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Architectural Spatial Form in the Javanese House at *Tegal* City of Indonesia in the year 1930

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Abstract:- *Het Nieuwe hoffdbureau der Semarang-Cheribon Stoomtrammaatschappij te Tegal* is a railroad office building owned by *Semarang Cheribon Stoomtrammaatschappij (SCS)* for design by architect *Maclaine Pont.* In 1910 created the design of this building in a the Netherlands, then the building built in year 1911-1913 in town *Tegal*, Indonesia. *SCS* Director in Den Haag is a parent in law of *Pont* and proposed *Pont* to handle the project. In the year 1930 woke up some house across the railway station. The houses inhabited by Javanese people who worked on the railway. Uniqueness form of the house allegedly designed by architect. Seeing the close relationship between the director of *SCS* with *Pont,* it is likely that residential building is also the *Pont* design input. With qualitative methods conducted the analysis on the couple dwelling housing. Based on the General guidelines of proportional, visibility of normal eyes, and bright light indoors by the sunlight. Then match the spatial form of residential architecture in the Java community in 1930.

Keywords:- spatial forms, javanese housing.

I. INTRODUCTION

Town in a world of the west represents center change, in China and Iran's town exactly represent a stability center [1]. *Tegal* formed by the dutch government as a center of trade stability.

Fig.1: Occupancy Java people in the Tegal city (source: kitlv.nl, survey 2013)

The 1900s development in *Tegal* reached its peak. One that is quite striking is the development of the *SCS* headquarters in 1913. The railway station in the town of Tegal, built in 1885 as part of the *Java station Maatschappij* (*JSM*) in Java. *SCS* railway company bought *JSM* in 1897 [2].

Entire this railway station in designing by architect *Maclaine Pont. SCS* is a railroad holding company route traveling *Cirebon-Semarang-Purwokerto*. *Tegal* chosen as the city where the office building of *SCS* for Tegal located in the middle of the three cities. The current mobilization from and to the city of *Tegal* is becoming increasingly easy. Industry in the railway network has created a labor market for cities that have a railway station. Using train, many workers from inland regions come to coastal cities in northern java to work in port, in a warehouse in factories, and as a traveling salesman [3].

Community mobilization events passenger trains can be an indication of an increase in the number of migrants in destination cities. The number of cumulative density of passengers for arrival or departure to the city of Tegal is enormous and is increasing each year. In 1912, passenger density reaches 2264; In **1913,** passenger density reaches 2770; And in **1914,** passenger density reaches 2981. Passenger density numbers indicate the current mobility of people in the city of Tegal is enormous. Most employment needed in the SCS and the railway station.

Table 1: Number density of passenger rail Semarang – Cirebon (Source: *SCS* 1914) [4]

Railway transport between cities	Passenger density train		
	1912	1913	1914
Semarang - Kaliwungu	1.287	1.445	1.502
Kaliwungu - Kalibodri	-	-	605
Kalibodri - Pekalongan	520	567	638
Pekalongan - **TEGAL**	**749**	**881**	**937**
TEGAL - Brebes	**1.068**	**1.333**	**1.425**
Brebes - Losari	746	879	1.000
Losari - Mundu	866	1.052	1.113
Mundu - Cirebon	1.134	1.368	1.433
Cirebon - Kadipaten	581	643	642
TEGAL - Balapulang	**447**	**556**	**619**
Cumulative figures for arrival and departure of the passengers Tegal city.	**749+1.068 +447 = 2.264**	**881+1.33 3+556 = 2.770**	**937+1.425 +619 = 2.981**

The growth of the business sector in the North Coast railway Java requires a lot of labor. Especially local people to occupy the position of a lowly job. Social stratification based on race (Europe, Eastern Foreign and local communities) is also valid in the stratification of the job position and salary and wage levels [6].

Table 2: Position and Amount Worker at *SJS* and *SCS*. (Sources: *SJS*, 1938) [5]

The position of workers	1934	1935	1936	1937	1938
Ambtenaar derived from the European	126	110	105	105	105
***Ambtenaar* derived from the people of Java**	**43**	**41**	**43**	**42**	**41**
European people who work as clerks	-	-	-	1	1
Javanese people who worked as a lowly servant	**1.351**	**1.400**	**1.391**	**1.423**	**1.457**

The need for labor in the Railroad Company in Tegal, including experts working in the SCS and operational station. These factors have implications with other social factors that settlement workers in Tegal railway companies. There are two kinds of residential community in Java. See the uniqueness its shape chosen object study in the java house that is building semidetached.

Fig. 2: Javanese housing typical (source: researh 2013)

II. RESEARCH METHOD

Using qualitative methods, made an analysis of the spatial form of the Java community working on this railroad. Measurements in each room and then selected some room for analysis. Analysis divided into two types: (1) Based on health visibility normal eye; (2) Based on bright light.

III. FRAMEWORK THEORY

A dwelling house almost all day long colonized by the family of its inhabitants. Occupant wants health and can see the beauty in the house. Health requirements in the house obtained from sight of the eye by the inhabitants. For that use other theories in the field of health to analysis the spatial form in the house. The theory used include:

- Clarity of detail that supports the theory of space that can be seen by the normal eye as far as 6.00 meters, combined with the theory of perspective to object will look proportional when plotted.
- The theory underpinning the clarity of a normal eye to read indoors due to the opening of the pit on the rooms based on the *Indonesia national standard (SNI).* The size of the aperture opening contributed to the room from health ailments.

IV. ANALYSIS OF THE JAVA HOUSE

This house consisting of a main building and building additional. Analysis conducted in closed rooms on a main building with size in the room (size in metres). It consists of a family room (number 3) 5.21 x 5.25, living room (number 2) 5.13 x 5.25, bedroom (number 5, 6) 3.75 x 5.13, bedroom (number 7) 5.13 x 5.75. Source of natural light from the front and side of the building, with an aperture opening reception of light by the door and windows.

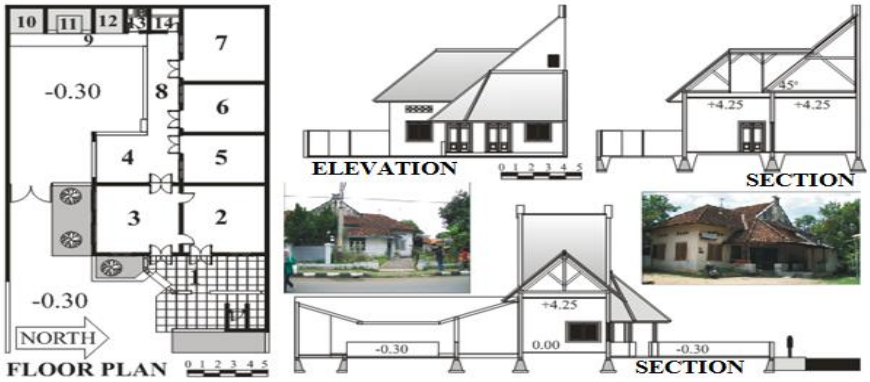

Fig. 3: Rooms in the main building and the shape of Java (Source: Survey, 2013)

V. A. ANALYSIS BASED UPON THE DISTANCE OF NORMAL VIEW FOR HEALTH OF THE EYE

Analyzed by using Snellen-chart for healthy eye on the theory that states to the maximum distance of 6.00 metres one can still clearly see the details of an object [7]. As according with the theory of perspective [8]. The theory explains that an object will look balanced and no distortion, if the point of view of an observer seeing the maximum reach 30º. The analysis carried out in the family room (3). Later in the same way be analyzed in the living room (2), and bedroom (5, 6, 7). Inhabitant of the house doing their activities in a state of sitting or standing. So that analyse conducted by pursuant to the position, at wide direction and also column length.

IV.A.1. Family room (number 3).

The family room (number 3) has the size of the room 5.21 metre x 5.25 metre, ceiling height 4.25 metre. This analysis conducted in a sitting position, and a standing position in the direction of the wide room 5.21 metre.

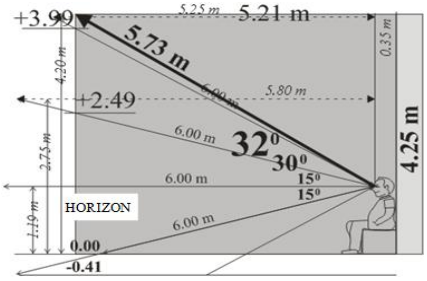

Fig 4: The sitting position (Source: Calculation, 2013).

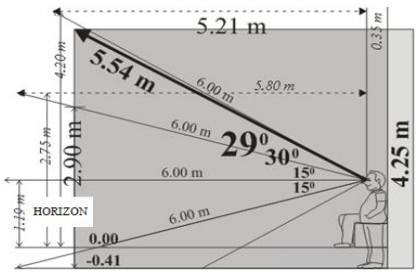

Fig.5: The standing position (Source: Calculation, 2013).

In the sitting position, the person looking at the width of the room 5.21 metre. Observers are in a sitting position with viewpoints 32°>30° with visibility normal for clarity excellent in seeing objects with little size,

namely by distance 5.73 metre < 6.00 metre. Health point of view of an eye (15°) is at an altitude of 2.49 metre with the visibility < 6.00 metre. The visibility proportionate (30°) at an altitude of 3.99 metre with the visibility < 6.00 metre.

In the standing position, the person looking at the width of the room 5.25 metre. Observers are in a standing position with viewpoints 29<30 with visibility normal for clarity excellent in seeing objects with little size, namely by distance 5.54 m<6.00 m. Health point of view of an eye (15°) is at an altitude of 2.90 m with the visibility < 6.00 metre. The visibility proportionate (30°) at an altitude of 4.25 metre with the visibility < 6.00 metre. In the same way conducted measurement long the room at 5.25 m, so that in produce a conclusion as seen on the table 3. Based on the results of the analysis are good at sitting position and standing in the living room (number 3), summed up in the following table:

Table 3: Application of the theory in a family room (3) (Source: calculation 2013)

The size of the room / Observers position on the theory		**Visibility 6.00 meters for clarity detail in the family room (3)**					
		Height (meter)	Long room 5.21 meter.	Conclusions	Height (meter)	Long room 5.25 meter.	Conclusions
Eye health theory	A sitting position with viewpoints 30°	**2.49** *(d <6.00)*		*A **sitting** position with viewpoints 32°>30°, within 5.73 meter < 6:00 meter.	**2.51** *(d <6.00)*		*A **sitting** position with viewpoints 31.5°>30°, within 5.75 meter < 6:00 meter.
	A standing position with viewpoints 30°	**2.90** *(d <6.00)*			**2.95** *(d <6.00)*		
Perspec-tive theory	A sitting position with viewpoints 30°	**3.90** *(d <6.00)*		*A **standing** position with viewpoints 29°<30°, within 5.54 meter < 6:00 meter.	**4.03** *(d=6.10 >6.00)*		*A **standing** position with viewpoints 28.6°<30°, within 5.60 meter < 6:00 meter.
	A standing position with viewpoints 30°	**4.25** *(d <6.00)*			**4.25** *(d <6.00)*		

A similar analysis conducted in the quest room (number 2), bedroom (number 5, 6), bedroom (number 7), having high ceiling 4.25 metre.

IV.A.2. Quest room (number 2)

The quest room (number 2) has the size of the room 5.13 metre x 5.25 metre, ceiling height 4.25 metre. This analysis conducted in a sitting position, and a standing position in the direction of the wide room 5.13 metre and 5.25 metre. After such an analysis conducted on the family room (number 3), then in the quest room (number 2), summed up in the following table:

Table 4: Application of the theory in a quest room (2) (Source: calculation 2013)

The size of the room / Observers position on the theory		**Visibility 6.00 meters for clarity detail in the quest room (2)**					
		Height (meter)	Long room 5.13 meter.	Conclusion	Height (meter)	Long room 5.25 meter.	Conclusion
Eye health theory	A sitting position with viewpoints 30°	**2.47** *(d <6.00)*		*A **sitting** position with viewpoints 32.5°>30°, within 5.67 meter < 6:00 meter.	**2.51** *(d <6.00)*		*A **sitting** position with viewpoints 31.9°>30°, within 5.75 meter < 6:00 meter.
	A standing position with viewpoints 30°	**2.88** *(d <6.00)*			**2.95** *(d <6.00)*		
Per-spective theory	A sitting position with viewpoints 30°	**3.95** *(d <6.00)*		*A **standing** position with viewpoints 29°<30°, within 5.48 meter < 6:00 meter.	**4.03** *(d=6.1 >6.00)*		*A **standing** position with viewpoints 28.6°<30°, within 5.60 meter < 6:00 meter.
	A standing position with viewpoints 30°	**4.25** *(d <6.00)*			**4.25** *(d <6.00)*		

IV.A.3. Bedroom (number 5, 6).

The bedroom (number 5, 6) has the size of the room metre 3.75 metre x 5.13 metre, ceiling height 4.25 metre. This analysis conducted in a sitting position, and a standing position in the direction of the wide room 3.75 metre and 5.13 metre. After such an analysis conducted on the family room (number 3), then in the bedroom (number 5, 6), summed up in the following table:

Table 5: Application of the theory in the bedroom (5, 6) (Source: calculation 2013)

The size of the room / Observers position on the theory		Visibility 6.00 meters for clarity detail in the bedroom (5, 6)					
		Height (meter)	Long room 3.75 meter.	Conclusions	Height (meter)	Long room 5.13 meter.	Conclusions
Eye health theory	A sitting position with viewpoints 30°	**2.11** *(d <6.00)*		*A **sitting** position with viewpoints 42°>30°, within 4.57 meter < 6:00 meter.	**2.47** *(d <6.00)*		*A **sitting** position with viewpoints 32.5°>30°, within 5.67 meter < 6:00 meter.
	A standing position with viewpoints 30°	**2.52** *(d <6.00)*			**2.88** *(d <6.00)*		
Per-spective theory	A sitting position with viewpoints 30°	**3.16** *(d <6.00)*		*A **standing** position with viewpoints 38°>30°, within 4.35 meter < 6:00 meter.	**3.95** *(d=6.1 >6.00)*		*A **standing** position with viewpoints 29°<30°, within 5.48 meter < 6:00 meter.
	A standing position with viewpoints 30°	**3.57** *(d <6.00)*			**4.25** *(d <6.00)*		

IV.A.4. Bedroom (number 7).

The bedroom (number 7) has the size of the room metre 5.13 metre x 5.75 metre, ceiling height 4.25 metre. This analysis conducted in a sitting position, and a standing position in the direction of the wide room 5.13 metre and 5.75 metre. After such an analysis conducted on the family room (number 3), then in the bedroom (number 7), summed up in the following table:

The size of the room / Observers position on the theory		Visibility 6.00 meters for clarity detail in the bedroom (7)					
		Height (meter)	Long room 5.13 meter.	Conclusions	Height (meter)	Long room 5.75 meter.	Conclusions
Eye health theory	A sitting position with viewpoints 30°	**2.47** *(d <6.00)*		*A **sitting** position with viewpoints 32.5°>30°, within 5.67 meter < 6:00 meter.	**2.64** *(d <6.00)*		*A **sitting** position with viewpoints 29°<30°, within 6.20 meter > 6:00 meter.
	A standing position with viewpoints 30°	**2.88** *(d <6.00)*			**3.05** *(d <6.00)*		
Per-spective theory	A sitting position with viewpoints 30°	**3.95** *(d <6.00)*		*A **standing** position with viewpoints 29°<30°, within 5.48 meter < 6:00 meter.	**4.25** *(d=6.1 >6.00)*		*A **standing** position with viewpoints 26°<30°, within 6.04 meter > 6:00 meter.
	A standing position with viewpoints 30°	**4.25** *(d <6.00)*			**4.25** *(d <6.00)*		

IV.B. Analyse by bright of sunlight in the room.

In Indonesia is the tropical climate areas, has formulated the Indonesian National Standard (SNI) [9], for the calculation of the needs of bright sunlight in the room. This standard for the calculation of bright light on the *main measuring points (TUU)* and the *next measuring point (TUS)* in a room. The lighting in the room as the restructuring effort, attempted to fit the need to look around and read the objects based on the requirements of at least 60 Lux [10]. A healthy house requires sufficient sunlight. Sunlight is essential for the health of the room because it could destroy pathogenic bacteria that could exist in a house such as tuberculosis bacteria.
Therefore, a healthy house should have an opening for the entry of sufficient sunlight. Should the opening hole of the influx of light the extent of 10% to 20% of the floor area house [11]. SNI is not necessary for the communicating directly towards the outside as on the porch. Analysis carried out indoors in the main building, which is a family room (3), quest room (2), bedroom (5, 6), bedroom (7).

IV.B.1. Family room (number 3)

In a family room (number 3), there are four kinds of openings that relate directly to the outside air. Namely double doors that opened individually comprise two doors (P1) and three windows that consist of two shutters on each window (J1=J2=J3).
(*) The door (P1) were 2.42 x 1.36 sqm, with an area of 3.29 sqm

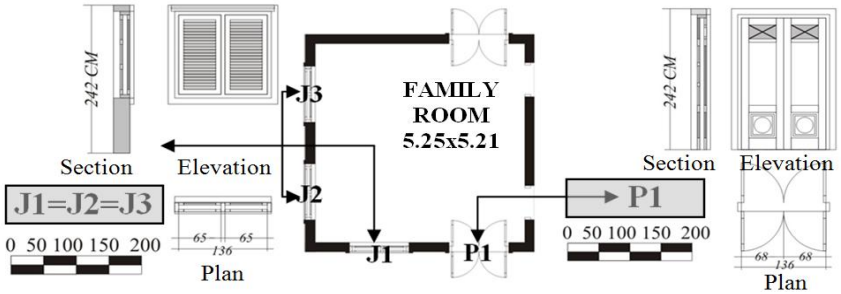

Fig. 6: The position and shape of the door, window, in the family room (number 3) - (Source: Researh, 2013).

(*) The windows (J1=J2=J3) were 1.52 x 1.36 sqm, with an area of 2.06 sqm @ 3 pieces = 6.18 sqm. (*) The floor space measuring 5.21 x 5.25 sqm, with a floor space (FS) 27.35 sqm.
Based on the calculation of SNI [9], the results obtained bright light on *TUU* and *TUS*, the following:

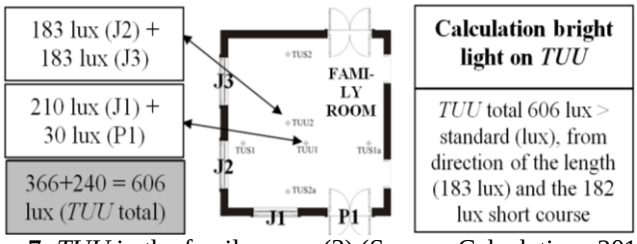

Fig. 7: *TUU* in the family room (3) (Source: Calculations 2013)

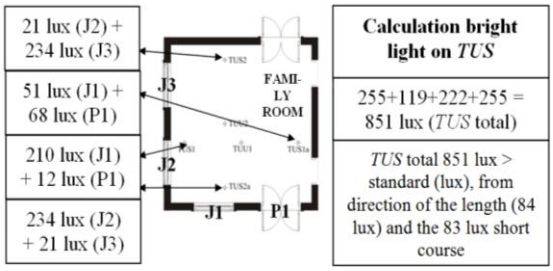

Fig. 8: *TUS* in the family room (Source: Calculations

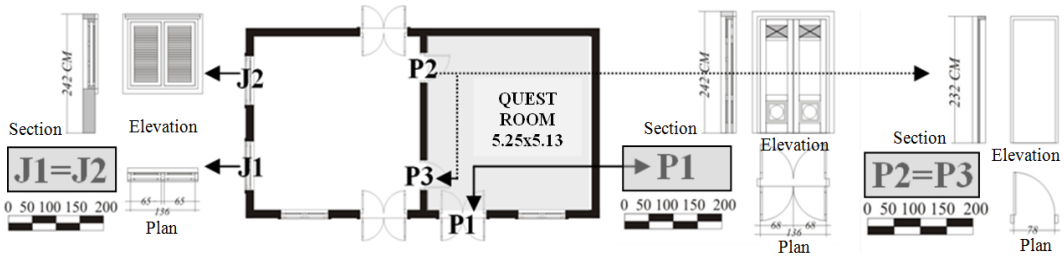

Fig. 9: The position and shape of the door, window, in the quest room (number 2) (Source: Research, 2013).

IV.B.2. Quest room (number 2)

In a quest room (number 2), there are three kinds of openings that relate directly to the outside air. Namely double doors that opened individually comprise two doors (P1), single leaf door P2 and P3 obtaining bright light from the window J1 and J2. (*) The door (P1) were 2.42 x 1.36 sqm, with an area of 3.29 sqm. (*) Window (J1=J2) that forwards bright sunlight into P2 and P3. Doors P2=P3 were 0.78 x 2.32 sqm, with an area of 1.80 square metres @ 2 pieces = 3.60 sqm. (*)The floor space measuring 5.13 metre x 5.25 metre, with a floor space (FS) 26.93 square metres.
Based on the calculation of SNI [9], the results obtained bright light on *TUU* and *TUS*, the following:

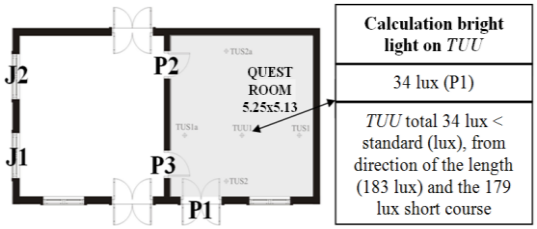

Fig. 10: *TUU* in the quest room (number 2) (Source: Calculations 2013)

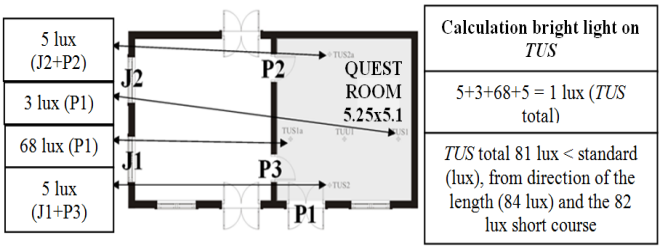

Fig. 11: *TUS* in the quest room (number 2) (Source: Calculations 2013)

IV.B.3. Bedroom (number 5, 6).

Fig. 12: The position and shape of the door, window, in the bedroom (number 5, 6) (Source: Research, 2013)

In a bedroom (number 5, 6), there are two kinds of openings that relate directly to the outside air. Namely one single leaf door with two leaves (P3), and a window with two leaf windows (J2). (*) The door (P3) were 2.31 x1.36 sqm, with an area of 3.14 sqm. (*) Window (J2) were 1.41 x1.36 sqm, with an area of 1.91 sqm. (*) The floor space measuring 3.75 x 5.13 sqm, with a floor space (FS) 19.24 sqm.
Based on the calculation of SNI [9], the results obtained bright light on *TUU* and *TUS*, the following:

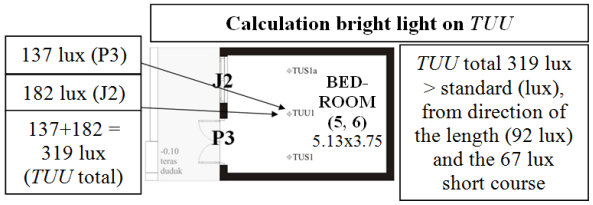

Fig. 13: *TUU* in the bedroom (5, 6) (Source: Calculations, 2013)

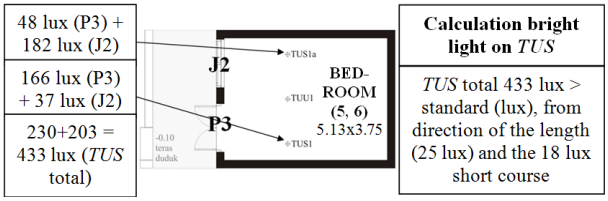

Fig. 14: *TUS* in the bedroom (5, 6) (Source: Calculations, 2013)

IV.B.4. Bedroom (number 7).

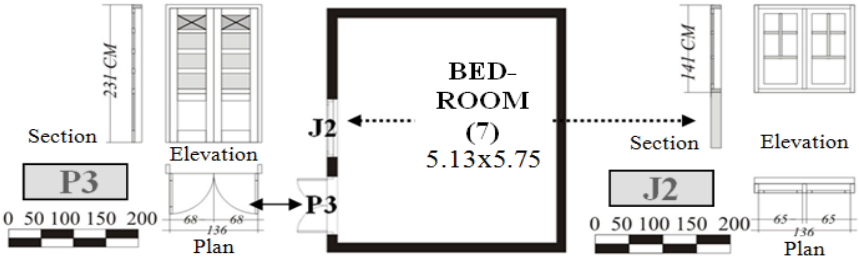

Fig. 15: The position and shape of the door, window, in the bedroom (number 7) (Source: Research, 2013).

In a bedroom (number 7), there are two kinds of openings that relate directly to the outside air. Namely one single leaf door with two leaves (P3), and a window with two leaf windows (J2). (*) The door (P3) were 2.31 x1.36 sqm, with an area of 3.14 sqm. (*) Window (J2) were 1.41 metre x1.36 sqm, with an area of 1.91 sqm. (*) The floor space measuring 5.13 x 5.75 sqm, with a floor space (FS) 29.50 sqm.
Based on the calculation of SNI [9], the results obtained bright light on *TUU* and *TUS*, the following:

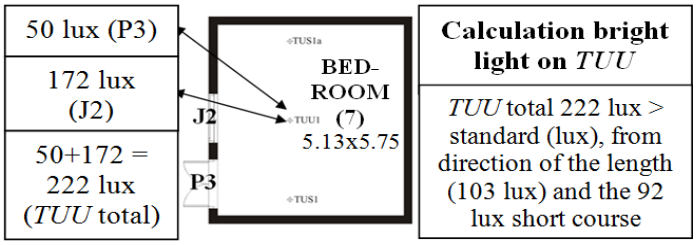

Fig. 16: *TUU* in the bedroom (7) (Source: Calculations, 2013).

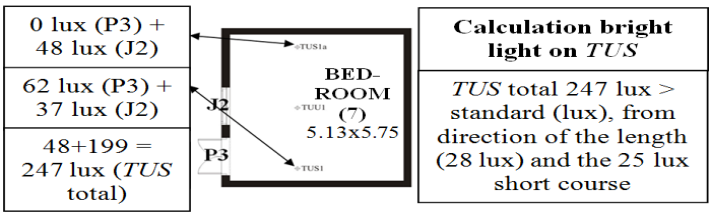

Fig. 17: *TUS* in the bedroom (7) (Source: Calculations, 2013)

V. FINDINGS FORM OF SPATIAL.

* Broad the hole of light *(BHL)* does not depend on the orientation of the Sun's position to his room, but the room should have a direct opening towards the outside air.

* Doors and Windows open in contribute to incorporate natural light directly into the outside air. Apparently with minimal *LLC* = 0:17 x *BHL* (17%), obtaining enough sun room. Good for the eye health for reading (> 60 lux), as well as for the health of bacterial pathogens in tropical countries.

VI. CONCLUSION.

1. Spans ideal room is 5.25 metre, as ideal for normal eyesight. Namely in a seated position or stands, having visibility farthest < 6.00 meters. However, his point of view is 31.9º > 30º. This matter not many influence, because approach direction can be conducted by moving just head.
2. Calculation light of the sun light (lux) in the family room (number 3), getting the *TUU* > 60 lux, *TUS* > 60 lux, with FS is 27.35 square meters. Light pit area (P1+J1+J2+J3) is a 9.47 square meters reach was 34.62% > 20% of the floor area of the room.
3. Calculation light of the sun light (lux) in the bedroom (number 5, 6), getting the *TUU* > 60 lux, *TUS* > 60 lux, with FS is 19.24 square meters. Light pit area (P3+J2) is a 5.05 square meters reach was 26.24% > 20% of the floor area of the room.
4. Calculation light of the sun light (lux) in the bedroom (number 7), getting the *TUU* > 60 lux, *TUS* > 60 lux, with FS is 29.50 square meters. Light pit area (P3+J2) is a 5.05 square meters reach was 17.12% < 20% of the floor area of the room.
5. The quest room (number 2), light holes for direct contact with outer space, have to go through another room. Although the total area of the light aperture is > 20% of the floor area. However the room still dark and does not meet the requirements of the bright light and eye health, because *TUU* < 60 lux, where as *TUS* room only a fraction are eligible, by the natural light of the openings of P1, on the whole room felt dark by *TUS*.

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