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DESIGNING OF OPEN CHANNELS AND CLOSED CHANNELS FOR DRAINAGE FACILITIES IN AIRSIDE

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Abstract

Drainage facilities are one part of the airside facilities that are important to ensure the safety of the airside area when weather changes occur. This study aims to make drainage that can be carried out to ensure the safety of the airside area from stagnant water. The calculation of airside drainage refers to the planned drainage calculation rules so that the drainage channels can design accordingly so as not to interfere with the operation of other facilities. In the design of drainage work, the material requirements for making open and closed channels at Dewadaru Karimun Jawa Airport must be precisely designed so that the work takes place by the specified planning and quality standards. The research uses a mixed methodology that the exploratory study by conducting a literature study that compares observation. The analysis starts by finding the volume for each work item based on Standar Nasional Indonesia (SNI) 2052-2017, a national iron and concrete standard. The result shows the excavation of soil for making channels, the total volume required is 880.24 m^3, the importance of sand is 40.76 m^3, the book of substantial rebates of a mixture ratio of 1: 2: 3 is 23.82 m^3, and the book of K300 Concrete works for U-Ditch type C channels (100 x 100) is 116.29 m^3. For the needs of the required iron volume of 16,415.09 kg, formwork of 1,408.45 m^2, stone river masonry size 100 x 100 by 139 m^3, stone river masonry size 50x50 amounted to 42.05 m^3, and the volume of plastering work of the channel amounted to 192.46 m^2. The conclusion of this study is the accuracy of design required to calculate each work item's volume.

Keywords: *airport, channels, drainage, designing, facility*

Introduction

Dewadaru Karimun Jawa Airport is the gateway for the arrival of domestic and foreign tourists to Karimun Jawa Island to support the safety and security of aviation service users. Then the fulfillment of facility standards on the air side, especially drainage, must be done. Based on the Regulation of the Directorate General of Civil Aviation Number: SKEP/77/VI/2005 concerning (Direktorat Jenderal Perhubungan Udara, 2005) Technical requirements for the operation of airport engineering facilities, which reads: drainage facilities are one part of the airside facilities that are important to ensure the safety of the airside area when weather changes occur (Almahera et al., 2020). The calculation of airside drainage refers to the rules of drainage calculation in general (Safriani et al., 2022). In the planning, we need to design the drainage channels so that they do not interfere with the operation of other facilities (Becker et al., 2018). The drainage system is a series of water buildings that reduce or remove excess water from an area or land to function optimally(Jifa et al., 2019).

The airport area requires rapid water absorption and an integrated drainage system. Water on the surface must immediately flow into the waterways so that puddles do not occur (Pangesti et al., 2022). The runway, taxiway, and apron areas must be free of standing water for logging safety (Republik Indonesia, 2009). A well-designed drainage system is essential for operational security and the efficiency and durability of asphalt roads (Sugiyarto, 2017). Inadequate drainage facilities can cause flooding, endangering air traffic, erosion, saturation, and weakening of asphalt road foundations (Anugrah et al., 2018). With the calculation of building material needs, it will produce building construction according to standards (Djaelani & Sinambela 2021). Based on the background described, it is necessary to make specific calculations regarding the material requirements for implementing open and closed channels in Dewadaru Karimun Jawa airport. This study's benefit is determining the material needs in making open and closed channels at Karimun Jawa Airport.

Methods

The research was conducted in Dewadaru Karimun Jawa Airport for six months during the job training activity. First, this research was exploratory, so we starting with a literature study that compared observation results (Tashakkori & Creswell, 2007). The literature study collected data related to written regulations needed to calculate materials. Furthermore, observations were made at Dewadaru Karimun Jawa Airport to determine the extent of drainage required.

Data Collection Methods consist of primary data and secondary data. The Primary data is directly obtained through observation and surveys in the field. The Preliminary data needed for this calculation is a physical survey, the location point of the plan to make an open and closed drainage system at Dewadaru Karimun Jawa Airport. Secondary Data result in detailed drawings of the design of the open and closed channels to be worked. The data was sourced from building and runway units of Dewadaru Karimun Jawa airport. However, this research is limited to calculating raw materials and describing the location of plans for closed and open channels. The author hopes future researchers can carry out calculations related to rainfall. Analysis of this research consists of six stages: 1. Theory, 2. Hypothesis, 3. Data Collection, 4. Findings, 5. Hypothesis confirmed or rejected, 6. revision of Theory.

Stage 1 is to collect theoretical theories from several Indonesian national standards related to concrete, sand, buildings, and pavement. The second stage is to make hypotheses, namely, estimating what materials are needed and the amount. Furthermore, the data collection stage is carried out by observing the area data of the Dewadaru Karimun Jawa airport and observing which areas will be built with open and closed channels. The fourth stage calculates the material of the place to be built and makes the design of the open and closed channels to be made. The next step is to find the least amount of how much building materials needs are needed. For the revision stage of the theory, further research can be done after the channel is built and tested on rainfall, whether there is flooding or the calculations made are fixed if there is inundation, it is necessary to revamp the drainage channel area.

Results and Discussions

There are eight steps for calculating material requirements for each job (Amran et al., 2022). First, Soil excavation works where the volume of each channel making, making U-ditch box culvert S size 100 x 100, making U-ditch type C size 100 x 100, stone drainage times size 100 x 100, stone drainage times size 50 x 50 (type 1), stone drainage times size 50 x 50 (type 2) and masonry channel size 30 x 30.

After adding up, the total volume of soil excavation is obtained. Second, fine aggregate sand works by calculating the volume of fine aggregate sand. Third, Rebate work concrete mix 1:2:3. Next, the U-Ditch type C (100 x 100) to measure K300 concrete volume (Falah, 2019). The fifth step is ironing, where we calculate the required volume of iron in this step. Sixth, Maintenance of formwork volume needs. Seventh, the stone drainage works times size 100 x 100, where we calculate the volume of stone drainage pair times, and the last stone drainage works times size 50 x 50, by calculating the volume of stone drainage pairs times the size of 50 x 50. Those eight steps can be shown in figure 1 below.

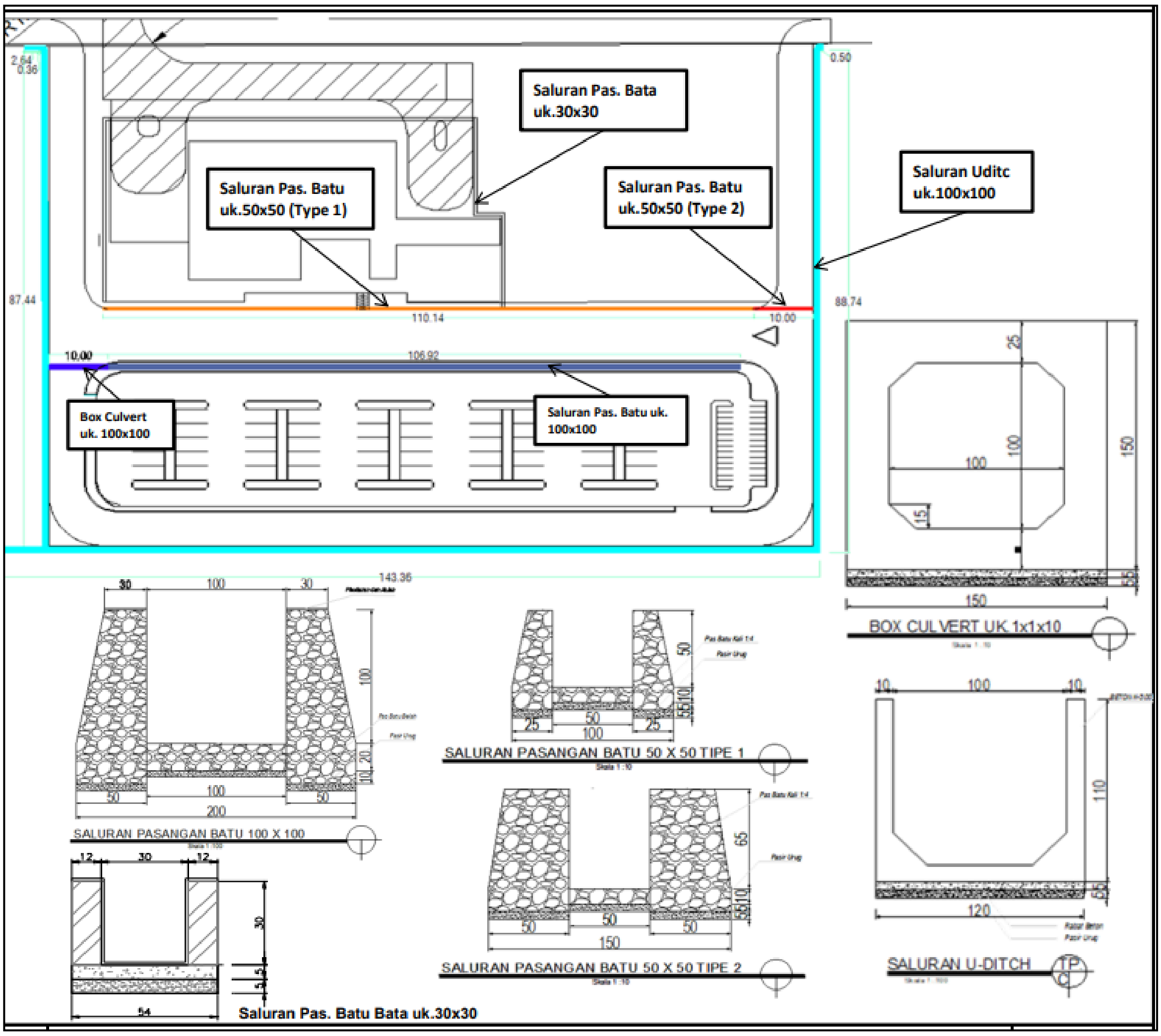

Figure 1. Design drawings obtained

Calculate the volume of excavation work by adding the length, width, and height of each channel, along with details of each volume of work (Falah, 2019). Making culvert box excavation measuring 100 x 100 with a volume requirement of 12 m^3, U-ditch Type C excavation measuring 100 x 100 with a volume requirement of 484.56 m^3, River stone drainage excavation measuring 100 x100 with a volume requirement of 279.99 m^3, River stone drainage excavation size 50 x 50 (Type 1) volume requirement of 71.59 m^3, Excavation drainage stone river size 50 x 50 (Type 2) volume requirement of 12 m^3 , Excavation of masonry channel size 30 x 30 volume requirement of 22.10 m^3. So, the total excavation volume is 880.24 m^3, requiring 211 times transportation using a dump truck with a capacity of $4m^3$ or 121 times transporting dump trucks with a capacity of $7m^3$ (Badan Standarisasi Nasional Indonesia, 2017).

Calculate sand needs by multiplying each channel's length, width, and height. Box Culvert manufacture size 100 x 100 requires a volume of 0.75 m^3, manufacturing U-ditch Type C size 100 x 100 requires a volume of 19.38 m^3, making river size stone drainage 100 x 100 requires a volume of 10.69 m^3, stone drainage times the size of 50 x 50 (type1) requires a volume of 5.51 m^3, stone drainage times the size of 50 x 50 (type 2) requires a volume of 0.75 m^3 and masonry channel size 30 x 30 requires a volume of 3.68 m^3. The total volume requirement for sand is 40.76 m^3, assuming nine times transportation using a dump truck with a capacity of 4 m^3 and five times transportation using a dump truck with a 7 m^3 volumes.

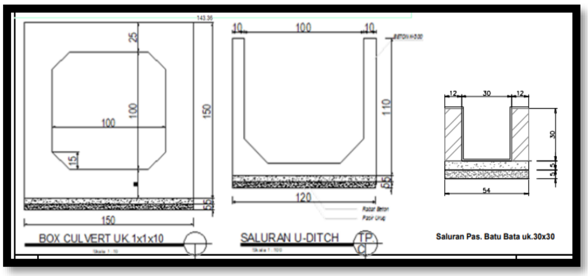

Figure 2. Concrete Rebate Work 1:2:3

Calculate the volume requirement of concrete rebate work with a mixture of 1:2:3 for manufacturing box culvert size 100 x 100 of 0.75 m^3. Manufacturing the U-ditch type C size 100 x 100 of 19,382 m^3 and 30 x 30 masonry channel of 3.68 m^3. The total volume requirement of the substantial rebate is 23.82 m^3, for a ratio of 0.5 water needs per m^3 of cement of 384.62 kg, sand 269.23 kg, gravel 1153.85 kg, and water of 3727.3 liters.

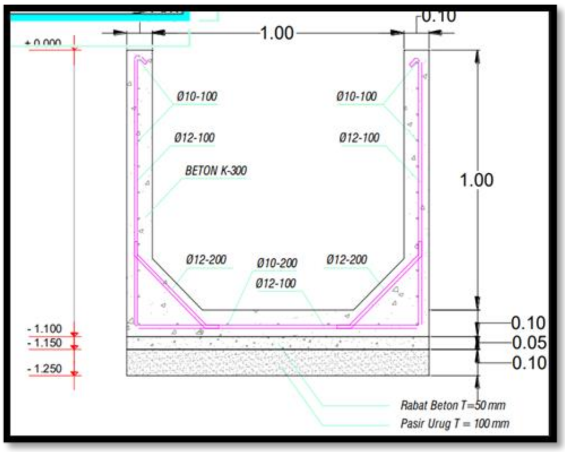

Figure 3. K300 Concrete Works

Calculate concrete volume requirements K300 by multiplying length, width, and height. For Type C U-ditch channel size 100 x 100, a volume of 116.29 m^3 is required. Details of cement needs of 47071.2 kg, sand 91878.1 kg, gravel 112407.46 kg, and water 22748.3 liters.

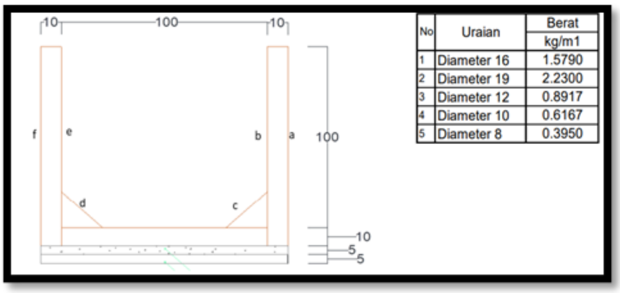

Figure 4. Ironing Works 1

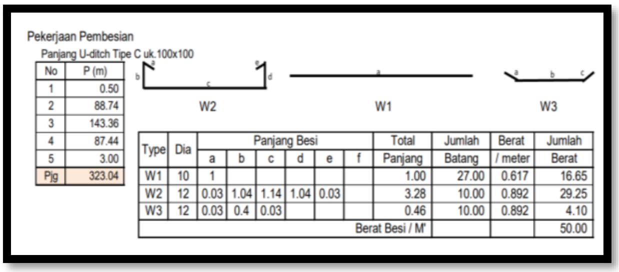

Figure 5.Ironing Works 2

The total need for iron with diameters of 16,19,12,10, and 8 is 16,415.09 kg.

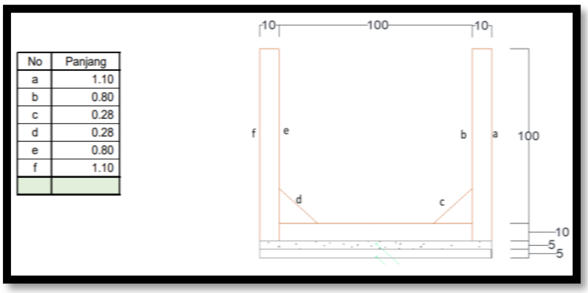

Figure 6. Formwork Work

The total volume requirement of inner, outer formwork, and U ditch channels is 1,408.45 m^2. This area requires 482 sheets of phenolic plywood measuring 122 x 244 cm.

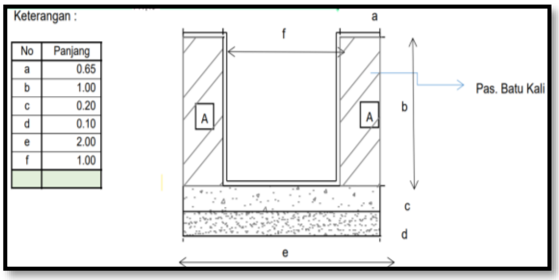

Figure 7. River Stone Drainage Work100x100

The total volume of river stone drainage pairs measuring 100 x 100 is 139.00 m^3 for the needs of river stone 152.9 m^3, sand 72.28 m^3, and cement 22,657 kg.

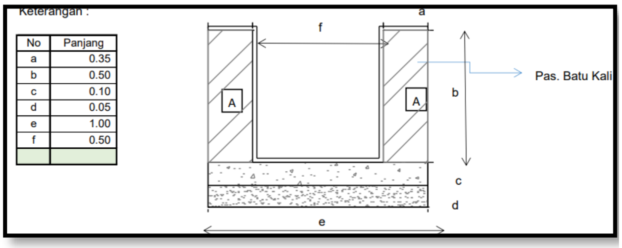

Figure 8. River Stone Drainage Work50x50

The total volume of river stone drainage pairs measuring 50 x 50 is 42.05 m^3 for the needs of river stone 46.26 m^3, sand 21.87 m^3, and cement 22,657 kg. For the needs of stucco work volume with a dose of 1 pc: 4 ps of 192.46 m^2, Requires cement of 1361.79 kg and sand of 3.27 m^3. The purpose of drainage at the airport is to maintain the carrying capacity of the soil by reducing water entry, keep the runway (runway) and shoulder runway (shoulder) not flooded with water that can endanger flights, and keep the entire airport area, including the terminal building from being flooded (Wiswakharma, 2017).

According to regulation of public works regulation No. 12 of 2004, there are several requirements in the manufacture of open channels and closed channels. Open channel requirements include 1. Channel-shaped 1/2 circle, with a minimum diameter of 20 cm, 2. The minimum channel slope is 2%, 3. The minimum channel depth is 40 cm. 4. Building materials: clay, concrete, natural stone, and river stone (Peng, Yu, Zhong, & Dong, 2022). In comparison, there are several requirements in making closed channels: 1. The channel is equipped with control holes at each distance of at least 10 meters and at every turn, 2. Minimum channel slope 2%, 3. Minimum channel depth 30 cm, 4. Building materials include PVC, clay, concrete, brick, and river stone (Kementerian Pekerjaan Umum dan Perumahan Rakyat, 2014).

Conclusion

After calculating the material requirements for making open and closed channels at Dewadaru Karimun Jawa Airport, the author can conclude that accuracy and accuracy are needed to calculate each work item's volume. So, it is expected that the results of the drainage canal construction workers are on the initial planning of the work and the quality that has been determined. This work also aims to meet the standards of the airside area supporting facilities available at the airport. It is expected that the movement of passengers using air transportation services can be appropriately served without any disruption to flight operations sourced from inadequate supporting facilities. Suggestions that can be given for making open and closed channels at Dewadaru Karimun Jawa airport require strict supervision of work related to technical specifications and building materials needed so that the work can run smoothly and on time and the maximum results of the outcome obtained.

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