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Preface

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Preface

On behalf of the organizing committee of the 3rd TICATE 2020, I would like to welcome all delegates to attend this international conference with great pleasure. In the concern of COVID-19 pandemic, this international conference is being held virtually from August 3rd – 4th, 2020 from Campus I of Universitas Tarumanagara at Jl. Letjen S. Parman No. 1, Jakarta 11440, Indonesia. The 3rd TICATE 2020 is organized by Universitas Tarumanagara and technically sponsored by IOP Publishing. The reason why this conference was changed to virtual format is that due to COVID-19 Pandemic, there are travel restrictions and social distancing ruled by almost all governments in the world, including Indonesian government. We still hold partially the physical presentations regarding the healthy protocols suggested by World Health Organization.

Instead of being postponed, we still hold this international conference virtually using Zoom Meeting because this conference is a forum for engineers, academics, practitioners, and students to exchange their experiences and knowledge. Many innovations and developments are being created from the last event to this one. These need to be shared among stake holders in the field of engineering and technology. Therefore, there is an urgent need to publish the newest results of researches in the conference proceedings.

The 3rd TICATE 2020 has attracted many academicians, scientists, engineers, postgraduates and other professionals from many countries. This conference accepted 217 papers from 5 different countries, those are Australia, Taiwan, India, Malaysia, and Indonesia. The aim of the conference is to promote exchange of ideas among engineers, researchers, and scientists active in the related areas of technology and engineering.

Our special thank goes to our Rector, Prof. Dr. Ir. Agustinus Purna Irawan, who has initiate this international conference, to our Plenary Speakers, Prof. Ir. Dr. Lee Sze Wei from Tunku Abdul Rahman University College, Malaysia, and Prof. Dr. Ir. Tresna P. Soemardi, S.E., M.S. from Universitas Indonesia, Indonesia, and to our Invited Speakers, Dr. Ayub Ahmed Janvekar from VIT University, Chennai, India and Prof. Ir. Dr. Mohd Zulkifli Abdullah from Universiti Sains Malaysia, Malaysia. Each keynote speaker will be given 30 minutes to hold his presentation and followed by 15 minutes Q&A session. At the parallel sessions, each presenter is given 15 minutes to present his/her work followed by 10 minutes Q&A session about the related topic. The parallel sessions are opened to all participants. The participants, including presenters at the parallel sessions, are attending this virtual international conference from Indonesia (Jakarta, Bandung, Medan, Yogyakarta, Aceh, Depok, Surabaya, etc.), Kuala Lumpur, Pulau Pinang (Malaysia), Australia, Taiwan, and India.

The virtual format of the 3rd TICATE 2020 still provides very satisfying overall technical quality of the conference, e.g. in presenting the articles. Because we used Zoom Meeting as the platform and a good internet connection to hold this virtual conference, the conference can be attended by about 500 participants from 5 countries without any problem.

We would like also to thank our partner international and national Universities in contributing and participating in this international conference. To all individuals and organizations such as the members of international editorial board, the conference organizers, the reviewers and the authors, for their contribution in making the 3rd TICATE 2020 as a successful international conference and a memorable gathering event. I am also grateful for the support of publication service of IOP Publishing.



We hope that the conference could present you wonderful memories to bring home in addition to new insights and friendship congregated during the event. We truly value your participation and support for the conference. We hope that you will gather many experiences and benefits from this event.

Dr. Hugeng, S.T., M.T. (SMIEEE)

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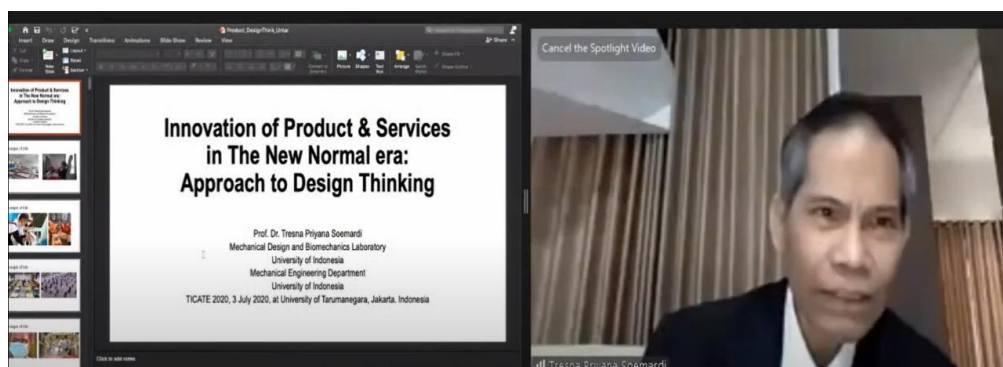
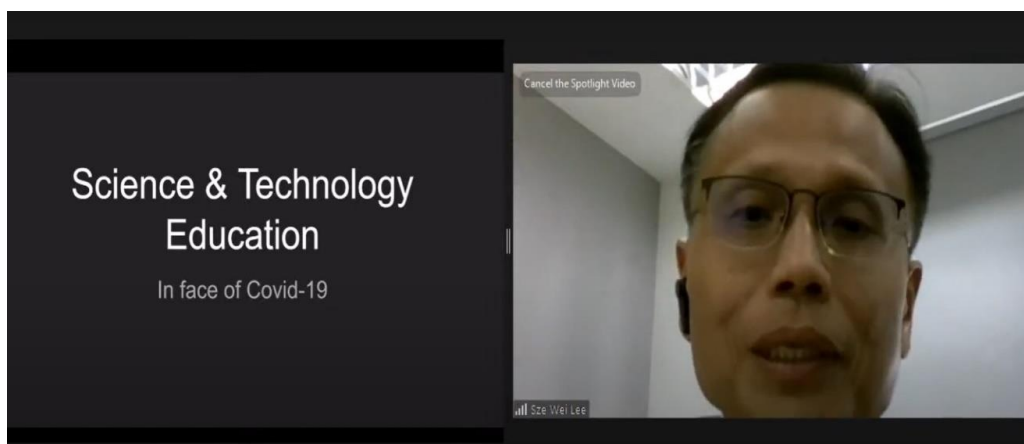
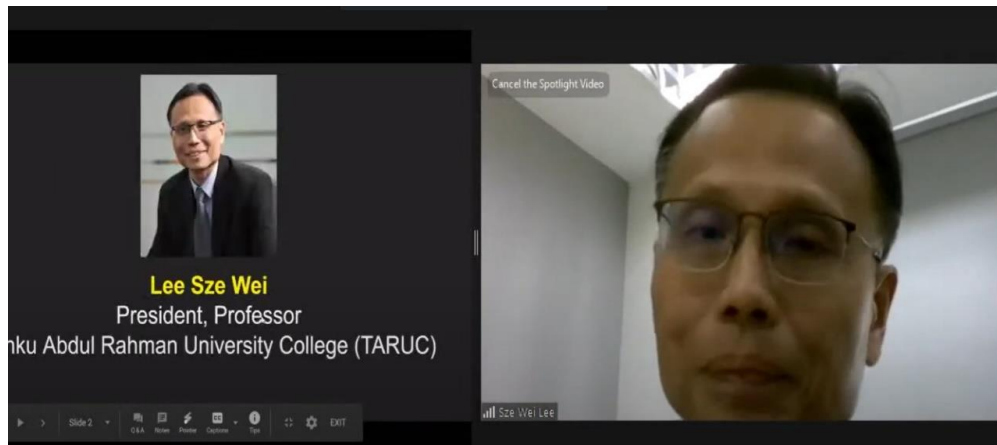
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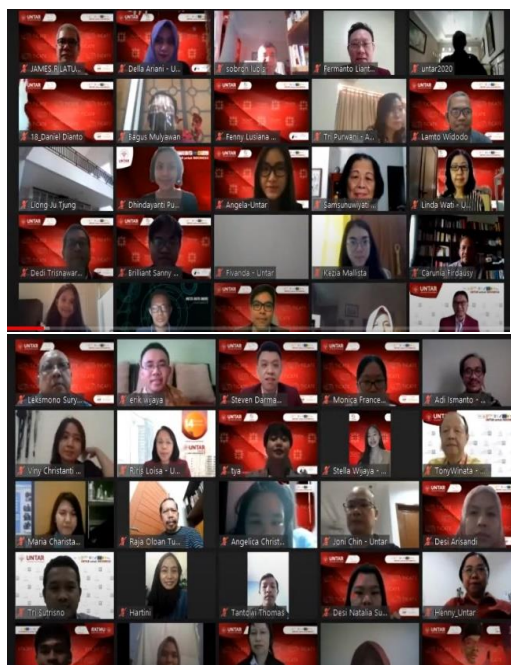
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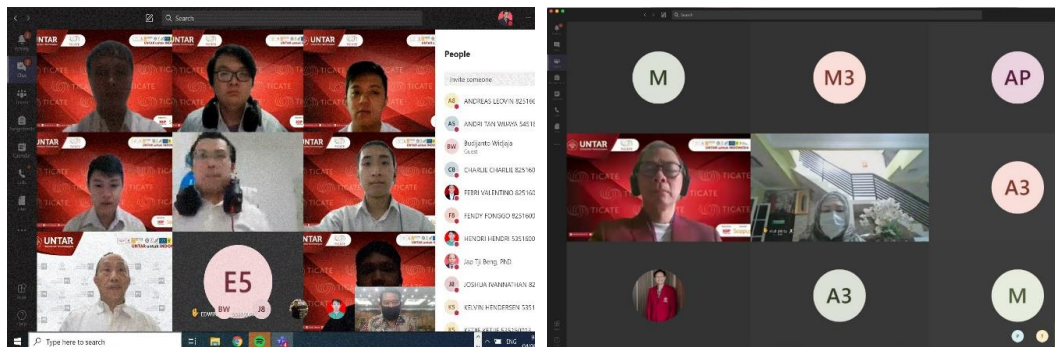
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All papers published in this volume of *IOP Conference Series: Materials Science and Engineering* have been peer reviewed through processes administered by the Editors. Reviews were conducted by expert referees to the professional and scientific standards expected of a proceedings journal published by IOP Publishing.

- **Type of peer review: Double-blind**
Each paper, where the names of authors are deleted, were given to two reviewers. The authors themselves also did not know who review their paper. When a reviewer had accepted and another reviewer had rejected, the paper was given to the third reviewer to see the result of review. The reviewers are experts according to field of the papers.
- **Conference submission management system:** by email ticate@untar.ac.id
- **Number of submissions received:** 512
- **Number of submissions sent for review:** 501
- **Number of submissions accepted:** 217
- **Acceptance Rate (Number of Submissions Accepted / Number of Submissions Received X 100):** 42.38
- **Average number of reviews per paper:** 2.2
- **Total number of reviewers involved:** 27
- **Any additional info on review process:**
- **Contact person for queries:** Bagus Mulyawan, M.M.

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Development of WBS Dictionary and Checklist Based On WBS (Work Breakdown Structure) on Support Facilities in Dam Construction Works For Safety Planning

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Assessment of existing urban drainage system under contemporary rainfall in Tangerang, Indonesia

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Abstract. Flood has been dealing a devastating damage to human civilization yet it even could be exacerbated by climate change which increases the amount of precipitation. The investigation on an area within Tangerang Regency reveals the recent rainfall data set has higher mean and maximum value than the older one. The newly estimated design rainfall is 1.43 times the old design rainfall. Hence the expansion of the drainage channels is required for the existing system can no longer drain the escalated rainfall. Several studies also support the revision of existing drainage systems in order to adapt the new hydrological regime due to climate changes.

1. Introduction

Flood is a perpetual and universal disaster which is yet to be contained. Policy makers, engineers, academicians, and other stakeholders have been putting great effort to handle this issue for flood is capable to inflict heavy damage. Some examples of financial damage caused by flood were:

- Lestari has reported the devastating loss of IDR 6.7 trillion for the flood in Jakarta in 2012 [1];
- Kompas newsportal estimated the loss of IDR 1 trillion for the most recent Jakarta flood in January 2020 [2];
- Another study estimated Jakarta suffered about USD 321 million (about IDR 4.7 trillion using USD 1 = IDR 14,654 conversion rate in May 2020) annually because of flooding [3];
- Wu appraised the economic loss of RMB 6.98 million (IDR 14.33 trillion using 1 RMB = 2053 IDR) for the flood in Lizhong Town in 2006 and RMB 2.2 million (IDR 4.52 trillion) for the flood in Houbai Town in 2015 [4]; and
- Huang reported the economic damage of USD 8.93 million (IDR 130 trillion) due to the flood in Hunan Province in 2008 [5].

Flood keeps recurring although most settlements already have drainage systems designed. Inadequate and erroneous existing design is one of major reason, but recent researches reveal the significance of climate change and urbanization (which results in land use change) [6] [7] as the major contributors. It is important to accurately identify the problem so stakeholders can precisely formulate solutions in order to prevent flood in future.

This study aims to assess if the existing drainage system in a local area is still sufficient to anticipate flood. The objective is achieved by comparing the rainfall data set used to design the existing drainage system with the more recent rainfall data set. Afterwards, both design rainfall and channels dimension are calculated and compared.



2. Case study

The location of the case study is at Pasar Kemis, West Tangerang, Indonesia. The coordinate of the area is $106^{\circ}31'17.28''\text{E}$ and $6^{\circ}12'24.26''\text{S}$ and the study focuses around the main street i.e. Otonom Pasar Kemis Street. The street is a very vital for it provides access for people and cargo to move from and to Pasar Kemis subdistrict where more than 200,000 people live [8]. Unfortunately, flood regularly strikes the area hence damaging many residential houses and infrastructures and putting the economic activities to halt.

Figure 1, **Figure 2**, and **Table 1** display the characteristics of the drainage system in the assessed area. **Figure 1** depicts the map of the drainage network and it shows the drainage channels are positioned at both sides of streets and the general flow direction is northward. **Figure 2** depicts the catchment area for each channel. The number labels in the figure are for **Table 1** where the table presents the design discharge as well as their dimensions.

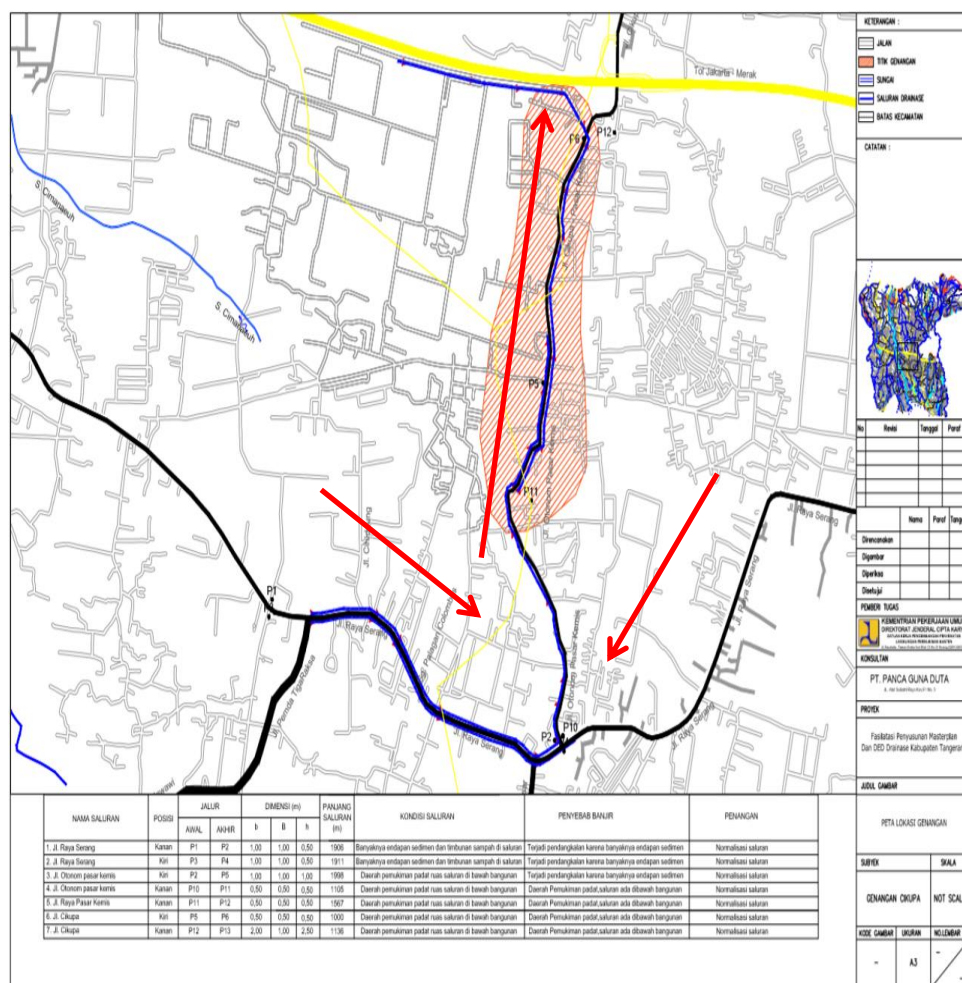


Figure 1. The plan view of the drainage network of Otonom Pasar Kemis Street (with slight modification from original figure) [9]

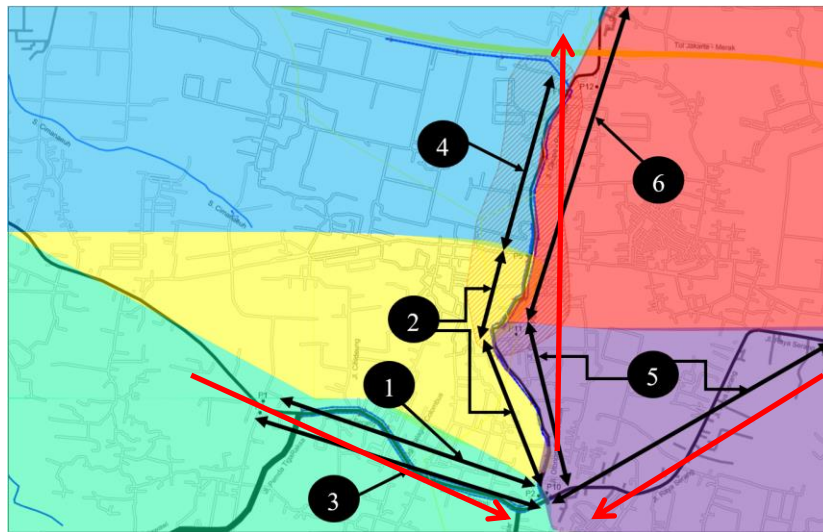


Figure 2. The sketch of catchment area of each drainage channel (based on **Figure 1**)

Table 1. The design discharge and the dimension of the channels [9]

Num	Channel (location)	Q_{design} ($10^{-3} \text{ m}^3/\text{s}$)	b_{design} (m)	h_{design} (m)
1	P1-P2 (Jl. Raya Serang)	89.7	1.0	0.5
2	P2-P5 (Jl. Otonom Pasar Kemis)	179.2	1.0	1.0
3	P3-P4 (Jl. Raya Serang)	89.5	1.0	0.5
4	P5-P6 (Jl. Cikupa)	455.2	0.5	0.5
5	P10-P11 (Jl. Otonom Pasar Kemis)	40.6	0.5	0.5
6	P11-P12 (Jl. Raya Pasar Kemis)	32.2	0.5	0.5

Table 2. The comparison of rainfall used for the existing design and for the design review

Year	Rainfall for the existing design (mm)	Rainfall for the design review (mm)
1982	98.88	
1983	65.49	
1984	76.86	
1985	57.12	
1986	75.93	
1987	92.61	
1988	65.83	
1989	71.44	
1990	68.61	
1991	53.90	
1992	93.23	
1993	94.78	
1994	64.01	
1995	115.68	
1996	131.50	
1997	58.50	
1998	72.50	
1999	93.75	
2000	112.75	
2001	73.50	

Year	Rainfall for the existing design (mm)	Rainfall for the design review (mm)
2002	57.50	
2003	65.00	
2004	86.75	96.00
2005	89.25	87.70
2006	63.00	68.10
2007	79.00	227.50
2008	76.25	82.00
2009	82.00	106.00
2010	100.27	83.40
2011	80.96	83.40
2012		120.00
2013		103.40
2014		112.50
2015		152.50
2016		103.50
2017		162.60
2018		78.00

The precipitation (rainfall) for the existing design were derived from the regional averaged value of rainfall station of Cinangka, Kalen Petung, Petir, and Cadas Sari which were averaged arithmetically. Unfortunately, the whereabouts and other information about the stations are no longer available. The rainfall data used for the design review is derived from Budiarto Curug meteorology station which is positioned at 106°33'50" E and 6°17'12"S at +46 m MSL. The station is located at the southeast of Pasar Kemis. Both data for the existing design and for the design review are presented on **Table 2**.

3. Result and analysis

Firstly, the statistical parameters of rainfall for the existing design and the design review are analyzed. The recent rainfall (2004-2018) are higher in maximum, average, and standard deviation (see **Table 3**). Consequently, the newer design rainfall will be higher than the previous one. Their probability of occurrences are also analyzed by plotting of non-exceedance probability for both rainfall data ($P = i / (n + 1)$; P = non-exceedance probability, i = series, n = population size). **Figure 3** shows the plotting and it clearly points out the trend shift towards heavier rain in the current condition rather than the past.

This finding is consistent with other studies which found the similarly increasing trend of maximum or extreme precipitation such as in Poland [10] or in Denmark [11]. However, this finding must be interpreted with caveat that the trend could differ from one place to others [12] hence further researches must be conducted to determine if the trend of escalating precipitation applies to its surrounding areas. Furthermore, it is very difficult to tell if the trend comes from nature, humans, or sampling variability [13].

Table 3. The comparison of statistical parameters between older and recent rainfall data

Parameter	Rainfall for the existing design (1982-2011)	Rainfall for the design review (2004-2018)
Maximum	131.50	227.50
Average	80.56	111.11
Standard deviation	18.87	41.61
Design rainfall	94.20	134.38

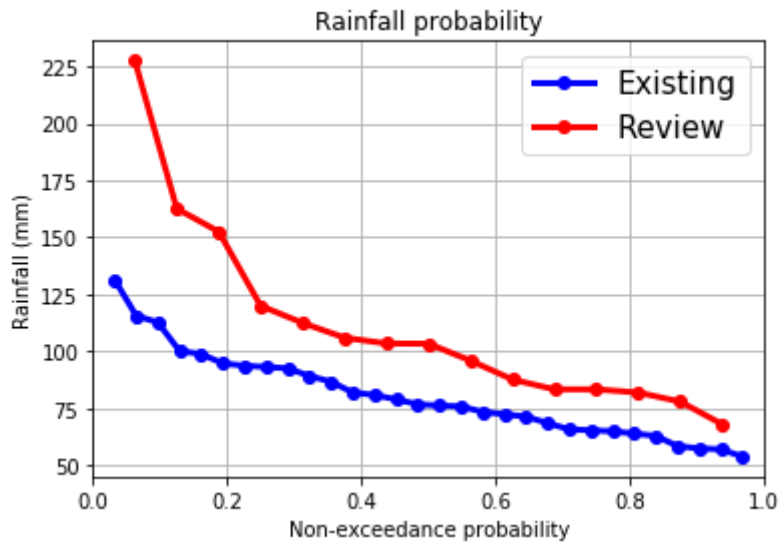


Figure 3. The probability of old and new rainfall data for existing and reviewed drainage system

The approach to obtain the channels' dimension for both design are referred to Indonesia national standard [14]. Firstly, the design rainfall is calculated by frequency analysis. By the regulation of the Public Work Ministry [15], the return period used is 5 years by taking into account the population of the city. The result is presented at the bottom line of **Table 3** which outlines the growth of the design rainfall by 43 % (from 94.20 mm to 134.38 mm).

The consequence of escalating rainfall is the necessity of larger drainage channels' capacity. Manning formula is employed to calculate the required channel's dimension in order to sufficiently drain the incoming flood. The design parameters for the design review are similar to the existing design except for the rainfall data. The results are presented on **Table 4** which indicates the increasing design discharge for the drainage network. It directly translates into the need to increase the dimension of the channels so that they can prevent incoming flood.

Table 4. The difference in the channels' specification between using the older rainfall data and the more recent data

Num	Channel	Existing design			Design review		
		Q_{design} ($10^{-3} \text{ m}^3/\text{s}$)	b_{design} (m)	h_{design} (m)	Q_{review} ($10^{-3} \text{ m}^3/\text{s}$)	b_{review} (m)	h_{review} (m)
1	P1-P2	89.7	1.0	0.5	128.0	1.0	0.6
2	P2-P5	276.0	1.0	1.0	393.7	1.0	1.3
3	P3-P4	89.5	1.0	0.5	127.7	1.0	0.6
4	P5-P6	43.4	0.5	0.5	61.9	0.5	0.6
5	P10-P11	40.6	0.5	0.5	57.9	0.5	0.6
6	P11-P12	32.2	0.5	0.5	45.9	0.5	0.6

4. Conclusion

The existing drainage system in Pasar Kemis (Tangerang) is no longer sufficient to drain the incoming flood under the new hydrological regime. It increases the maximum or extreme rainfall which results in the need to expand the existing drainage channels' dimension. Furthermore, the effect of urbanization has not been taken into account thus the required expansion could be possibly even larger.

It is still technically difficult for certain to attribute the trend of the escalating maximum rainfall to climate changes and more researches are required to confirm this. Many studies around the world have

already been performed which indicate the need to increase the capacity of the current urban drainage system due to climate changes [16] [17] [18]. However, there are still so many uncertainties about the relation between climate changes and precipitation characteristics. Climate changes could increase extreme or mean precipitation such as in this paper, but it also could change its duration and temporal distribution throughout a year and it could change other things yet to be hitherto revealed. Although the relation between them is still vague at best, incorporating the effect of climate change in designing drainage system is very important to protect people from flood.

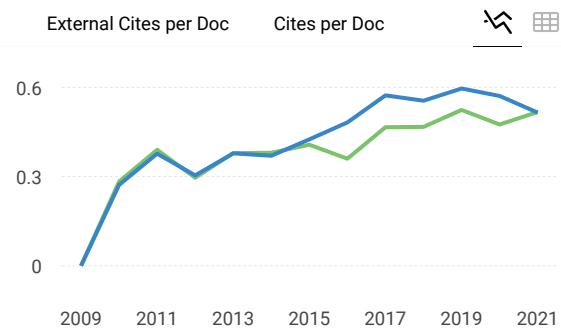
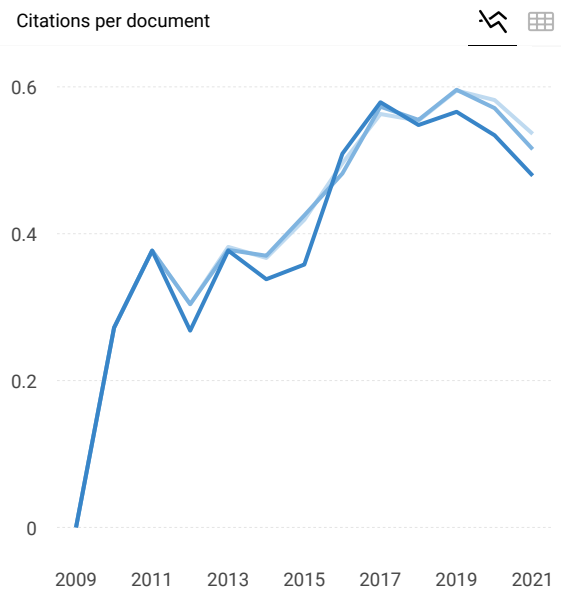
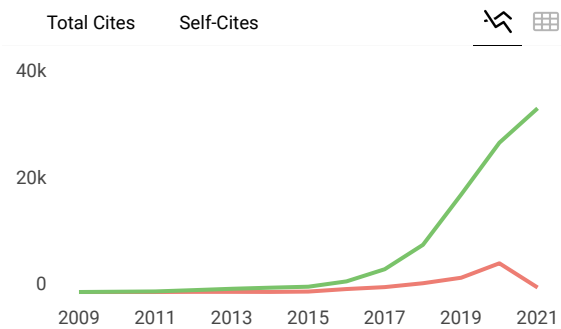
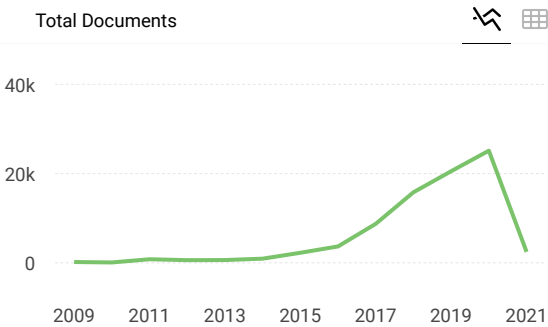
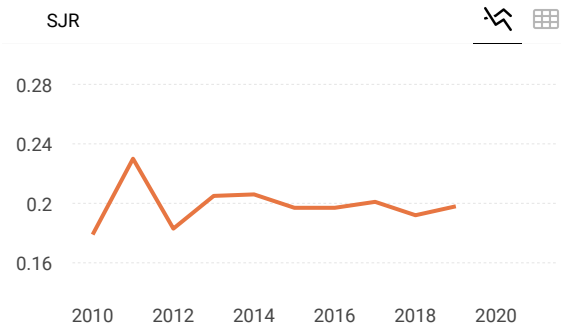
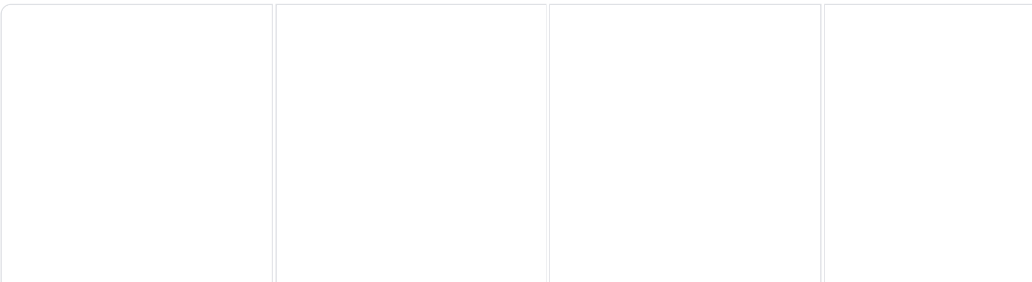
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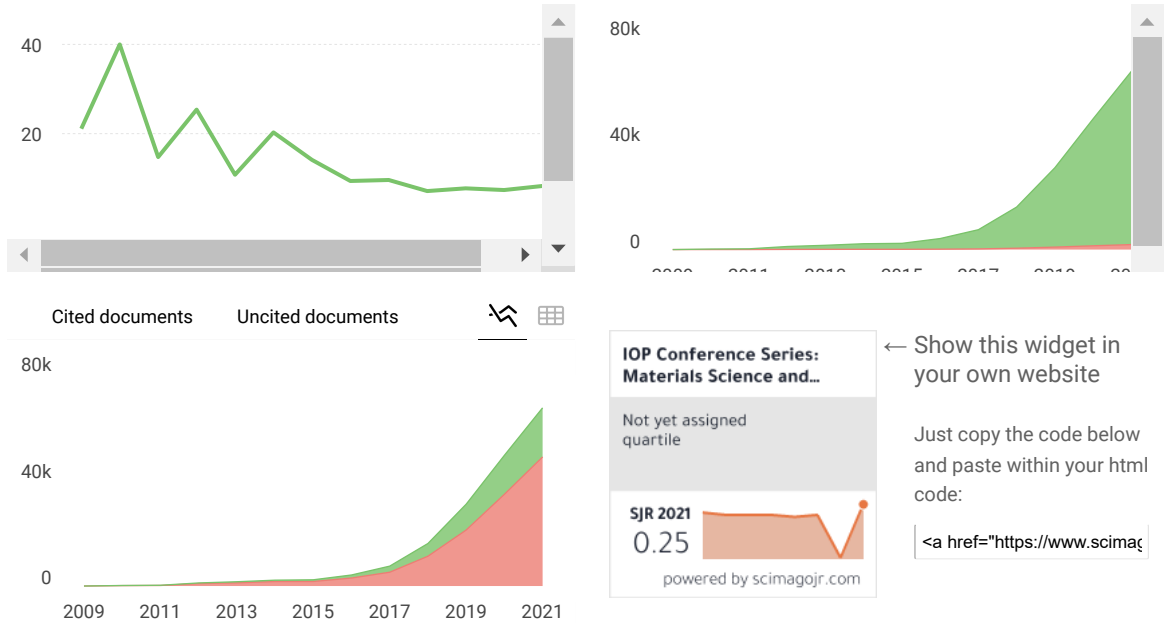
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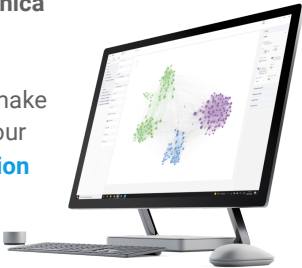
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