OnlineISSN:2249-4596
PrintISSN:0975-5861
DOI:10.17406/GJRE

Global Journal

of Researches in Engineering: J

General Engineering

Evaluate Different Properties

Assessment of the Expected Flood

Highlights

Impact of Different Seam Types

Sleeve Types on Marker Efficiency

Discovering Thoughts, Inventing Future

VOLUME 19 ISSUE 4 VERSION 1.0

Global Journal of Researches in Engineering: J
General Engineering

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General Engineering

Volume 19 Issue 4 (Ver. 1.0)

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USA Tax ID: 98-0673427

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Contents of the Issue

Global Journal of Researches in Engineering: J General Engineering
Volume 19 Issue 4 Version 1.0 Year 2019
Type: Double Blind Peer Reviewed International Research Journal
Publisher: Global Journals
Online ISSN: 2249-4596 & Print ISSN: 0975-5861

Effect of Varying Concentration of Soda Ash on Fastness Properties of Reactive Dyed Cotton Fabric

By Tofazzal Hossain, Palash Kumar Saha, Sonjit Kumar Saha, Md. Abul Hasan, Sonatan Kumar Biswas & Md. Masud Rana
Northern University Bangladesh

Abstract- In this study, it was observed that the effect of soda ash on fastness properties of reactive dyed cotton fabric was compared with the varying concentration of soda ash. Here, five different concentration of soda ash (10g/l, 15g/l, 20g/l, 25g/land 30g/l) were used to compare the fastness. Different fastness properties of cotton dyed fabric were investigated such as washing fastness, perspiration fastness, rubbing fastness, and light fastness. Most of the cases, the fabric fastness properties such as washing, rubbing, perspiration, and light were improved at soda 20gm/L after further increasing the amount of soda, the fastness properties were same. So, the result of fastness properties at 20gm/L concentration of soda ash was excellent.

Keywords: *reactive dye, soda ash, cotton knitted fabric, fastness properties.*

GJRE-J Classification: *FOR Code: 091599*

Strictly as per the compliance and regulations of:

Effect of Varying Concentration of Soda Ash on Fastness Properties of Reactive Dyed Cotton Fabric

Md. Tofazzal Hossain [α], Palash Kumar Saha [σ], Sonjit Kumar Saha [ρ], Md. Abul Hasan [ω], Sonatan Kumar Biswas [¥] & Md. Masud Rana [§]

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Keywords: reactive dye, soda ash, cotton knitted fabric, fastness properties.

I. Introduction

Cotton fiber is the most popular textile fiber in the world for their comfort and it is renowned for its breathability, strength and versatility. [1]Cellulosic fiber dyeing with reactive dyes is one of the most convenient and popular method. Cotton also favorable to dye with reactive dyes due to it' s hydroxyl group (–OH). Dyeing is the process of adding colour to textile products like fibers, yarns, and fabrics. Dyeing is normally done in a solution, containing dyes and required chemicals. Dyeing of cotton with direct dye has poor wash fastness due to weak bond between dye-fiber molecules. [2] A dye, which is capable of reacting chemically with a substrate to form a covalent bond, is known as reactive dye. After dyeing, dye molecules have strong chemical bond with cellulosic fiber molecules. Here the dye contains a reactive group and these reactive groups make the covalent bond with the cellulosic fiber polymer and act as an integral part of fiber and give good wash fastness. [3] During the application of reactive dyes to cellulose (cotton) fibers under highly alkaline condition, a hydrolysis reaction takes place, originating the non-reactive oxi-dye form and those dye (oxi-dye) stay on fabric surface. As a result, most of the cases it is seen that fastness properties of reactive dyed cotton fabric is not good. Therefore, fixing agent is applied on reactive dyed fabric to develop the different fastness properties in after treatment process. [4] The salt is associate in nursing exhausting agent to push the color towards polysaccharide molecules and therefore the alkali (soda ash) is hydrolyzing/fixing agent for the reactive colors. Sohel et. al Studied the effect of soda on dyeing of woven cotton fabric with reactive dye. They were found good result on colour fastness to wash, water, and Rubbing. They were used in this thesis 100% cotton woven fabric, 140 gsm, Reactive dye (Procion red H-3B, Reactive black B), soda percentage (5%,10%,15%). [5] Paul et. al study on the effect of alkali on dyeing of cotton fabric with reactive dye (shade 1%) and they found in their study the wash and rubbing fastness was good to excellent.[6] Now our paper deals with the Effect of Varying Concentration of Soda (other parameters was kept same) on Fastness Properties in Dyeing of Cotton Fabric with Reactive Dye. The aim of this paper is to examine the effect of varying of soda on different fastness properties. So the color fastness to washing, rubbing, perspiration, and light are tested and evaluated.

II. Materials and Methods

a) Fabic used

100% bleached cotton knitted single jersey (160 GSM) were used in this research.

b) Chemicals used

Reactive dyes, Soda ash (Na_2CO_3), anhydrous Glauber salt (Na_2SO_4), Sequestering agent, leveling agent, and anti-creasing agent were used.

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Collection of Bleached Fabric
↓
Dyeing (Dyeing with Reactive dye)
↓
Washing (wash with Dekol SN)
↓
Drying
↓
Conditioning (20±2°C for 4 hours)
↓
Preparation for Fastness Properties
↓
Color Fastness Test (Wash, Perspiration, Rubbing, Light)
↓
Fastness Grading
↓
Result

c) *Dyeing Recipe*

Table 1: Black Shade Recipe

Materials Name	Recipe 01	Recipe 02	Recipe 03	Recipe 04	Recipe 05
Nova. Sup. Black G	4.0%	4.0%	4.0%	4.0%	4.0%
Nova. Yellow S3R	0.5%	0.5%	0.5%	0.5%	0.5%
Nova. Ruby S3B	0.5%	0.5%	0.5%	0.5%	0.5%
Soda Ash	10 gm/L	15 gm/L	20 gm/L	25 gm/L	30 gm/L
Salt	80 gm/L	80 gm/L	80 gm/L	80 gm/L	80 gm/L
Time	60 min	60 min	60 min	60 min	60 min
Temperature	60°C	60°C	60°C	60°C	60°C
M:L	1:10	1:10	1:10	1:10	1:10

Table 2: Turquoise Shade Recipe

Materials Name	Recipe 01	Recipe 02	Recipe 03	Recipe 04	Recipe 05
Nova. Turq. Blue GN	0.10%	0.10%	0.10%	0.10%	0.10%
Nova. Blue TS3G	0.56%	0.56%	0.56%	0.56%	0.56%
Avi. Brill. Yellow SE	0.02%	0.02%	0.02%	0.02%	0.02%
Soda Ash	10 gm/L	15 gm/L	20 gm/L	25 gm/L	30 gm/L
Salt	40 gm/L	40 gm/L	40 gm/L	40 gm/L	40 gm/L
Time	60 min	60 min	60 min	60 min	60 min
Temperature	60°C	60°C	60°C	60°C	60°C
M:L	1:10	1:10	1:10	1:10	1:10

Table 3: Red Shade Recipe

Materials Name	Recipe 01	Recipe 02	Recipe 03	Recipe 04	Recipe 05
Nova. Blue TS3G	0.02%	0.02%	0.02%	0.02%	0.02%
Nova. Ruby S3B	2.0%	2.0%	2.0%	2.0%	2.0%
Nova. Yellow S3R	1.0%	1.0%	1.0%	1.0%	1.0%
Soda Ash	5 gm/L	10 gm/L	15 gm/L	20 gm/L	25 gm/L
Salt	55 gm/L	55 gm/L	55 gm/L	55 gm/L	55 gm/L
Albatex DBC	1.0 gm/L	1.0 gm/L	1.0 gm/L	1.0 gm/L	1.0 gm/L
Time	60 min	60 min	60 min	60 min	60 min
Temperature	60˚C	60˚C	60˚C	60˚C	60˚C
M:L	1:10	1:10	1:10	1:10	1:10

d) Dyeing Process

Dyeing of cotton fabric was done with Reactive dye, the fabric sample was immersed in the dyeing solution (dye bath liquor) at 60˚C for 60 minutes. Dyeing was performed in stainless-steal beaker. After dyeing washed the sample in shaker bath at 90˚C with shopping agent (Dekol SN) then washing dry the sample and ironing.

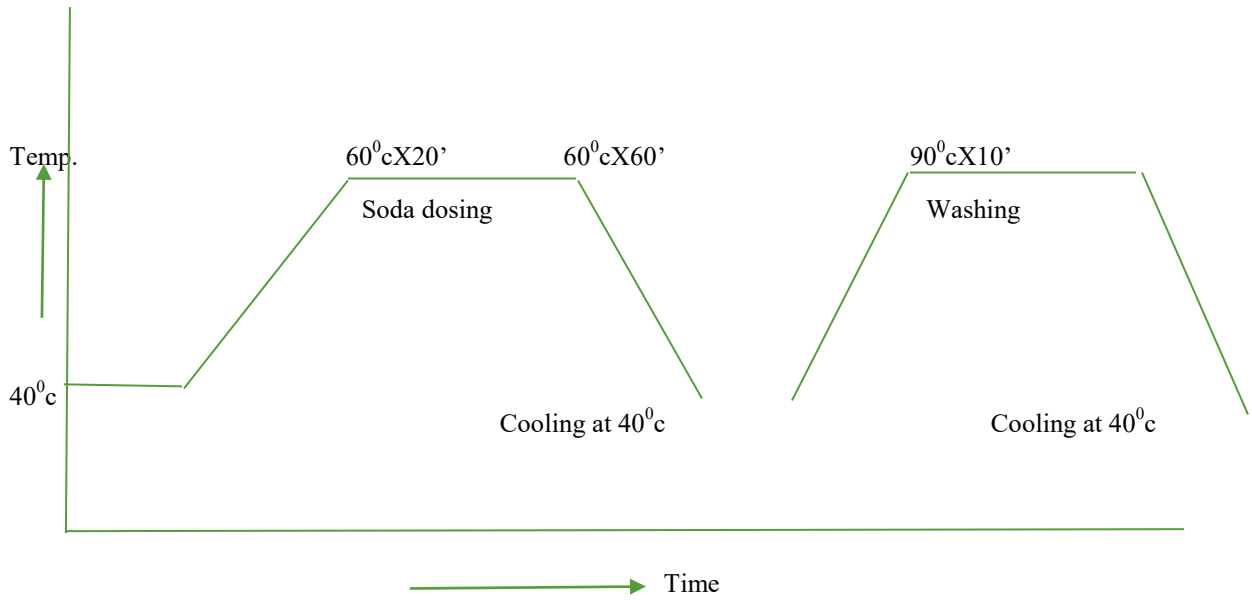

Figure 1: Dyeing Curve

e) Methods of Testing

Different standard testing procedures were followed for the assessment of the color fastness properties.

Color fastness to washing was assessed by following the standard method of ISO-105-C06-C2S. [7]

Color fastness to rubbing was evaluated by following the standard method of ISO-105X12. [8]

Color fastness to perspiration was assessed by following the standard method of ISO-105-E04. [9]

Color fastness to light was evaluated assessed by following the standard method of ISO-105-B02. [10]

III. Results & Discussions

a) For Black Shade

Table 4: Color Fastness to Washing

Soda gm/L	Change in Color	Color Staining					
		Acetate	Cotton	Nylon	Polyester	Acrylic	Wool
10	4	4-5	3	4-5	4-5	4-5	4-5
15	4	4-5	4	4-5	4-5	4-5	4-5
20	4	4-5	4-5	4-5	4-5	4-5	4-5
25	4	4-5	4-5	4-5	4-5	4-5	4-5
30	4	4-5	4-5	4-5	4-5	4-5	4-5

Table 5: Color Fastness to Perspiration (acid)

Soda gm/L	Change in Color	Color Staining					
		Acetate	Cotton	Nylon	Polyester	Acrylic	Wool
10	4	4-5	3-4	4-5	4-5	4-5	4-5
15	4	4-5	3-4	4-5	4-5	4-5	4-5
20	4	4-5	4	4-5	4-5	4-5	4-5
25	4	4-5	4	4-5	4-5	4-5	4-5
30	4	4-5	4	4-5	4-5	4-5	4-5

Table 6: Color Fastness to Perspiration (Alkali)

Soda gm/L	Change in Color	Color Staining					
		Acetate	Cotton	Nylon	Polyester	Acrylic	Wool
10	4	4-5	3	4-5	4-5	4-5	4-5
15	4	4-5	3	4-5	4-5	4-5	4-5
20	4	4-5	3-4	4-5	4-5	4-5	4-5
25	4	4-5	3-4	4-5	4-5	4-5	4-5
30	4	4-5	3-4	4-5	4-5	4-5	4-5

From the above table, it is shown that, the color fastness is increased with the increased of soda at a level of 20 gm/L and a further increasing of soda ash does not effect on the color fastness. So it is concluding that, soda 20gm/L concentration result is best in case of color fastness.

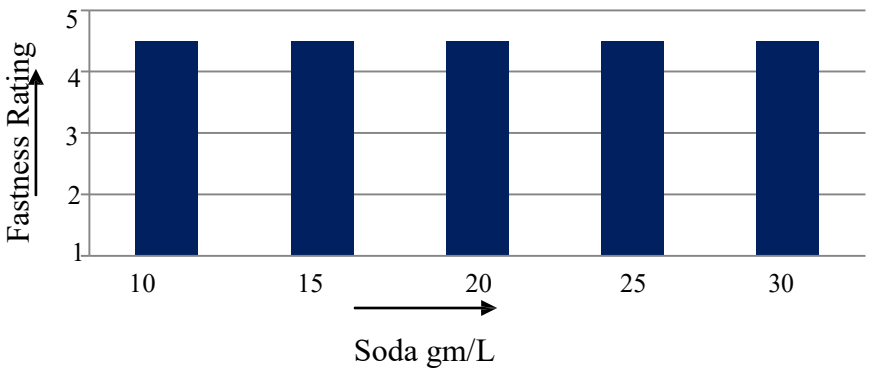

Figure 2: Color Fastness to Dry Rubbing

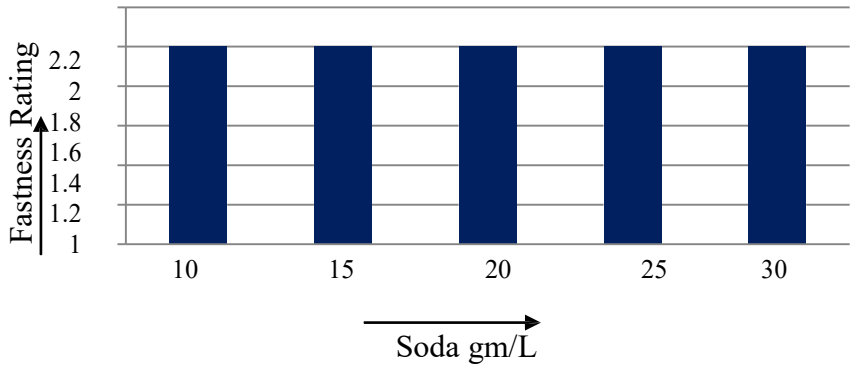

Figure 3: Color Fastness to Wet Rubbing

From the chart, it is found that color fastness to dry rubbing is excellent but colour fastness to wet rubbing is not up to the mark in relation to different concentration of soda.

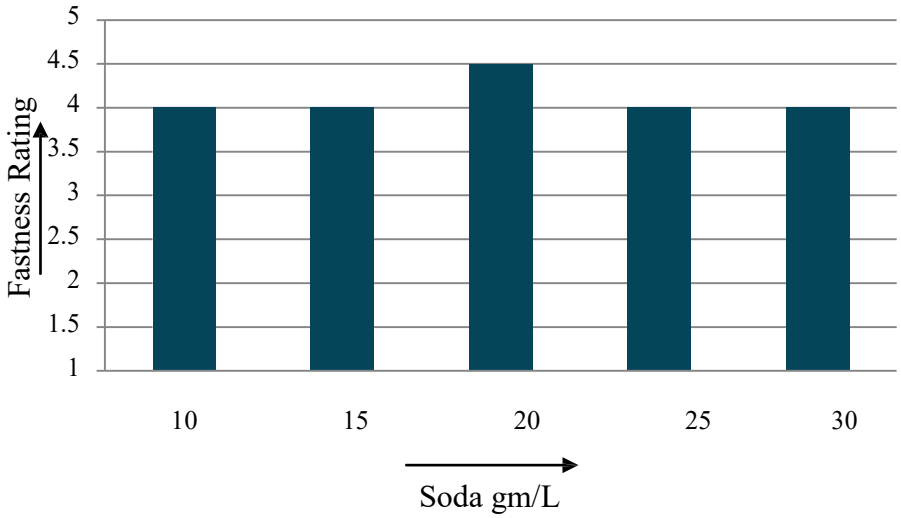

Figure 4: Color Fastness to Light

From figure- 4 it is concluded that, 20 gm/L soda ash concentration has better color fastness to light compare to other concentration of soda ash, though the properties of color fastness to light is excellent in all concentration.

b) For Turquoise Shade

Table 7: Color Fastness to Washing

Soda gm/L	Change in Color	Color Staining					
		Acetate	Cotton	Nylon	Polyester	Acrylic	Wool
10	4	4-5	3-4	4-5	4-5	4-5	4-5
15	4	4-5	3-4	4-5	4-5	4-5	4-5
20	4	4-5	4	4-5	4-5	4-5	4-5
25	4	4-5	4	4-5	4-5	4-5	4-5
30	4	4-5	4	4-5	4-5	4-5	4-5

Table 8: Color Fastness to Perspiration (Acid)

Soda gm/L	Change in Color	Color Staining					
		Acetate	Cotton	Nylon	Polyester	Acrylic	Wool
10	4	4	2	3-4	4	3-4	3-4
15	4	4	2	3	3-4	3	3-4
20	4	4-5	2	3-4	4	3-4	3-4
25	4	4-5	2	3-4	4	3-4	3-4
30	4	4-5	2	3-4	4	3-4	3-4

Table 9: Color Fastness to Perspiration (Alkali)

Soda gm/L	Change in Color	Color Staining					
		Acetate	Cotton	Nylon	Polyester	Acrylic	Wool
10	4	4	2-3	3-4	4	4	3-4
15	4	4	2-3	3	4	4	3-4
20	4	4-5	2-3	3-4	4-5	4-5	4
25	4	4-5	2-3	3-4	4-5	4	3-4
30	4	4-5	2-3	3-4	4-5	4-5	4

The results of the above tables show that, the properties of color fastness to perspiration (acid & alkali) are poor. Among this poor fastness property the 20 gm/L soda ash concentration has a comparatively better result. .Although fastness property to perspiration in all concentration is poor; 20 gm/L soda ash concentration has relatively better than other concentration.

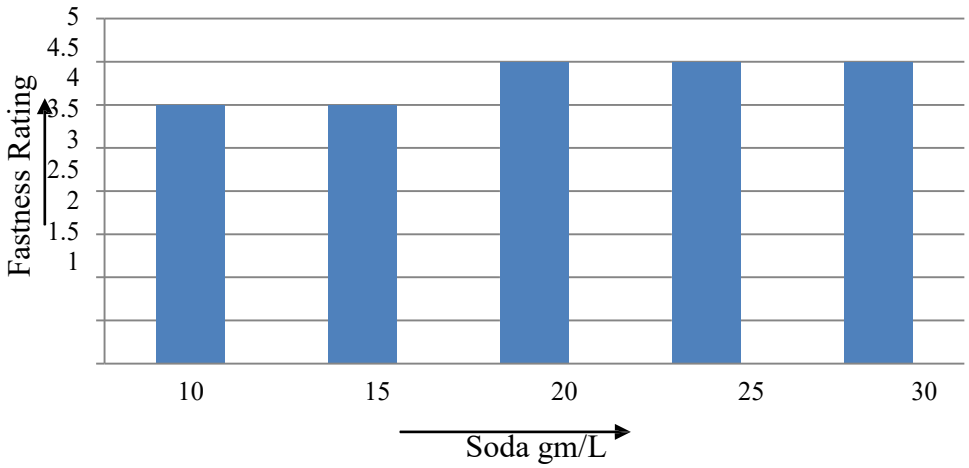

Figure 5: Color Fastness to Dry Rubbing

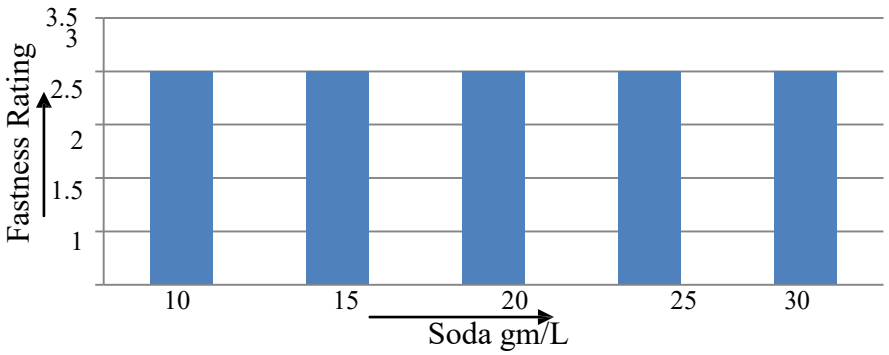

Figure 6: Color Fastness to Wet Rubbing

The above graphs show that, the color fastness to wet rubbing is same for all concentration of soda ash, whereas color fastness to dry rubbing is disparate in different concentration. In wet rubbing optimum fastness properties found in 20, 25 & 30 gm/L soda ash concentration.

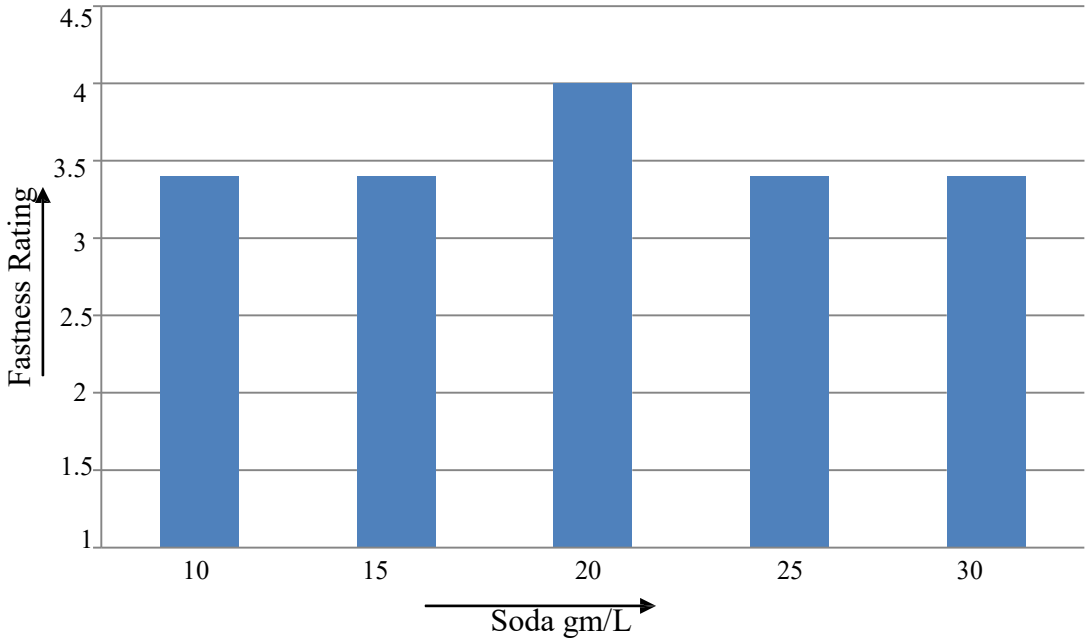

Figure 7: Color Fastness to Light

From the above graph, the result of color sada gm/L is a peak at 20 gm/L soda ash concentration.

c) For red shade

Table 10: Color Fastness to Washing

Soda gm/L	Change in Color	Color Staining					
		Acetate	Cotton	Nylon	Polyester	Acrylic	Wool
10	4	4-5	3-4	4-5	4-5	4-5	4-5
15	4	4-5	3-4	4-5	4-5	4-5	4-5
20	4	4-5	4	4-5	4-5	4-5	4-5
25	4	4-5	4	4-5	4-5	4-5	4-5
30	4	4-5	4	4-5	4-5	4-5	4-5

Table 11: Color Fastness to Perspiration (Acid)

Soda gm/L	Change in Color	Color Staining					
		Acetate	Cotton	Nylon	Polyester	Acrylic	Wool
10	4	4	2	4	4	3	3
15	4	4	2	3-4	4	3	3
20	4	4	2	3	4	3	3
25	4	4	2	3-4	4	3	3
30	4	4	2	3-4	4	3	3

Table 12: Color Fastness to Perspiration (Alkali)

Soda gm/L	Change in Color	Color Staining					
		Acetate	Cotton	Nylon	Polyester	Acrylic	Wool
10	4	4	2	3	4	3	3
15	4	4	2	3	4	3	3
20	4	4	2	4	4	3	3
25	4	4	2	4	4	3	3
30	4	4	2	4	4	3	3

From the above tables it is shown that, 20, 25 & 30 gm/L concentration give the best result of color fastness to washing.

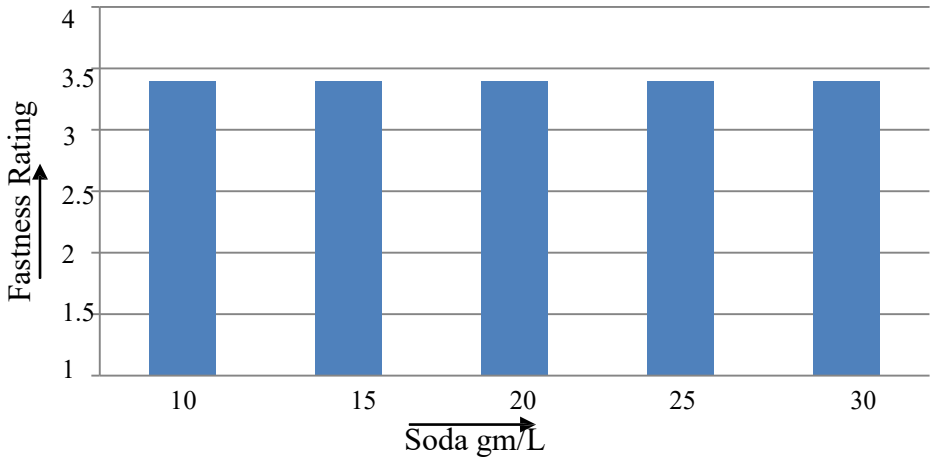

Figure 8: Color Fastness to Dry Rubbing

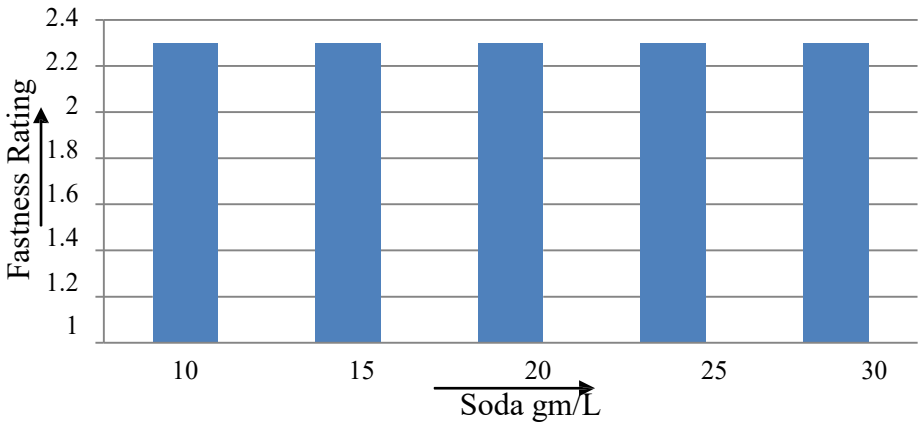

Figure 9: Color Fastness to Wet Rubbing

From figures 8 & 9, it is found that color fastness to wet rubbing and dry rubbing are almost same in all concentration of soda ash.

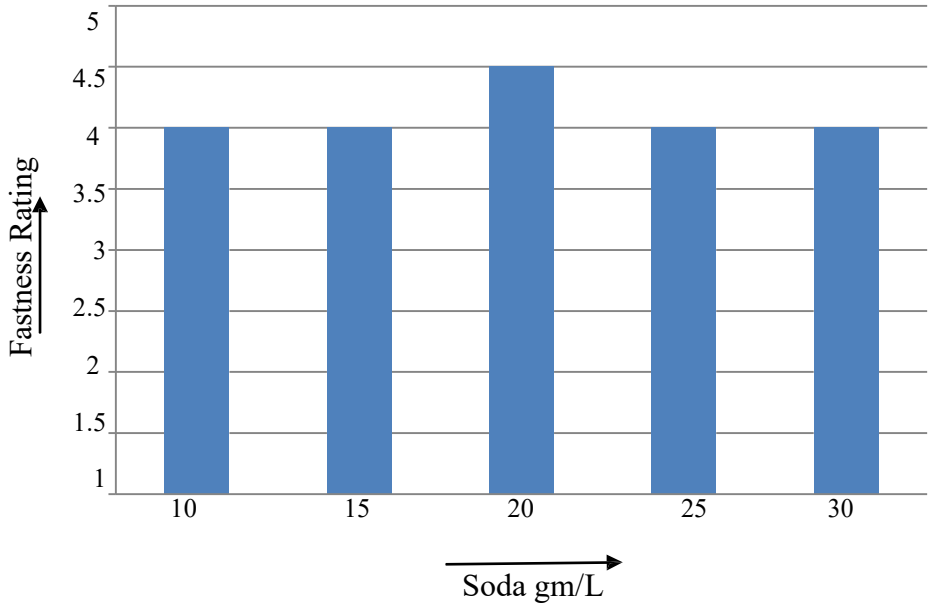

Figure 10: Color Fastness to Light

Figure 10 shows that, color fastness to light for red shade is best at 20 gm/L soda ash concentration.

IV. Conclusion

In this research work finally it is conclude that, the varying of soda ash concentration has effects on fastness properties of reactive dyed cotton fabric with various shades. With the increase of soda ash, fastness properties increased due to much amount of dye fixation into the fiber. But it was also shown that 20gm/L soda ash concentration provides the best results rather than other concentration of soda ash. Over 20 gm/L concentration of soda ash also give, similar result so it is unwise to use more soda ash as it is one kind of wastage of soda ash.

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10. ISO 105-B02:1994; Textiles—Tests for color fastness—Part B02: Color fastness to artificial light

Global Journal of Researches in Engineering (J) Volume XIX Issue IV Version I Year 2019
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Global Journal of Researches in Engineering: J General Engineering
Volume 19 Issue 4 Version 1.0 Year 2019
Type: Double Blind Peer Reviewed International Research Journal
Publisher: Global Journals
Online ISSN: 2249-4596 & Print ISSN: 0975-5861

Impact of Sleeve Types on Marker Efficiency and Fabric Consumption

By Mazharul Islam, Palash Kumar Saha, Md. Nazmul Islam, Sonjit Kumar Saha & Sonatan Kumar Biswas
Northern University Bangladesh

Abstract- In present day, the apparel industries should be very versatile and should capable of processing any kinds of design as per buyer demand. Better quality in every sense of the word warrants a better price point, but the idea and real trend are to mitigate risk and maximize net profits. During order taking, we need to make fabric consumption using mathematical estimates before actual marker making consumption. Two types of mathematical methods of fabric consumption are widely used by many factories. But due to lack of knowledge, what type of formula is suitable for which type of garments, it is not clear to all. So, the objective is to find out the accurate method of consumption when sleeve type varies. For this experiment, six garments having three different sleeve types; set-in, raglan & kimono for both short & long sleeve have been used.

Keywords: *fabric consumption, sleeve types, lectra modaris, diamino, pattern making, marker making.*

GJRE-J Classification: *FOR Code: 291899*

Strictly as per the compliance and regulations of:

Impact of Sleeve Types on Marker Efficiency and Fabric Consumption

Md. Mazharul Islam [α], Palash Kumar Saha [σ], Md. Nazmul Islam [ρ], Sonjit Kumar Saha [ω] & Sonatan Kumar Biswas [¥]

Abstract- In present day, the apparel industries should be very versatile and should capable of processing any kinds of design as per buyer demand. Better quality in every sense of the word warrants a better price point, but the idea and real trend are to mitigate risk and maximize net profits. During order taking, we need to make fabric consumption using mathematical estimates before actual marker making consumption. Two types of mathematical methods of fabric consumption are widely used by many factories. But due to lack of knowledge, what type of formula is suitable for which type of garments, it is not clear to all. So, the objective is to find out the accurate method of consumption when sleeve type varies. For this experiment, six garments having three different sleeve types; set-in, raglan & kimono for both short & long sleeve have been used. After that, patterns & markers are created using Lectra Modaris & Diamino software having a width of 60 inches. Then consumptions have been calculated for all six garments using two mathematical & one marker planning method. After analyzing the result, it can be concluded that for set-in sleeve single or individual formula can be used before production for fabric consumption, but in case of raglan sleeve only single formula can be used, and for kimono sleeve, only individual formula should be used. As it has been well-known that, marker planning method consumption is the best method of fabric consumption because it gives the most accurate consumption. But before production, when pattern & marker is not prepared, merchandisers have to make consumption for cost calculation and order processing. So, the guideline will help the industry by saving a lot of fabric from unnecessary wastage due to misuse of a mathematical formula.

Keywords: fabric consumption, sleeve types, lectra modaris, diamino, pattern making, marker making.

I. Introduction

During the later part of the 20th century, the clothing and textile industries of many developed and developing countries have changed dramatically. The Textile & fashion industry is highly complex, with some of the longest and most complicated pipelines of the manufacturing sector [1-6]. No longer are clothes manufactured and retailed in specific local regions. Fashion and clothing have joined textiles in becoming a truly global operation with many manufacturing functions blurring [3, 5, 7, 8]. In the past, the clothing industry has only two-season cycle (summer and winter collections). As consumers became more fashion aware, the clothing industry responded in adding two more season, spring and autumn collections. Nowadays increased collection ascended to six and eight collections a year and even some companies have more; for example, Calvin Klein has ten collections within a year [9]. Fashion today has accelerated; retailers have moved from seasonal collections to offering new merchandise on an ongoing basis. The trend towards smaller orders in a variety of styles and colors, combined with shorter-than-ever lead times, has become the industry norm. To reestablish a competitive position in the international marketplace, the apparel industry is focusing on upgrading its responsiveness to customer needs. Smaller orders are placed in a more dynamic fashion, forcing the efficient production of smaller lots. Like other business, apparel factory is set for profit generation. Profit can be improved by saving from each cost factors of garment making. Fabric is the most important part of a garment, and it represents around 60-70% of total product manufacturing cost. Fabric cost of a product depends on how much fabric is consumed to make the garment, including cut wastes and end bits. Fabric consumption is the quantity of fabric which is required to produce a garment. In recent years, materials continuously increases, so any increase in material utilization rate directly affects the production cost [10]. Any reduction in the amount of cloth used per garment leads to increased profit [11]. The minimization of fabric wastage is crucial to the reduction of production costs [12].And as we all know that improving the material utilization rate is one of the most important means of reducing the production costs and improving product competitiveness [13]. Any material left in the fabric store is also a waste as it will be disposed of at a much cheaper rate [14].In garment industry, profit or lose mostly depend on the total consumption of fabric in an

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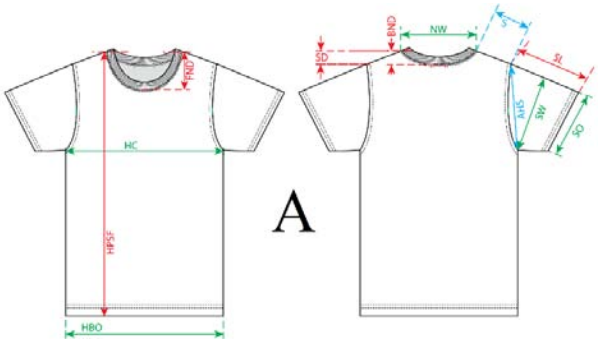
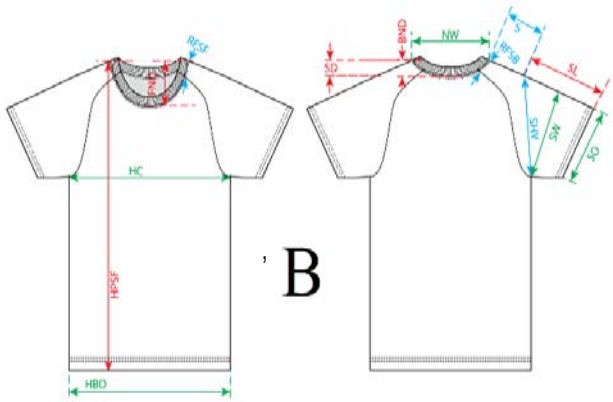
order. Therefore, fabric consumption must be calculated properly before fabric cutting. There are three methods to calculate the fabric consumption, namely two mathematical methods & one marker planning method. During order taking, we need to make fabric consumption using mathematical estimates before actual marker making consumption. Mathematical methods give the fabric consumption quickly, and time required for costing will be less. But the development of marker is a time- consuming process since costing should be submitted to the buyer within the given time frame. Again manual marker making is not possible if multiple styles are going on at a time. To supply customers with the right products in the right place at the right time and affordable prices, it is necessary to investigate the process or method of fabric consumption based on different garment design. So, the objective of this paper is to investigate the effect of different sleeve variations & fabric consumption calculation methods on fabric consumption.

II. Materials & Methods

For this experiment, six garments having three different sleeve types; set-in, raglan & kimono for both short & long sleeve have been used having the same GSM (160). After that, patterns have been made according to the measurements and markers have been created using Lectra Modaris & Diamino software having a width of 60 inches. Then consumptions have been calculated for all six garments using two mathematical & one marker planning method.



A



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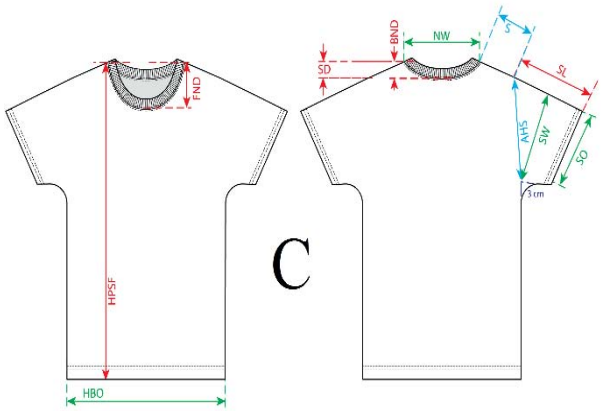

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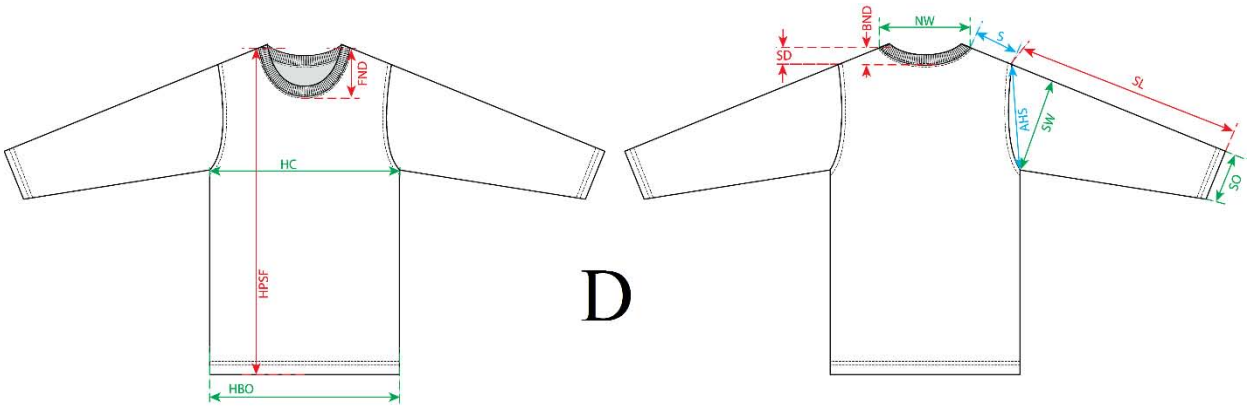

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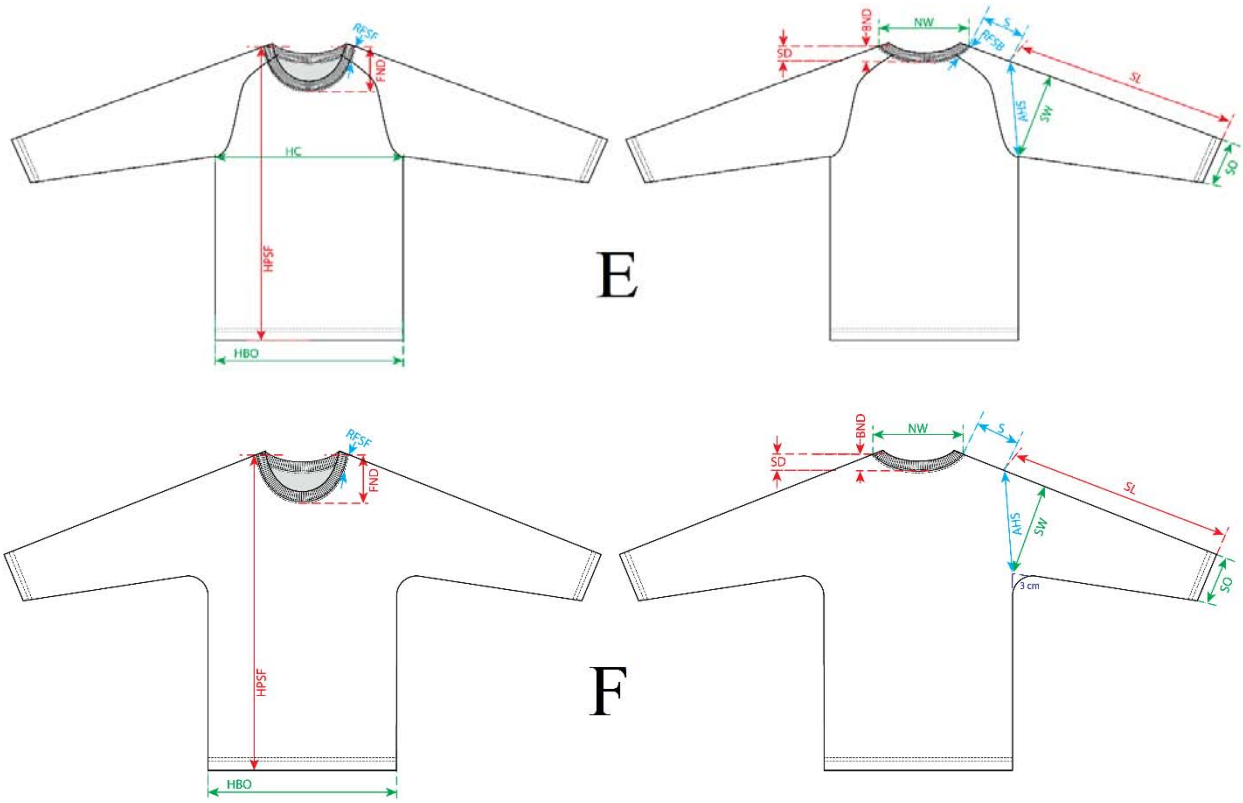

Figure 1: Specification of T-shirt (A = Short Set-in Sleeve, B = Short Raglan Sleeve, C = Short Kimono Sleeve, D = Long Set-in Sleeve, E = Long Raglan Sleeve, F = Long Kimono Sleeve)

Table 1: Combined Measurements of All types of T-shirt

POM	Measurement Name	S	M	L	XL	XXL	Unit
HC	Half Chest	48	51	54	57	60	cm
HBO	Half Bottom Opening	48	51	54	57	60	cm
HPSF	High Point Shoulder Front	70	72	74	76	78	cm
NW	Neck Width	16	17	18	19	20	cm
FND	Front Neck Drop	8	8.5	9	9.5	10	cm
BND	Back Neck Drop	1.5	1.5	1.5	1.5	1.5	cm
SD	Shoulder Drop	5	5	5	5	5	cm
S	Shoulder length	15	16	17	18	19	cm
AHS	Arm Hole Straight	24	25	26	27	28	cm
SL	Short Sleeve Length	21	22	23	24	25	cm
SO	Short Sleeve Opening	18	19	20	21	22	cm
SW	Short Sleeve Width	23	23.75	24.5	25.25	26	cm
SL	Long Sleeve Length	55	56	57	58	59	cm
SO	Long Sleeve Opening	15	15.5	16	16.6	17	cm
SW	Long Sleeve Width	23	23.75	24.5	25.25	26	cm
RFSF	Raglan Forward Shoulder Front	5	5	5	5	5	cm
RFSB	Raglan Forward Shoulder Back	3	3	3	3	3	cm

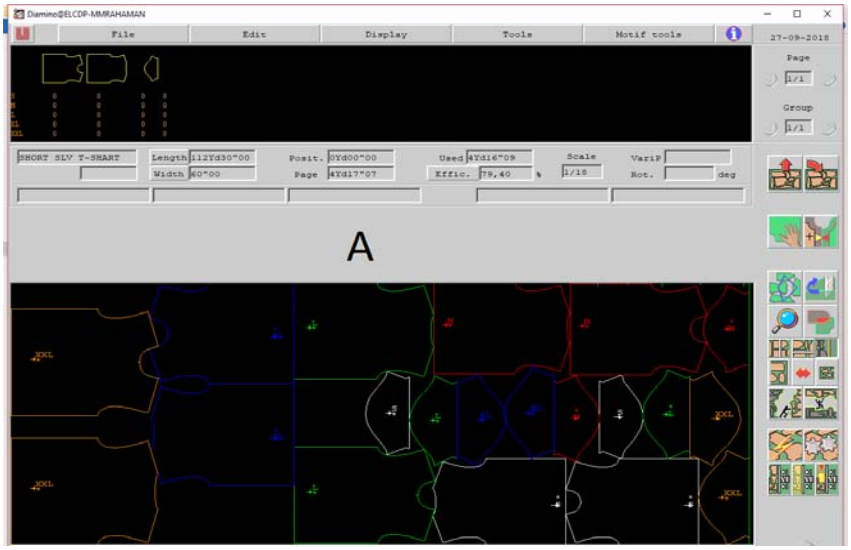

Figure 2: Marker of Short Set-in Sleeve T-shirt

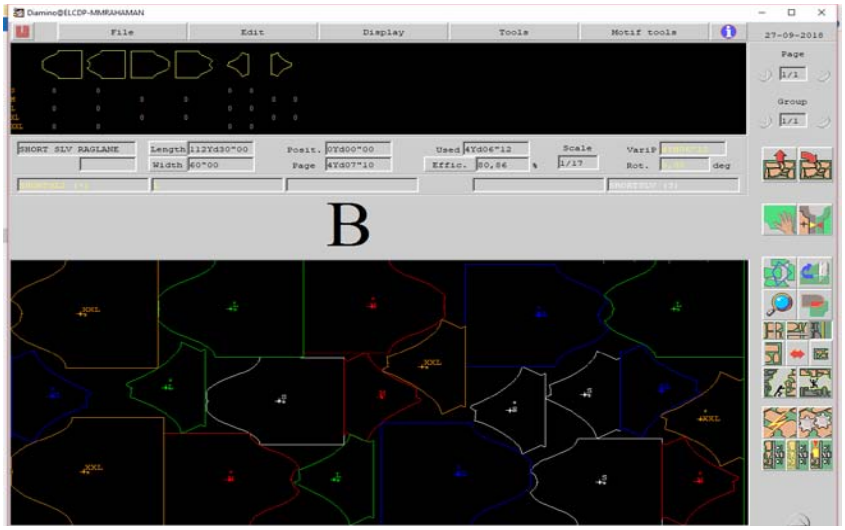

Figure 3: Marker of Short Raglan Sleeve T-shirt

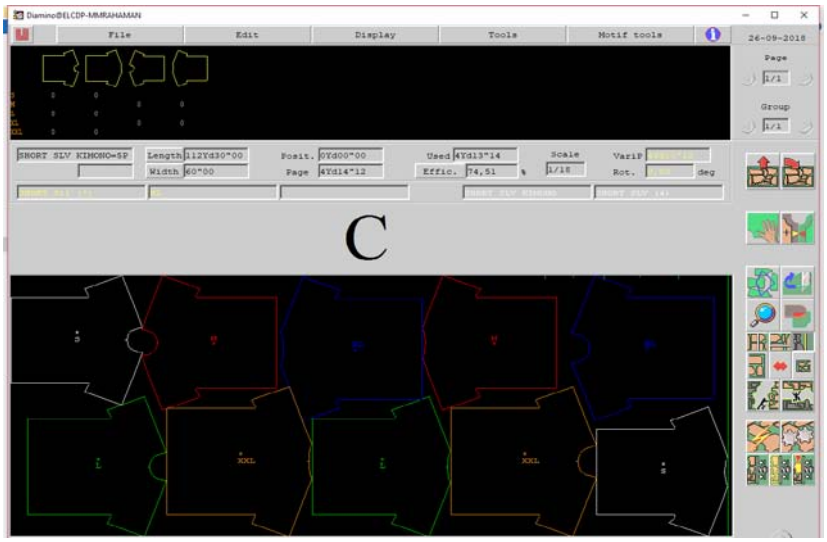

Figure 4: Marker of Short Kimono Sleeve T-shirt

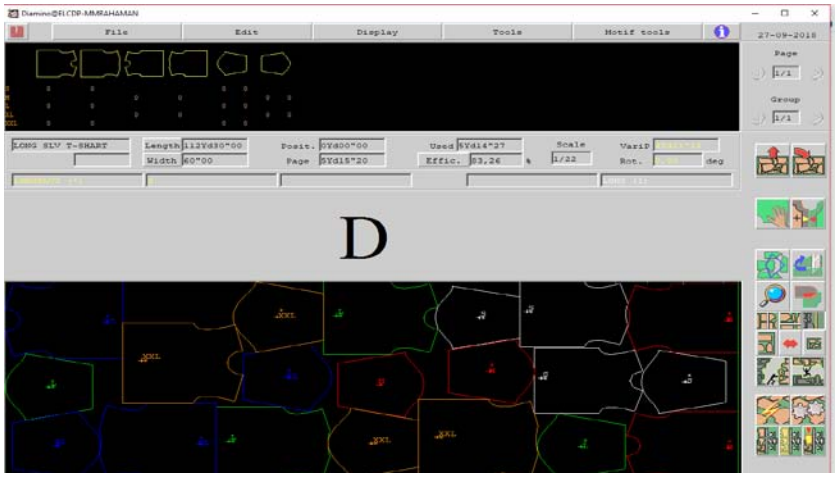

Figure 5: Marker of Long Set-in Sleeve T-shirt

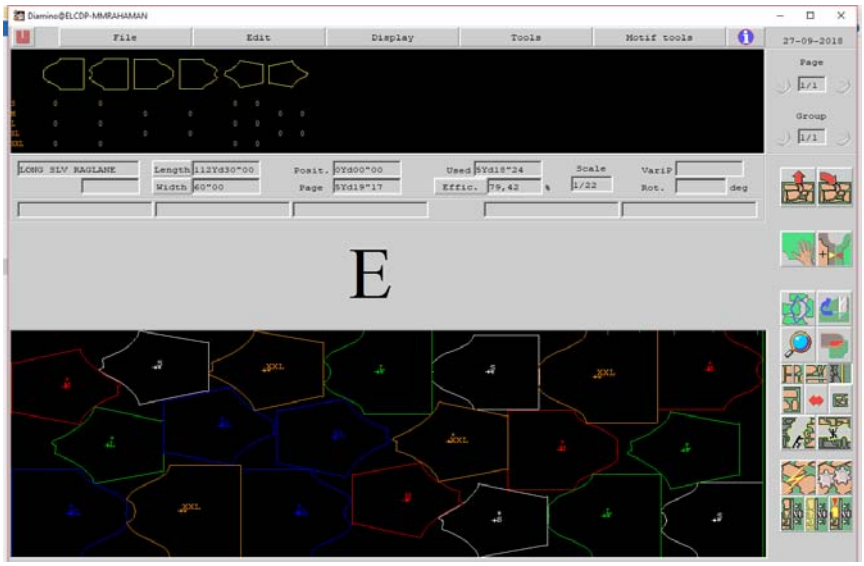

Figure 6: Marker of Long Raglan Sleeve T-shirt

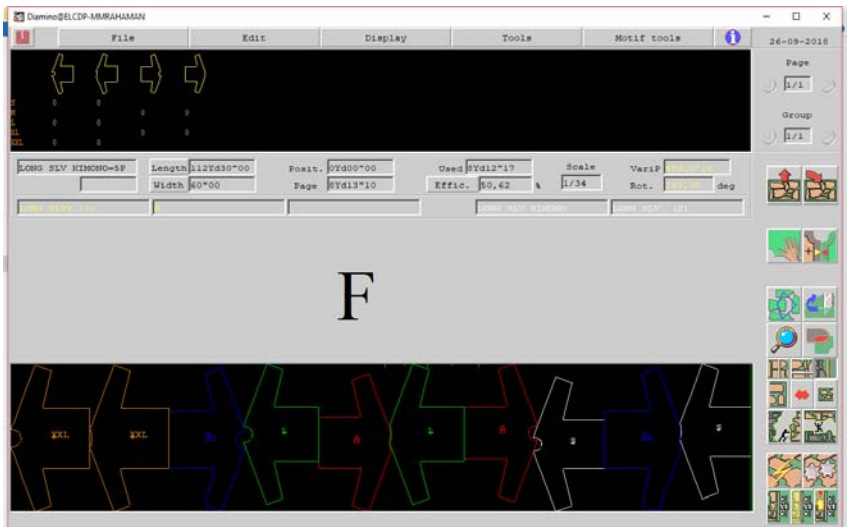

Figure 7: Marker of Long Kimono Sleeve T-shirt

III. The Formula used for Making Consumption

Consumption per dozen of the T-shirt by Single formula

$$= \frac{(BL + SL + All) \times (HC + All) \times 2 \times 12 \times GSM}{100 \times 100 \times 1000} + Wastage\%$$

Consumption per dozen of the T-shirt by individual formula (maximum dimension)

$$\text{Body part consumption} = \frac{(BL + All) \times (HC + All) \times 2 \times 12 \times GSM}{100 \times 100 \times 1000} + Wastage\%$$

$$\text{Sleeve Consumption} = \frac{(SL + All) \times (SW \times 2 + All) \times 2 \times 12 \times GSM}{100 \times 100 \times 1000} + Wastage\%$$

Total consumption = Body part consumption + Sleeve Consumption

Consumption per dozen of the T-shirt by marker planning method

$$= \frac{Mar\ker\ Width(Inch) \times Mar\ker\ Length(Inch) \times 12 \times GSM}{1550 \times 1000 \times \text{Number of Garments in the Marker}} + Wastage\%$$

IV. Result

In this project, fabric consumptions have been calculated using three methods for six T-shirts (three short & three long) having three different types of sleeve variations (set-in, raglan and kimono sleeve). After calculation the following results have been found.

Table 2: Comparison Table for marker efficiency

Sleeve Type	Efficiency found	
	Short Sleeve T-Shirt	Long Sleeve T-Shirt
Set-in Sleeve	79.40%	83.26%
Raglan Sleeve	80.86%	79.42%
Kimono Sleeve	74.51%	50.62%

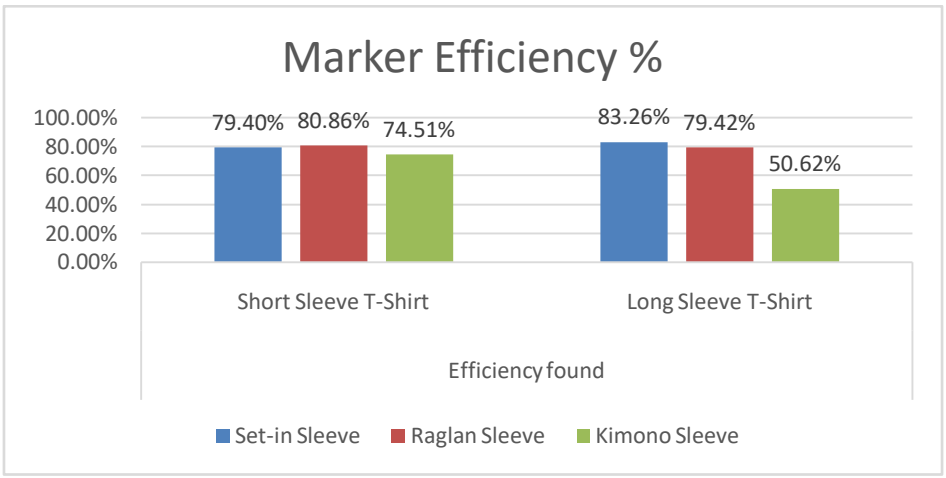

Figure 8: Graphical representation of the marker efficiency % of different garments

Table 3: Comparison table for fabric consumption

Formula Used	Fabric Consumption (Kg/Doz)					
	Short Sleeve T-Shirt			Long Sleeve T-Shirt		
	Set-in Sleeve	Raglan Sleeve	Kimono Sleeve	Set-in Sleeve	Raglan Sleeve	Kimono Sleeve
Single Formula	2.436	2.436	2.436	3.24	3.24	3.24
Individual Formula	2.381	2.736	2.637	3.113	3.479	4.709
Marker Planning Method	2.616	2.452	2.567	2.943	3.253	4.921

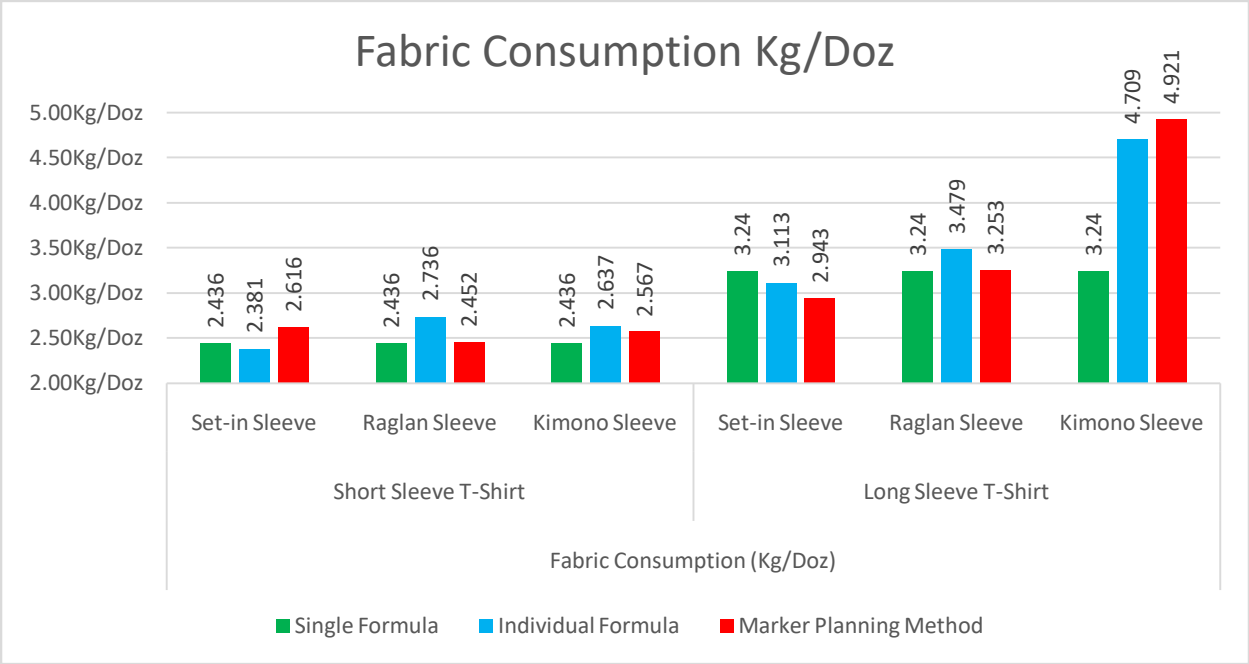

Figure 9: Graphical representation of the different fabric consumption of different garments

V. Result Discussion

From table 2 & figure 8, it can be said that Set-in sleeve T-shirt has more efficiency than Raglan sleeve T-shirt and Raglan sleeve T-shirt has higher efficiency than Kimono sleeve T-shirt. From figure 9 &table 3, it can be said that for set-in sleeve, can use single or individual formula before production for fabric consumption, but in case of raglan sleeve, should only use single formula and for kimono sleeve, should only use individual formula.

VI. Conclusion

As it has been well-known that, marker planning method consumption is the best method of fabric consumption because it gives the most accurate consumption. But before production when pattern & marker is not prepared, apparel merchandisers have to make consumption for cost calculation for order taking & processing. Single formula or individual formula (maximum dimension) method both are used in the factory. But neither any apparel books nor any textile blogs suggest which formula should use for what type of garments. So, this experiment have been done to show the comparison of different fabric consumption method for different types of garment products. If anyone follow the guideline or recommendation and can implement it in the industry; a lot of fabrics can be saved and hence saved money.

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Global Journal of Researches in Engineering: J General Engineering
Volume 19 Issue 4 Version 1.0 Year 2019
Type: Double Blind Peer Reviewed International Research Journal
Publisher: Global Journals
Online ISSN: 2249-4596 & Print ISSN: 0975-5861

An Approach to Evaluate Different Properties of Printed Cotton Fabric by using Polyethylene and Silicon Softener

By Tanjim Hossain, Faisal Rahman, Md. Shafiqul Islam Chowdhury, Md. Tareq Rahman & Md. Lutfor Rahman

Northern University Bangladesh

Abstract- This study shows the different effects of silicon softener and polyethylene softener on cotton printed fabric. The samples were treated with both softeners, and different tests have been examined like color fastness to washing, color fastness to water, color fastness to perspiration, pH. These tests results are all the same but color fastness to rubbing with polyethylene softener (Dry: 4/5, Wet: 2/3) is better than the silicon softener (Dry: 4, Wet: 2). Also, tensile & tear strength of fabric with polyethylene softener (Tensile Strength in Warp: 209N, Tensile Strength in Weft: 214N and Tear Strength in Warp: 12.41N, Tear Strength in Weft: 14.17N) is better than the silicon softener (Tensile Strength in Warp: 177N, Tensile Strength in Weft: 158N and Tear Strength in Warp: 9.81N, Tear Strength in Weft: 10.67N).

GJRE-J Classification: FOR Code: 091599

An Approach to Evaluate Different Properties of Printed Cotton Fabric by using Polyethylene and Silicon Softener

Md. Tanjim Hossain [α], Faisal Rahman [σ], Md. Shafiqul Islam Chowdhury [ρ], Md.Tareq Rahman [ω], & Md. Lutfor Rahman [¥]

Abstract- This study shows the different effects of silicon softener and polyethylene softener on cotton printed fabric. The samples were treated with both softeners, and different tests have been examined like color fastness to washing, color fastness to water, color fastness to perspiration, pH. These tests results are all the same but color fastness to rubbing with polyethylene softener (Dry: 4/5, Wet: 2/3) is better than the silicon softener (Dry: 4, Wet: 2). Also, tensile & tear strength of fabric with polyethylene softener (Tensile Strength in Warp: 209N, Tensile Strength in Weft: 214N and Tear Strength in Warp: 12.41N, Tear Strength in Weft: 14.17N) is better than the silicon softener (Tensile Strength in Warp: 177N, Tensile Strength in Weft: 158N and Tear Strength in Warp: 9.81N, Tear Strength in Weft: 10.67N). On the other hand, hand feel of the sample finished with silicon softener is better than the fabric treated with polyethylene softener. In overall context, this study shows that, if better hand feel is required then silicon softener can be used but, if hand feel as well as other test requirements(tensile, tear, etc.)which is required by buyer, polyethylene softener is appropriate to use.

I. Introduction

Softener is a completing operator that connected to material enhances its handle giving satisfying touch. When in doubt, the softening specialists connected are greasing up operators, which encourage the fiber sliding inside the texture structure, along these lines allowing simpler twisting and wrinkling of the texture. By and large, the term of the impact is constrained since the items connected amid the treatment are disposed of by ensuing washing; hence, they should be connected in the last phase of the treatment. [1]

Cleanser (likewise called texture conditioner) is utilized to anticipate static stick and make texture milder, i.e. Softening operators are connected to materials to enhance their hand, wrap, cutting and sewing characteristics. It is accessible as a fluid or as dryer sheets. Cleansing agents work by covering the surface of the material filaments with a thin layer of synthetic concoctions; these synthetic substances have ointment properties and are electrically conductive, consequently making the strands feel smoother and averting development of friction-based electricity. As the material goes under different mechanical and compound procedures that make the surface of the material cruel.For instance, Removal of normal oil and waxes by scouring and fading. Pitch completing of material additionally grants some level of brutality. Soaping of material likewise adds brutal inclination to the material. As buyers are significantly more thinking about the dash of material. This is an additional explanation behind utilizing conditioner. [2]

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II. Literature Review

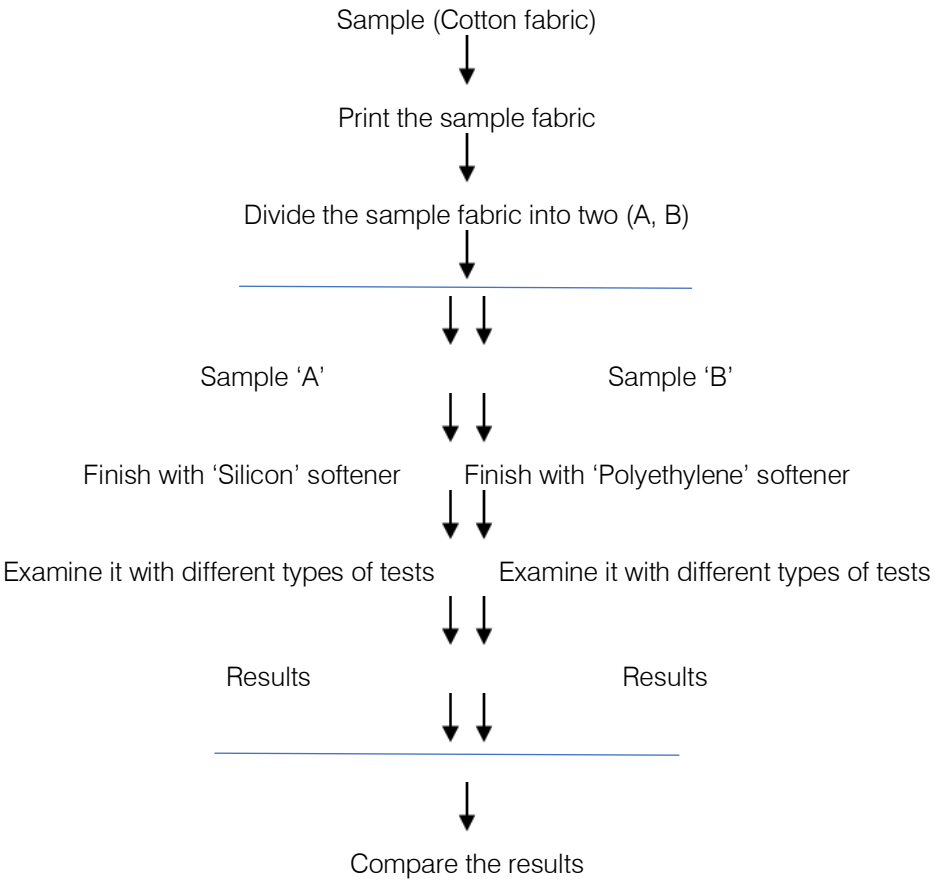
Polyethylene can be modified by air oxidation in the melt at high pressure to add hydrophilic character (mainly carboxylic acid group). Emulsification in the presence of alkali provides higher quality and more stable products. They show high lubricity that is not durable to dry cleaning. They are stable to extreme pH conditions and heat at normal textile processing condition, and compatible with resins and fluorescent brightening agents. They impart lubricity especially required for yarns. Matsoft PE emulsion and Matsoft PEW emulsion belongs to this category.

Silicones are macromolecules comprised of a polymer backbone of alternating Silicon and Oxygen atoms with organic groups attached to silicon. Silicone's softening capability comes from the siloxane backbone's flexibility and its freedom of rotation along the Si-O bonds.

They are insoluble in water, and therefore must be applied on fabrics after emulsification or dissolution in organic solvents. They feature quite a good fastness to washing. They create a lubricating and moderately waterproof film on the surface and give fabrics a silky hand. They show good temperature stability and durability, with a high degree of permanence for those products that form cross-linked films and a range of properties from hydrophobic to hydrophilic. According to requirements, the required properties the organ reactive group is modified and the results are achieved. A complete range of silicone softeners were developed

by Matex, like Diamino silicone (DAS), Reactive amino silicone (RAS), Amino functional silicone (AFS), Organofunctional silicone (OFS), Premium amino functional silicone (PAS), polyether silicone (HYS) and epoxy silicone (NYS). [1]

III. Methodology



IV. Materials and Methods

a) Materials

Fabric: (20×10/40×36, 100% BCI Cotton)

Pigment & Chemicals

Yellow KR	Crenovo International Limited
Red TN	Crenovo International Limited
Black KBN	Cabot Corporation
Violet RLE	Crenovo International Limited
Urea	Huntsman
Binder PD SF	Huntsman
Liquor Ammonia	Huntsman
Wacker SD 97	Wacker
BL- 100	Huntsman
PT 7000	Huntsman
Polyethylene softener	Local

b) Method

Printing: Screen printing was done by using Rotary Screen-Printing machine as per the recipe.

Curing: Curing was done by using 150°C temperature for 4-5 minutes

Finishing: Then we divide the fabric into half. Each half has one meter of fabric. We finish one half of the fabric with 'Silicon' softener &another half of the fabric with 'Polyethylene' softener by the 'Monforts' stenter machine

Table 4: Finishing Recipe of Polyethylene Softener

Polyethylene Softener	3 kg
Acetic Acid	0.05 kg
Temperature	150°C
Speed	20 m/min

Finishing recipe of silicon softener for 100 Liter of liquor for 1 meter of sample fabric-

Table 5: Finishing Recipe of Silicon Softener

Silicon Softener	3 kg
Acetic Acid	0.05 kg
Temperature	150°C
Speed	20 m/min

c) *Test Method*

Nature of test	Testing Standard/ method
Color Fastness to Water	EN ISO 105-E01
Color Fastness to Washing	ISO 105 C06
Color Fastness to Rubbing	ISO 105 X12
Color Fastness to Perspiration	EN ISO 105-E04
pH	ISO 3071-1980
Thread in EPI & PPI	ISO 7211-2
GSM (g/m^2)	ISO 3801
Tensile Strength	ISO 13934 (Part 1)
Tear Strength	ISO 13937 (Part 2)
Hand feel	

V. Result and Discussion

Table 6: Results

Nature of Test	Testing Standard/ method	Silicon Softener	Polyethylene Softener
Color Fastness to Water	EN ISO 105-E01	Change in color 4 Cross Staining 4/5	Change in color 4 Cross Staining 4/5
Color Fastness to Washing	ISO 105 C06	Shade Change 4	Shade Change 4
Color Fastness to Rubbing	ISO 105 X12	Dry 4 Wet 2	Dry 4/5 Wet 2/3
Color Fastness to Perspiration	EN ISO 105-E04	Change in Color Acid 4 Alkaline 4 Cross Staining Acid 4/5 Alkaline 4/5	Change in Color Acid 4 Alkaline 4 Cross Staining Acid 4/5 Alkaline 4/5
pH	ISO 3071-1980	5.8	5.3
Thread in EPI & PPI	ISO 7211-2	Warp (EPI)-41 Weft (PPI)-35	Warp (EPI)-41 Weft (PPI)-34
GSM (g/m^2)	ISO 3801	132.8	126.92
Tensile Strength	ISO 13934 (Part 1)	Warp-177N Weft-158N	Warp-209N Weft-214N
Tear Strength	ISO 13937 (Part 2)	Warp-9.81N Weft-10.67N	Warp-12.41N Weft-14.17N
Hand feel		Excellent	Good

VI. Discussion

As we can see from this table, we can compare these two softeners by the following-

1. Thread in PPI (Pick per Inch) of fabric treated with silicon softener is a little bit higher than the fabric treated with polyethylene softener.
2. GSM of fabric treated with silicon softener is a little bit lower than the fabric treated with polyethylene softener.
3. Tensile strength of fabric treated with polyethylene softener is better than the fabric treated with silicon softener.
4. The same way tearing strength of fabric treated with polyethylene softener is better than the fabric treated with silicon softener.
5. Also, color fastness to rubbing is more improved of fabric treated with polyethylene softener than the fabric treated with silicon softener.
6. But we can see that the color fastness to Washing, Water, Perspiration are equally the same for both fabrics which individually treated with silicon & polyethylene softener.
7. The pH of fabric treated with silicon softener is a little bit higher than the fabric treated with polyethylene softener.
8. The hand feel of fabric treated with silicon softener is better than the fabric treated with polyethylene softener.

After observing all the above topics, we can conclude that the polyethylene softener is more appropriate to finish the fabric than with silicon softener.

VII. Conclusion

This report shows that, for getting a better hand feel, silicon softener is preferable, but the required strength cannot be achieved by it.

This report also shows that to get required strength and color fastness to rubbing polyethylene softener is preferable, though hand feel is not as good as silicon softener.

This report demonstrates the comparison between the effects of silicon and polyethylene softener on printed cotton fabric, and it has been observed that polyethylene softener is more appropriable than silicon softener for printed cotton fabric.

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Global Journal of Researches in Engineering: J General Engineering
Volume 19 Issue 4 Version 1.0 Year 2019
Type: Double Blind Peer Reviewed International Research Journal
Publisher: Global Journals
Online ISSN: 2249-4596 & Print ISSN: 0975-5861

Impact of Different Seam Types on Seam Strength

By Mazharul Islam, Palash Kumar Saha, Md. Nazmul Islam, Md. Masud Rana & Md. Abdul Hasan
Northern University Bangladesh

Abstract- Seam strength is the strength of the seam measured from a sewn garment. A seam can be failed due to different reasons like breaking of sewing thread, tearing of fabric, excessive seam slippage or can be a combination of those. The objective of this study is to find out the effect of different seam on seam strength. For this experiment, a denim fabric having the construction of (68*9)/(46*7) has been collected. Then the samples are prepared according to ASTM D1683 (EQ28C) method having dimension of 10cm width & 20cm long. After that seam strength of all the samples have been done using tensile strength tester. Some properties like sewing thread counts of the needle, bobbin and lopper are 40/2 Ne for all (100% polyester) remain constant and some properties are varied like seam types (SSa1, LSa1 & LSc1), stitch type (Lock stitch 301 & Chain stitch 401) etc.

Keywords: *seam strength, seam types, stitch types.*

GJRE-J Classification: *FOR Code: 291899*

Strictly as per the compliance and regulations of:

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Keywords: seam strength, seam types, stitch types.

I. Introduction

Seam is used to assemble two or more pieces together to make 3D garment. Sewing is defined as a two or more fabric pieces are joined using sewing machines, sewing threads and various types of stitching methods [1].Fabric and sewing thread are the basic raw-materials of garment industry. Properties of the raw material influences the seam quality of the garment. Fabric quality alone does not fulfil all the criteria for high quality garments production [2, 3].Proper selection of raw material not only gives comfort to the wearer but also helps in smooth functioning of manufacturing process and finally lead to defect free product [4]. In the garment industry, overall seam quality defined through various types of functional and aesthetic performances required for the garments product during their end-use. The quality of a garment not only depends on its appearance but also on its technical properties. For getting a quality product it is necessary to select the appropriate type of fabric, seam and sewing conditions. The functional performance mainly refers to the strength, efficiency, tenacity, elasticity, elongation, flexibility, bending stiffness, abrasion resistance, washing resistance and dry cleaning resistance of the seam under stress mechanical conditions for a definite period of time [5-7].Good seams are essential for durability, quality, and aesthetic appearance of the garments. Seam performance is influenced by a selection of seam type, appropriate sewing thread, sewing process parameters, and ease of sewability of the fabric [8]. Properties like as, strength, tenacity and efficiency is required for determining the serviceability of apparel. When joining materials aesthetic appeal, strength and durability are some factors of others should be considered [9].Seam efficiency is also an important factor and has been defined as the ratio of seam strength to the strength of fabric un-sewn expressed as percentage of fabric strength [8, 10, 14].The simplest seam type of ISO stitch class is stitch class 1 which is formed by superimposing the edge of one piece of material on to another.ISO Class 2 of lapped seams is common used in jeans; this provides a very strong seam in garments that will take a lot of wear, though there is a possibility that the thread on the surface may suffer abrasion in areas such as inside leg seams [13]. To maximize a potential seam, it must be ensure that seam will interact with the components of the fabric to ensure the best product durability [11-12]. So, the objective of this paper is to investigate the effect of different seams on seam strength.

II. Material & Methods

For this experiment a denim fabric having construction of (EPI = 68, PPI = 46, Warp Count = 9 Ne & Weft count = 7 Ne) has been collected. Then the samples are prepared according to ASTM D1683 (EQ28C) method having dimension of 10cm width & 20 cm long. After that seam strength of all the samples have been done using tensile strength tester. Some properties like sewing thread counts of the needle, bobbin and lopper are 40/2 Ne for all (100% polyester) remain constant and some properties are varied like seam types (SSa1, LSa1 & LSc1), stitch type (Lock stitch 301 & Chain= stitch 401) etc. Finally the seam strength reports are collected from the machine.

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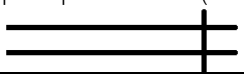
III. Result

For this paper work, we have measured seam strength of different seam. The results are summarized below:

Table 1: Comparative study on seam strength based on seam & stitch type

Fabric types	Seam types	Stitch types	Avg. seam strength (N)	
			Warp	Weft
Denim	Superimposed Seam (SSa1) 	301	364.9	363.5
		401	147.7	136.1
	Lapped Seam 1 (LSa1) 	301	235.6	211.3
		401	164.5	145.24
	Lapped Seam 2 (LSc1) 	301	246.3	215.84
		401	144.9	140.8

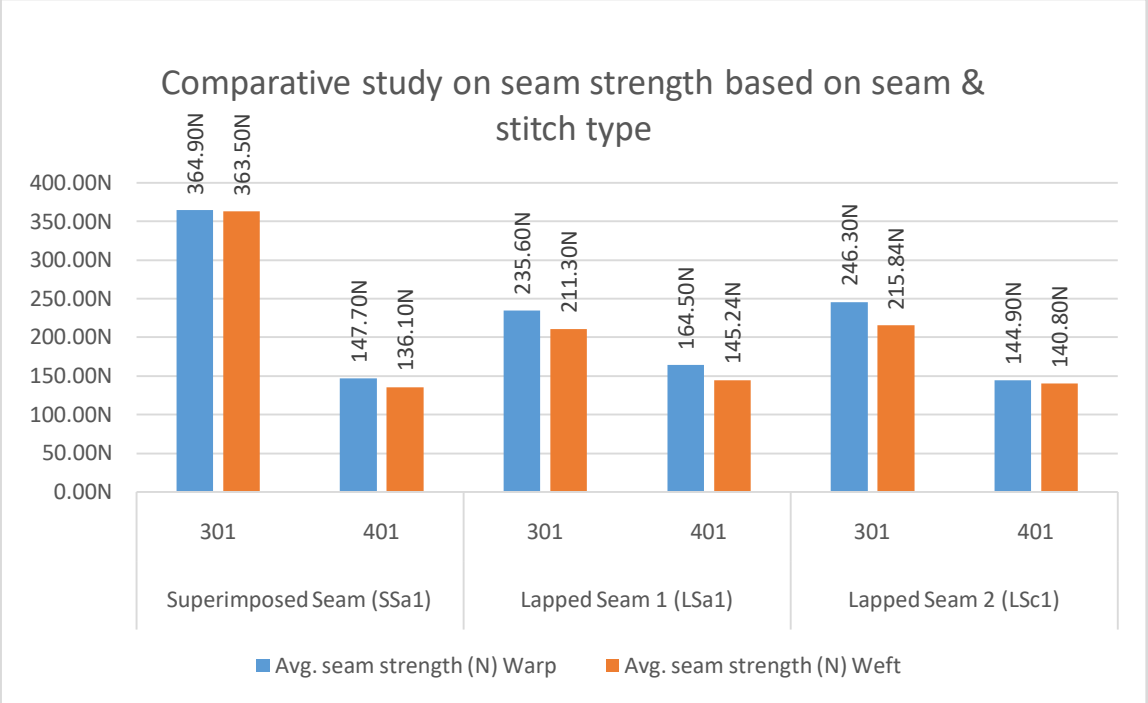


Figure 1: Comparative study on seam strength based on seam & stitch type

IV. Result Discussion

From Table 1 & figure 2, it can be said that superimposed seam (SSa1) has higher strength than lapped seam 2 (LSc1) which has higher strength than lapped seam 1 (LSa1). Lock stitch seam has higher strength than chain stitch for all kinds of seam and seam strength of warp-way has higher strength than weft-way seam.

V. Conclusion

The apparel makers select stitch types, seam type based on fabric type and sewing threads without paying attention to their effect on the overall performance of the apparel being made. The seam strength & slippage must be tested to guarantee that they meet those standards before entering the international market to enable consumers assured of the quality of garment product in the market which will help the consumers achieve desired results in terms of seam efficiency. Based on the outcomes of the current study, it is recommended that apparel manufacturers should be more conscious about using appropriate seam & stitch types in the construction of apparels to ensure the quality full apparel products.

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Global Journal of Researches in Engineering: J General Engineering
Volume 19 Issue 4 Version 1.0 Year 2019
Type: Double Blind Peer Reviewed International Research Journal
Publisher: Global Journals
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Assessment of the Expected Flood Hazards of the Jizan-Abha Highway, Kingdom of Saudi Arabia by Integrating Spatial-Based Hydrologic and Hydrodynamic Modeling

By Ashraf Abdel Karim

Abstract- Various infrastructure in Saudi Arabia are affecting by floods and rainfall that may damage construction at urban areas within its zone because the water flows in main valleys and streams. Jizan-Abha Highway recently affected by flood outflow risks that cause lost in properties, people, and infrastructure along with sunk the most of the near urban settlements. This study presents a proposal of new methods to assess expected flood risks that impacted the infrastructure projects by simulate Jizan-Abha Highway modeling case. The model will be based on the integration between hydrological and hydraulic modeling. It will develop a classification map of the flood risk impacted areas along the Jizan-Abha Highway, and settled the solution maps with suggested and proper alternatives to scram those flood risks. The study based on applying the WMS program to draw valleys and outflow basins and compute their morpho metric attributes.

Keywords: *GIS, wms, hec-ras, flood risk assessment infrastructure. jizan-abha highway, classification flood risks map, saudi arabia's vision of 2030.*

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Keywords: GIS, wms, hec-ras, flood risk assessment infrastructure. jizan-abha highway, classification flood risks map, saudi arabia's vision of 2030.

I. Introduction

Urbanization is the main cause of changes in hydrological and hydraulic processes and urban flooding. It increases total runoff volume and increases its maximum flow [1-4]. Land use and land cover changes are affected by attempts to meet human needs such as the construction of residential and industrial facilities Agriculture, mining and other infrastructure, which are key processes associated with the economic and sustainable growth of a particular area, [5] and the proper use of each part of the available land is essential for improving the economic and planning situation of the area without expansion in areas prone to risk is essential for sustainable planning [5,6].

Land use change plays an important role in the hydrological behavior of drainage basins and affects the local hydrological cycle, several studies have been carried out to evaluate the impact of land use changes on runoff amounts [7–11]. Also, many authors have acknowledged the fact that increasing urban activities in flood plain areas will increase peak discharge, decrease the time to peak, and increase runoff volume [12–16]. A better understanding and evaluation of land use changes that have a direct impact on watershed hydrologic processes has become crucial for planning, management, and sustainable development of the watershed [17–20].

A lot of infrastructure facilities in Saudi Arabia are exposed to the torrential rains and floods that may occur with sever damages to the infrastructure in those areas. That happens due to the rainfall and its consequences as an inflow in the main valleys and their streams. Jizan-Abha Highway recently disclosed to floods that caused several damages of properties, people, and infrastructure along with sunk the most of the near urban settlements.

The used hydrological models to estimate the peak flow and hydrograph curve calculation had developed. That was paralleled with the spatial information sources afforded by remote sensing (RS) technologies. Both of GIS and remote sensing techniques are considering as useful tools since they were integrating the geomorphological terrain and Hydrology along with the land use and land cover. This integration is considered as one of the most important inputs for hydraulic and hydrological modeling. [21].

The Watershed Modeling System program affords an advanced drawing environment to build and operate huge numbers of special mathematical models. Those models are built to hydraulic and hydrological

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computations such as; HEC-1, TR-55, TR-20, NSS, HEC-HMS, GSSHA, MODRAT, OC Rational, HSPF, OC Hydrograph, SWMM, Rational method [22].

HEC-HMS modeling achieved a wide prevalence to extract the hydrograph unit for immeasurable basins in dry areas. These models were applied in lots of studies, as Laouacheria and Mansouri [23] used the HEC-HMS model by using a frequented storm to simulate runoff hydrograph in the small urban watershed at Northeast Algeria. Khalil and others used the HEC-HMS model [24], and Muskingum–Cunge approach to computing the lost outflow of secondary watersheds by using GIS-based methods for Al-layth valley at Saudi Arabia.

Syntayah used HEC-HMS model [25], and Snyder Unit Hydrograph to simulate runoff hydrograph the upper basin of the Blue Nile. Norhan and others [26] applied the simulation the runoff and rainfall relationship using HEC-HMS model in the dry environment in Aqiq valley at Medina Al-Monawarah, Saudi Arabia. As well as Sambath and others [27] designed the relationship between rainfall and runoff using HEC-HMS model in the tropical watershed at Sri Lanka, and Meeling and others [28] also used HEC-HMS model to simulate the water runoff at the Semi-arid zone in Northwest China.

Al-Zahrani and others [29] presented a simulation flood model of the watershed in Hafr-Elbaten city, Egypt. That model consists of hydraulic and hydrological models plus using interpretation tools before and after processing operation. Bets Woody Row [30] used the flow model of the kinetic channel and presented a binary propagation wave for the flow of alluvial plain, as to simulate the flood immersion that designed to work with a high accurate grid. Abdel Karim, Ashraf and others [22] adapted a new approach to fix the flood risk insecure urban areas at the Tabouk city, with presenting a suggested mechanism to protect the city by integrated hydrology and hydraulic models. Saudi Arabia officially admitted these models in earlier 2017 through the Ministry of Municipal and Rural Affairs, and the Geological Survey Authority as they are the official responding organizations for certified hydrological studies. Hence the decree No. (28865) had published in 28/3/1438 Hijri to generalize the usage of both WMS and HEC-RAS programs when preparing hydraulic and hydrological studies for preventing the dangers of the flood.

Jizan area witnessed frequented events of flood disasters recently caused by heavy amounts of rainfall in very short duration resulted in wildly velocity inflow streams. The consequences were enormous human and properties losses, as population displacement and destroying farms, buildings, roads, bridges…etc.

Wadi Bayad considers as important Jizan secondary streams, and the opposite road of Wadi Bayad is also accounted as a vital part in Jizan area. Its area, length, and characteristics of the runoff are highly affected in the Jazan-Abha Highway. This area testified frequent floods, and it has been threatened by major dangers to the surrounding urban and villages.

This study developed to assess the effective impact of the sudden flooding on the Jizan-Abha infrastructure as a model for Saudi Arabia's frequent floods. Since the neglecting to develop a flood hazard classification map with the absence of settling the proper proposals, alternatives, and scenarios to mitigate the disaster impact are leading to increasing the loss of the life and properties.

The poor distribution of existing water drainage facilities, such as bridges, line of communication bridge, and dry support bridges under the Jazan-Abha Highway resulting in a significant defect in the draining system. As this causing increasing or decreasing the water drainage system leads to significant damages impacted the path of the road. An inventive approach was developed to dealing with Saudi Arabia's infrastructure flooding risks, which based on GIS, RS, WMS, HEC-HMS, HEC-RAS. This approach proposes preventive alternatives measures in the study area to help mitigate the impact of flooding on the Jizan-Abha Highway, as a model for Saudi Arabia infrastructure projects.

II. Area of Study

The Jizan-Abha Highway is one of the main transport axes in Saudi Arabia. According to the development of different urban and residential increasing aspects along with the economic growth, Saudi Arabia has developed its transportation sector due to its pivotal role as promoting its network to link Saudi cities in different zones. Furthermore, its contribution to support the logistic aspects and vital role in supplying the GDP of Saudi Arabia as well as the future role to achieve the vision of 2030. The Jizan-Abha Highway extends for 180 km at the southern zone of Saudi Arabia between the Jizan and Asir zones. Particularly it extended between the longitude of 42°11'41.77" E and the latitude of 17°38'7.75" N, and a lot of main valleys are intersecting with Jizan-Abha Highway that estimated as more than 25 main valleys.

A model for the most frequently exposed areas was selected recently on the Jizan-Abha Highway, which is represented by the Wadi Al-Bayd watershed area. Wadi Al-Bayad watershed area, which affects the area of study, is located between latitudes 17°40"1.10' and 17°32"6.45' N, and longitudes of 42°37"45.86' E, and 42°17"22.58' E. the basin levels ranged between 705 meters and 781 meters. The valley ended at the level of 705 metesr above the sea level, and Wadi Al-Bayd is supplied by various secondary streams; El Hamda, Joan, Qalyta, Eldahra, Habab, and Batyeh. The basin extends with about 71.6 km, and an area of 704.81 Square kilometers as its slop reached 0.058 m/m, as shown in figures (1,2).

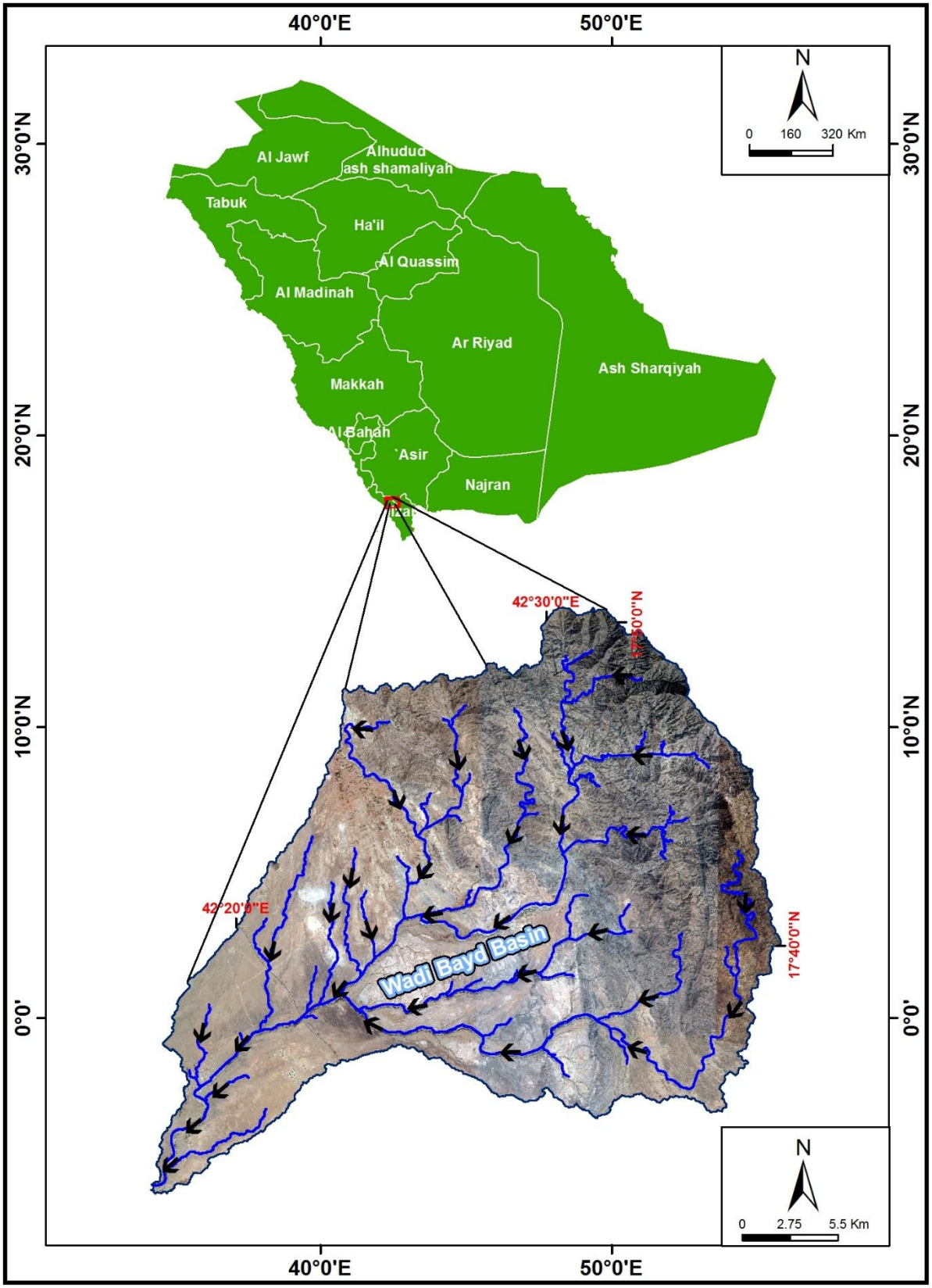

Figure 1: The location of Wadi Bayad at Saudi Arabia in 2019

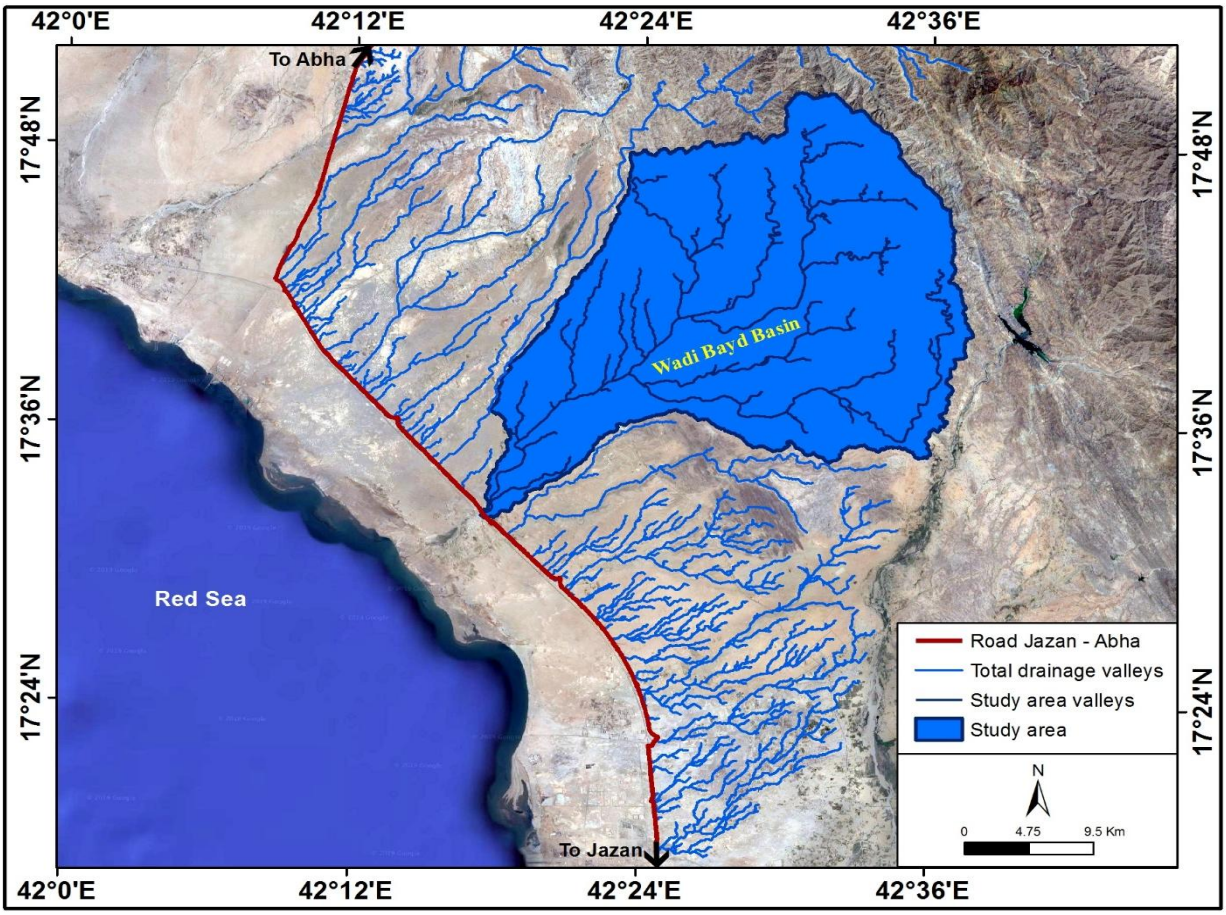

Figure 2: The location of Eadi Bayad basin out of basins impacted the Jizan- Abha Highway in 2019

III. Reasons for Selecting the Study Area and the Consequences of Flash Floods on the Jizan-abha Highway

The flood runoff flow of the Jizan streams presents one of the most important local environmental problems which impacting sustainable urban development. What makes this problem more seriousness is the high density of the valleys network that are more than 25 main valleys, which intersect directly with the international Jizan-Abha Highway such as; Wadi Khlab, Damd, Sebya, Besh, Aquod, Hily, Albatna, Segag, Ser, Bayd, Alaslab, Reem, Haswa, Tabab, Algarfah, Nakhab, Herman, and Albarakah. The flood runoff flow starts from the west to the east, which intersects with the international road. Set of factors are participated in repeated, and seriousness of those floods, as the most of important, is the occurrence suddenly and the unpredictability of their occurrence for the scarcity of monitoring stations.

Furthermore, the lack of early warning systems and poor distribution of the flood water facilities under Jizan-Abha Highway, and the inability of the majority to allow the flood runoff flow. Additionally, the unplanned and random expansion of the urban settlements, and other factors related to the shortage of detailed hydrological studies. The other associated factors are the absence of the engineering solutions for the upper streams of the valleys, as this came along with changing in the land use attributes during infrastructure development of the Jizan-Abha Highway path. Finally, the crowded density of draining network and it's severed slops that affecting Jizan-Abha Highway.

The site visit had conducted to verify the path of Jizan-Abha Highway during floods dated 15/4/1440 Hijri to determine the most impacted zones along the route. Moreover, the historical flood record was verified of the same area during interviews with local people and decision makers. The pervious verifications insure that the Wadi Al-Bayd, the current area of study, is the most affected dangerous area on the Jizan-Abha Highway for the frequency of collapses of infrastructure facilities. Especially this observation was after both Samrat Elged and Arequ Menshabah villages to drown during the recent floods. Those flash floods lead to loss lives, and damages of urban and infrastructure facilities as the highway in the study area, as well as hit vehicles and corrosion effects along the road. Figure (3) shows the impact of flash floods between 2018 and 2019, and that what makes the researcher select Wadi Al-Bayd watershed and its impacts on the Jizan-Abha Highway as a case study model.

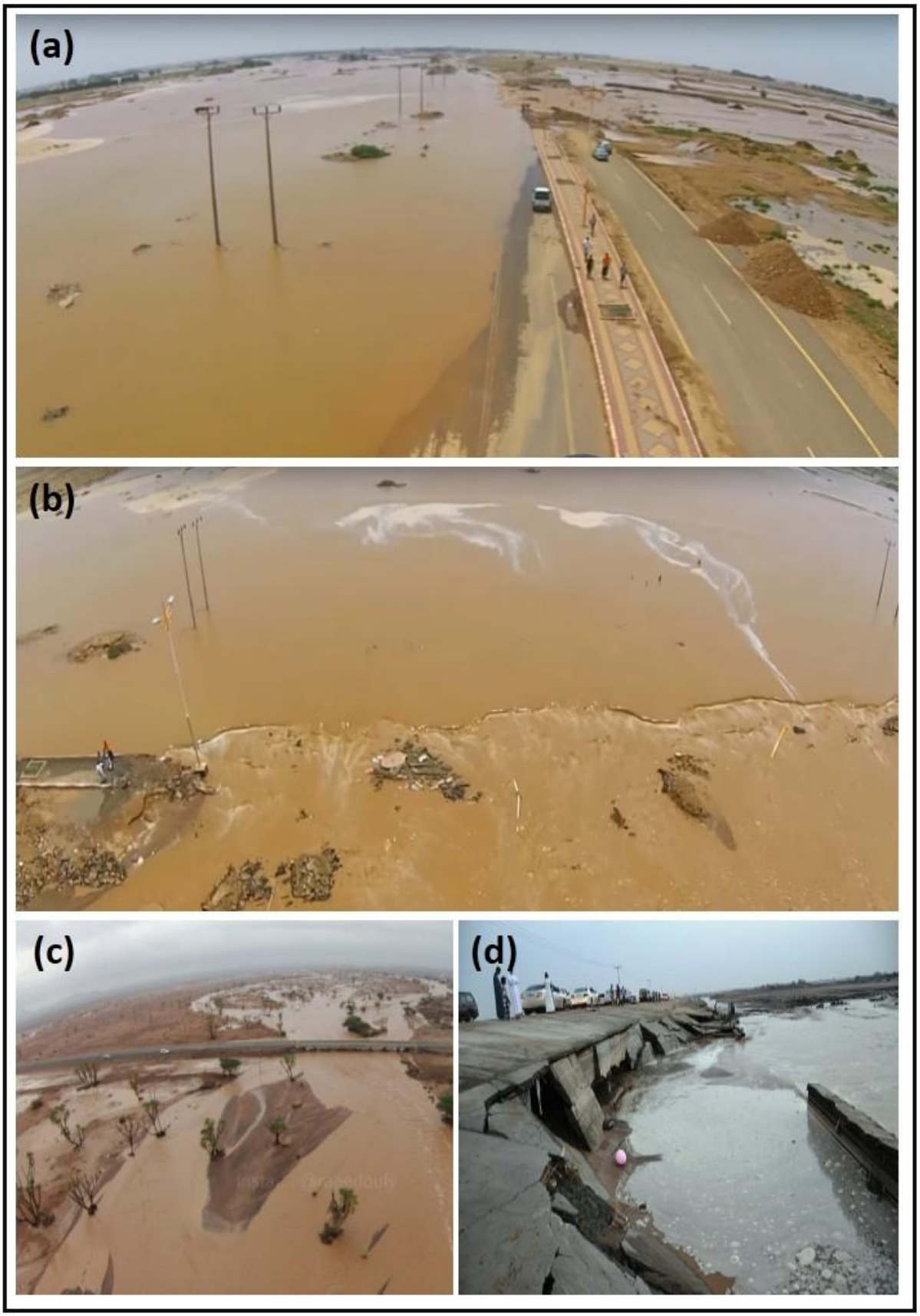

Figure 3: Flood risks on Jizan-Abha Highway, (a) shows the drowning of the Jazan-Abha road on 15/4/1440 H, (b) showing the drowning of the sides of the road. The picture (c) shows the flood passing under Jazan-Abha road as a result of Wadi Bayad floods. The picture (d) shows the Jizan road - Abha collapses.

IV. The Research Methodology and Data Processing

The determination and assessment for flood risk exposed areas are based on implement the HEC-RAS model for Jizan-Abha Highway. This for fixing the distribution, velocity, and the depth of the Wadi Al-Bayd flood runoff flow intersected with the international highway. That came along with the evaluation of the efficiency and abilities of the existing flood water drainage facilities as bridges and dry communication infrastructure below the Jizan-Abha Highway to allow the peak flow using Culvert master. A new approach had settled and suggested a proper mechanism to mitigate flood risks for infrastructure projects, particularly the existing and proposed roads. To achieve the study objectives, HEC-HMS of WMS was implemented to compute the floods hydrographs for different watersheds. The calculations of water quantities and inflow rates were based on SCS unit Hydrograph approach, as well as computing rainfall properties (rainfall depth) and IDF Curve for the watershed impacting Jizan-Abha Highway during the different referenced time using HYFRAN program. GIS and remote sensing also are used to produce different land use, soil, geological maps of the watershed that are the main inputs to run HEC-HMS/HEC-1 models. Culvert master again used to assess the efficiency of facilities as bridges and dry communication infrastructure and its abilities to deal with the runoff inflow, as well as HEC-RAS to determine the flood exposed areas. It was necessary to use mathematical equations that represented rainfall loss or that linked runoff to total rainfall. Kirpich's equation [31] was used to calculate the time of concentration (Table 1, Equation (1)), which is the time that passes between the rainfall and the highest level of floodwater going through the watershed area. Lag time, which is the time that passes between the occurrence of a unit of rainfall and a unit of runoff, was calculated according to Soil Conservation Service (SCS) guidance (Table 1, Equation (2)). To calculate the effective rainfall for each basin, it was necessary to use mathematical equations representing rainfall loss or linking runoff to total rainfall (Equations (3)–(5), Table 1). The depth of rain or direct flood in the basin was calculated to derive the total quantity of floodwater from the actual rain value using Equation (3) (Table 1). The amount of water in the area before the occurrence of flooding, such as filtration and suspended rain on plants, was estimated using Equation (4) (Table 1), and Equation (2) could be simplified as shown in Equation (5) (Table 1). The maximum effort for soil moisture (Sr; maximum retention in cm) Was calculated from the curve number [32]. Peak discharge (m3/s) was calculated for each basin for different return periods using Equation (7) (Table 1), and the time to flood peak was calculated using Equation (8) (Table 1).

Table 1: Equations used in the current study

Equation	Formula	Description
1	$t_c = 0.0195\left(\frac{L^{0.77}}{S^{0.385}}\right)$	TC = time of concentration (min); L = maximum flow distance (m); S = maximum flow distance slope (%); T_{LAG} = lag time (hour); Sr = maximum the effort for soil moisture (maximum retention) calculated from curve number (cm); Y = basin slope (%); P = rainfall for different return periods (cm); Ia = amount of water before the occurrence of flood, such as filtration and suspended rain on plants; qp = peak discharge (m^3/s); A = basin area (km^2); T_P = time to peak (hour); Q = direct runoff (mm); Δt = duration of designed storm water
2	$T_{LAG} = \frac{L^{0.8}[Sr+1]^{0.7}}{1900\sqrt{Y}}$	
3	$Q = (P - Ia)2/(P - Ia + Sr)$	
4	$Ia = 0.2Sr$	
5	$Q = (P - 0.2Sr)2/(P + 0.8S)$	
6	$Q = (P - 0.2Sr)2/(P + 0.8Sr)$	
7	$qp = \frac{0.208AQ}{Tp}$	
8	$T_P = \Delta t/2 + T_{LAG}$	

The used methodology data processed are illustrated in figure (4) in detailed through nine steps as follows;

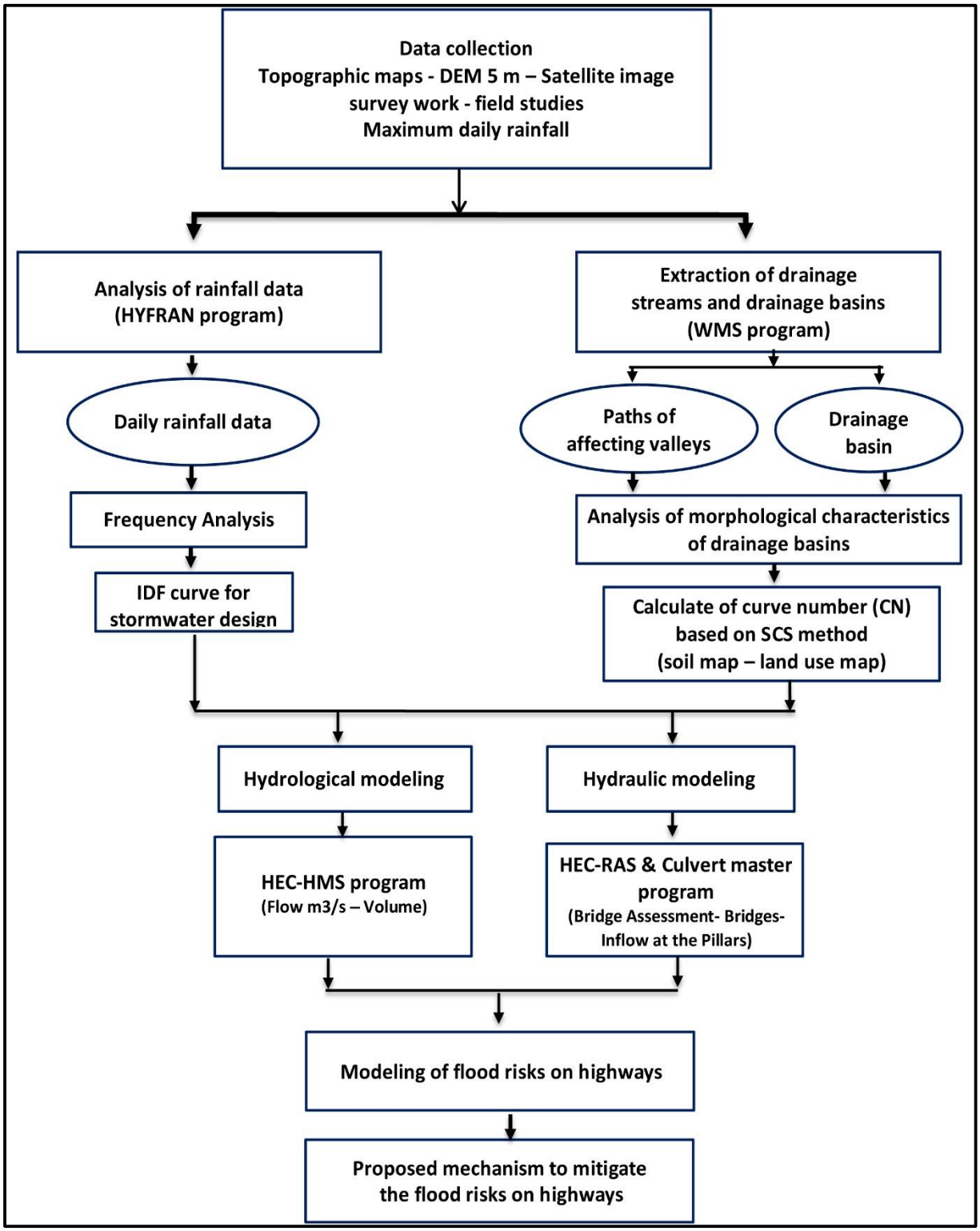

Figure 4: Study methodology in the flood risk mitigation & assessment on Jizan-Abha Highway in 2019

a) Determine of the Data Sources

To identify and extract the streams network affecting the Jizan-Abha Highway, several sources were used. The most important source was the high-resolution digital elevation model 5 meter, and the Vertex position belonged to NASA. Topographic maps provided by Geological Survey Authority in Saudi Arabia were also used on the scale of 1:50000, as well as geological maps, scaled 1:250000 to insure the streams path along with updated satellite images as Landsat 8/OLI sourced by USGS. The field visit played a vital role in determining the valleys and trails reefs in the study area, and the mathematical model (WMS) also

supported to determine the drainage basins. Figure (5) shows the data used in the study sources.

b) *Precipitation Quantity Analysis of the Different Regression Periods and Determination of the IDF Curves*

The accurate rainfall calculated amount in the basin is one of the important factors that helps to flood watershed computations [22]. It also considers as a correct principle for water statistics and the possibility of the floods recurrence. According to stations records of the Ministry of Water and Electricity, Presidency of Meteorology and Environment (PME) the study area has two stations that are Aldarb (SA102) and Wadi Beesh (SA204). The rainfall depth was concluded for different frequented times as (5,10,20,50,100, 2 years) using Hyfran [33]. Likewise different statistical patterns were adapted like Normal, Log-Normal, Log-Pearson Type III, Pearson Type III, Gumbel, Exponential, and this obtained that the (Exponential) is the best approach used by both Aldarb and Wadi Beesh monitoring stations as clarified in table (2) and figures (6,7,8).

Table 2: Rainfall depth for different time based on Aldarb (SA102) and Wadi Beesh (SA204) stations

Frequented Periods	2	3	5	10	20	25	50	100
Aldarb (SA102)	20.9	32.3	46.7	66.3	85.9	92.2	112	131
Wadi Beesh (SA204)	33.7	45.3	60.0	79.8	99.7	106	126	146

c) *Digitizing and Extracting Streams and Basins*

Watershed Modeling System (WMS) used to extract and digitize the streams and basins through the model of Drainage module from DEM menu, with is the main list of extracting and digitizing streams and basins by Compute flow direction/Accumulation. The system creates TOPAZ to determine the inflow directions and paths of valleys since the DEM is used with 5-meter accurate break. The outcomes compared by valleys paths of topographic maps scaled 1:50000 and the satellite images. As per observation, there is the main valley impacting the study area, it was Wadi Al-Bayd.

d) *Morphological Characteristics*

The extraction of the morphometric characteristics of the watershed is developed by Watershed Modeling System (WMS) model via Drainage module over computing basins data, since it computed automatically. Those characteristics are clarifying over the Display option, as there is a main basin impacting the study area, Wadi Al-Bayd. Wadi Al-Bayd has an area of 704.81 Km2, and a length of almost 71.6 Km with total slop of 0.0158m\m, as per table (3) and figures (9,10).

Table 3: The important morphometric characteristics for the secondary watershed of Wadi Al-Bayd, 2019

Basin Name	Area (Km^2)	Length (m)	Slope (m/m)	Average level	Time base (minute)	Concentration time (minute)
Wadi Al-Bayd	704.81	71597	0.0158	578	311.26	518.77

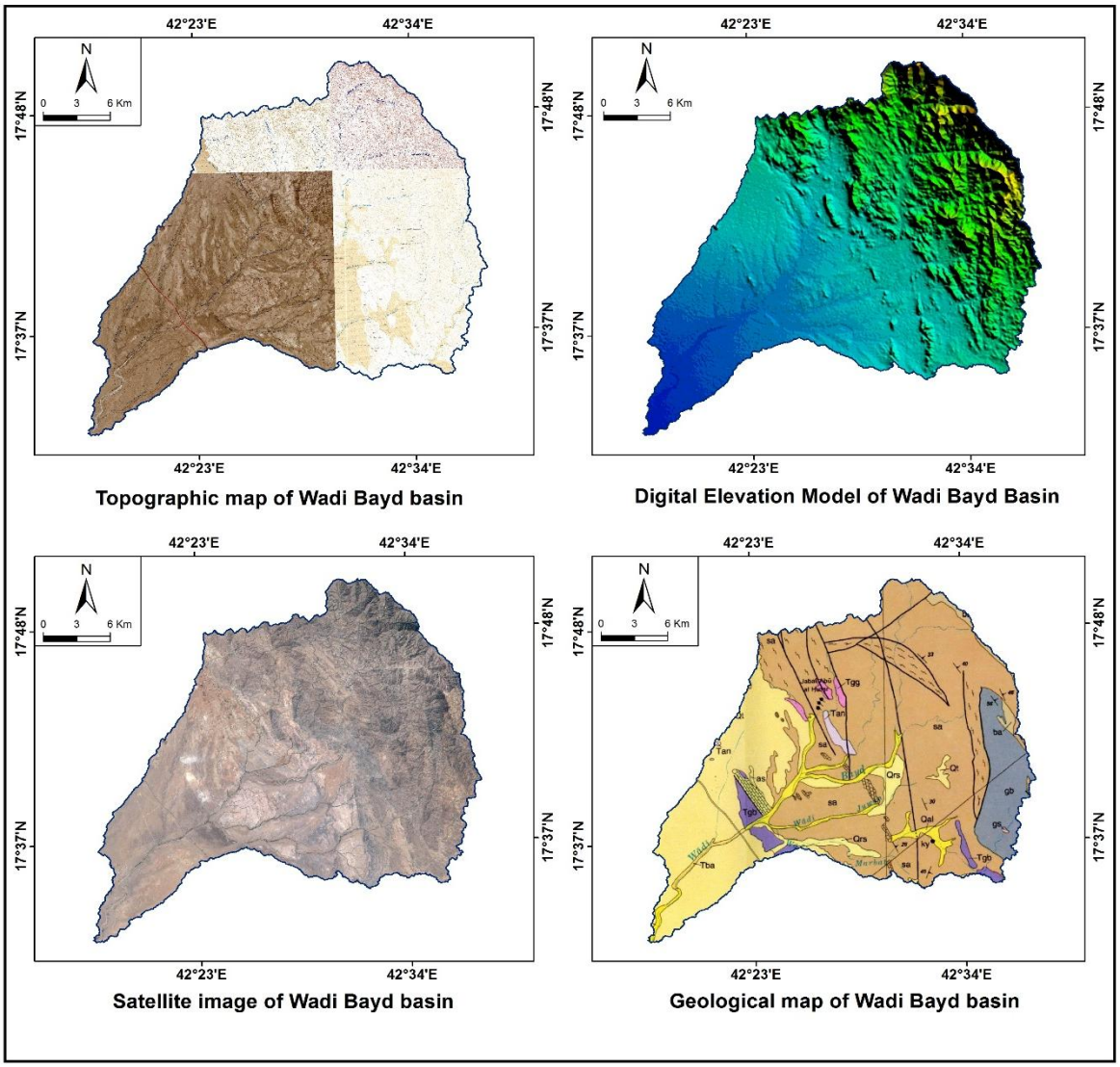

Figure 5: Some of the study-based data source in 2019

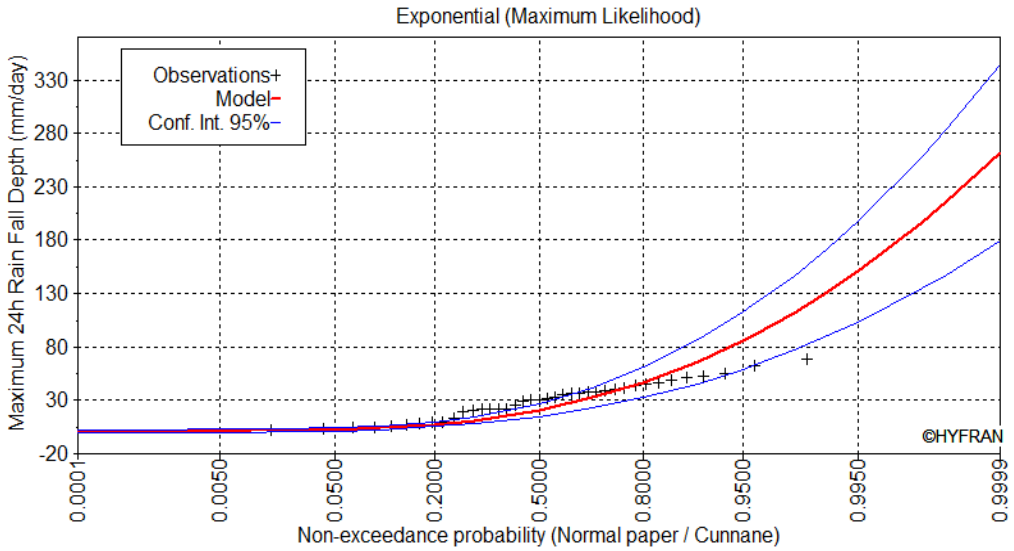

Figure 6: The expected distribution curve for data of the Darb Station (AS102) using Exponential method

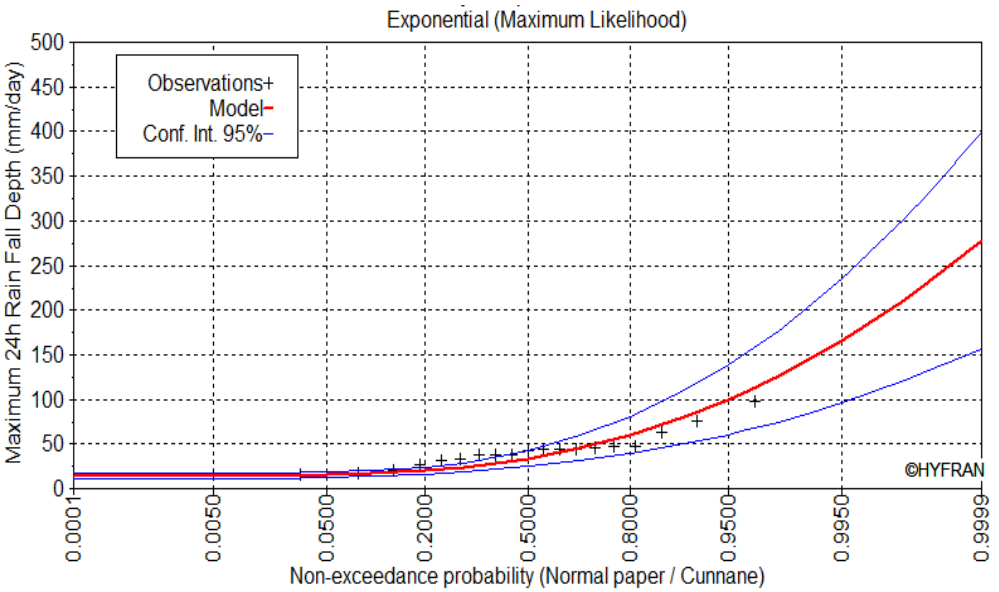

Figure 7: The expected distribution curve for data of the Wadi Beesh Station (AS204) using Exponential method

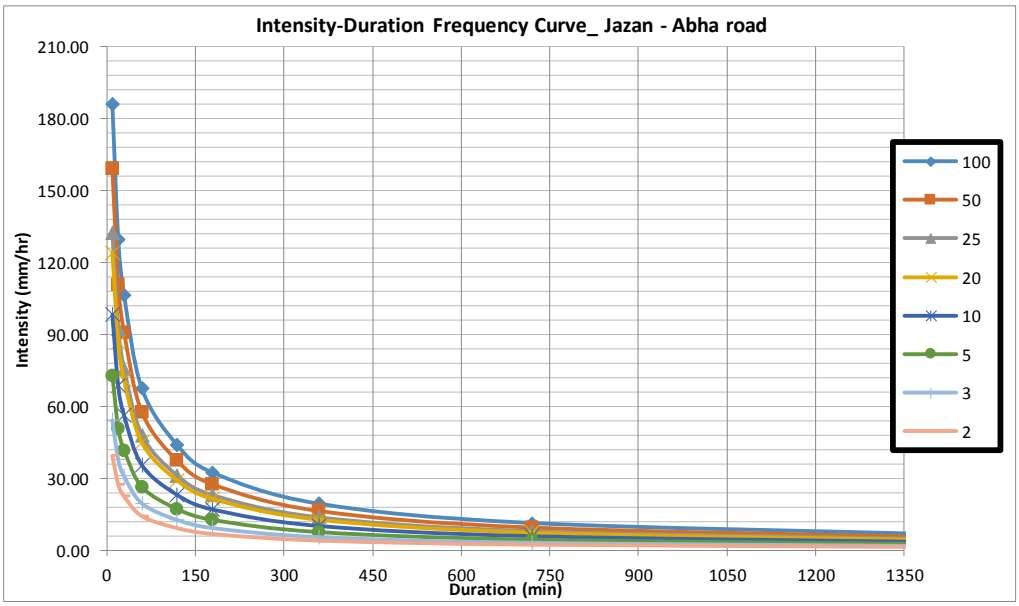

Figure 8: Intensity curves- duration-frequency (IDF Curve) for the rain monitoring stations

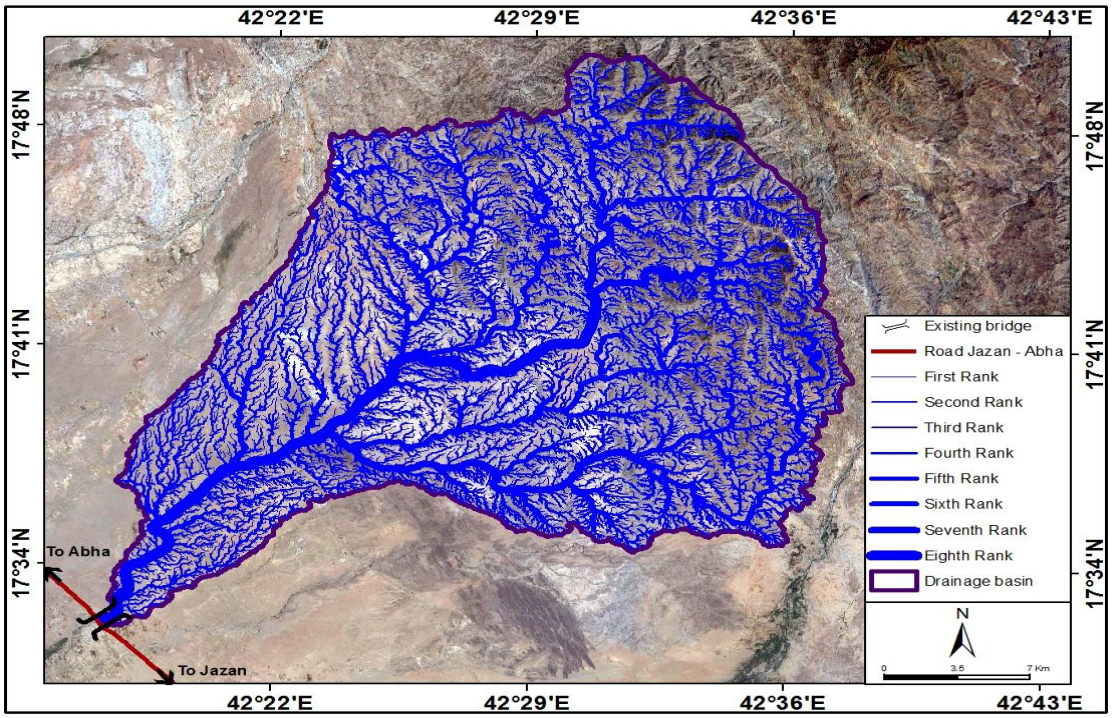

Figure 9: Streams ranked map of Wadi Bayad impacting Jizan-Abha Highway in 2019

Figure 10: Field Study in the area of Study in 15/4/1440, (a) identify the characteristics of the existing structures below the Jazan-Abha road, (b) Urbanization in Wadi Bayad, (c, d, e) properties of Urbanization and valley down the road

e) Extraction of concentration time and lag time

The WMS model obtained an enormous list of mathematical approaches to compute the time base and concentration time as most important morphometric parameters to compute the flood hydrograph. One of the prominent mathematical approaches in the WMS to compute concentration time is the Fort Bend county method, Kirpich method for overland flow on bare earth (mountains), ADOT method (Urban), Ramser method for channel flow. As well as it presents a vast list of mathematical approaches to computing the time base like Denver method, Tulsa rural method, SCS method, Riverside mountains method.

f) Rainfall Definition

The defining rainfall is one of the most important processes in WMS. There are several methods to define precipitation within the hydrological models provided by both HEC-1 and HEC-HMS. The most important is the Basin averages used in the case of knowing the rainfall amount/ quantities and insert them directly without calculating the weights of rainfall stations. This method does not take into account the effect of each station on the basins bodies. While the method of the Precipitation Gage Weight is used in case of small basin numbers and more than one station in the basin area, the Theissen Polygon polygons used to determine the effect of each station on basins. Nevertheless, the method of Stochastic modeling is used when large numbers of basins are existing. Figures (11,12) illustrates the hydrograph of different regression periods.

g) Definition of the Hydraulic Group

One of the basic parameters to calculate the CN is the definition of the hydrological sets of soil and land uses, since the value of CN is depending on both of them. The SCS method determined four hydrological sets of soil due to the speed of water transition inflow rate through. Those sets are (A-B-C-D), and each has its characteristics of runoff. The watershed of Wadi Bayad is presented in those Hydrological soil groups since the Hydrological soil group (A) represents an area of almost 171.35 km2 and it presented in the high permeable soil, while the Hydrological soil group (B) dominated as an area of almost 33.78 Km2. The Hydrological soil group (C) covers an area of 54.33 km2, and the Hydrological Group of Soil (D) covers an area of 445.35 km2 as shown in figures (13), (14).

h) Determine the Land use

The land uses were extracted by using the satellite images of Landsat8/OLI over the Erdas Imagine program. The land use layer is processed in WMS by insert land use layer after identifying layers as "New coverage" through the GIS data, and then select "Add shape file data." There are four categories for using land use in Wadi Bayad basin such as; the first category is desert zones with an area estimated by 269.33 Km2, and the second category is presented by the urban zones that cover an area of 5.08 Km2 out of the Wadi Bayad total watershed area. While the third category shows the agriculture areas of 51.65 Km2, the fourth category presents the rocked zones with an area of 378.75 Km2, as shown in figure (15).

i) Computation of the Curve Number

To compute the over precipitation quantity, it must use the mathematical rates that either shows rain losses or relates the runoff inflow and the total precipitation. The WMS provides many hydrological models such as HEC-1 and HEC-HMS, and each of them affords formulas to compute the losses and leakages. The most important methods within these models are Uniform Loss Method (LU), and Exponential Loss (LE), and Green & Ampt (LG) Method particularly the leakage in soil, Holtan (LH) Method, and the service management soil reservation for computing losses (SCS) loss Method. CN is the curve number method which is widely used to estimate water leakages in soil. CN based on three main factors, those are pre-condition of the soil moisture, land cover, and hydrological soil group, and its value is ranged between 0 and 100. Those factors are expressing the water response to the land cover component in watersheds, and also debriefing the surface hardness. Since values are indicating high numbers, to 100, that means the surfaces are less hardness, [34], as per figure (16).

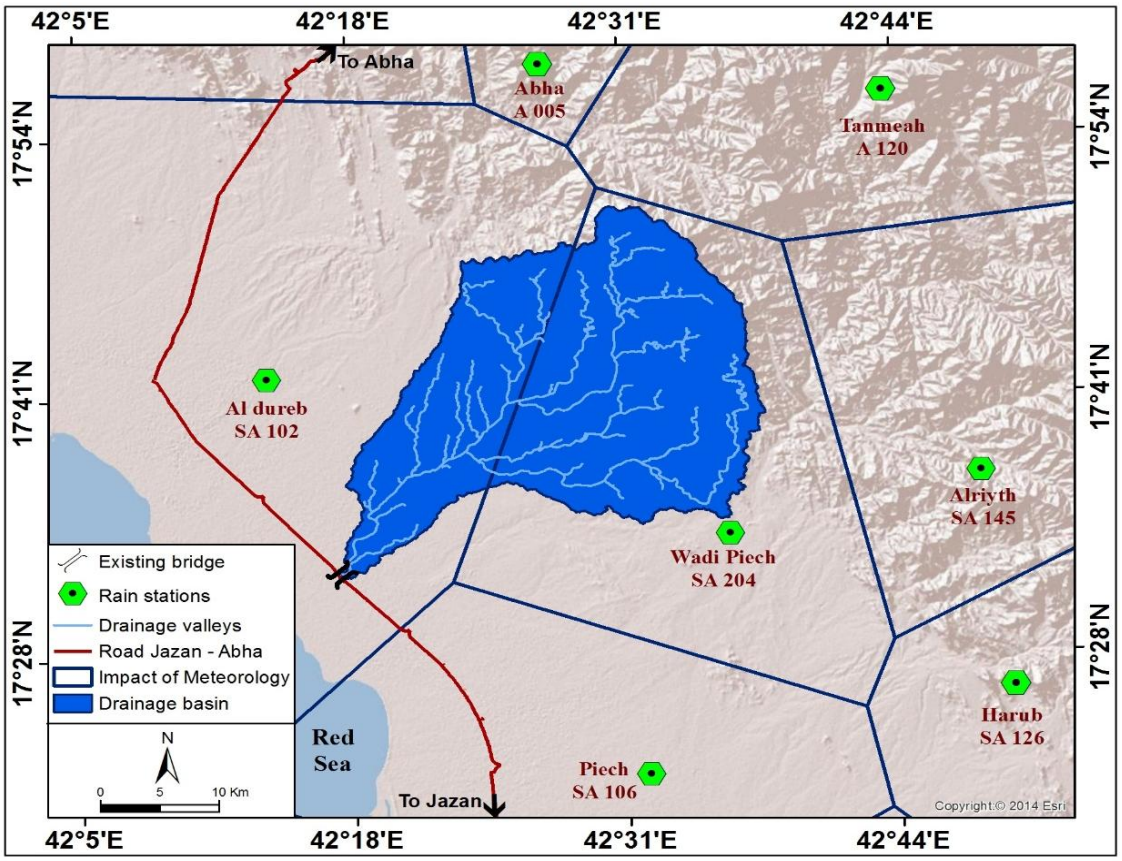

Figure 11: Rain measurement stations surrounding the area of Study in 2019

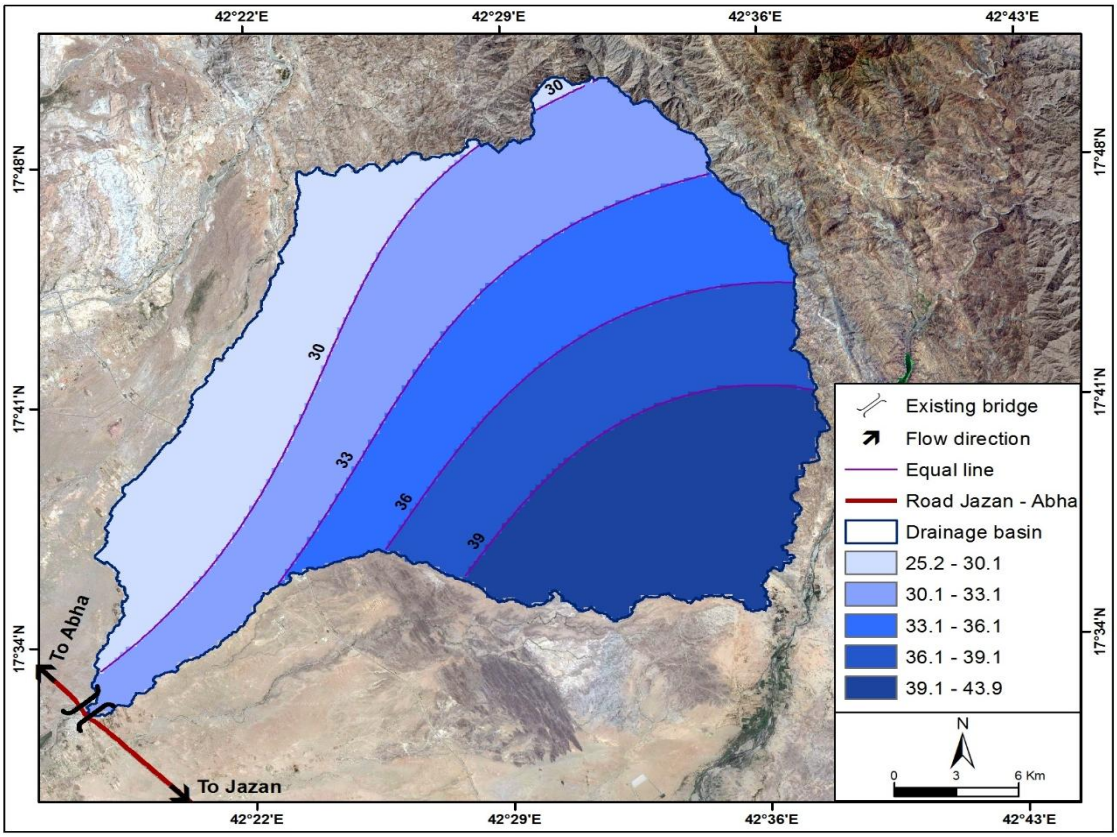

Figure 12: Rainfall Isohyets in the area of Study in 2019

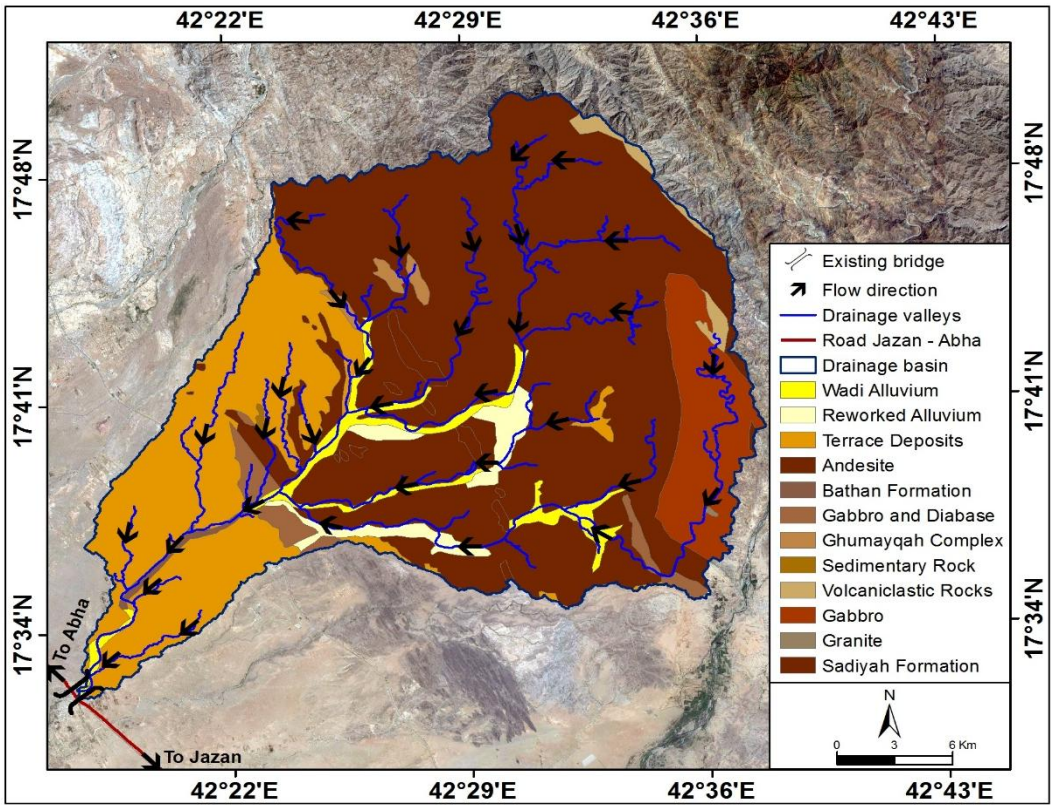

Figure 13: Geological map of the Wadi Bayad in 2019

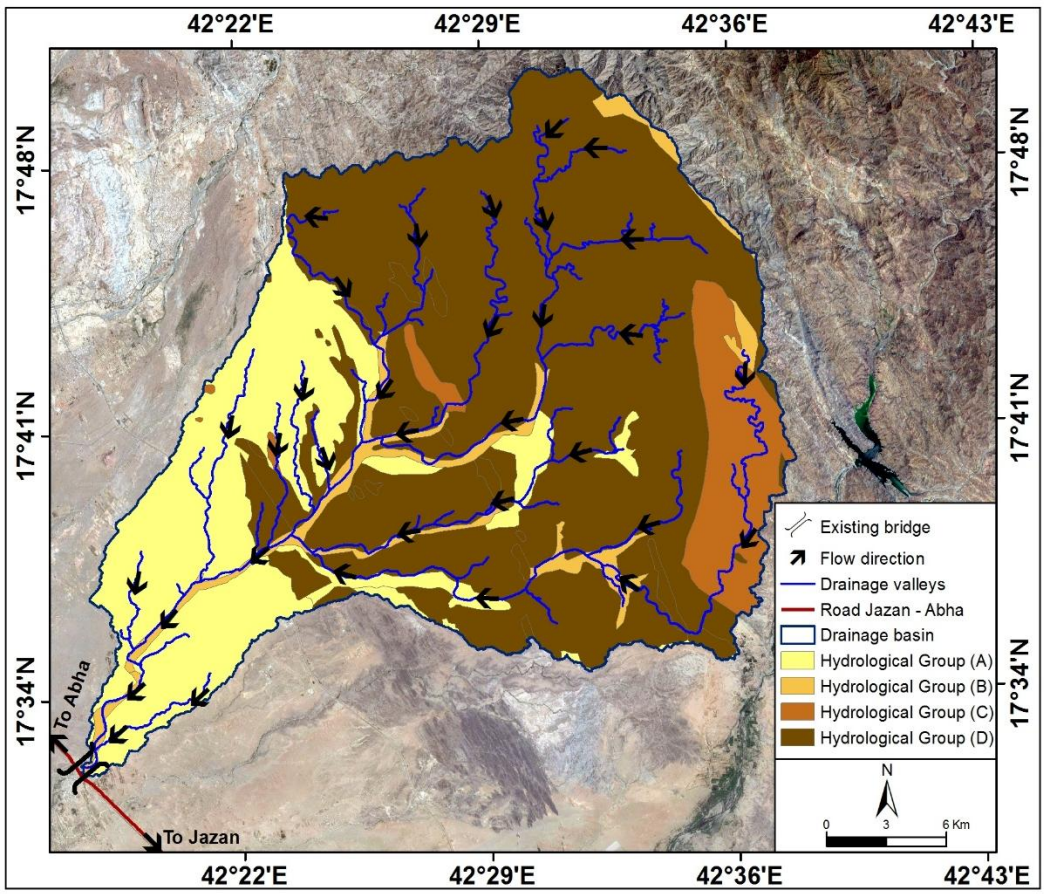

Figure 14: Hydrological soil group of the Wadi Bayad in 2019

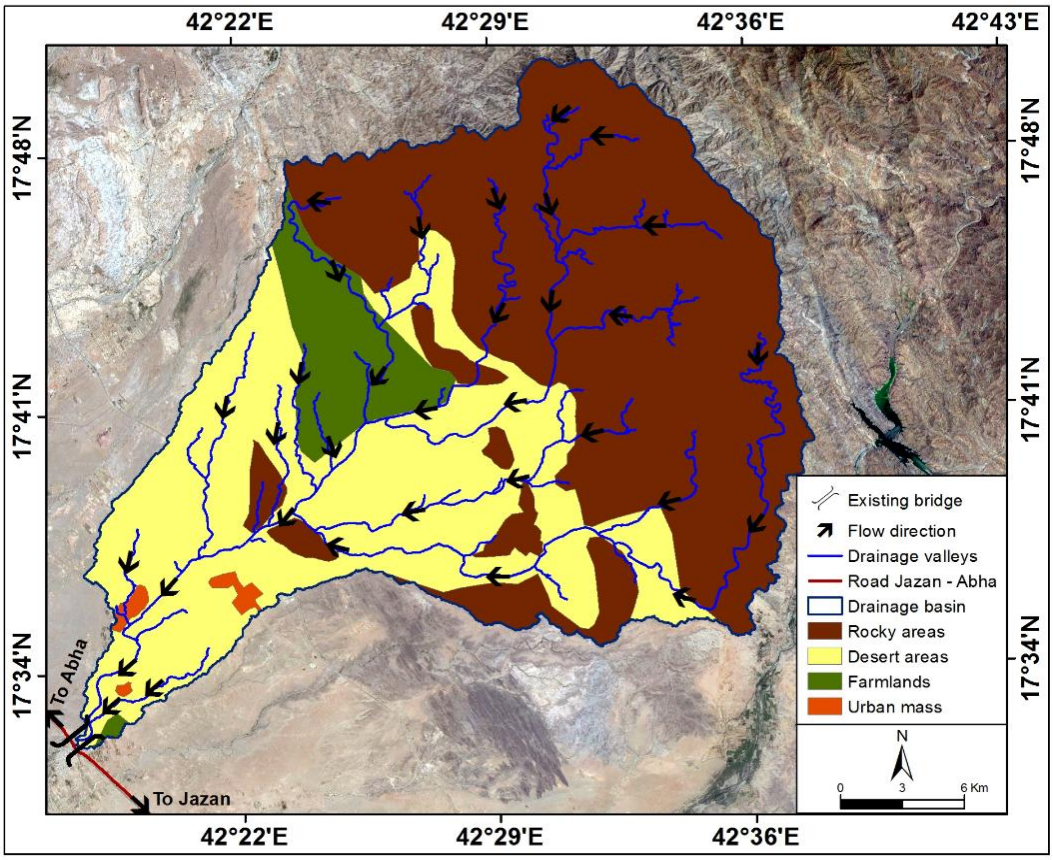

Figure 15: Land uses of the Wadi Bayad basin in 2019

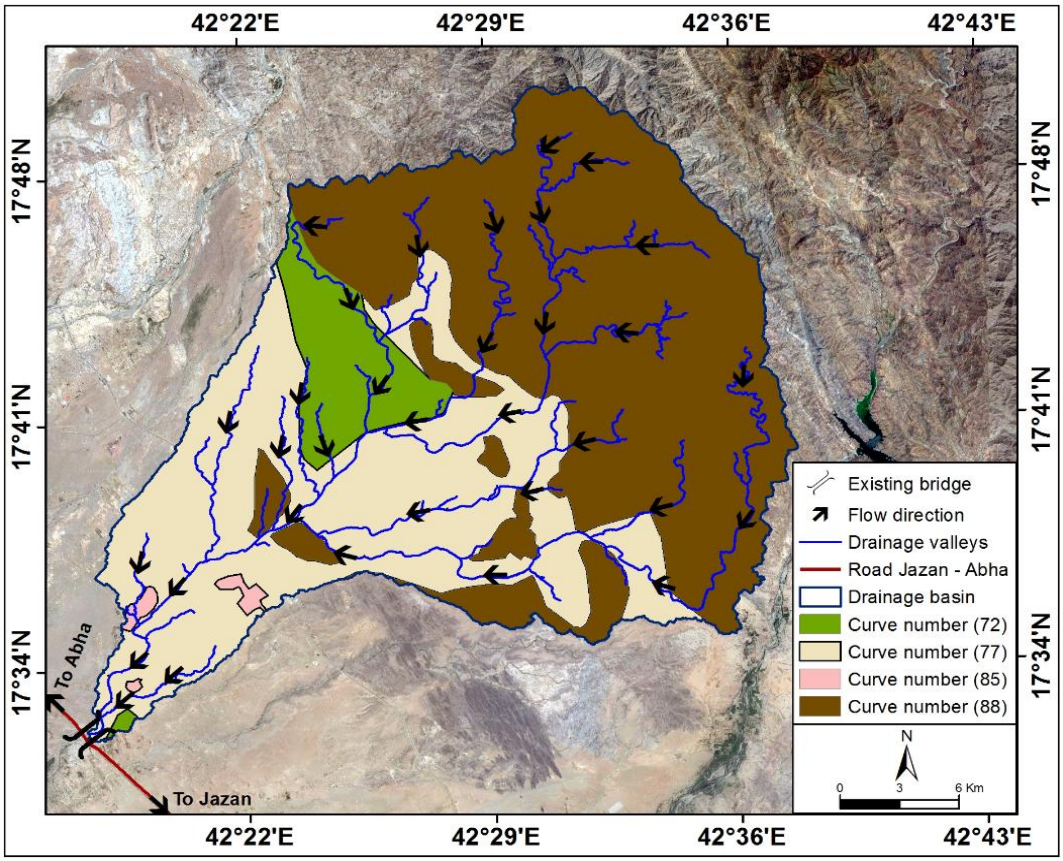

Figure 16: Curve Number (CN) of the Wadi Bayad in 2019

V. Results

Any hydrological model such as HEC-HMS or another depends on a range of important inputs to calculate the flood hydrographs. The most important of these inputs are area and slope, concentration and base/delay time, CN values, and rainfall amounts. Accordingly, there are two methods for the HEC-HMS processing, as either through the program directly with the previous data preparation or preparing the mentioned data by the WMS program then transfers it to HEC-HMS. This was computed in the previous part of the study.

a) Compute the Flood Hydrograph of the Watersheds

HEC-HMS was implemented for its capabilities to compute the hydrographs in various methods due to both complicated and simple forms of the watersheds by artificial and normal methods [35]. WMS afford many hydrological models, as HEC-1 and HEC-HMS are considering as the most important models of them. Each of those models produces formulas to compute hydrographs. Accordingly, it must be realized, in case of selecting the hydrological model, that this will be related to the methods of computing the concentration period and base period/ delay time, losses, and hydrographs. For example; when select HEC-1 the program will provide fundamental methods are allowing computing hydrographs such as Clark (UC), Snyder (US), SCS dimensionless (UD), Given unit Hydrograph (UI), Kinematic wave (UK), and each of them affords hydrographs formulations.

b) Floods Volume Estimation

The hydrological model (HEC-HMS) was adapted using a designed storm with 24 Hr. duration with using the distribution of SCS TYPE II and SCS methods to calculate both delay and concentration periods. This was for different frequency periods of 10,20,50,100 years, and output results of the used hydrological model used to obtained flood hydrograph of the watersheds. It observed that the flood volume ranged between 14,354,700 – 64,618,400 m3, as shown in table (4) and figure (17).

c) The Maximum Flood Inflow Estimation

The values of the maximum flood inflow are varying for the basin affecting in the study area, and as per different precipitation volumes on each of the watershed areas. Accordingly, it obtained that the values of the peak floods inflow in the project location are ranged between 693.40 and 3,173.20 m3\S; as illustrated in Table (4) and figure (17).

Table 4: The characteristics of flood water of the secondary watershed in Wadi Bayad in different frequented period

Basin Name	Variables	The characteristics of flood water of the secondary watershed in different frequented period				
		5	10	25	50	100
Wadi Bayad	Maximum discharge ($m^3\S$)	693.40	1,214.30	1,967.50	2,568.50	3,173.20
	Flood volume (m^3)	14,354,700	24,737,400	39,911,500	52,167,000	64,618,400

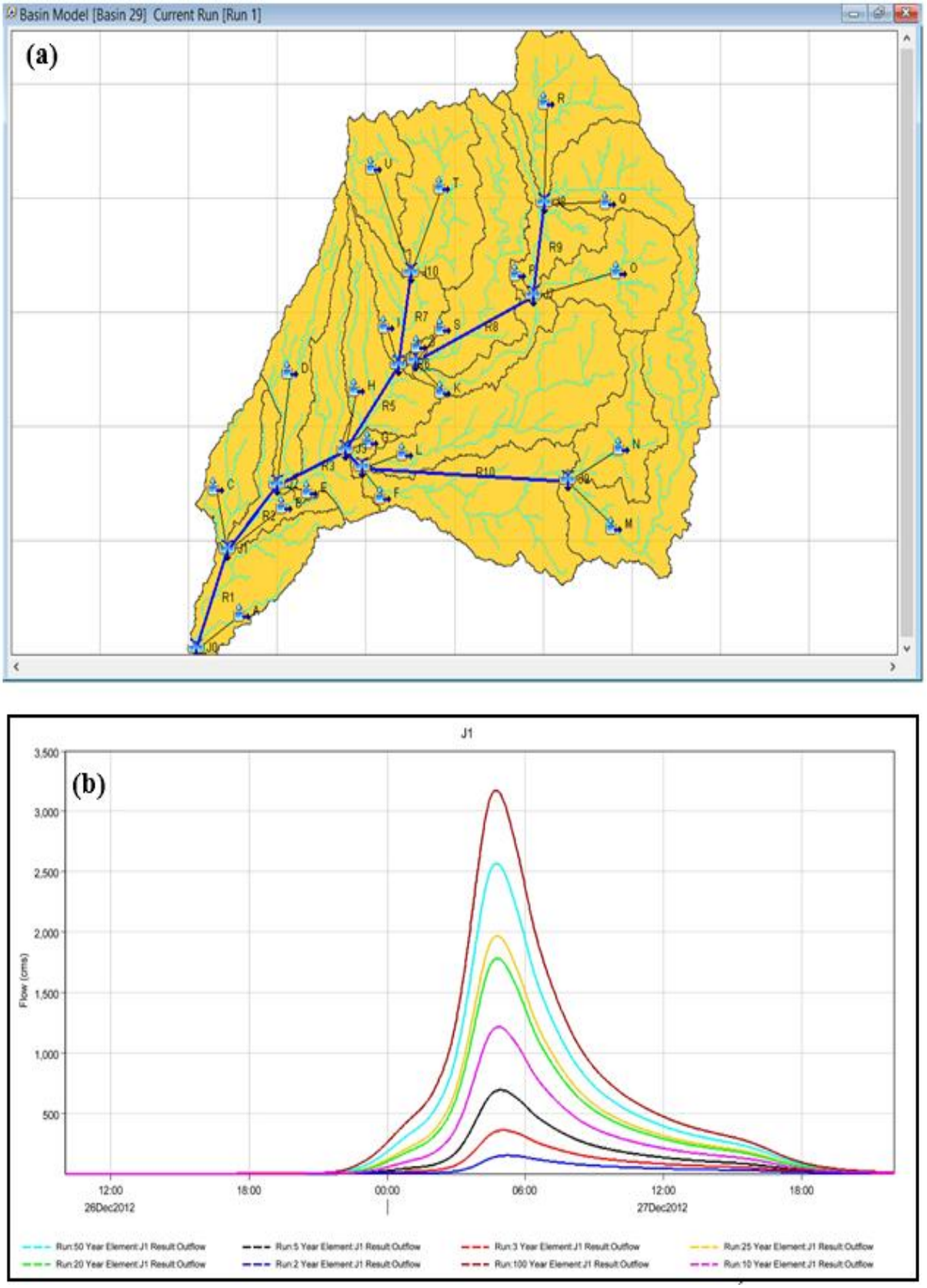

Figure 17: (a) Hydrological model HEC-HMS of the Wadi Bayad, (b) flood inflow hydrograph of the Wadi Bayad for regression periods (5,10,20,25,50, 100 years)

d) Producing the Flood Plain Using HEC-RAS

This phase is based on the modeling of the Wadi Bayid watershed inflow, and transforming it into a two-dimensional model showing the flood inflow As well as the velocity and depth of the flood runoff and this can only be done by using the hydraulic modeling of HEC-RAS to produce the floodplain. At this phase, the existing bridges under the Jizan-Abha Highway have evaluated that pass the maximum inflow of the Wadi Bayad basin using HEC-RAS, as shown in Figure (18).

The bridge study aims to determine its importance and ability to transfer and pass resulted inflows from the Wadi Bayad basin, which intersected by the Jizan-Abha Highway, figure (19). The Hydraulic model was developed using the HEC-RAS program to ensure that the bridge proposed engineering dimensions of the current case study is address.

Moreover, ensure that the bridge' designed criteria which required for the hydraulic design is proper to allow the inflow without causing damage to the highway structure or the adjacent areas. This program is capable of performing stable and non- Stabilized water runoff, as well as some hydraulic designs.

The developed of floodplain modeling of Wadi Bayad basin is based on insert the peak inflow as 3,173.20 m3\S during the strongest storm occurred during 100 years. As well as creating the cross-sections of the valley based on DEM. Figures (20), (21) show the samples of Cross-sections of the main valley of the Wadi Bayad basin.

e) Existing Bridge Assessment Using HEC-RAS

The bridges in the case study are used at the intersection of the valleys that are characterized by high inflows and a clear known Cross-section with the suggested pathways. Likewise, the study of the bridges aims to determine their importance and ability to transmit and pass inflows from the Wadi Bayad basin, which intersecting with the Jizan-Abha Highway. Also, the purpose of hydraulic analysis and bridge design is to identify the highest water surface level during the maximum flood runoff causing by the bridge, Figures (22),(23). As well as determine the water velocity before and after the bridge to dedicate the proper and required maintenance. Furthermore, its importance to determine the resulted erosion depth caused by the inflow at the pillars and supported walls. The hydraulic study of the bridges is based on the rainstorm repeated every 100 years.

Due to the Ministry of transportation in Saudi Arabia, it recommended addressing the proper vertical main bearing between water surface levels occurred during flood passing and the point of the minimum level on the bridge body. The aim of this main vertical bearing is to allow frequented floods to pass without damages in the bridge's body, as it mustn't be less than the minimum below the bridges than given values and criteria by the Ministry of transportation as shown in table (5)

Table 5: Min. vertical clearance, m

Inflow (m^3\S)	Min. vertical clearance, m
≤ 400	1.0
400 – 2000	1.2
2000 - 4000	1.4
≥ 4000	1.5

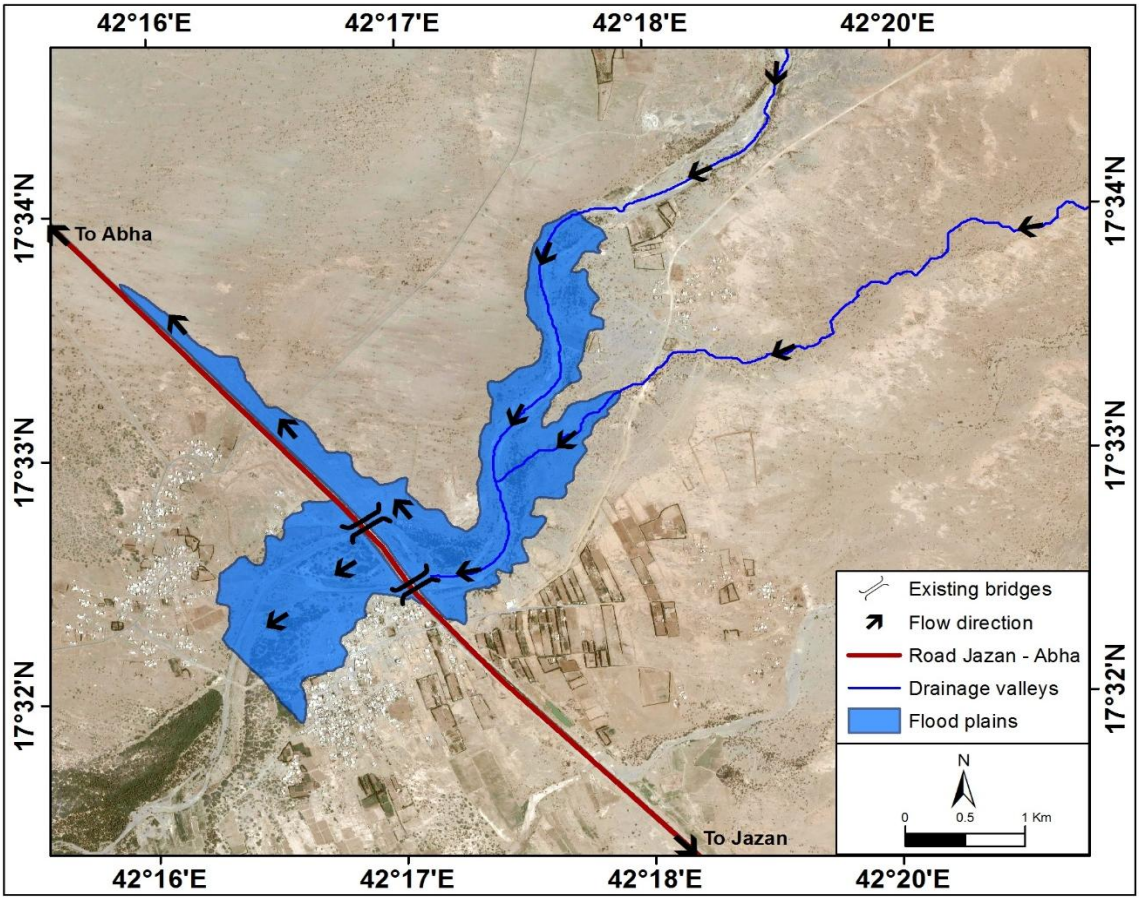

Figure 18: Floodplain two-dimensional modeling and existing hydraulic assessment in the area of Study in 2019

Figure 19: Field Study in the area of Study in 15/4/1440

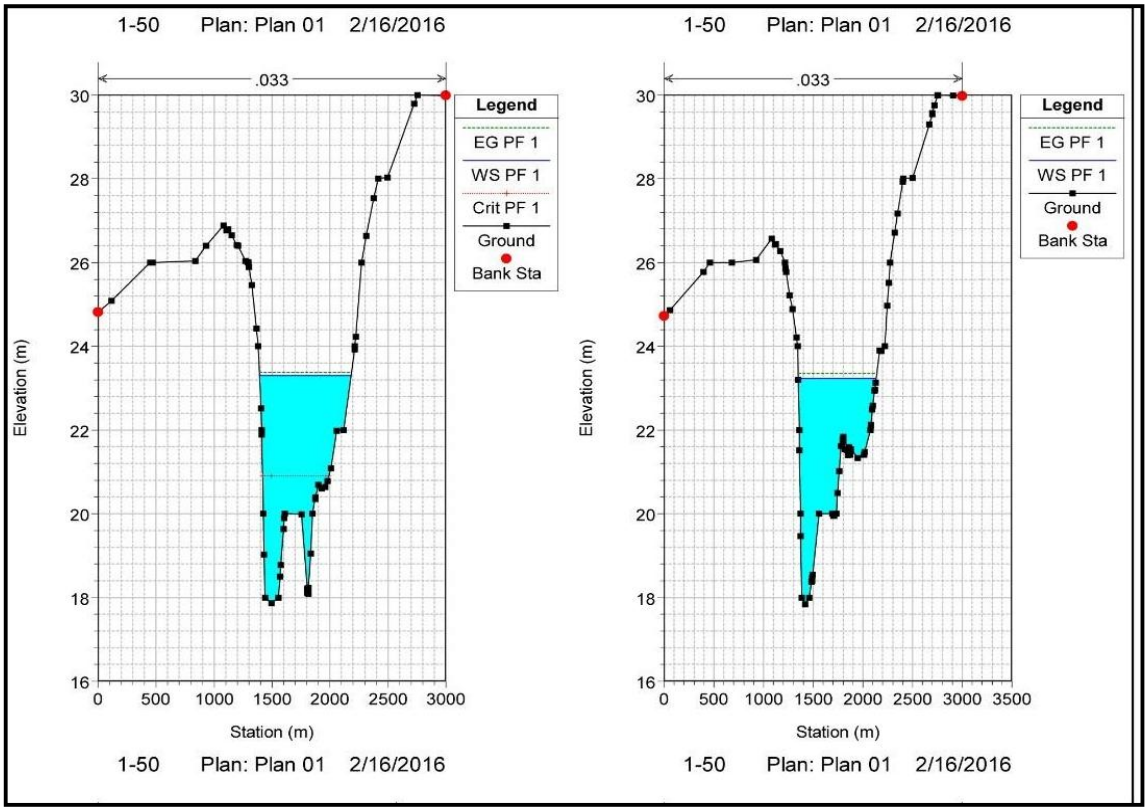

Figure 20: Samples of the Cross-sections for the main valley of the Wadi Bayad in 2019

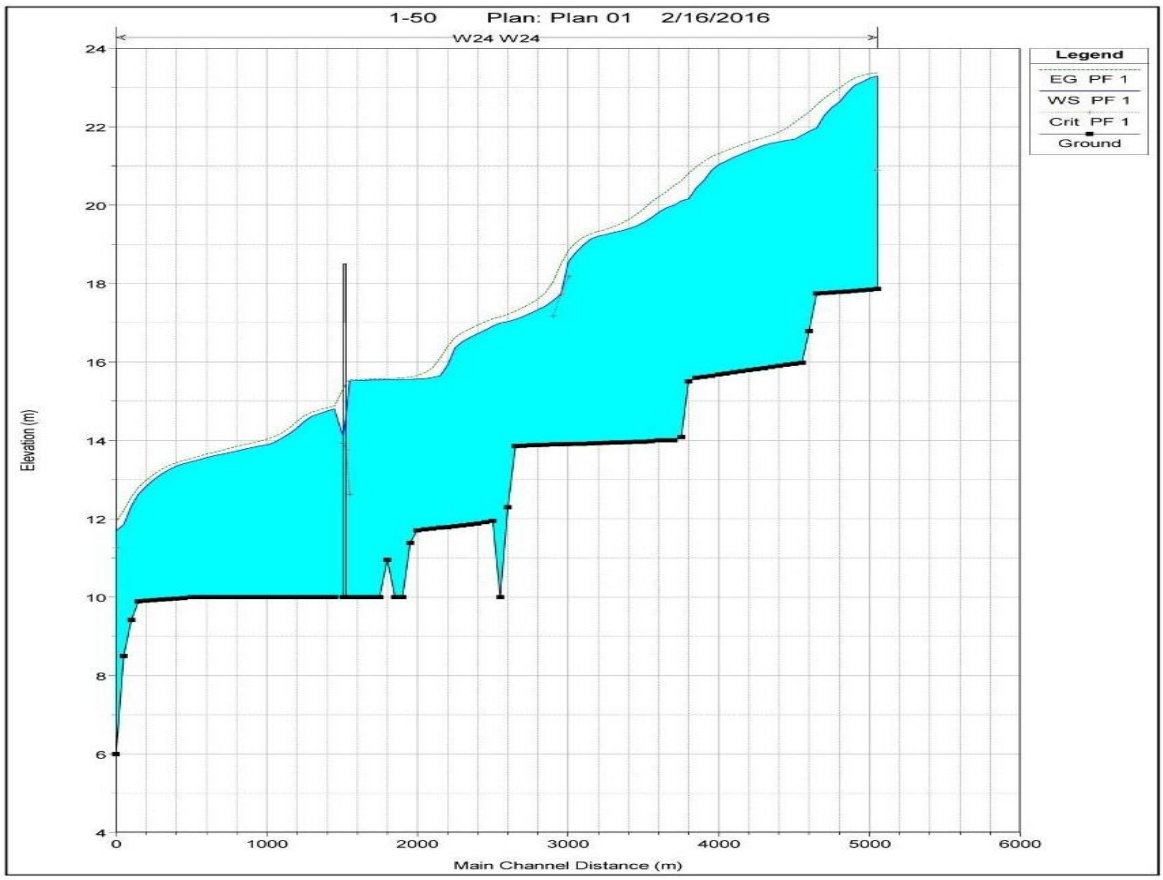

Figure 21: Samples of the main loge section of the Wadi Bayad in 2019

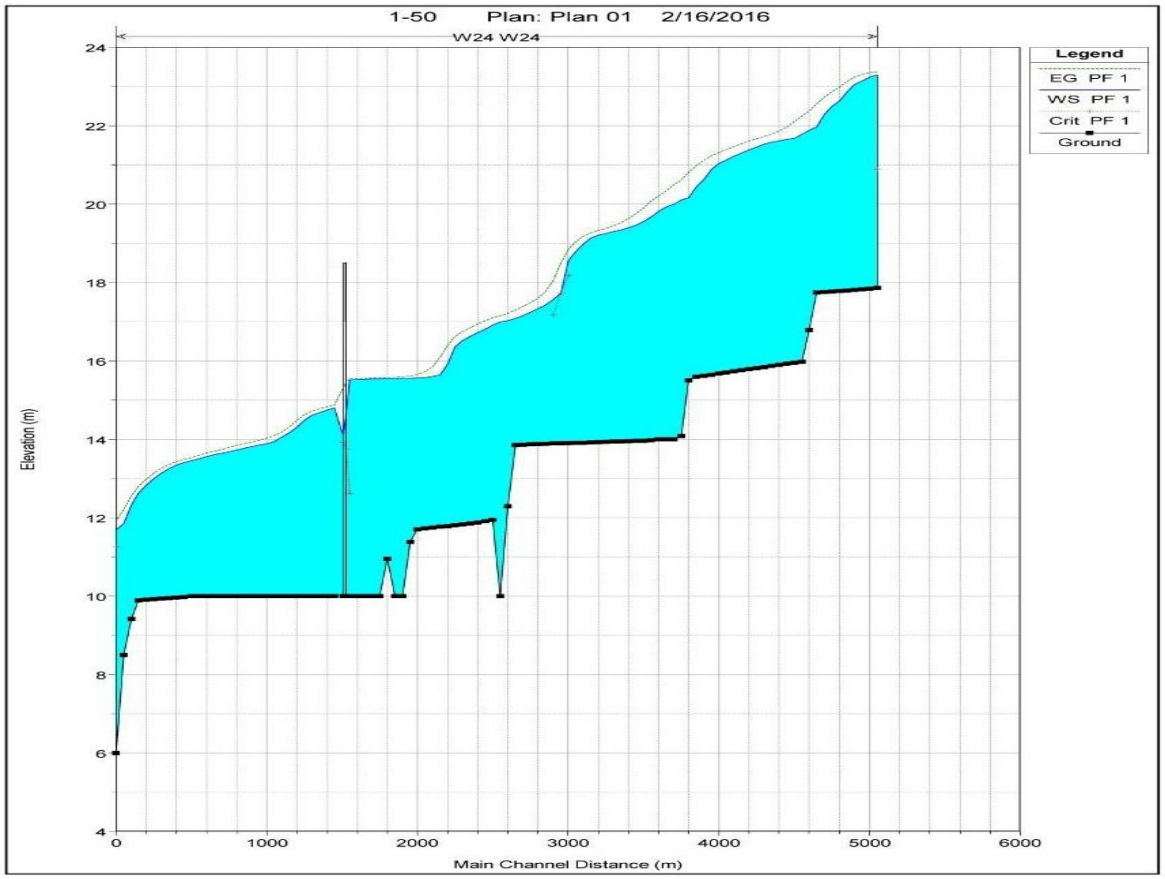

Figure 22: The Three-dimensional model of the existence bridges

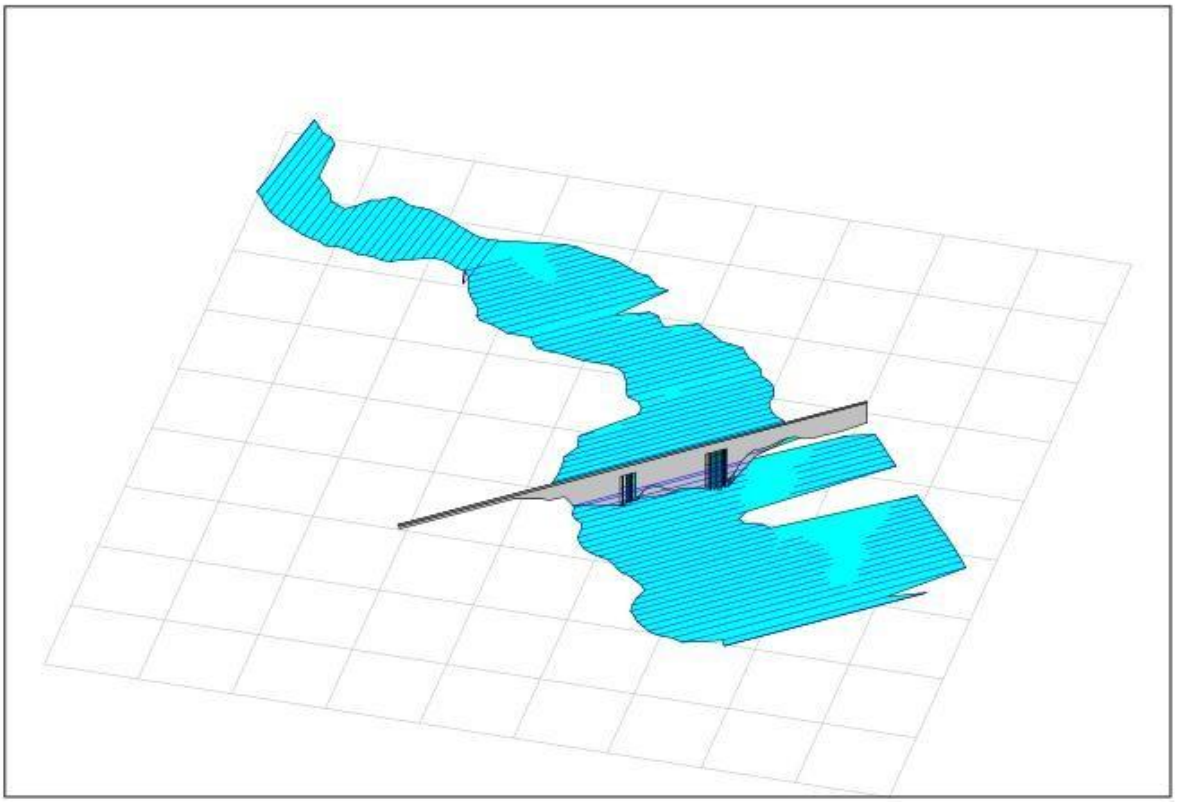

Figure 23: The water level in the existence bridges

It was verified that the suggested engineering dimensions of the bridge are achieved the design criteria that must be met in the hydraulic design, which allow the inflow without causing damage to the Highway structure or neighboring areas. Table (6) shows the characteristics hydraulic analysis of the existing bridges to pass inflows of the Wadi Bayad.

Table 6: Hydraulic analysis characteristics for existing bridges to pass the inflow of Wadi Bayda

Bridge Number	Water velocity (m\S)	Water level (m)	Inflow (m^3\S)	Bridge dimensions		
				Numbers of Slots	Slot width (m)	Total width (m)
1	1.23	14.69	1,608.02	7	20	140
2	1.23	14.69	1,608.02	5	20	100

VI. Discussion

a) Risks Map Analysis

Urban flooding has been and continues to be a major problem for many cities throughout the developed and developing world. The need to formulate a sound flood management policy driven by a knowledge of the frequency and magnitude of these floods is essential to improving the impacts of these floods. Flood risk maps can be used as an effective tool for water resources and urban planning by design engineers to assess the vulnerability of the infrastructure and residents of that area to flood events [36].

Flood risk mapping and hazard analysis for any watershed or drainage basin engage several factors or parameters and criteria [37,38]. Geographic information system (GIS) and remote sensing (RS) techniques have made significant contributions in natural hazard analysis [39,40], During the last few decades, researchers were involved in developing different methods and models for natural hazard mapping using RS and GIS techniques [41,42]. Frequency ratio [43,44], analytical hierarchy process [45], fuzzy logic [46], logistic regression [47], artificial neural networks [48–50] and weights-of-evidence [51], and multi-criteria decision support systems [52,53], Hydraulic modeling is a fundamental tool for managing and mitigating flood risk [22, 54-59].

The first step to managing the flood exposed infrastructure is preparing an indicator as flood Hazard Index. Due to the survey through the literature reviews, the flood hazards modeling over the urban areas is present as one of the most widespread methods in the scientific, engineering communities. That flood hazards modeling depends on the hazard matrix, which relies on developing the 2D model that computes the flood velocity, depth, and water spread using a hydraulic model (HEC-RAS) to assess the flood hazard. It provides a 2D environment, which is vital in urban hazard modeling [60], The hazard matrix shows the spatial dimension of the expected floods in different scenarios that may present in both qualitative and quantitative approaches. The hazard assessment is to determine a certainly expected hazard, in a particular future period, as well as its effected area and impacts. This approach is more distinctive for it's appropriate to the urban areas. Water depth maps were developed as well as flood velocity and flood intensity level maps. Table (7) clarifies the hazard levels due to HEC-RAS the cross-section must be established and inserted to run this model, and the inflow rate in the valley starting point (m3/s) [61].

Using the Energy conservation equation, the computation of water depth and velocity is applicable [62], since various studies shown that this model obtained accurate and effective results in related floods studies [63,64]. Figure (24) illustrates the classifications of hazard affected human being using hazard assessment (HR), and table (8) shows the hazard classification map based on hazard assessment (HR) which depend on the water depth and velocity.

Table 7: Flood intensity levels

levels of severing flood	Maximum water depth (m)		Water maximum outcomes (h) with the highest velocity V (m^2/S)
high	h> 1.5 m	or	v h >1.5 m^2/s
Moderated	0.54 m < h< 1.5 m	or	0.5 <vh< 1.5 m^2/s
Low	0.1 m < h< 0.5 m	and	0.1 m2/s <vh< 0.5 m^2/s

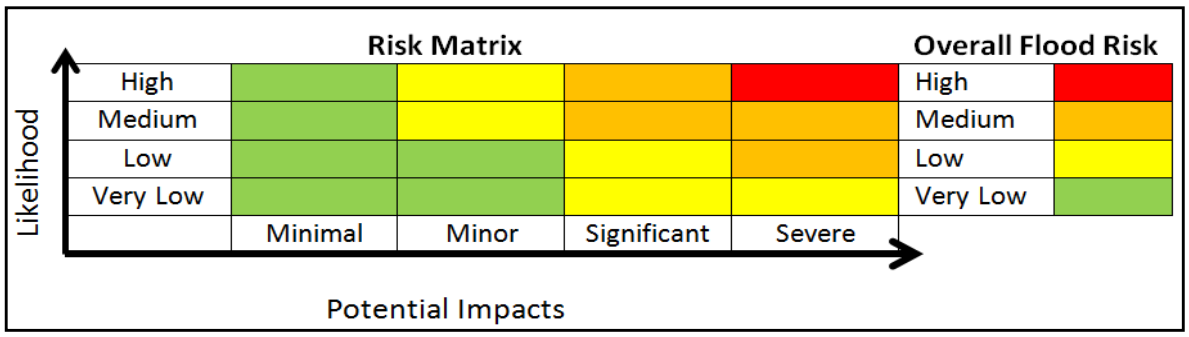

Figure 24: Hazard classification on the human using hazards assessment (HR)

Table 8: Hazard classification using hazard assessment (HR)

Risk rate	Risk categories impacted the Human	Color symbol
Less than 0.75	Very low risk	
0.75:1.25	the Risk for some ages included Children and oldest	
1.25:2.00	the Risk for the majority – included all population	
More than 2:00	the Risk for all – included emergency cases	

The flood intensity is determined by a combination of depths and maximum flow velocities. It defined as the result obtained by the maximum depth and maximum velocity based on the CVFED [21]. As per HEC-RAS, the low-risk category (0.0-0.5 m3\S) dominating by share of 45%, and it forms about 2.7Km of Jizan-Abha Highway. While the high-risk zones (1.5 m3\S and more) a share of 35%, its area covers about 1.7 km of the Jizan-Abha Highway. About the middle-risk category, which ranged between (0.5-1.5 m3\S), it participated by 10% and, constitute about 1.2 km of the Jizan-Abha Highway. All of those mentioned areas of Jizan-Abha Highway are expected to be flooded by Wadi Bayad basin outflow, as shown in figure (25).

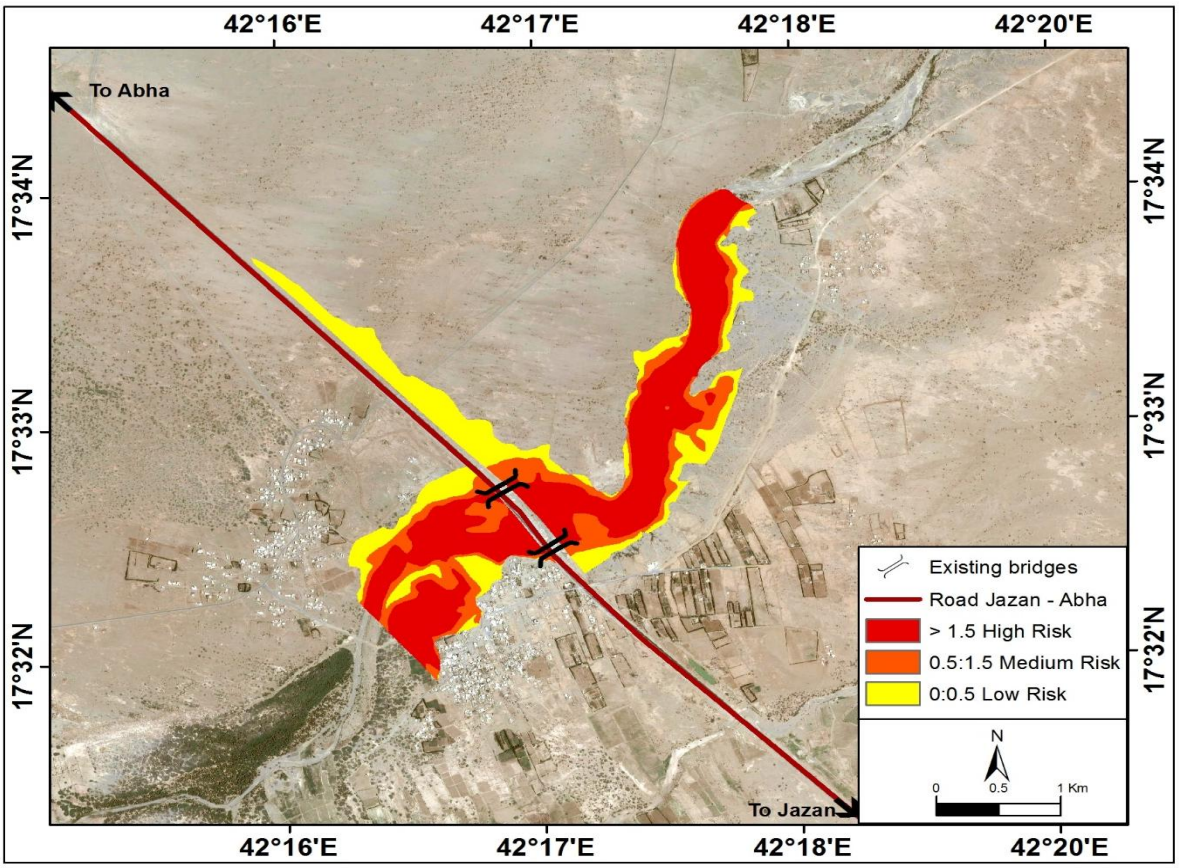

Figure 25: The risks map of Wadi Bayad watershed impacted the Jizan-Abha Highway in 2019

b) Proposed Analysis Mechanism to Project the Road From Flood Hazards

The urban environmental management of the Saudi cities, as per Road jazan model, required Advanced applied technologies to confront flood hazards. Those technologies must be able to determine And test the quick affecting variables in the urban growth and changing of the land use. This will Contribute to understanding the flooded nature in those environments witnessed dynamic changes. Since both old maps and traditional instruments are disabled to support in developing effective and visibility, Adapted studies to face flood changes and urban growth. Therefore, this study came to discuss the implementation of the 2D model shows the flood water depth, spread, and velocity which based on Hydraulic modeling of (HEC-RAS) program in case of urban developing areas. The study also provides the 2D model of the flood water inflow spread, velocity, and depth, as those characteristics are not available in the flood water inflow one dimension model.

The conducted study clarifying that the Jizan-Abha Highway intersected by the main valley, which is Wadi Bayad basin, so it must be considered in design to increase the ability of the highway to face flood risks that it may, be exposed to The maximum inflow in the last 100 years was the main based input in this study. The floodplain and risk maps are helping in determine the exposed sites to the floods, as the inflow intensity could be known in any site of the highway to clarify the risk extreme at this site. Moreover, to understand the engineering solutions proposed properly.

According to this study, as it deals with a highway, it is important to keep it safe from the dangers of the floods or water erosion. Since the general erosion depth in the stream may be great, in this case, the obtained solution suggests protecting the highway sides by disconnected stones. Stones are placed on both highway sides to guard it, as the low-risk Cross-sections parts reaching about 3.2 Km. While the Cross-sections at moderate risk were about 1.3 km, the high-risk Cross-sections of the highway was about 1.6 km.

The general erosion is calculated through the Lacey method, as well as the determination the diameter of the disconnected stones is necessary because it must be unmovable when floods are occurring belonging to 100 years. Since the stones must resist the shear forces caused by the inflow and velocity. The Isbach equation was used to calculate the diameter of the required diameter of the stones. Figure (26) and Table (9) are illustrating the proposed protection of the Jizan-Abha Highway.

$$D_{50} = \frac{1}{\varphi^2} \times \left(\frac{\gamma_w}{\gamma_s - \gamma_w} \right) \times \frac{V^2}{2g}$$

D50: Mean diameter of riprap (mm)
ϕ : Empirical Coefficient (ϕ =1.2)
Yw: Specific gravity of water (Yw = 1.0 t/m3)
Ys : Specific gravity of riprap stone (Ys = 2.65 t/m3)
G: Gravitational acceleration (g= 9.81)
V: Velocity of water (m/s)

Table 9: Proposed Protection characteristic of Jizan-Abha Highway opposite to Wadi Bayad in 2019

Water depth (m)	Velocity (m/S)	Protection characteristic		
		Length (m)	D50 (mm)	Layer thickness (m)
4.09	1.23	3750	200	0.60

c) Proposed Protection for The Urban Areas Below Jizan-Abha Highway

Recently, geomatics of remote sensing (RS) and geographic information systems (GIS) have been employed as powerful and effective tools for determining land-use changes [65,66], In this study, four satellite images were downloaded every 10 years through the United States Geological Survey (USGS), to monitor the features of land-use change, The first in 1988, the second in 1998, and the third in 2013 of the TM sensor on the US satellite Landsat 4-5, While the fourth satellite images in 2019 from OLI sensor on the satellite Landsat 8, table (10), The classification process was conducted using the Maximum Likelihood method, The accuracy of the classification was done for satellite images, and the Change Detection were monitored For each type of phenomenon classified by accounts and different quantitative indicators, Where changes were measured by banding.

Table 10: Characteristics of satellite images used to monitor the urban changes of Wadi Bayad basin during the period 1988 – 2019

Date of satellite images capture	Path	Row	Satellite	- Spatial accuracy	Sensor type	Bands
11/1988	169	45	Landsat 4-5	30	TM	7
11/1998	169	45	Landsat 4-5	30	TM	7
12/2013	169	45	Landsat 4-5	30	OLI	11
8/2019	169	45	Landsat 8	30	OLI	11

The field study outcomes, satellite images classification, flood records, and figure (27) are indicating that there are expansions in both of Samrat Elged and Warequ Menshabah villages in the direction of the Wadi Bayad expected risk zone. The total urban area of those villages reaching about 1.42 km2 and 1.62 km2 in 2019 respectively, since this expansion is related to the fertile areas for grazing and agriculture. At the same time, it was a major concern in light of the frequent flooding fears of the Wadi Bayad that latterly recorded in 1440 Hijri. It destroyed almost half of the buildings of the villages according to the field study in 15/4/1440 Hijri. Accordingly, it must stop the urban expansion towards the area of the Wadi Bayad basin, Regarding the proposed protection of the urban areas below the Jizan-Abha highway, the researcher proposes the buffer zone to display the limits of the flood plain amounting to about 1.52 km. This proposed buffer must fix, handled, lining the course by the mortar stones, and prevent encroachment by the residents.

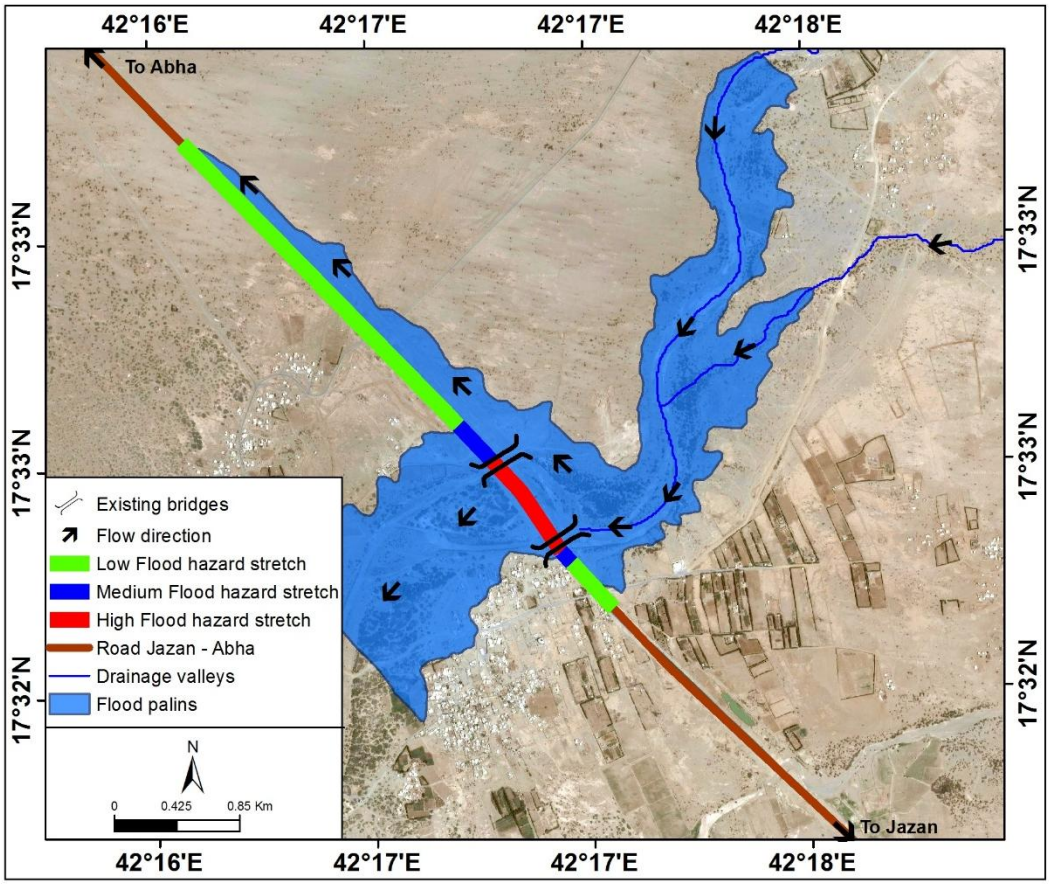

Figure 26: The Proposed mechanism to mitigate the flood risks in the area of Study in 2019

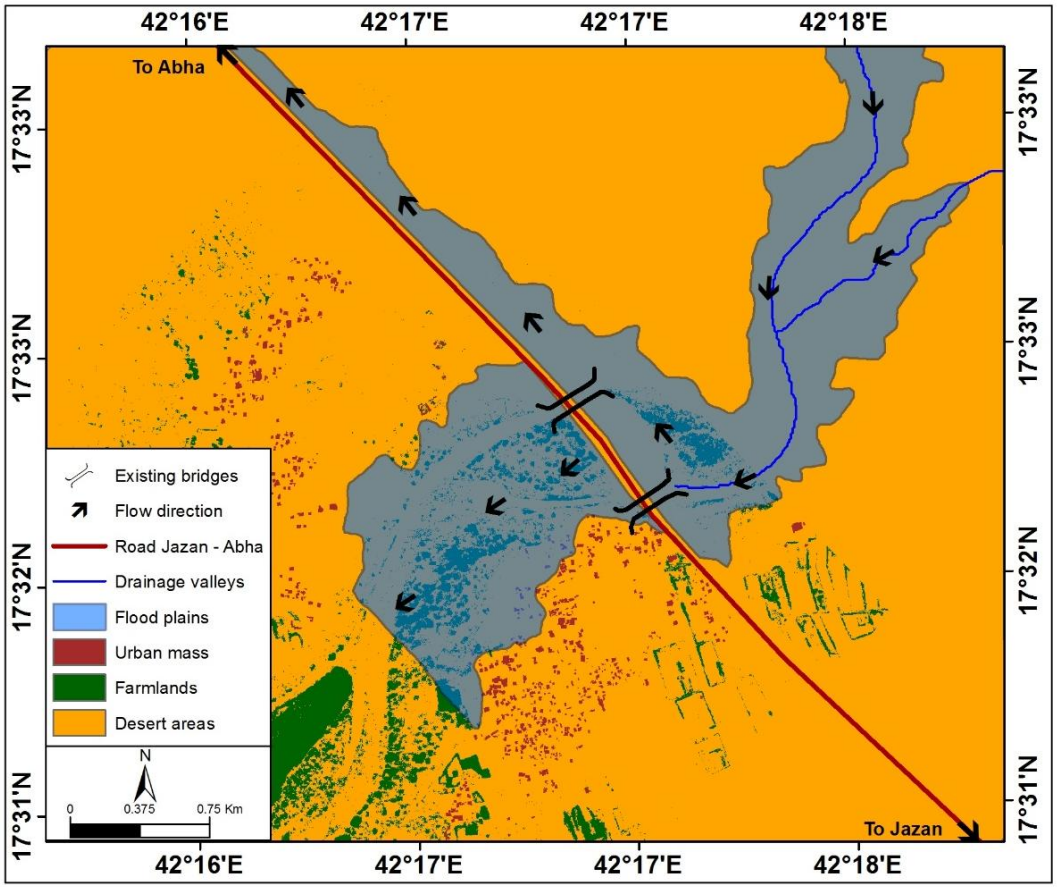

Figure 27: Urban areas exposed to drown below the Jizan-Abha Highway in 2019

VII. Recommendations

The proposed recommendations, due to this study, are giving priority to adapt to the flood risks protection plan and infrastructure for deification, which presents the Jizan-Abha Highway. As maintaining the existing water drainage facilities that found in the existing bridges with maintaining them continuously, with the importance of engineering penetrations to stop water erosion for about 4.3 km. Along with the need to maintain the highway from the erosions, the study is also prevents planning, developing, and land use works or usage inside or outside the urban development areas. The study also gives attention to the prime minister's dissension in 4/5/1428 Hijri which determine the procedures must take when facing flood risks, and admitted the hydrological studies, and technical design necessary before certifying urban and agriculture plans. The implementation of the hydraulic and hydrological models of WMS, HEC-HMS, and HEC-RAS is critical in the study of preventing the flood risks, and management infrastructure facilities, especially roads. The integration of these techniques with spatial modeling programs (GIS and RS) has proven to be very effective in identifying areas vulnerable to flooding and contributing to infrastructure management and risk mitigation.

VIII. Conclusions

The Jizan-Abha Highway has recently been exposed to the dangers of floods that have caused many damages to living property, infrastructure, and the flooding of nearby urban areas. The seriousness increased in the case study areas by the intensive valleys density, which exceeds 25 major valleys intersected directly with the Highway. The area of the Wadi Bayad basin, which is the current study model, one of the most dangerous areas on the road for its recurrence to different collapses of the infrastructure facilities, since both of Samrat Elged and Warequ Menshabah villages were exposed to drown during the recent floods on 15/4/1440 Hijri.

The flood risk category map indicates the part of the Highway, which placed opposite to Wadi Bayad basin is witnessing serious floods exceeding 3,173.20 m3\S, and flood velocity reached almost 1.23 m\S. Moreover, the average flood depth was about 4.09 m, and about 45% of the evaluated risk was considered low-risk. While it covers about 2.7 km, the moderate risk dominates 10% and an area of about 1.2 km. The high risk controlled about 35% and reached almost 1.7 km of the total length affected by the flood. The Jizan-Abha highway is needed to maintain against the flood erosions since the general erosion depth in the stream

is large and impacted. This study proposes to protect the highway sides by using disconnected stones with an action of stopped the urban expansion in the nearby villages towards Wadi Bayad basin.

This research may helps the decision makers in Jizan city and in many areas of the Saudi Arabia and the neighboring Arab countries to understand the flash flood impacts on the infrastructure such as roads. Since it provides an alternative solution can be studied and implemented to protect Roads from expected future floods.

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The IBOARS can initially review research papers of their institute and recommend them to publish with respective journal of Global Journals. It can also review the papers of other institutions after obtaining our consent. The second review will be done by peer reviewer of Global Journals Incorporation (USA) The Board is at liberty to appoint a peer reviewer with the approval of chairperson after consulting us.

The author fees of such paper may be waived off up to 40%.

The Global Journals Incorporation (USA) at its discretion can also refer double blind peer reviewed paper at their end to the board for the verification and to get recommendation for final stage of acceptance of publication.

The IBOARS can organize symposium/seminar/conference in their country on behalf of Global Journals Incorporation (USA)-OARS (USA). The terms and conditions can be discussed separately.

The Board can also play vital role by exploring and giving valuable suggestions regarding the Standards of "Open Association of Research Society, U.S.A (OARS)" so that proper amendment can take place for the benefit of entire research community. We shall provide details of particular standard only on receipt of request from the Board.

The board members can also join us as Individual Fellow with 40% discount on total fees applicable to Individual Fellow. They will be entitled to avail all the benefits as declared. Please visit Individual Fellow-sub menu of GlobalJournals.org to have more relevant details.

We shall provide you intimation regarding launching of e-version of journal of your stream time to time. This may be utilized in your library for the enrichment of knowledge of your students as well as it can also be helpful for the concerned faculty members.

After nomination of your institution as "Institutional Fellow" and constantly functioning successfully for one year, we can consider giving recognition to your institute to function as Regional/Zonal office on our behalf.
The board can also take up the additional allied activities for betterment after our consultation.

The following entitlements are applicable to individual Fellows:

Open Association of Research Society, U.S.A (OARS) By-laws states that an individual Fellow may use the designations as applicable, or the corresponding initials. The Credentials of individual Fellow and Associate designations signify that the individual has gained knowledge of the fundamental concepts. One is magnanimous and proficient in an expertise course covering the professional code of conduct, and follows recognized standards of practice.

Open Association of Research Society (US)/ Global Journals Incorporation (USA), as described in Corporate Statements, are educational, research publishing and professional membership organizations. Achieving our individual Fellow or Associate status is based mainly on meeting stated educational research requirements.

Disbursement of 40% Royalty earned through Global Journals : Researcher = 50%, Peer Reviewer = 37.50%, Institution = 12.50% E.g. Out of 40%, the 20% benefit should be passed on to researcher, 15 % benefit towards remuneration should be given to a reviewer and remaining 5% is to be retained by the institution.

We shall provide print version of 12 issues of any three journals [as per your requirement] out of our 38 journals worth $ 2376 USD.

Other:

The individual Fellow and Associate designations accredited by Open Association of Research Society (US) credentials signify guarantees following achievements:

- The professional accredited with Fellow honor, is entitled to various benefits viz. name, fame, honor, regular flow of income, secured bright future, social status etc.

- In addition to above, if one is single author, then entitled to 40% discount on publishing research paper and can get 10%discount if one is co-author or main author among group of authors.
- The Fellow can organize symposium/seminar/conference on behalf of Global Journals Incorporation (USA) and he/she can also attend the same organized by other institutes on behalf of Global Journals.
- The Fellow can become member of Editorial Board Member after completing 3yrs.
- The Fellow can earn 60% of sales proceeds from the sale of reference/review books/literature/publishing of research paper.
- Fellow can also join as paid peer reviewer and earn 15% remuneration of author charges and can also get an opportunity to join as member of the Editorial Board of Global Journals Incorporation (USA)
- • This individual has learned the basic methods of applying those concepts and techniques to common challenging situations. This individual has further demonstrated an in–depth understanding of the application of suitable techniques to a particular area of research practice.

Note :

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- In future, if the board feels the necessity to change any board member, the same can be done with the consent of the chairperson along with anyone board member without our approval.
- In case, the chairperson needs to be replaced then consent of 2/3rd board members are required and they are also required to jointly pass the resolution copy of which should be sent to us. In such case, it will be compulsory to obtain our approval before replacement.
- In case of "Difference of Opinion [if any]" among the Board members, our decision will be final and binding to everyone.

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We accept the manuscript submissions in any standard (generic) format.

We typeset manuscripts using advanced typesetting tools like Adobe In Design, CorelDraw, TeXnicCenter, and TeXStudio. We usually recommend authors submit their research using any standard format they are comfortable with, and let Global Journals do the rest.

Alternatively, you can download our basic template from https://globaljournals.org/Template.zip

Authors should submit their complete paper/article, including text illustrations, graphics, conclusions, artwork, and tables. Authors who are not able to submit manuscript using the form above can email the manuscript department at submit@globaljournals.org or get in touch with chiefeditor@globaljournals.org if they wish to send the abstract before submission.

Before and during Submission

Authors must ensure the information provided during the submission of a paper is authentic. Please go through the following checklist before submitting:

1. Authors must go through the complete author guideline and understand and *agree to Global Journals' ethics and code of conduct,* along with author responsibilities.
2. Authors must accept the privacy policy, terms, and conditions of Global Journals.
3. Ensure corresponding author's email address and postal address are accurate and reachable.
4. Manuscript to be submitted must include keywords, an abstract, a paper title, co-author(s') names and details (email address, name, phone number, and institution), figures and illustrations in vector format including appropriate captions, tables, including titles and footnotes, a conclusion, results, acknowledgments and references.
5. Authors should submit paper in a ZIP archive if any supplementary files are required along with the paper.
6. Proper permissions must be acquired for the use of any copyrighted material.
7. Manuscript submitted *must not have been submitted or published elsewhere* and all authors must be aware of the submission.

Declaration of Conflicts of Interest

It is required for authors to declare all financial, institutional, and personal relationships with other individuals and organizations that could influence (bias) their research.

Policy on Plagiarism

Plagiarism is not acceptable in Global Journals submissions at all.

Plagiarized content will not be considered for publication. We reserve the right to inform authors' institutions about plagiarism detected either before or after publication. If plagiarism is identified, we will follow COPE guidelines:

Authors are solely responsible for all the plagiarism that is found. The author must not fabricate, falsify or plagiarize existing research data. The following, if copied, will be considered plagiarism:

- Words (language)
- Ideas
- Findings
- Writings
- Diagrams
- Graphs
- Illustrations
- Lectures

- Printed material
- Graphic representations
- Computer programs
- Electronic material
- Any other original work

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1. Substantial contributions to the conception and acquisition of data, analysis, and interpretation of findings.
2. Drafting the paper and revising it critically regarding important academic content.
3. Final approval of the version of the paper to be published.

Changes in Authorship

The corresponding author should mention the name and complete details of all co-authors during submission and in manuscript. We support addition, rearrangement, manipulation, and deletions in authors list till the early view publication of the journal. We expect that corresponding author will notify all co-authors of submission. We follow COPE guidelines for changes in authorship.

Copyright

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Appealing Decisions

Unless specified in the notification, the Editorial Board's decision on publication of the paper is final and cannot be appealed before making the major change in the manuscript.

Acknowledgments

Contributors to the research other than authors credited should be mentioned in Acknowledgments. The source of funding for the research can be included. Suppliers of resources may be mentioned along with their addresses.

Declaration of funding sources

Global Journals is in partnership with various universities, laboratories, and other institutions worldwide in the research domain. Authors are requested to disclose their source of funding during every stage of their research, such as making analysis, performing laboratory operations, computing data, and using institutional resources, from writing an article to its submission. This will also help authors to get reimbursements by requesting an open access publication letter from Global Journals and submitting to the respective funding source.

Preparing your Manuscript

Authors can submit papers and articles in an acceptable file format: MS Word (doc, docx), LaTeX (.tex, .zip or .rar including all of your files), Adobe PDF (.pdf), rich text format (.rtf), simple text document (.txt), Open Document Text (.odt), and Apple Pages (.pages). Our professional layout editors will format the entire paper according to our official guidelines. This is one of the highlights of publishing with Global Journals—authors should not be concerned about the formatting of their paper. Global Journals accepts articles and manuscripts in every major language, be it Spanish, Chinese, Japanese, Portuguese, Russian, French, German, Dutch, Italian, Greek, or any other national language, but the title, subtitle, and abstract should be in English. This will facilitate indexing and the pre-peer review process.

The following is the official style and template developed for publication of a research paper. Authors are not required to follow this style during the submission of the paper. It is just for reference purposes.

Manuscript Style Instruction (Optional)

- Microsoft Word Document Setting Instructions.
- Font type of all text should be Swis721 Lt BT.
- Page size: 8.27" x 11'", left margin: 0.65, right margin: 0.65, bottom margin: 0.75.
- Paper title should be in one column of font size 24.
- Author name in font size of 11 in one column.
- Abstract: font size 9 with the word "Abstract" in bold italics.
- Main text: font size 10 with two justified columns.
- Two columns with equal column width of 3.38 and spacing of 0.2.
- First character must be three lines drop-capped.
- The paragraph before spacing of 1 pt and after of 0 pt.
- Line spacing of 1 pt.
- Large images must be in one column.
- The names of first main headings (Heading 1) must be in Roman font, capital letters, and font size of 10.
- The names of second main headings (Heading 2) must not include numbers and must be in italics with a font size of 10.

Structure and Format of Manuscript

The recommended size of an original research paper is under 15,000 words and review papers under 7,000 words. Research articles should be less than 10,000 words. Research papers are usually longer than review papers. Review papers are reports of significant research (typically less than 7,000 words, including tables, figures, and references)

A research paper must include:

a) A title which should be relevant to the theme of the paper.
b) A summary, known as an abstract (less than 150 words), containing the major results and conclusions.
c) Up to 10 keywords that precisely identify the paper's subject, purpose, and focus.
d) An introduction, giving fundamental background objectives.
e) Resources and techniques with sufficient complete experimental details (wherever possible by reference) to permit repetition, sources of information must be given, and numerical methods must be specified by reference.
f) Results which should be presented concisely by well-designed tables and figures.
g) Suitable statistical data should also be given.
h) All data must have been gathered with attention to numerical detail in the planning stage.

Design has been recognized to be essential to experiments for a considerable time, and the editor has decided that any paper that appears not to have adequate numerical treatments of the data will be returned unrefereed.

i) Discussion should cover implications and consequences and not just recapitulate the results; conclusions should also be summarized.
j) There should be brief acknowledgments.
k) There ought to be references in the conventional format. Global Journals recommends APA format.

Authors should carefully consider the preparation of papers to ensure that they communicate effectively. Papers are much more likely to be accepted if they are carefully designed and laid out, contain few or no errors, are summarizing, and follow instructions. They will also be published with much fewer delays than those that require much technical and editorial correction.

The Editorial Board reserves the right to make literary corrections and suggestions to improve brevity.

Format Structure

It is necessary that authors take care in submitting a manuscript that is written in simple language and adheres to published guidelines.

All manuscripts submitted to Global Journals should include:

Title

The title page must carry an informative title that reflects the content, a running title (less than 45 characters together with spaces), names of the authors and co-authors, and the place(s) where the work was carried out.

Author details

The full postal address of any related author(s) must be specified.

Abstract

The abstract is the foundation of the research paper. It should be clear and concise and must contain the objective of the paper and inferences drawn. It is advised to not include big mathematical equations or complicated jargon.

Many researchers searching for information online will use search engines such as Google, Yahoo or others. By optimizing your paper for search engines, you will amplify the chance of someone finding it. In turn, this will make it more likely to be viewed and cited in further works. Global Journals has compiled these guidelines to facilitate you to maximize the web-friendliness of the most public part of your paper.

Keywords

A major lynchpin of research work for the writing of research papers is the keyword search, which one will employ to find both library and internet resources. Up to eleven keywords or very brief phrases have to be given to help data retrieval, mining, and indexing.

One must be persistent and creative in using keywords. An effective keyword search requires a strategy: planning of a list of possible keywords and phrases to try.

Choice of the main keywords is the first tool of writing a research paper. Research paper writing is an art. Keyword search should be as strategic as possible.

One should start brainstorming lists of potential keywords before even beginning searching. Think about the most important concepts related to research work. Ask, “What words would a source have to include to be truly valuable in a research paper?” Then consider synonyms for the important words.

It may take the discovery of only one important paper to steer in the right keyword direction because, in most databases, the keywords under which a research paper is abstracted are listed with the paper.

Numerical Methods

Numerical methods used should be transparent and, where appropriate, supported by references.

Abbreviations

Authors must list all the abbreviations used in the paper at the end of the paper or in a separate table before using them.

Formulas and equations

Authors are advised to submit any mathematical equation using either MathJax, KaTeX, or LaTeX, or in a very high-quality image.

Tables, Figures, and Figure Legends

Tables: Tables should be cautiously designed, uncrowned, and include only essential data. Each must have an Arabic number, e.g., Table 4, a self-explanatory caption, and be on a separate sheet. Authors must submit tables in an editable format and not as images. References to these tables (if any) must be mentioned accurately.

Figures

Figures are supposed to be submitted as separate files. Always include a citation in the text for each figure using Arabic numbers, e.g., Fig. 4. Artwork must be submitted online in vector electronic form or by emailing it.

Preparation of Eletronic Figures for Publication

Although low-quality images are sufficient for review purposes, print publication requires high-quality images to prevent the final product being blurred or fuzzy. Submit (possibly by e-mail) EPS (line art) or TIFF (halftone/ photographs) files only. MS PowerPoint and Word Graphics are unsuitable for printed pictures. Avoid using pixel-oriented software. Scans (TIFF only) should have a resolution of at least 350 dpi (halftone) or 700 to 1100 dpi (line drawings). Please give the data for figures in black and white or submit a Color Work Agreement form. EPS files must be saved with fonts embedded (and with a TIFF preview, if possible).

For scanned images, the scanning resolution at final image size ought to be as follows to ensure good reproduction: line art: >650 dpi; halftones (including gel photographs): >350 dpi; figures containing both halftone and line images: >650 dpi.

Color charges: Authors are advised to pay the full cost for the reproduction of their color artwork. Hence, please note that if there is color artwork in your manuscript when it is accepted for publication, we would require you to complete and return a Color Work Agreement form before your paper can be published. Also, you can email your editor to remove the color fee after acceptance of the paper.

Tips for Writing a Good Quality Engineering Research Paper

Techniques for writing a good quality engineering research paper:

1. Choosing the topic: In most cases, the topic is selected by the interests of the author, but it can also be suggested by the guides. You can have several topics, and then judge which you are most comfortable with. This may be done by asking several questions of yourself, like "Will I be able to carry out a search in this area? Will I find all necessary resources to accomplish the search? Will I be able to find all information in this field area?" If the answer to this type of question is "yes," then you ought to choose that topic. In most cases, you may have to conduct surveys and visit several places. Also, you might have to do a lot of work to find all the rises and falls of the various data on that subject. Sometimes, detailed information plays a vital role, instead of short information. Evaluators are human: The first thing to remember is that evaluators are also human beings. They are not only meant for rejecting a paper. They are here to evaluate your paper. So present your best aspect.

2. Think like evaluators: If you are in confusion or getting demotivated because your paper may not be accepted by the evaluators, then think, and try to evaluate your paper like an evaluator. Try to understand what an evaluator wants in your research paper, and you will automatically have your answer. Make blueprints of paper: The outline is the plan or framework that will help you to arrange your thoughts. It will make your paper logical. But remember that all points of your outline must be related to the topic you have chosen.

3. Ask your guides: If you are having any difficulty with your research, then do not hesitate to share your difficulty with your guide (if you have one). They will surely help you out and resolve your doubts. If you can't clarify what exactly you require for your work, then ask your supervisor to help you with an alternative. He or she might also provide you with a list of essential readings.

4. Use of computer is recommended: As you are doing research in the field of research engineering then this point is quite obvious. Use right software: Always use good quality software packages. If you are not capable of judging good software, then you can lose the quality of your paper unknowingly. There are various programs available to help you which you can get through the internet.

5. Use the internet for help: An excellent start for your paper is using Google. It is a wondrous search engine, where you can have your doubts resolved. You may also read some answers for the frequent question of how to write your research paper or find a model research paper. You can download books from the internet. If you have all the required books, place importance on reading, selecting, and analyzing the specified information. Then sketch out your research paper. Use big pictures: You may use encyclopedias like Wikipedia to get pictures with the best resolution. At Global Journals, you should strictly follow here.

6. Bookmarks are useful: When you read any book or magazine, you generally use bookmarks, right? It is a good habit which helps to not lose your continuity. You should always use bookmarks while searching on the internet also, which will make your search easier.

7. Revise what you wrote: When you write anything, always read it, summarize it, and then finalize it.

8. Make every effort: Make every effort to mention what you are going to write in your paper. That means always have a good start. Try to mention everything in the introduction—what is the need for a particular research paper. Polish your work with good writing skills and always give an evaluator what he wants. Make backups: When you are going to do any important thing like making a research paper, you should always have backup copies of it either on your computer or on paper. This protects you from losing any portion of your important data.

9. Produce good diagrams of your own: Always try to include good charts or diagrams in your paper to improve quality. Using several unnecessary diagrams will degrade the quality of your paper by creating a hodgepodge. So always try to include diagrams which were made by you to improve the readability of your paper. Use of direct quotes: When you do research relevant to literature, history, or current affairs, then use of quotes becomes essential, but if the study is relevant to science, use of quotes is not preferable.

10. Use proper verb tense: Use proper verb tenses in your paper. Use past tense to present those events that have happened. Use present tense to indicate events that are going on. Use future tense to indicate events that will happen in the future. Use of wrong tenses will confuse the evaluator. Avoid sentences that are incomplete.

11. Pick a good study spot: Always try to pick a spot for your research which is quiet. Not every spot is good for studying.

12. Know what you know: Always try to know what you know by making objectives, otherwise you will be confused and unable to achieve your target.

13. Use good grammar: Always use good grammar and words that will have a positive impact on the evaluator; use of good vocabulary does not mean using tough words which the evaluator has to find in a dictionary. Do not fragment sentences. Eliminate one-word sentences. Do not ever use a big word when a smaller one would suffice.

Verbs have to be in agreement with their subjects. In a research paper, do not start sentences with conjunctions or finish them with prepositions. When writing formally, it is advisable to never split an infinitive because someone will (wrongly) complain. Avoid clichés like a disease. Always shun irritating alliteration. Use language which is simple and straightforward. Put together a neat summary.

14. Arrangement of information: Each section of the main body should start with an opening sentence, and there should be a changeover at the end of the section. Give only valid and powerful arguments for your topic. You may also maintain your arguments with records.

15. Never start at the last minute: Always allow enough time for research work. Leaving everything to the last minute will degrade your paper and spoil your work.

16. Multitasking in research is not good: Doing several things at the same time is a bad habit in the case of research activity. Research is an area where everything has a particular time slot. Divide your research work into parts, and do a particular part in a particular time slot.

17. Never copy others' work: Never copy others' work and give it your name because if the evaluator has seen it anywhere, you will be in trouble. Take proper rest and food: No matter how many hours you spend on your research activity, if you are not taking care of your health, then all your efforts will have been in vain. For quality research, take proper rest and food.

18. Go to seminars: Attend seminars if the topic is relevant to your research area. Utilize all your resources.

19. Refresh your mind after intervals: Try to give your mind a rest by listening to soft music or sleeping in intervals. This will also improve your memory. Acquire colleagues: Always try to acquire colleagues. No matter how sharp you are, if you acquire colleagues, they can give you ideas which will be helpful to your research.

20. Think technically: Always think technically. If anything happens, search for its reasons, benefits, and demerits. Think and then print: When you go to print your paper, check that tables are not split, headings are not detached from their descriptions, and page sequence is maintained.

21. Adding unnecessary information: Do not add unnecessary information like "I have used MS Excel to draw graphs." Irrelevant and inappropriate material is superfluous. Foreign terminology and phrases are not apropos. One should never take a broad view. Analogy is like feathers on a snake. Use words properly, regardless of how others use them. Remove quotations. Puns are for kids, not grunt readers. Never oversimplify: When adding material to your research paper, never go for oversimplification; this will definitely irritate the evaluator. Be specific. Never use rhythmic redundancies. Contractions shouldn't be used in a research paper. Comparisons are as terrible as clichés. Give up ampersands, abbreviations, and so on. Remove commas that are not necessary. Parenthetical words should be between brackets or commas. Understatement is always the best way to put forward earth-shaking thoughts. Give a detailed literary review.

22. Report concluded results: Use concluded results. From raw data, filter the results, and then conclude your studies based on measurements and observations taken. An appropriate number of decimal places should be used. Parenthetical remarks are prohibited here. Proofread carefully at the final stage. At the end, give an outline to your arguments. Spot perspectives of further study of the subject. Justify your conclusion at the bottom sufficiently, which will probably include examples.

23. Upon conclusion: Once you have concluded your research, the next most important step is to present your findings. Presentation is extremely important as it is the definite medium though which your research is going to be in print for the rest of the crowd. Care should be taken to categorize your thoughts well and present them in a logical and neat manner. A good quality research paper format is essential because it serves to highlight your research paper and bring to light all necessary aspects of your research.

Informal Guidelines of Research Paper Writing

Key points to remember:

- Submit all work in its final form.
- Write your paper in the form which is presented in the guidelines using the template.
- Please note the criteria peer reviewers will use for grading the final paper.

Final points:

One purpose of organizing a research paper is to let people interpret your efforts selectively. The journal requires the following sections, submitted in the order listed, with each section starting on a new page:

The introduction: This will be compiled from reference matter and reflect the design processes or outline of basis that directed you to make a study. As you carry out the process of study, the method and process section will be constructed like that. The results segment will show related statistics in nearly sequential order and direct reviewers to similar intellectual paths throughout the data that you gathered to carry out your study.

The discussion section:

This will provide understanding of the data and projections as to the implications of the results. The use of good quality references throughout the paper will give the effort trustworthiness by representing an alertness to prior workings.

Writing a research paper is not an easy job, no matter how trouble-free the actual research or concept. Practice, excellent preparation, and controlled record-keeping are the only means to make straightforward progression.

General style:

Specific editorial column necessities for compliance of a manuscript will always take over from directions in these general guidelines.

To make a paper clear: Adhere to recommended page limits.

Mistakes to avoid:

- Insertion of a title at the foot of a page with subsequent text on the next page.
- Separating a table, chart, or figure—confine each to a single page.
- Submitting a manuscript with pages out of sequence.
- In every section of your document, use standard writing style, including articles ("a" and "the").
- Keep paying attention to the topic of the paper.

- Use paragraphs to split each significant point (excluding the abstract).
- Align the primary line of each section.
- Present your points in sound order.
- Use present tense to report well-accepted matters.
- Use past tense to describe specific results.
- Do not use familiar wording; don't address the reviewer directly. Don't use slang or superlatives.
- Avoid use of extra pictures—include only those figures essential to presenting results.

Title page:

Choose a revealing title. It should be short and include the name(s) and address(es) of all authors. It should not have acronyms or abbreviations or exceed two printed lines.

Abstract: This summary should be two hundred words or less. It should clearly and briefly explain the key findings reported in the manuscript and must have precise statistics. It should not have acronyms or abbreviations. It should be logical in itself. Do not cite references at this point.

An abstract is a brief, distinct paragraph summary of finished work or work in development. In a minute or less, a reviewer can be taught the foundation behind the study, common approaches to the problem, relevant results, and significant conclusions or new questions.

Write your summary when your paper is completed because how can you write the summary of anything which is not yet written? Wealth of terminology is very essential in abstract. Use comprehensive sentences, and do not sacrifice readability for brevity; you can maintain it succinctly by phrasing sentences so that they provide more than a lone rationale. The author can at this moment go straight to shortening the outcome. Sum up the study with the subsequent elements in any summary. Try to limit the initial two items to no more than one line each.

Reason for writing the article—theory, overall issue, purpose.

- Fundamental goal.
- To-the-point depiction of the research.
- Consequences, including definite statistics—if the consequences are quantitative in nature, account for this; results of any numerical analysis should be reported. Significant conclusions or questions that emerge from the research.

Approach:

- Single section and succinct.
- An outline of the job done is always written in past tense.
- Concentrate on shortening results—limit background information to a verdict or two.
- Exact spelling, clarity of sentences and phrases, and appropriate reporting of quantities (proper units, important statistics) are just as significant in an abstract as they are anywhere else.

Introduction:

The introduction should "introduce" the manuscript. The reviewer should be presented with sufficient background information to be capable of comprehending and calculating the purpose of your study without having to refer to other works. The basis for the study should be offered. Give the most important references, but avoid making a comprehensive appraisal of the topic. Describe the problem visibly. If the problem is not acknowledged in a logical, reasonable way, the reviewer will give no attention to your results. Speak in common terms about techniques used to explain the problem, if needed, but do not present any particulars about the protocols here.

The following approach can create a valuable beginning:

- Explain the value (significance) of the study.
- Defend the model—why did you employ this particular system or method? What is its compensation? Remark upon its appropriateness from an abstract point of view as well as pointing out sensible reasons for using it.
- Present a justification. State your particular theory(-ies) or aim(s), and describe the logic that led you to choose them.
- Briefly explain the study's tentative purpose and how it meets the declared objectives.

Approach:

Use past tense except for when referring to recognized facts. After all, the manuscript will be submitted after the entire job is done. Sort out your thoughts; manufacture one key point for every section. If you make the four points listed above, you will need at least four paragraphs. Present surrounding information only when it is necessary to support a situation. The reviewer does not desire to read everything you know about a topic. Shape the theory specifically—do not take a broad view.

As always, give awareness to spelling, simplicity, and correctness of sentences and phrases.

Procedures (methods and materials):

This part is supposed to be the easiest to carve if you have good skills. A soundly written procedures segment allows a capable scientist to replicate your results. Present precise information about your supplies. The suppliers and clarity of reagents can be helpful bits of information. Present methods in sequential order, but linked methodologies can be grouped as a segment. Be concise when relating the protocols. Attempt to give the least amount of information that would permit another capable scientist to replicate your outcome, but be cautious that vital information is integrated. The use of subheadings is suggested and ought to be synchronized with the results section.

When a technique is used that has been well-described in another section, mention the specific item describing the way, but draw the basic principle while stating the situation. The purpose is to show all particular resources and broad procedures so that another person may use some or all of the methods in one more study or referee the scientific value of your work. It is not to be a step-by-step report of the whole thing you did, nor is a methods section a set of orders.

Materials:

Materials may be reported in part of a section or else they may be recognized along with your measures.

Methods:

- Report the method and not the particulars of each process that engaged the same methodology.
- Describe the method entirely.
- To be succinct, present methods under headings dedicated to specific dealings or groups of measures.
- Simplify—detail how procedures were completed, not how they were performed on a particular day.
- If well-known procedures were used, account for the procedure by name, possibly with a reference, and that's all.

Approach:

It is embarrassing to use vigorous voice when documenting methods without using first person, which would focus the reviewer's interest on the researcher rather than the job. As a result, when writing up the methods, most authors use third person passive voice.

Use standard style in this and every other part of the paper—avoid familiar lists, and use full sentences.

What to keep away from:

- Resources and methods are not a set of information.
- Skip all descriptive information and surroundings—save it for the argument.
- Leave out information that is immaterial to a third party.

Results:

The principle of a results segment is to present and demonstrate your conclusion. Create this part as entirely objective details of the outcome, and save all understanding for the discussion.

The page length of this segment is set by the sum and types of data to be reported. Use statistics and tables, if suitable, to present consequences most efficiently.

You must clearly differentiate material which would usually be incorporated in a study editorial from any unprocessed data or additional appendix matter that would not be available. In fact, such matters should not be submitted at all except if requested by the instructor.

Content:

- Sum up your conclusions in text and demonstrate them, if suitable, with figures and tables.
- In the manuscript, explain each of your consequences, and point the reader to remarks that are most appropriate.
- Present a background, such as by describing the question that was addressed by creation of an exacting study.
- Explain results of control experiments and give remarks that are not accessible in a prescribed figure or table, if appropriate.
- Examine your data, then prepare the analyzed (transformed) data in the form of a figure (graph), table, or manuscript.

What to stay away from:

- Do not discuss or infer your outcome, report surrounding information, or try to explain anything.
- Do not include raw data or intermediate calculations in a research manuscript.
- Do not present similar data more than once.
- A manuscript should complement any figures or tables, not duplicate information.
- Never confuse figures with tables—there is a difference.

Approach:

As always, use past tense when you submit your results, and put the whole thing in a reasonable order.

Put figures and tables, appropriately numbered, in order at the end of the report.

If you desire, you may place your figures and tables properly within the text of your results section.

Figures and tables:

If you put figures and tables at the end of some details, make certain that they are visibly distinguished from any attached appendix materials, such as raw facts. Whatever the position, each table must be titled, numbered one after the other, and include a heading. All figures and tables must be divided from the text.

Discussion:

The discussion is expected to be the trickiest segment to write. A lot of papers submitted to the journal are discarded based on problems with the discussion. There is no rule for how long an argument should be.

Position your understanding of the outcome visibly to lead the reviewer through your conclusions, and then finish the paper with a summing up of the implications of the study. The purpose here is to offer an understanding of your results and support all of your conclusions, using facts from your research and generally accepted information, if suitable. The implication of results should be fully described.

Infer your data in the conversation in suitable depth. This means that when you clarify an observable fact, you must explain mechanisms that may account for the observation. If your results vary from your prospect, make clear why that may have happened. If your results agree, then explain the theory that the proof supported. It is never suitable to just state that the data approved the prospect, and let it drop at that. Make a decision as to whether each premise is supported or discarded or if you cannot make a conclusion with assurance. Do not just dismiss a study or part of a study as "uncertain."

Research papers are not acknowledged if the work is imperfect. Draw what conclusions you can based upon the results that you have, and take care of the study as a finished work.

- You may propose future guidelines, such as how an experiment might be personalized to accomplish a new idea.
- Give details of all of your remarks as much as possible, focusing on mechanisms.
- Make a decision as to whether the tentative design sufficiently addressed the theory and whether or not it was correctly restricted. Try to present substitute explanations if they are sensible alternatives.
- One piece of research will not counter an overall question, so maintain the large picture in mind. Where do you go next? The best studies unlock new avenues of study. What questions remain?
- Recommendations for detailed papers will offer supplementary suggestions.

Approach:

When you refer to information, differentiate data generated by your own studies from other available information. Present work done by specific persons (including you) in past tense.

Describe generally acknowledged facts and main beliefs in present tense.

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Introduction	Containing all background details with clear goal and appropriate details, flow specification, no grammar and spelling mistake, well organized sentence and paragraph, reference cited	Unclear and confusing data, appropriate format, grammar and spelling errors with unorganized matter	Out of place depth and content, hazy format
Methods and Procedures	Clear and to the point with well arranged paragraph, precision and accuracy of facts and figures, well organized subheads	Difficult to comprehend with embarrassed text, too much explanation but completed	Incorrect and unorganized structure with hazy meaning
Result	Well organized, Clear and specific, Correct units with precision, correct data, well structuring of paragraph, no grammar and spelling mistake	Complete and embarrassed text, difficult to comprehend	Irregular format with wrong facts and figures
Discussion	Well organized, meaningful specification, sound conclusion, logical and concise explanation, highly structured paragraph reference cited	Wordy, unclear conclusion, spurious	Conclusion is not cited, unorganized, difficult to comprehend
References	Complete and correct format, well organized	Beside the point, Incomplete	Wrong format and structuring

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ISSN 9755861