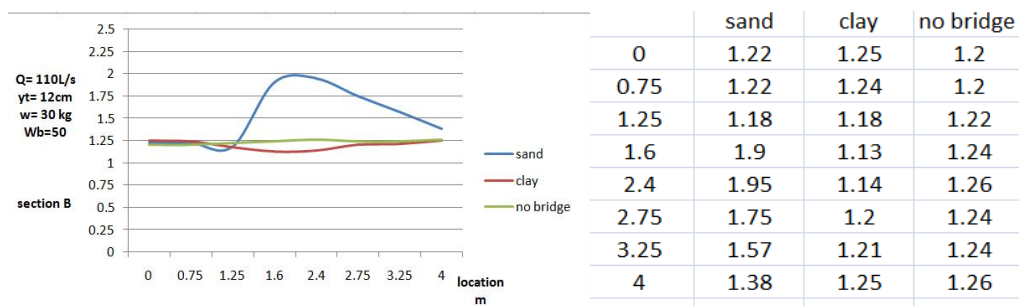


Fig. 13. Effect of flow velocity by changing soil type

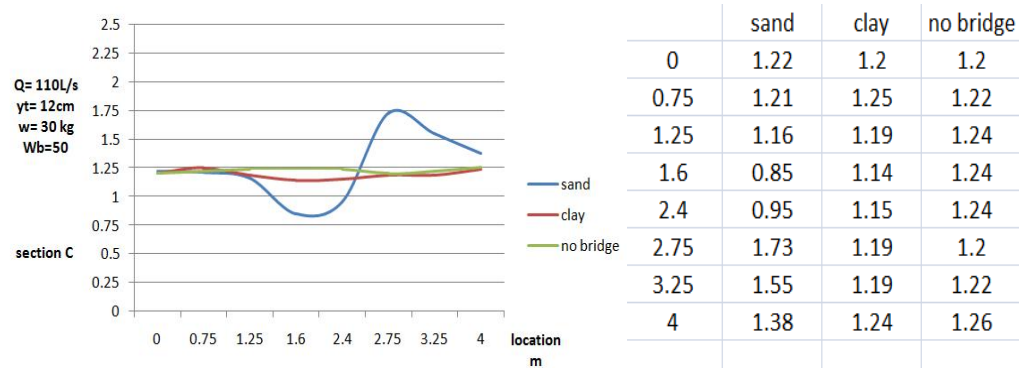


Fig. 14. Effect of flow velocity by changing soil type

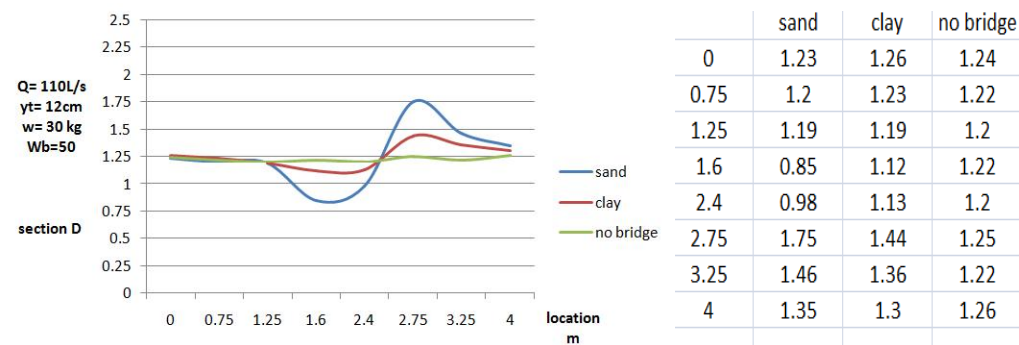


Fig. 15. Effect of flow velocity by changing soil type

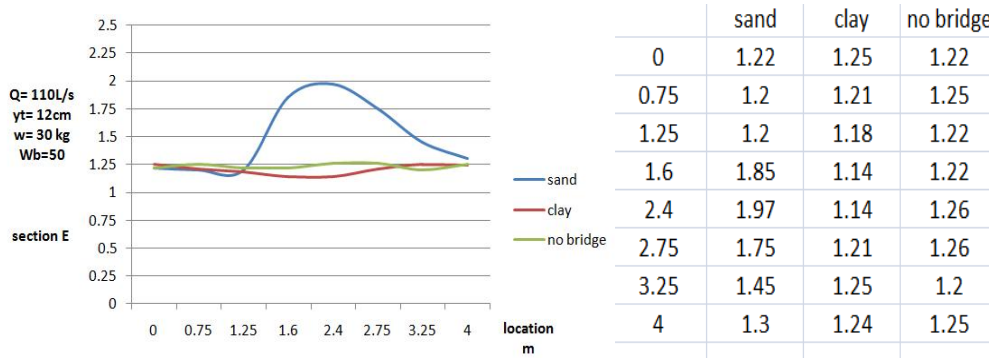


Fig. 16. Effect of flow velocity by changing soil type

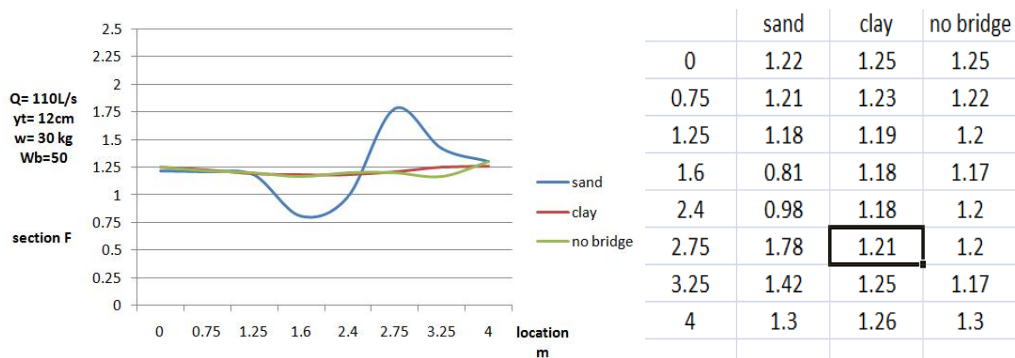


Fig. 17. Effect of flow velocity by changing soil type

## 6.2 Influence Discharge

The curves indicate the effect of discharge on the flow velocity. The discharge has a great effect on the flow velocity. The greater the discharge the faster the flow. Through our experiments and the same conditions when the soil is sandy, the increase rate of discharge shows a large change

in velocity. ) L / s change velocity (100%, 42%, 38%) When the soil is sandy. However, if the soil is clay and for the same conditions, when the discharge increases (100%, 64%, 45%) l / s, the velocity changes (100%, 59%, 41%) from (45 to 64-100) l/s as in Curved shows the velocity and the same conditions without a floating bridge and sandy soil (Figs. 18, 19).

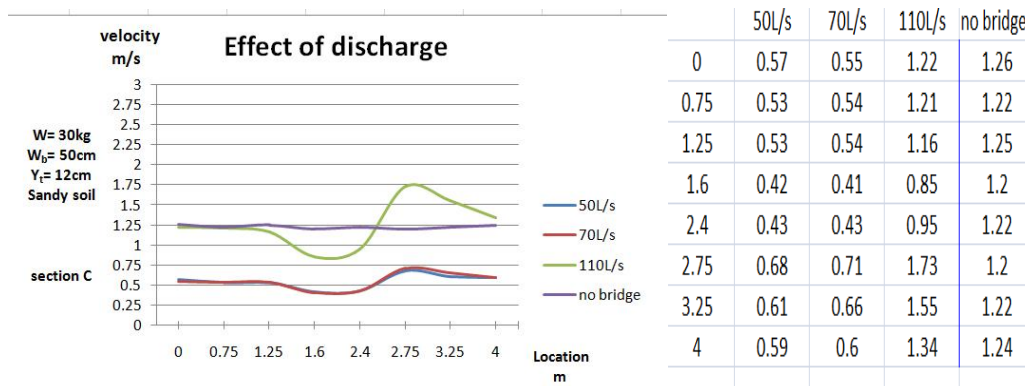


Fig. 18. Effect of flow velocity by changing discharge

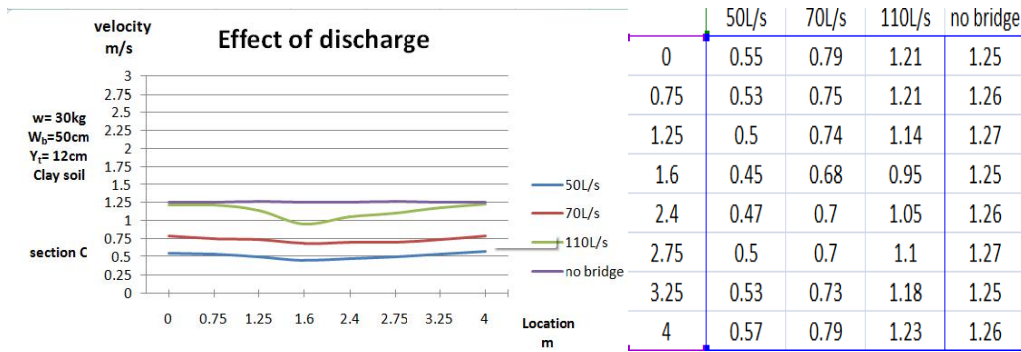


Fig. 19. Effect of flow velocity by changing discharge

### 6.3 Influence of the Floating Bridge Width

The width of the bridge is proportional to the velocity of the flow. The width of the bridge affects the flow velocity according to the same conditions and data. The lower the width of the bridge with the same loads, the greater the floating part of the floating bridge. The lower part of the floating bridge was used. We used bridges with a width of (100%, 85%, 71%) cm. When the soil was sandy, we obtained a velocity of (80%, 82%, 100%) In clay soils and for the same conditions, velocity (90%, 95%, 100%) We note that the change in the velocities in the soil is more stable than in the less stable soil as 0.875/100 and can be curved shows the velocity and the same conditions without a floating bridge and sandy soil shown in (Figs. 20, 21).

### 6.4 Influence of the Floating Bridge Weight

Curves the effect of loads on the floating bridge indicates the flow velocity of the channel. Loads on the floating bridge have a direct effect on channel erosion by changing the shape of the channel. The velocity increases, increasing erosion and settling in the channel. The higher

the load on the floating bridge, the greater the erosion under the floating bridge and through our experiments when increasing the weight on the floating bridge by (100%, 83%, 66%) the velocity rate increases in sandy soils by (100%, 78%, 61%) In clay soil, the increase rate is (100%, 68%, 62%) cm. Curved shows the velocity and the same conditions without a floating bridge and sandy soil as in (Figs. 22, 23).

### 6.5 Influence of the Floating Bridge Depth

The depth of water in the channel has a significant effect on velocity. The lower the water depth of the channel at a certain discharge, the faster the channel will be. The same conditions, such as constant discharge and the width of a fixed bridge and the same total on the bridge and sand soil, finding that the reducing the water depth in the channel increases the velocity by a certain percentage, when reducing the water depth in the channel (100%, 87.5%, 75%) cm increase velocity. (50%, 75%, 100%) As well as the same conditions, but when the soil clay, the velocity increases by (71%, 78%, 100%) Curved shows the velocity and the same conditions without a floating bridge and sandy soil. same (Figs. 24, 25).

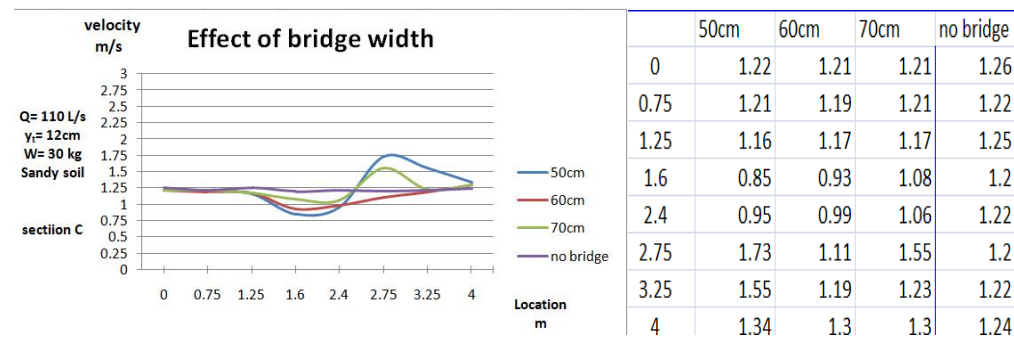


Fig. 20. Effect of flow velocity by changing width

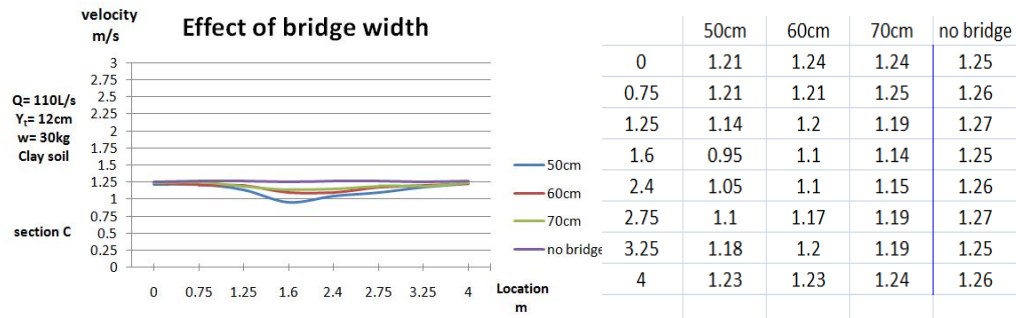


Fig. 21. Effect of flow velocity by changing width

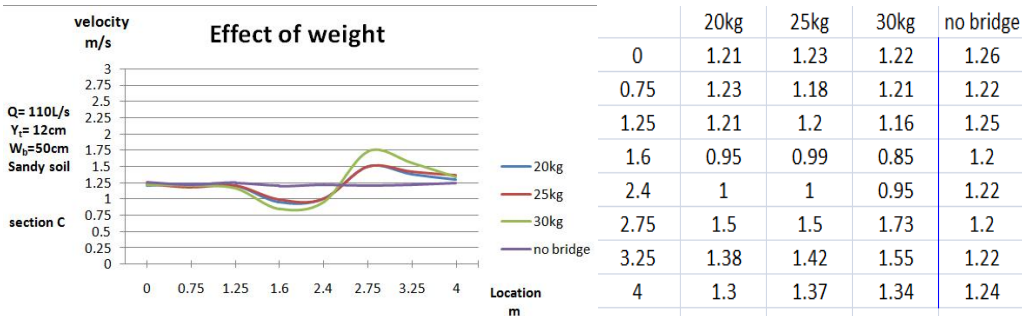


Fig. 22. Effect of flow velocity by changing weight

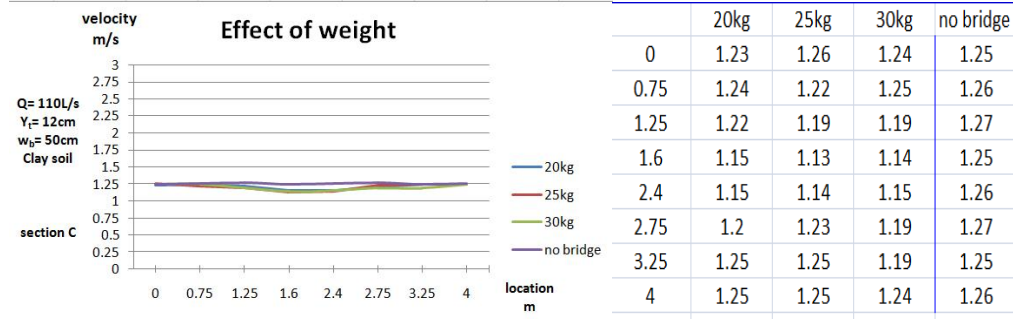


Fig. 23. Effect of flow velocity by changing weight

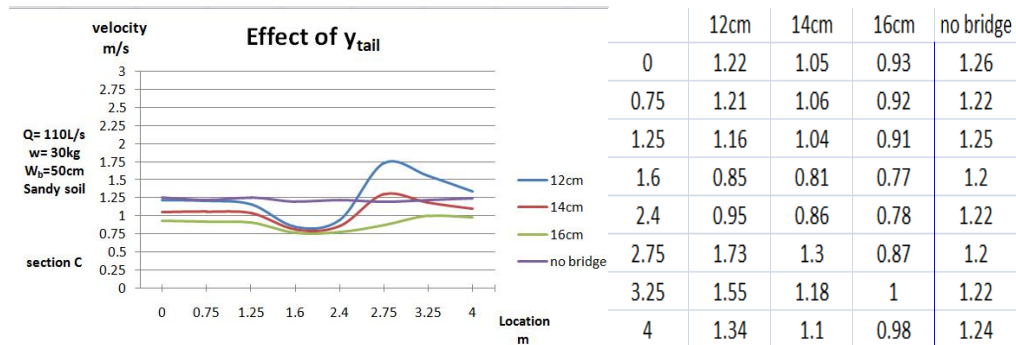


Fig. 24. Effect of flow velocity by changing depth



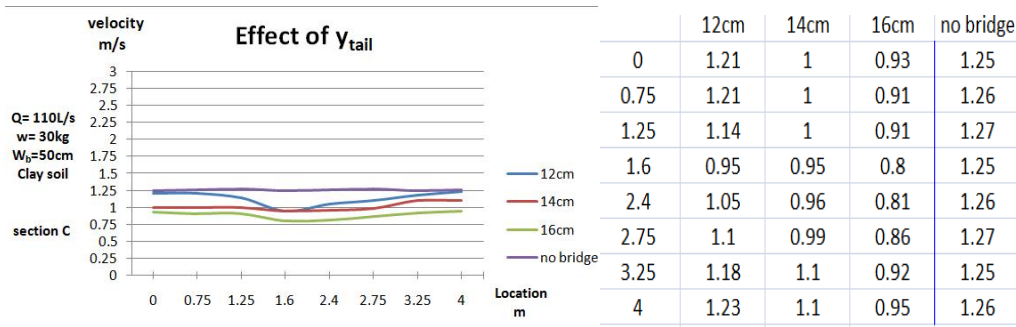


Fig. 25. Effect of flow velocity by changing depth

The strategies for controlling erosion and sedimentation involve reducing soil detachment, reducing sediment transport, and trapping sediment before it reaches water [18]. Erosion control is desirable not only for environmental reasons, but also for highway safety purposes. Uncontrolled erosion during highway construction and subsequent sedimentation could potentially cause adverse impacts on streams, damage to drainage structures and public or private lands, and cause public criticism. When installed correctly, BMPs minimize soil erosion, which prevents.

In our practical experiments, encountered several obstacles, foremost of which is the knowledge of the discharge volume of each pump and the installation of the discharge required throughout the experiment. The water falling in the channel needs a hydration to dissipate the energy. It also requires a full-flowing iron cage to regulate the flow and obtain regular flow at the beginning of the channel. Experienced the installation of the gate level and the movement of the gate on the fixed level were able to install the back gate to obtain a fixed depth (12,14,16) cm. We also suffered from the problem of cutting the cork with the required dimensions to design the bridge on the canal. The biggest obstacle was after putting the weight on the floating bridge in fixing the floating bridge on the waterway and ensuring its movement despite being subjected to great pressure by the running water in the canal. We noticed that the soils used on the bottom mud soil was more stable than sand soils and work impediments counting the end of each experiment we do the soil brushes and work to settle and clean the watercourse and add materials if needed And the changing of the gate and the loads and the bridge width and type of soil was the process of control of these variables is very difficult, which necessitated to work with caution and focus on

each variable to ensure the completion of work on time.

## 7. CONCLUSION

Experiments were carried out on the study of corrosion under floating bridges in Block Ghannam plant in Asdira Safli village, in the left coast area - Sharqat district - Salah ad Din province in the great Republic of Iraq. The concrete channel was constructed with a mixture of (1, 2, 4) cement: sand: gravel. For the floors and the construction of walls in the block. We used five pumps to get three discharges (110,70,50) l / s, and we used a hoe to remove (70 \* 50 \* 40) cm in the first channel. We also used the flow regulator cage to remove (70 \* 50 \* 40) cm in the first channel (2L / 18) and thus ensure that the water flows smoothly. The depth of the channel is 50 cm. The study area (11L / 18) is from the beginning of the channel and the study area ends with 15L / 18 and the floating bridge center (13L / 18). Three water depths were used in the channel (12,14,16 cm) We placed three weights on the bridge (20,25,30) kg. (50,60,70) cm The purpose of this project is to know the effect of the floating bridge on the velocity, erosion and sedimentation in the study area using the five variables (drainage, loads on the bridge, bridge width, water depth in the channel, bottom soil type) Identifying negatives and positives and seeking treatment methods ie effective and study solutions to problems that occur under floating bridges. By changing one of the variables and stabilizing the rest, we get different results to see the worst conditions and deal with them. This study will confirm the installation of information and one change in each experiment, so that the total number of experiments in this study (3 \* 3 \* 3 \* 3 \* 2) experiment, as well as six experiments without floating bridge and two soil types. Thus, the total number of experiments (168) was an experiment.

We studied the relative change between discharge, velocity, load, velocity, floating bridge width, velocity, water depth of channel and velocity and both types of soil. And after the installation of the drainage and the depth of the channel and the width of the bridge and loads on the bridge and using two types of soil and compared to sandy soil without a bridge, it was found that the most affected point is in the middle of channel (c) We have chosen this point to compare the effect discharge, by (100%, .64%,45%) The velocity in the sandy soil changes (100%, 42%, 38%) and the velocity in clay soil changes (100%, 59%, 41%) As well as change the width of the bridge by (100%, 85%, 71%) velocity changes by (80%, 82%, 100%) for sandy soil and the ratio of clay soil to (90%, 95%,100%) As well as weight change by (100%, 83%,66%) the rate of velocity in the sandy soil to (100%,78%,61%) also change the velocity in clay soils to (100%,68%,62%) as well as depth change (100%,87%,75%) The speed in the sandy soil changes to (50%,75%,100%) and also changes in clay soils by (71%,78%,100%) Thus, we have a knowledge of the rates of change and the effect of each variable on velocity.

## ACKNOWLEDGEMENTS

This work has been completed at Block Al-Ghannam plant in the village of Asdira - the left coast area - Al-Sharqat district - Salah al-Din province in Iraq. I extend my thanks and gratitude to all those who supported us in accomplishing this work.

## COMPETING INTERESTS

Authors have declared that no competing interests exist.

## REFERENCES

1. Daniel VJ. Numerical and experimental investigation of ribbon floating bridges, Master of Applied Science in Civil Engineering, Carleton University, Ottawa, Ontario; 2018.
2. Watanabe E, Utsunomiya T. Analysis and design of floating bridges. Progress in Structural Engineering and Materials. 2003;5(3):127-144.
3. Heidi B. Concept study and analysis of a floating bridge, Master thesis in Norwegian University of Science and Technology; 2017.
4. Wu JS, Sheu JJ. An exact solution for a simplified model of the heave and pitch motions of a ship hull due to a moving load and a comparison with some experimental results. Journal of Sound and Vibration. 1996;192(2):495-520.
5. Zhang J, Miao GP, Liu JX, Sun WJ. Analytical models of floating bridges subjected by moving loads for different water depths. Journal of Hydrodynamics. 2008;20(5):537-546.
6. Humar JL, Kashia. Dynamic response of bridges under travelling loads, Canadian Journal of Civil Engineering. 1993;20:287-298.
7. Paultre P, Proulx J, Talbot M. Dynamic testing procedures for highway bridges using traffic loads. Journal of Structural Engineering, ASCE. 1995;121(2):362-376.
8. Wang CM, Wang BT. Large floating structures, technological advances. Springer Singapore, Singapore; 2015.
9. Kristina HL. Description and analysis of floating bridges. Master thesis, Norwegian University of Science and Technology; 2017.
10. Ravi C, Pulkit S, Hemant. Review paper on submerged floating tunnels. International Journal of Engineering Technology Science and Research. 2018;5(4):345-350.
11. Zhengshun C, Zhen G, Torgeir M. Numerical modeling and dynamic analysis of a floating bridge subjected to wind, wave, and current loads. J. Offshore Mech. Arct. Eng. 2018;141(1):1-18.
12. Seif M, Inoue Y. Dynamic analysis of floating bridges. Marine Structures. 1998; 11(1-2):29-46.
13. Yanyan S, Jørgen A, Cato D, Zhaolong Yu. Numerical Investigation of the Collision Damage and Residual Strength of a Floating Bridge Girder, 37th International Conference on Ocean, Offshore and Arctic Engineering. 2018;11A.
14. Xu X, Erik S, Oyvind N, Bernt J, Mathias EE, Per Norum L, Bernt S. Viscous damping modelling of floating bridge pontoons with heaving skirt and its impact on bridge girder bending moments, 36th International Conference on Ocean, Offshore and Arctic Engineering, Ocean Engineering, Trondheim, Norway. 2017; 7B.
15. Kristine Senderud. Modelling and analysis of floating bridge concepts exposed to environmental loads and ship collision.

- Master thesis Norwegian University of Science and Technology; 2018.
16. Erosion and Sediment Control best management Practice manual. Report of West Virginia, Department of Environmental; 2016.
17. Joy P. Michaud, Marlies Wierenga. Estimating discharge and stream flows; 2005.
18. Joan L. Florsheim, Jeffrey F. Mount, Anne Chin. Bank erosion as a desirable attribute of rivers. BioScience. 2008;58(6):519–529.

---

© 2018 Ibrahim et al.; This is an Open Access article distributed under the terms of the Creative Commons Attribution License (<http://creativecommons.org/licenses/by/4.0>), which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited.

*Peer-review history:*  
*The peer review history for this paper can be accessed here:*  
<http://www.sdiarticle3.com/review-history/46475>