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Handling Channel Drainage/Culverts on the Samarinda Seberang – Sanga Sanga Road Section

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Abstract: Jalan Samarinda Seberang – Sanga Sanga is route connecting two areas in East Kalimantan. However, the condition channel drainage and culverts along the section road This often experience problems that impact on smoothness Then cross, comfort user road, and potential damage infrastructure road. Problem general covering accumulation sediment, narrowing channel, damage structure culverts, and lack of routine maintenance. Improper handling adequate to issue drainage This can result in water puddles at the moment season rain, road erosion, and shortening age use road. The method used covering survey field, analysis hydrology simple, and study literature related standard drainage road. Handling results expected can give recommendation concrete technical matters, including repair structure damaged culverts, normalization dimensions channel drainage, dredging sediment in a way periodically, and maintenance program implementation preventive. Implementation recommendation This expected can increase function drainage optimally, reducing risk damage the road, and guarantee sustainability infrastructure road on the road Samarinda Seberang – Sanga Sanga.

Keywords: Culvert; Drainase; Samarinda Seberang; Sanga Sanga

1. Introduction

Management of runoff and rainwater through provision facility good and safe drainage have position strategic in development road, especially on the Samarinda Seberang – Sanga Sanga road section(Suripin, 2004). Management (handling) of drainage that is not Good often become base problem, then when feeling safe and comfortable user road No fulfilled. Management drainage that is not well, often arise and relate with social, economic and cultural problems of the community (Works, 2006).The suboptimal condition of drainage and gutters impact significant to various aspects. In terms of direct, problem This often cause puddles on the surface the road, which is not only bother smoothness Then cross but also has the potential cause accident (Novira & Utomo, 2019). Further again, constant waterlogging and stagnant water flow controlled can speed up damage structure pavement the way, like the emergence holes, cracks, or even subsidence on the road body (Highways, 2017). Damage infrastructure This naturally will need cost big improvement as well as bother activity public in term long (Sutarto, 2010). Understand matter t said, then need held Handling repeat for drainage on the section the with "Handling Channel Drainage/Culverts on the Samarinda Seberang – Sanga Sanga Road Section".

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2. Materials and Methods

2.1. Study Area

Based on location geography subdistrict Samarinda across climate tropical wet with average rainfall The monthly rainfall is 148.91 mm and the average daily rainfall is 148.91 mm. Rain around 9 days per month. Rainfall highest occurred in November, namely as much as 279 mm with 16 days Rain during a month, while rainfall Rain lowest happened in the month February that is as much as 85 mm in 5 days Rain during a month. Scope the work to be done implemented make map section road Samarinda Seberang – Sanga sanga 1 : 5000, with wide Review ± 13000 Ha (Siregar & Nasution, 2020).

Dotted reject the handling process drainage based on the concept of sustainable development (development with an environmental perspective) environment, especially in frame conservation source water power so that surface water is accelerated flowed and absorbed, then the procedure Handling plan parent drainage on the road road Samarinda Seberang – Sanga sanga must can reach objective achievement results proper masterplan handling with Technical handling provisions with pay attention to factors that influence like intensity rain, catchment area, growth area micro, environmental factors as well as product others, so that can functioning as runway Handling surface water control so that it does not disturbing activity society and can give benefit for activity life man (Asdak, 2010).

Furthermore as consequence from draft base said, then must also pay attention to factors general related such as socio- economic factors, growth population, urbanization, needs real and priority region, balance of development in city, availability of land use, such as physical development city in a way economical (Rosyidi, 2008).

Related with concept this then effort conservation source water power also needs to be considered, because in principle RIS is drainage must can describe concept policy pattern rainwater management so that more many absorb into land and not many wasted as eyebrows surface among others with make building infiltration artificial, pond landscaping, landscaping and so on (Arsyad, 2006).

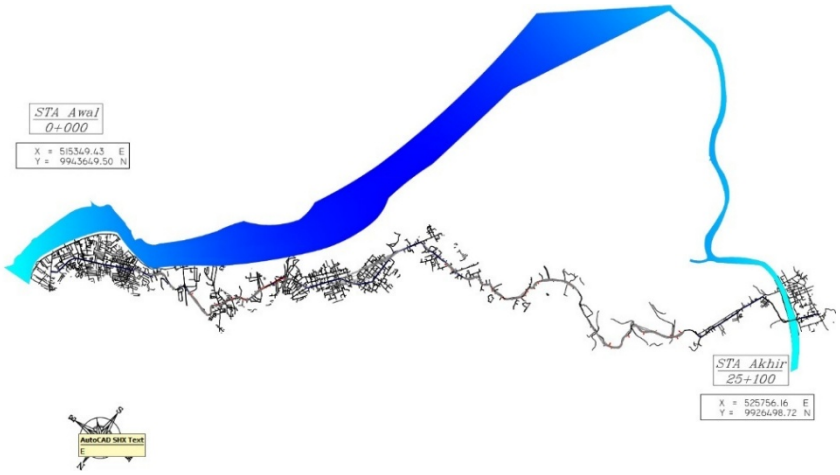

Figure 1. Study Area

2.2. Research Method

Based on the previous discussion, it can discussed for get desired outcome on goal handling that is results topography, function land which is land that will be used for facilities, infrastructure and other including land settlements, agricultural areas, schools, places of worship, and other facilities general. And from results discussion can outlined (Fang, 2010).

1. Topography

   Based on topography, then the city area Samarinda is located across at the height between 0-200 meters above sea level, and almost 24.17% are at an altitude of 0–7 meters above sea level, generally

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located near the Mahakam River 41.19% are located in height 7–25 meters above sea level, and 32.48% are located at an altitude of 25–100 meters above sea level

2. Rainfall Intensity Analysis Results

From the results collection of related data with objective review Handling channel drainage road section Samarinda Seberang and surrounding areas in Samarinda, rainfall data Rain daily maximum used is from 2010 to with 2019, the following this Bulk Analysis Results Rain average maximum:

a. Bulk value average rainfall (X) = 198.8 mm
b. Standard deviation (S) = 109.46 mm
c. Coefficient of variation (Cv) = 0.242
d. Asymmetry coefficient (Cs) = 0.975
e. Kurtosis coefficient (Ck) = 4.103

Table 1. Rainfall Calculation Plan

Repeat Words	2	5	10	25
Xτ = R	438,531	534,564	598,412	680,769

3. Handling Calculation Results Dimensions Channel

From the results comparison capacity channel with flow rate, showing that For a number of channel drainage with capacity allowed channels more small compared to with flow rate, with thus existing dimensions need enlarged. Then it will planned form cross section drainage shaped four rectangle display that can seen as following (Subekti & Gunawan, 2012).

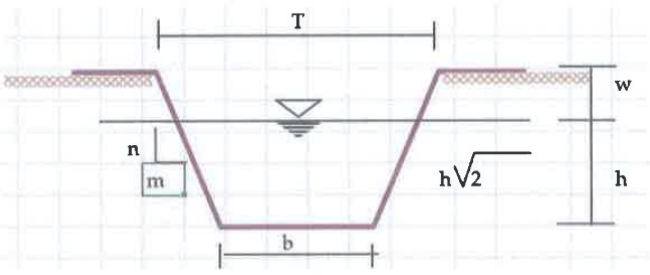

Figure 2. Shape Dimensions Repeat Cross Section Drainage

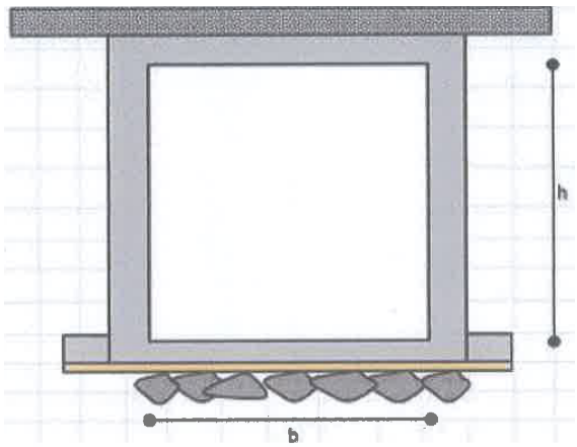

Figure 3. Shape Dimensions Culvert

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3. Results

3.1. Channel Dimension Calculation

In general planned debit calculation use formula rational modification and dimensions channel counted with Manning's formula (Mays, 2001; Wirjosoekarno, 1995; Putra & Yuwono, 2018). Formula rational the is:

$$Q = 0.002778.C..Cs.IA$$

Where :
Q = Planned Discharge (m^3/sec)
C = Coefficient flow / runoff
Cs = Coefficient Correct
I = Intensity rainfall Rain (mm/hour)
A = Area of the region drainage (ha)

Debit plan in task This planned on the road raya with assumed length of 7.65 km The same with the length of the river with 5.4 m wide.
So that obtained :

A = 7650 m x 5.4 m = 41,310 m^2 = 4,131 ha
I_2 = 6.973 mm/hr

Determine coefficient Runoff Coefficient, C) with formula :

$$C = 0.9.1 +(1- I) Cp$$

Where :
Cp = Coefficient overflow for area No waterproof
I = Comparative value to the head flow

Cp values vary with characteristic original land, slope and AMC conditions. In land use this planned on housing (density) medium-high) with characteristics of 40 houses/ha. So that can used recommended C and I values as in the following table:

Table 2. Runoff Coefficient and Watertightness Comparison Value

Land Use	Characteristics	Runoff Coefficient Cp	Flow Density Comparison Value (I)	Description
Business and shopping centers		0,9	100%	
Industry	Full	0,8	80%	Compare the flow impervious with the developing area which CN* = 85
Residential (medium-high density)	20 houses/ha	0,48	30%	
	30 houses/ha	0,55	40%	
	40 houses/ha	0,65	60%	
	60 houses/ha	0,75	75%	
Residential (low density)	10 houses/ha	0,4	< 20%	
Parks	Flat Area	0,3	0%	
Parking		0,95	100%	

C = 0.9.I + (1 - I) Cp
C = 0.9(0.6) + (1 – 0, 6) 0.65 = 0.8

If connected with wide catchment area (A), suggested correction factor Cs is :

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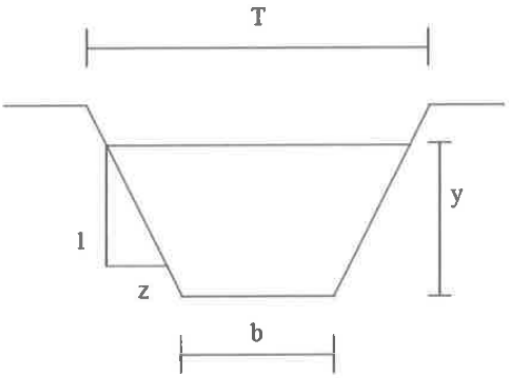
A < 20 ha Cs = 1
20 ha < A < 50 ha Cs = 1.05
50 ha < A < 100 ha Cs = 1.10
100 ha < A Cs = 1.15
So that for handling road with area of 4,131 ha used Cs value = 1.

Debit plan for period 2nd birthday
Q = 0.002778.C .Cs.IA
Q = 0.002778 x 0.8 x 1 x 6.973 x 4.131 = 0.064 m³/sec

Drainage Dimensions Road
On drainage this planned cross section channel trapezium shaped. Channel dimensions counted with Manning's formula (Sutarto, 2010)
Q = V x A
Q = $\frac{1}{n}$x R⅔ x S½ x A
Calculation dimensions channel :



Calculation Wide Peak (T)
T = b + 2zy
Plan channel with T = 0.8 m and b = 0.4 m
So that :
0.8 = 0.4 + (2.z.0.8)
0.8 = 0.4 + 1, 6.z
0.4 = 1, 6.z
Z = $\frac{04}{16}$= 0.25 m

Calculation wide cross section (A)
A = (b + zy) y
With ; A = Cross-sectional area
y = depth channel
plan channel with depth y = 0.8 m
so that :
A = (0.4 +0.25. 0. 8) 0.8
A = 0.48

Calculation around wet (P)
R = $\frac{A}{P}$= $\frac{048}{2125}$= 0.226 m

Trial and Error Test for Q-plan ≤ Q-design
Q = V x A

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Q = $\frac{1}{n}$x R⅔ x S½ x A
Q = $\frac{1}{0020}$x 0.226⅔ x 0.00023½ x 0.48 = 0.136 m³/ second

Debit plan for period 2nd birthday:
Q = 0.064 m³/ sec

Q-plan ≤ Q-design ……(OK)
0.064 ≤ 0.136 ……(OK)

3.2 . Culvert Calculation

Calculation culvert aiming for determine size and capacity channel lower land (culvert) so that it is able to flow water discharge safe and efficient, especially moment Rain torrential or flow peak. Slope culvert between 0.5% – 2% with consideration of other possible factors result in the occurrence sedimentation erosion water enters the part expenditure (Darsyah, 2020).

Calculation of culvert dimensions and energy loss.
Building passerby culvert form aspect four.
Q-Channel = 0.40 m³/s
V_1 = Speed upstream channel = 0.60 m/s
V_2 = Speed in the culvert = 1.3 m/s
V_3 = Speed downstream channel = 0.6 m/s
g = Perc. Gravity = 9.81 m/s²
n = Coefficient Manning's roughness = 0.0178

Cross-sectional area Culverts
A = $\frac{Q}{V_2}$
= $\frac{040}{13}$ = 0.31087 m²

The height of the water surface of the culvert (h) can be calculated :
A = bxh (Assumption h = b)
0.31087 = h x h
h = 0.56 m

So, width culvert:
b = 0.56 m

Around Wet:
P = b + 2h
= 0.56 + 2 x 0.56
= 1.67267 m

Fingers Hydraulic
R = $\frac{A}{P}$
= $\frac{031087}{16773}$ = 0.185852 m

Channel Base Slope
S = $\left(\frac{V^2 \, x \, n}{R^{2/3}}\right)^2$

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$= \left(\frac{\mathbf{13\ x\ 0018}}{\mathbf{0326}}\right)^{\mathbf{2}}$ = 0.0050 = 0.50%

Lost Energy :

hc = 0.50 $\frac{(\boldsymbol{V^2 x\ V^1})^2}{\mathbf{2g}}$

= 0.50 $\left(\frac{\mathbf{13\ 060}}{\mathbf{2\ x\ 981}}\right)^{\mathbf{2}}$ = 0.0125 m

Consequence Friction

Coefficient value rudeness strickler (k) for concrete 70

hf = $\frac{\boldsymbol{Cf\ V_2{}^2}}{\mathbf{2\ g}}$ Cf = $\frac{\mathbf{1}}{\boldsymbol{K}}$ R ⅔ = $\frac{\mathbf{1}}{\mathbf{70}}$ 0.186 ⅔ = 0.011 m

= $\frac{\mathbf{0011\ x\ 13}^{\mathbf{2}}}{\mathbf{2\ x\ 981}}$ = 0.0009 m

Consequence expenditure

ho = 0.11 $\frac{(\boldsymbol{V^2 x\ V^1})^2}{\mathbf{2g}}$

= 0.11 $\frac{(\mathbf{13\ x\ 060})^2}{\mathbf{2\ x\ 981}}$ = 0.0027 m

HTotal = hc + hf + ho

= 0.0125 + 0.0009 + 0.0027

= **0.0162 m**

4. Discussion

The problem drainage on the Samarinda Seberang – Sanga Sanga road section is complex and impactful issues big to continuity function infrastructure road as well as comfort and safety user road (Subekti & Gunawan, 2012). Analysis results in study show that dimensions channel existing not yet adequate in accommodate flow discharge, esp moment period rainfall rain high. This is aggravated by conditions channels that experience narrowing, accumulation sediment, and damage physique culvert (Novira & Utomo, 2019; Darsyah, 2020). From the results planned debit calculation use formula rational modification, known that for period 2 year anniversary, planned debit of 0.064 m³/ second, while results design channel show capacity up to 0.136 m³/ second, which means dimensions channel new capable accommodate planned debit with good (Triatmodjo, 2008). Cross section channel trapezoidal shape gives efficiency sufficient flow Good in condition open (Wirjosoekarno, 1995). Calculation culvert show that with flow rate of 0.40 m³/s, dimensions culvert rectangle four with width and height 0.56 m rated adequate (Highways, 2017). Slope base channel by 0.50% indicates flow enough gravity for prevent sedimentation without cause erosion excessive. Calculation lost energy consequence friction and turbulence, namely of 0.0162 m, is classified as small so that no give influence significant to efficiency flow (Gupta, 2001).

5. Conclusions

From the results Handling got that reason the occurrence puddle of water existing channels no the capacity of the flow rate that occurs with flow rate for every channel drainage varies between 0.03414 m³/ sec up to 1.30542 m³/ second, while capacity existing channels also vary between 0.101 m³/ second up to 1,312 m³/ second. And from results calculation this obtained dimensions capable channels accommodate and channel the flow of water that occurs in the channel drainage section road Samarinda Seberang – Sanga – Sanga is this is minimum width (b) = 1 m, height minimum water level (h) = 0.65 m, height minimum guard (w) = 0.35 m, height minimum channel (H) = 1 m.

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