

# **ARRANGEMENT AND IMPROVEMENT GUIDELINES OF COASTAL SETTLEMENTS ON THE EFFECT OF SPECIFIC WEATHER IN KAMPUNG TAMBAK DERES, KELURAHAN KENJERAN SURABAYA**

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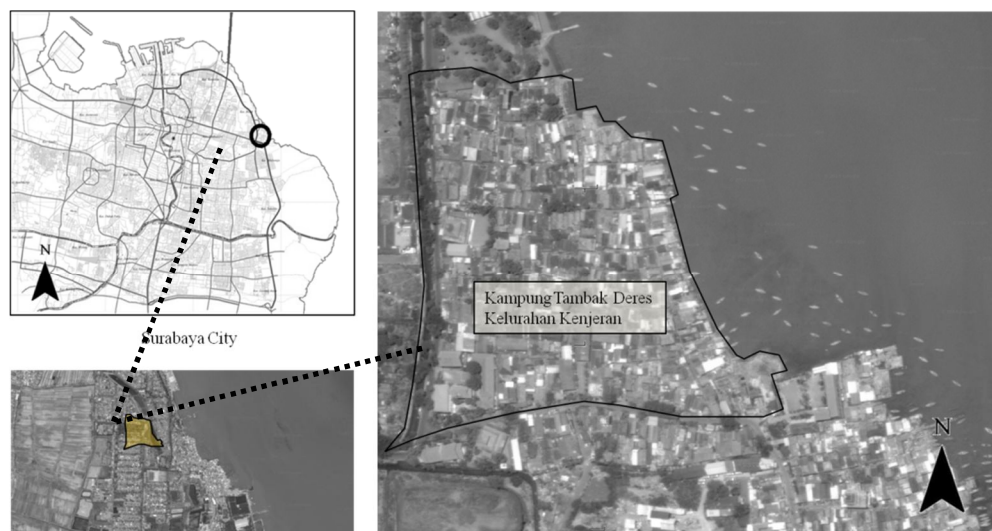
**Abstract** – The sea breeze and land breeze are the specific coastal weather widely used by fishermen to go fishing and return to their home. When wind occurs quite extreme, these conditions may threaten the coastal settlements especially in Kampung Tambak Deres, Kelurahan Kenjeran that located in eastern Surabaya. It often brought many waste and also potentially produced dangerous wind turbulence in the middle of the settlement. Coastal communities should be helped to overcome problems related to the threat by used technique analysis of field data using space syntax and depthmap that collaborated with CFD (*Computerial Fluid Dynamic*). The result of this technique is making a map of vulnerable points that potentially could be threats around coastal settlements. Furthermore, it will be used as a basic for making schematic design to countermeasure coastal weather. The results of this study are expected to assist the community in determining the direction of settlements and buildings arrangement in coastal areas. The intended guidelines are comprehensive, thorough and sustainable with target that is not singular.

*Keywords: Sea breeze, land breeze, coastal settlements, schematic design, Tambak Deres*

## 1. INTRODUCTION

Surabaya is the capital of East Java province that bordered by Madura strait. The location of this strait stretches from the north side to the east side of Surabaya. The area has been developed into a residential community, due to the lowland topography on the east side. It tends to be used as a place for living and earning revenue. This place can fulfill their economic needs. Most of the populations work in the field of fisheries. They are known as the Madurese community, which migrants from Madura Island. This island located on the east side of Surabaya and Madura strait.

The location that has been studied is Kampung Tambak Deres, Kelurahan Kenjeran, Surabaya. The scope of research area is described step by step from the map of Surabaya to the area of study as described on Figure 1. Most of the activity of the community is working as fishermen who sail at night and return in the afternoon. Then, small groups cultivate their haul to be raw materials that ready to sell. In some circumstances, the coastal settlements are prone to get some threats due to land breeze and sea breeze. The viability of building construction from the impact of wind cycle can cause the community concern. It can destroy houses both permanent and semi-permanent buildings at any time.



**Figure 1** Kampung Tambak Deres as area of study

Based Community Service activities on an ongoing basis (Darjosanjoto, 2007a, 2007b, 2010 and Defiana, 2012) with variety the application of presentation techniques and advanced analysis - part of the *ICT* program (*Integrated Communication Technology*) has found some facts and problems on the ground. Land breeze and sea breeze caused damage on buildings and environment on coastal settlements. This wind

cycle entered inside the street settlements then meets tall buildings to make wind turbulence. Beside that, it also brought accumulation of garbage at seaside of coastal settlements.

Limited access to information and lack of socialization regarding the arrangement of buildings around the coast are causing lack of awareness of appropriate mitigation to minimize the impact of weather on the surroundings. Besides that, collects waste can also endanger the health of coastal communities and destroy the elegant view of the coastal environment.

By considering at this phenomenon, the basis of this research is to propose the direction of arrangement of coastal settlements in the schematic design form. The activities focused on prevention action by considering the influence of specific coastal weather, the movement of the local people and the newcomers (stranger) that could potentially threat security and environmental safety.

## 2. THEORITICAL REVIEW

The wind climate around an isolated obstacle such as a building is well documented by Hosker (1985) and Meroney (1982) in Oke (1988). The flow in an envelope surrounding the building is perturbed. They found that there are three main zones of disturbance. First is an *isolated roughness flow*. There is a bolster eddy vortex due to flow down the windward face, behind there is a lee eddy drawn into the cavity of low pressure due to flow separation from the sharp edges of the building top and sides, and further downstream is the building wake characterized by increased turbulence but lower horizontal speeds than the undisturbed flow (Figure 2). *Wake interference flow* is characterized by secondary flows in the canyon space where the downward flow of the cavity eddy is reinforced by deflection down the windward face of the next building downstream. At even greater H/W and density, a stable circulatory vortex is established in the canyon and transition to a *skimming flow* regime occurs where the bulk of the flow does not enter the canyon (Figure 3).

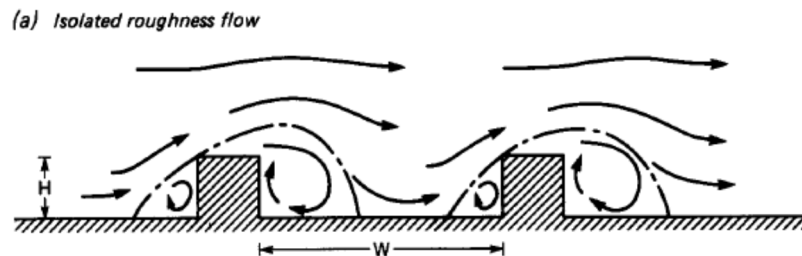


Figure 2 Isolated Roughness Flow

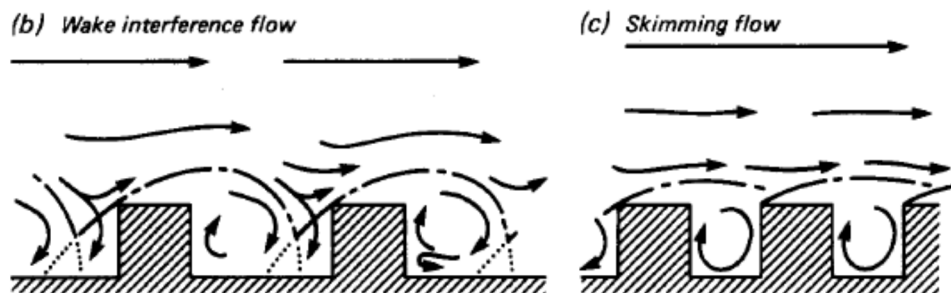


Figure 3 Wake Interference Flow and Skimming Flow

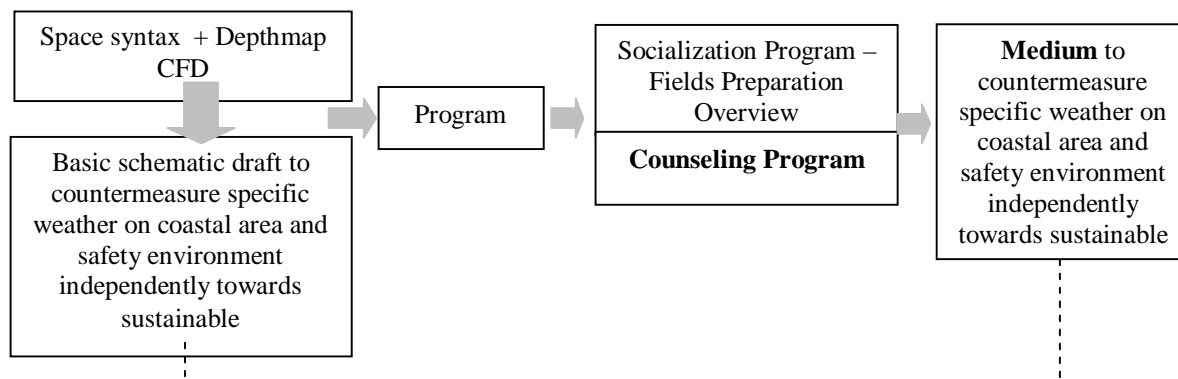
Urban approach is also still used in this study. The concept of place attachment theory mentions that behavior, desire, and the need of inhabitants are the important things in determining the quality, settlement, and its environment (Fischer, 1978). Therefore, human life frequently influences and generates an environment (Oliver, 1987). As an example in the location of study, coastal settlements as a place for daily activities and then it creates a psychological meaning for the inhabitants to develop their environment and fulfill their needs. It also related to the term "place". It grows as a space that has a specific meaning for the

users. The concept of "place" is based on the interaction between human, the physical setting, and the activity that occurs on the site.

### 3. METHODOLOGY

The activity began with the excavation of the relationship between space and function using several analytical techniques. The analysis technique is a symbiosis between presentation techniques and analysis of space - *Space Syntax* and *Depthmap* that combined with *CFD* (*Computational Fluid Dynamics*). CFD simulations showed dots of wind turbulence. This turbulence is caused by land breeze or sea breeze that met the empty spaces in the coastal settlement. The result that obtained from this analysis technique is making the map of vulnerable points in the coastal settlement area that pose a threat to the environment.

The next activities of community service in the field include, first, working together with the Head of Information Housing and Settlements Building Technology Department from Dinas PU Cipta Karya dan Tata Ruang of East Java Province, along with officials administrative local to socialize the results of research in the draft-schematic form. Then, counseling program is expected to give guidance of the implementation of the schematic design program. In this step, the local community should have no doubt about the determination of the direction of improvement their settlements and buildings in coastal areas. Second, the continued guidance and monitoring, including the evaluation of the achievement results need to be provided to improve the implementation of ongoing programs, which is a program of activities that has the characteristic of problem solving, comprehensive, complete and sustainable with target that is not singular.

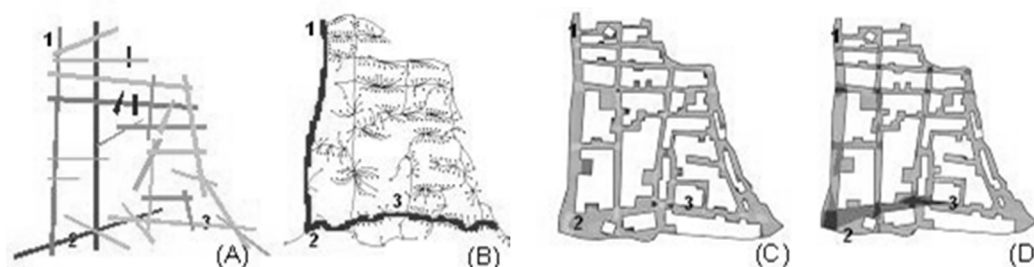


**Figure 4** Methodological Programs on Tambak Deres Community

## 4. RESULT OF COMMUNITY SERVICE PROGRAM AND SCHEMATIC DESIGN

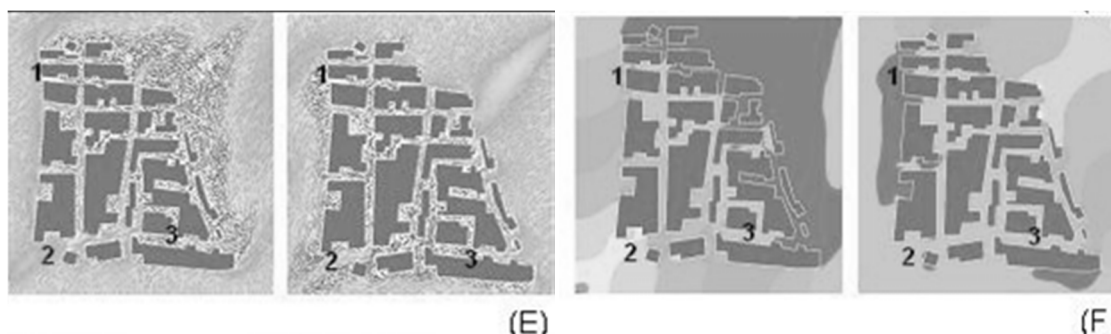
### 4.1. Result of Movement and Wind Flow Analysis

This research result was presented in the Scientific Inauguration Speech in the field of Architecture and Urban Morphology which titled "*Konfigurasi, Budaya dan Penggunaan Ruang dalam Morfologi Arsitektur dan Perkotaan – Configuration, culture, and use of space in architectural and urban morphology*" (Darjosanjoto, Endang TS, 2007) and described as follows : Application of spatial analysis techniques demonstrated its strength and consistent relationship between axis line and permeability with space and the use of space (specifically for the flow of movement). This relationship has been explored in more depth understanding with the application of the visibility of space analysis. The method of presentation and interpretation with these computer graphics process aimed to identify potential section-by-section or places on the path network around the location and also for the overall layout.



**Figure 5** Movement Analysis on Tambak Deres Settlements (Darjosanjoto, 2007)

Picture (A) and (B) shows the results of presentation, analysis and measurement of integration space or path with space syntax. Each map shows the position and the level of integration of open space or path. In principle, red (in picture shows with black) is the space or path with the highest integration of space, and the lowest are shown in blue (grey). Through *depthmap* software, the image (C) and (D) shows the potential for section-by-section places on the path network. Red (black) represents areas where control can be performed, otherwise blue (grey) shows areas beyond the reach of control.



**Figure 6** Wind Flow Analysis on Tambak Deres Settlements (Darjosanjoto, 2007)

Picture (E) shows the analysis results of wind flow in showing the influence of land breeze and sea breeze with CFD software. Results of the analysis showed part-by-part in the path network in the *kampung* who acquired turbulence. While the picture (F) shows the section-by-section around or outside the *kampung* that received direct influence land breeze and sea breeze.

The analysis results of permeability and visibility of space is a combination of simulation results which developed by other disciplines, especially science architecture. In this process, the strength of open space structure of the settlement area can be considered from different perspectives, that is wind flow. Digital models of settlements through analysis application shows the advantages of the merger between, accessibility, use of space and wind flow.

This idea of space configuration in the settlements is not linked to a single factor, that is the culture of the occupants in the use of space (spatial culture). Permeability and visibility of the space looks to be a main mover on the one hand, while on the other side wind flow and local weather should be something important for a settlement. The merger and comparison the results of syntactic analysis and visibility of space using *space syntax* analysis techniques and wind flow analysis based *computer fluid dynamic* (CFD) conducted a proof that also reinforces the idea outlined.

#### 4.2. Result of Community Service Program

The following step is socialization of permeability analysis results and visibility to the community of Kampung Tambak Deres. This program is held on Friday, September 19, 2014. On this occasion (Figure 7a), also described the prevention of wind turbulence which occurred in the settlements. The community were advised to avoid their activity in areas such as the stalemate or cul-de-sac. One of the community leaders also expressed that these winds often occurred at the edge of the coast. While in the settlement area, the wind was often met the tall building that caused wind turbulence.





**Figure 7** Socialization to the community of Kampung Tambak Deres

The socialization process was held twice (Figure 7b) in order to ensure the community how they faces their environmental problems. In the last socialization on October 13, 2014, issue raised about the proposed prevention in schematic-draft form at the Kampung Tambak Deres. The draft is expected to change the habits of people in coastal settlements even before, they often disposed their household waste directly into the sea. It also increases their awareness about their environment. Communities also took this chance to explaine about the wind conditions that are usually blowing at 21:00 to 22:00 PM. Due to the wind flow, many fishermen are reluctant to go to sea because they feel unsafe, so the fishermen are switching their professions. Some schematic draft disseminated to the local community including the arrangement of coastline street at seaside, the arrangement of connecting street between coastline and settlement, and also how the community should remained their house construction in order to give beautiful scenery of their environments. The following illustration of arrangement are :



**Figure 8** The Arrangement of Connecting Street between Coastline and Settlement. Before (Left) and After (Right)



**Figure 9** The Arrangement of Coastline Street. Before (Left) and After (Right)



**Figure 10** Visualization of Settlement in Coastal Area. Before (Top) and After (Bottom)

## 5. CONCLUSION

Within the scope of the settlement, the application of space syntax, depthmap and CFD are very significant in restructuring parts of the space (street), especially in securing the environment from the threat of coastal weather (land breeze and sea breeze). The making of the design-schematic can be done by viewing the location of vulnerable points in the coastal settlements that shown in blue (grey). These results can be considered for countermeasuring coastal weather and making environmental safety in self sustainable way.

Based on the results and findings of the analysis, schematic design criteria for coastal settlements need to consider:

**First**, the arrangement for community settlement is recommended to face the coast.

**Second**, there must provide a connecting street (street access) of settlement to the coast. These streets are designed with a slope leading to the sea. It prevents the waste to carry over into the settlement area (Figure 8).

**Third**, the coastline street needs to be provided as a transition space between the settlements and the sea. The location of this street should be adjustable as contour lines of the community settlement (Figure 9).

**Fourth**, the existing construction of settlement need to be maintained which is built with a stilt house system (Figure 10).

These considerations can help in carrying out to repair and to make improvement of environmental safety. It may be discussed again by the community and local authorities. It can be forwarded in some steps from the lowest level of community. It may starts from the smallest community of fishermen, and then continues in the next levels of local authority (RW) until meet the village government (Kelurahan).

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