# ANALYSIS OF FLOATING HOUSE PLATFORM STABILITY USING POLYVINYL CHLORIDE (PVC) PIPE MATERIAL

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# Background

1. Indonesia is a country that has a water area of 70% of the total area of Indonesia.
2. The high demand for strategic land-to-build, makes the price of land more expensive. Various efforts were made to obtain land to build houses for shelter, one of them by way of beach reclamation or pond hoarding.
3. The area of the pond that was originally functioned as a water catchment area, then became new land-land, so that bad for the environment such as the occurrence of floods due to lack of recharge area.

Based on the description of the background, this study offers the concept of a house by building without reclamation or changing the physical form of the environment is with Floating house concept. The platform material from the floating house to be discussed in this study is to use PVC Pipe (*polyvinyl chloride*).

# Problem Formulation

There are three research questions.

1. How to calculate the floating house platform foundation structure's stability by using PVC pipe material toward the structural weight laying above.
2. Why is the connection system among PVC pipe materials established as a floating platform structure component.
3. How is the floating house cost plan analysis using PVC pipe material as a floating platform.

# Research Methode

## 1. General Data

The Building area is 8 m x 10 m (80 m2), with 3.5 m high building (Sloof Structure - Ringblock) and 2.5 m (Structure of the horses). Types of Platform Foundation with PVC Pipe are with floating system.

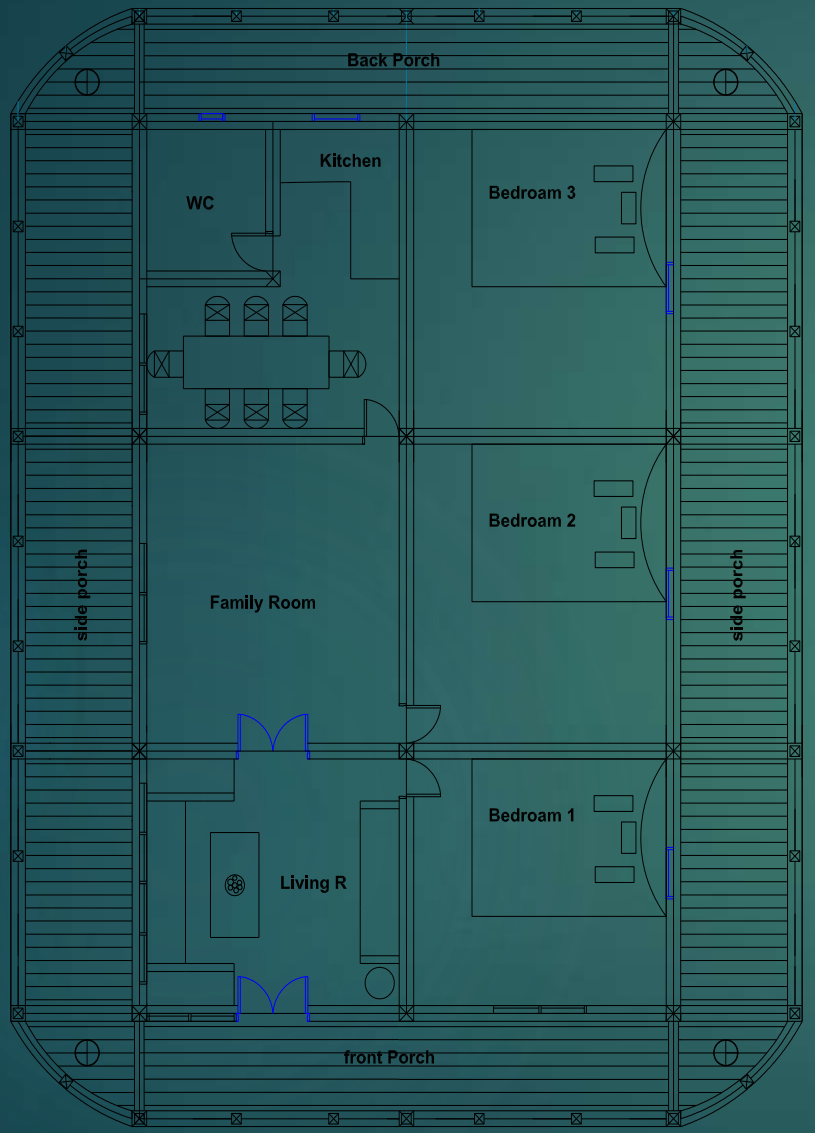
## 2. Upper Structure Data

- Sloof structure, ironwood (15 cm x 15 cm)
- Column structure, cold formed steel ( I.150 mm x 150 mm x 50 mm )
- Ring block structure, cold formed steel( I.150 mm x 150 mm x 50 mm)
- Wall, kalsiboard (partisi)

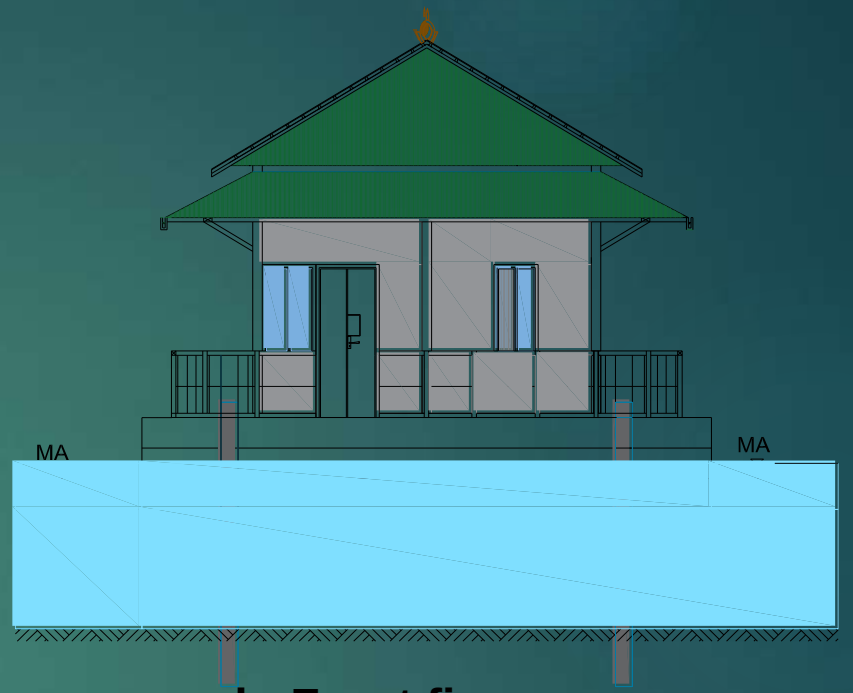
## 3. Bottom Structure Data

- PVC pipe diameter (30 cm)
- Frame platform beam using ironwood (5 cm x 7 cm)
- Conection using bolt 3 cm and anchor 22 cm

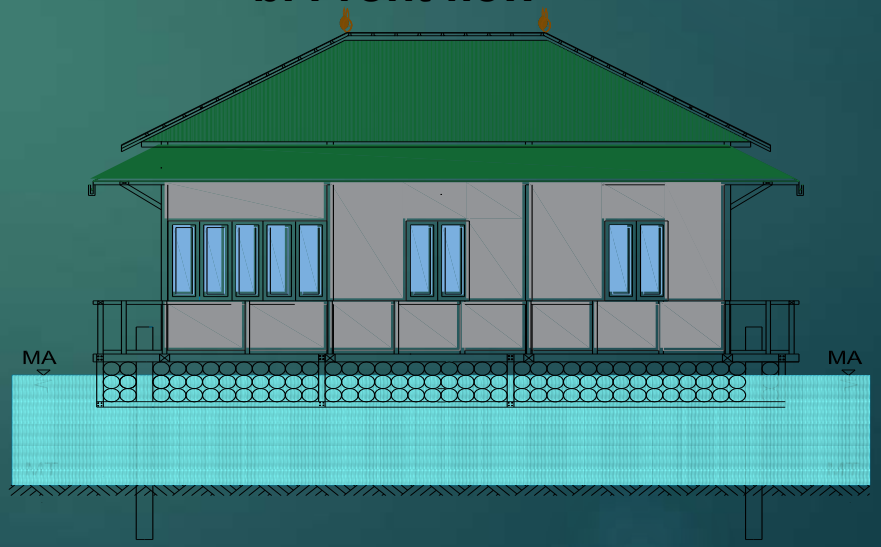
# 2. Floating House Plan




a. Floor plan (Type 80)



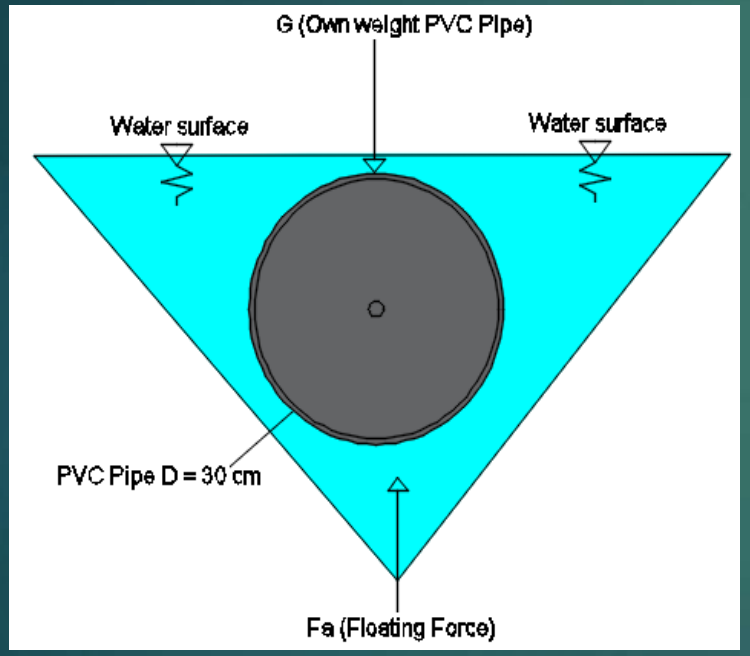

b. Front fiew




c. Side fiew

# Result and Discussion

## 1. Buoyancy Force with Completely Submerged (Fa)




$$Fa = (\pi.d^2/4).\rho.g.l$$

Where:

| | |
|---|---|
| Fa | : Buoyancy Force with Completely Submerged (N) |
| ρ | : Fluid specific mass ($kg/m^3$) |
| d | : *platform* diameter |
| π | : 3,14 |
| g | : Specific gravity ($m/s^2$) |
| l | : *platform* length (m) |

# 2. Upper structure weight analysis

Furthermore the load was simulated in a structural model using SAP2000 V.16 software to calculate the total weight of the structure.

| Output CaseText | Globa FX Kgf | Global FY Kgf | Global FZ Kgf | Global MX Kgf-m | Global MY Kgf-m | Global MZ Kgf-m |
|---|---|---|---|---|---|---|
| Comb All | 0,000002 | -0,0000003 | 44557,8 | 289620 | 15524,59 | 0,000001 |
| Comb All | -40 | -2900,26 | 21610,26 | 140462 | -32102,7 | -2324,19 |

**Structure weight caused by working load = 445.578 Newton**

# 3. Sub structure weight analysis

**Platform frame weight** **= Live load + Dead Loda**

**= 17.661,6 Newton**

# 4. Total Structure weight

**Up Structure weigt + Sub Struktur weight**

**= 445.578 + 17.661,6**

**= 463.239,6 Newton**

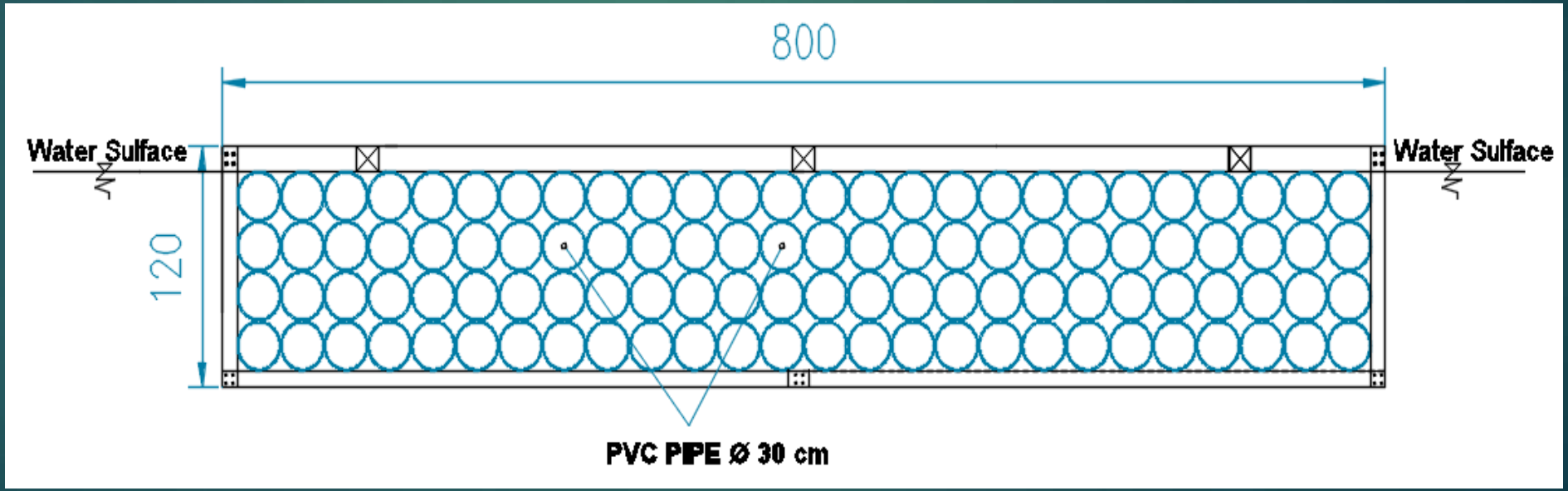
# 5. Platform Floating Force Analysis

**Buoyant force with completely submerged**

$$= \pi.d^2/4.\rho.g.L$$

**= 648.793 Newton**

**So the structure of floating house platform using PVC pipe material required the number of pipe as much as 208 stems with length 6 and 4 meters. The foundation system is made of 4 layers with 52 layers of layers.**



# 6. Structure Stability Analysis

$$Fa - (G \cdot SF)$$

$$Fa - (G.SF) \geq 0 \rightarrow Ok$$

**Floating house Structure total weight (G)** = 463.239,6 Newton

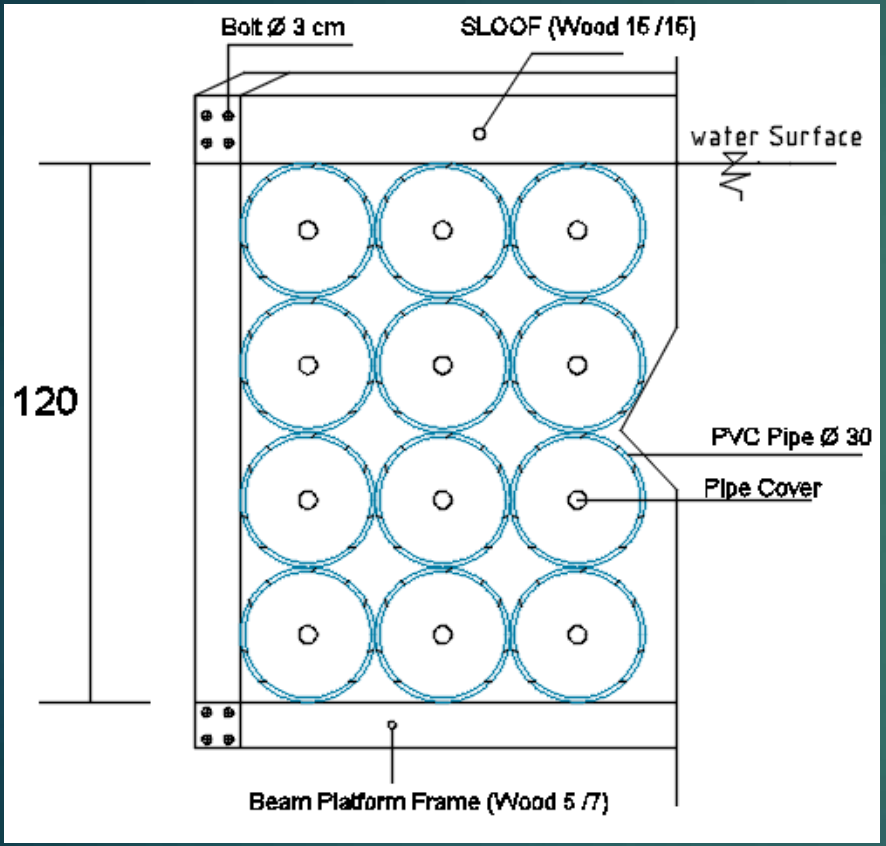
**SF (safety factor)** = 1,2

**Buoyant forcé (Fa)** = 648.793 Newton

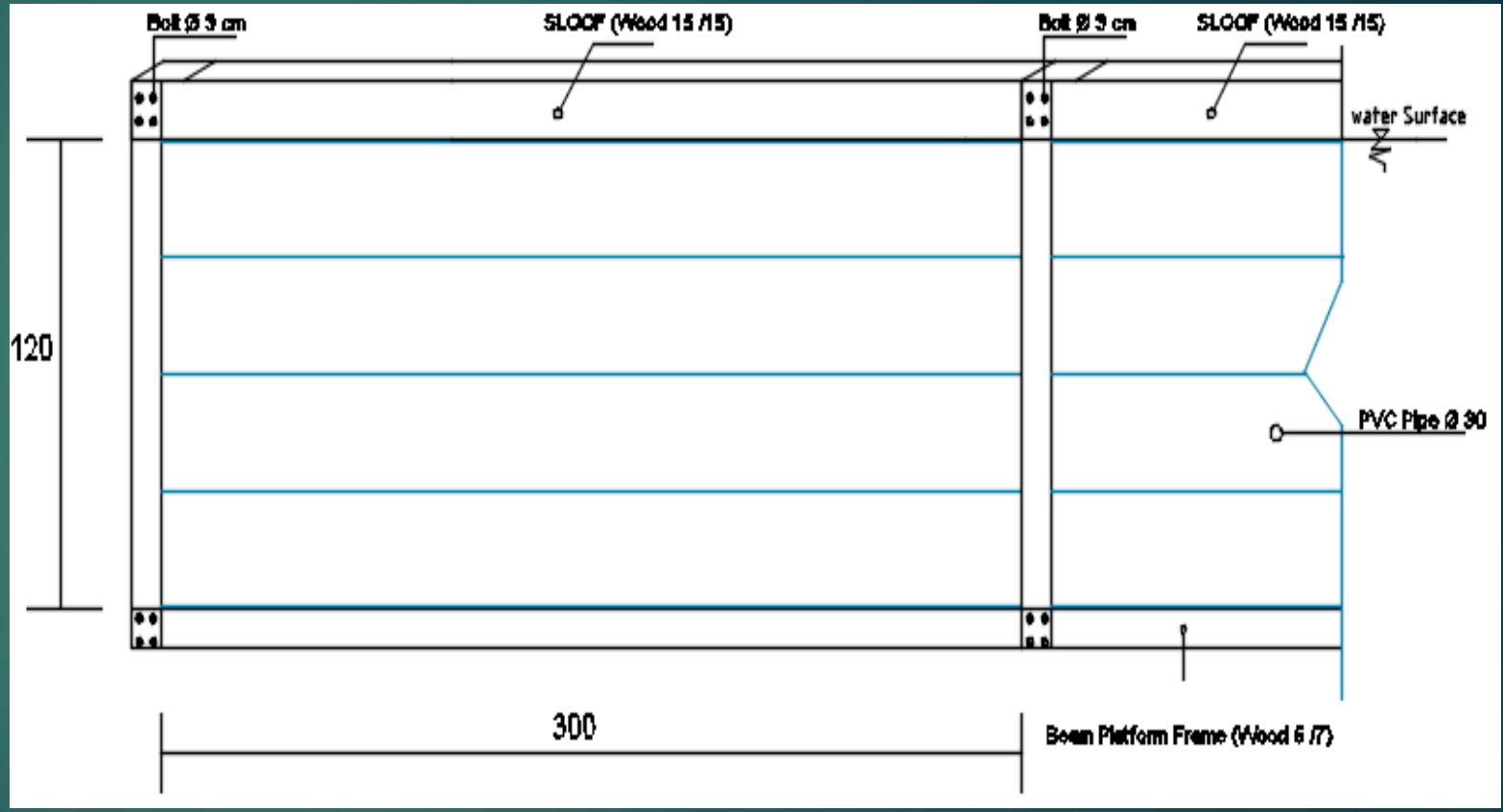
= 648.793 – (463.239,6 x 1,2)

= 92.905,9 Newton > 0 ➔ Ok

# 7. Model of PVC Pipe Connection Platform




(a. Cross Section)




(b. Long Section)

# 8. Recapitulation of PVC Pipe Platform Budget Plan

| No | SPECIFIC WORK | PRICE |
|---|---|---|
| I | Preparation | 2.360.000 |
| II | Platform PVC Pipe (PVC Pipe 12 inch) | 266.840.000 |
| III | Sloof work | 6.300.000 |
| IV | Floor work | 4.975.000 |
| V | Column work | 4.830.000 |
| VI | Ring block work | 4.790.000 |
| VII | Wall work | 13.510.000 |
| VIII | Doors and Windows work | 12.970.000 |
| IX | Framework | 12.630.000 |
| X | Roof work | 7.488.000 |
| XI | Sanitation work | 5.340.000 |
| XII | Mechanical Electrical work | 2.060.000 |
| XIII | Finishing | 1.000.000 |
| **Total** | | IDR 345.093.000,00 |
| **As a whole** | | IDR 345.000.000,00 |
| **Tax 10 %** | | IDR 34.500.000,00 |
| **Total Price** | | **IDR 379.500.000,00** |

# Conclusion

Based on the results of the analysis, it can be concluded that the total weight of the upper structure and platform structure (G) is equal to 555.887,5 Newton with a safety factor of 1.2. The force of the buoyant force (Fa) of the plate structure made of PVC Pipe material is 648.793 Newton. The connection system on the framework of the floating house platform is a bolt connection system, that is 3 cm in diameter with an anchor length of 22 cm and with a total of 4 bolts on each connection. Budget Cost Plan Analysis using PVC Pipe Materials requires a fee of IDR 379.500.000,00.

# Thank You for Your Attention