Identification of typology related to the coastal line changes in Bantul

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Abstract. Typology of coastal associated with landforms and shoreline changes. This study was conducted to determine the relationship typology of coastal especially on the parent material of a coastal with changing shoreline due to changes in the flow of ocean waves. Bantul coastal typology identified using remote sensing data to find the coastal character and patterns. Field surveys conducted for calibration areas undoubtedly result interpretation. The results of this study indicate coastal in Bantul Regency entirely included sandy beaches. The main factor of shoreline change caused by coastal erosion and sedimentation, frequent anomalies shoreline due to erosion and sedimentation. Abrasion occurred in Bantul district south coast will greatly affect reducing the shoreline because of its major parent material is sand. Sedimentation also play a dominant role in influencing increasing in the shoreline in Bantul because many large rivers that flow into the southern coast of Bantul.

1. Introduction
Typology is a beach characteristic in terms of the formation process, material, designation, and the shape of the beach slope. The study of the typology of the beach is very important to do because it is based on the identification of the typology, we can know the potential and the problems that occur on a beach. One of the problems that occur in the coastal region is shoreline change [1-5]. In recent years, changes in the shoreline become a serious issue related to the coastal management [6]. Shoreline change profile changing shoreline is in the process of stability (either forward or backward) caused by various phenomena such as abrasion, accretion, sedimentation, reclaimed or natural disasters. Controlling factor shoreline changes include wind, waves, currents, water levels, sediment supply and coastal structures [7].

Shoreline change pose environmental problems [8-11]. Some issues related to changes in the shoreline of which is the destruction of the environment, the terrain is narrowed, damage to infrastructure, disruption of human activities and administrative boundaries problems. The problem of shoreline change requires serious handling because it can cause a variety of problems including vertical and horizontal conflicts. Real example of the conflict due to changes in the shoreline in
Indonesia is shoreline change caused problems of land management in several regions in Indonesia such as West Java, Yogyakarta, East Java, Ambon and some other areas in Indonesia [12, 13, 14].

One area that is vulnerable to changes in the shoreline in Indonesia is the Special Region of Yogyakarta (DIY). Yogyakarta region vulnerable to shoreline change due to three main reasons: 1) typology sandy beach; 2) direction toward the ocean; and 3) supply of material from upstream. One district in the province that is vulnerable to shoreline changes is Bantul. Shoreline changes in Bantul caused by erosion, sedimentation, wind, big waves and land use changes. Several previous studies indicate that the impact of shoreline change on public economic activities [15-18]. One example abrasion disrupt economic activities in Bantul Regency is abrasion in Kwaru Beach which caused dozens of stalls collapsed. Conditions in Kwaru Beach stalls after abrasion can be seen in Figure 1.

![Figure 1. Building collapsed by abrasion in Kwaru](Source: Field Survey, 2016)

The risk reduction due to shoreline changes can be done by several methods. Mapping of the shoreline changes and typology of the beach is one method that can be used to minimize the shoreline change risk (Formerly, et al., 2013; Kumar, et al., 2010; Adamo, et al., 2014; Misra and Balaji, 2015; Shetty, et al., 2015) [19-21]. Based on the results of risk mapping shoreline changes and morphological analysis, can be specified mitigation efforts that can be done to reduce the impact of the shoreline changes. The purpose of this study was to identify the typology beach related to coastal changes of Bantul District so it can be on reducing the shoreline change risk.

2. Data and Methodology
The data used in this study is the Topographic Map of Indonesia, Landsystem Map, BingMaps Imagery and SRTM 30m. The field survey was conducted to collect typology data, aerial photographs and analysis of changes in the shoreline due to erosion and sedimentation. Furthermore, remote sensing data in the form of photos taken during the survey also inclined the field to reinforce the findings of the post-field [23]. Photos taken using the inclined DJI Phantom 4. In-depth interviews were conducted in areas whose interpretation is still doubtful.

Analysis of the data used in the form of spatial analysis. Based on the spatial analysis data can be determined typology in the southern coastal of Bantul District. Spatial data that were analyzed with descriptive methods described explorative. Analysis of exploratory description used for the results of a deeper study by linking between one variable with another variable.

3. Study Area
In general, most of Bantul Regency is located on alluvial plains, karst hills, and coastal landforms. Alluvial plains scattered in the central part of Bantul. This area is influenced by the presence of volcanic sediment material derived from Merapi Volcano. Located in the hilly area that is a path that slopes steep hills with dominant steep slope of more than 70% with a height of 400 meters above sea
This area is formed by the formation Nglanggran and Wonosari. The beach area is located in the southern part of Bantul. In this area, there is a beach and sand dunes (fluvimarine) with a gentle slope. This area is formed by loose material with a size sand gravels. While in the western part of the district of Bantul are low hills with a gentle slope-steep and located at an altitude of 150 meters above sea level. Study area can be seen in Figure 2.

Bantul Regency is one of regencies in DIY. Based on 2010-2020’s data, population projections, the population of Bantul Regency in 2015 was 971,511 inhabitants spread over 75 villages and 17 subdistricts [24]. Bantul Regency has so many potency. From the broad range of potential, such as tourism potential [25], the potential of agriculture [26], until the potential of culture and tradition that is still awake. Bantul Regency has potential in agriculture in the form of rice, onion, and chili [27]. Potential traditions and cultures that exist among them is the art Ketoprak, Jathilan art and the art of puppetry which is still maintained by the community. In addition to the potential for tourism, agriculture, and cultural traditions that had been mentioned, the Bantul district south section immediately adjacent to the waters of the Indian Ocean region, needs special attention. Because it also has the potential of coastal disasters such as abrasion [28] and wave [29] Spatial planning should pay attention to aspects of existing natural vulnerability.

4. Results and Discussion

4.1. South Coastal of Bantul Typology

Based on the analysis can be seen that the height of the class with the most extensive deployment lies at an altitude of between 25 to 100 meters with an area of 27,709 ha, or about 54.67% of the total Bantul. Grades lowest height that is less than seven meters has an area narrower than most other classes, namely 3,228 ha or approximately 6.37% of the total area throughout Bantul. In general, low-altitude region is an area directly adjacent to the Indian Ocean. In addition, the region located at an altitude of more than 100 meters above sea level are the most Dlingo, Imogiri, Piyungan, and Pajangan.
Shoreline of Bantul (Bantul Regency, 2013). Bantul has three major rivers and three other rivers, namely (1) Oya River in Sub Dlingo and Imogiri with a length of 35.75 km, (2) the Progo River which flows in the District Sedayu, Pajangan, Pandak, and Srandakan with length of 24 km, (3) the Opak River flowing in the District Piyungan, Banguntapan, Pleret, Jetis, Imogiri, Pundong, and Kretak with a length of 18.75 km, (4) Winongo flowing in the District of Sewon, Bantul, Jetis, Pundong, Kretak with a length of 18.75 km, (5) Bedog River flowing in Kasihan, Pajangan, Bantul, and Pandak with a length of 9.50 km, (6) the Code River which flows in the District Banguntapan, Pleret, Sewon, and Jetis with a length of 7 km.

Typology beach in Bantul consists of three kinds, namely sandy beach, rocky beach and the muddy sand. The sandy beach is characterized by low relief, smooth curved up rough, there is rubble (for the type of white sandy beaches), and comes from a volcanic eruption (for the type of black sand). Several sandy beaches are derived from volcanic material flows through the river. White sandy beach material comes from rocks that experienced the rapture.

The process of formation that occurred beach consists of ocean processes derived from wave energy in areas close to the sea and aeolian processes in the region more toward land. The form of the coastal region is derived from these processes is the physical form of the coast as a result of the sea and the sand dunes as a result of aeolian processes. Coastal formed by deposition of land has the characteristics of a flat relief to choppy and material composed of mud. The process of fluvial processes that occur are due to the flow of the river [30].

![Shoreline of Bantul](image)

Muddy lots formed then in the region ramps and associated with mangrove and seagrass ecosystems. Sometimes to distinguish between muddy and sloping sandy beach is quite difficult, because the sloping sandy beaches tend to be composed of fine sand that can be mixed and accumulated mud so it will be more difficult to overcome [31]. Bantul district has little muddy, the beach average lies at the mouth of the river or are in the delta estuaries, such as the Opak River Estuary and Progo River Estuary because, meetings sandy beach with a river delta or estuary of the river carrying sediment will lead to the muddy shore. Samas beach is just one example of the beach in flow Opak River estuary, around the mouth of the river Opak is a substrate of the beach turned into muddy. Samas beach is a sandy beach with black sand (Sandy Beach), in addition to the slopes on ramps as well Samas beach and coastal Samas beach area with a long shoreline.

Tirtohargo muddy mangrove area has a uniqueness in terms of constituent materials. Mangrove areas generally have a constituent material in the form of mud. The base substrate owned mangrove
areas Tirtohargo substrate is muddy and mixed with fine sandy material. The base substrate sandy mud in mangrove areas is caused due to the mixing of sediment material in the form of sand and silt carried by the Opak River. The blow waves are not far away in the mangrove areas indirectly contributes to refine the material carried by the Opak River. The sand in the area of mangrove came from the eruption of Merapi Volcano is then carried away by the river and anchored to the ocean. Opak estuarine waters is one estuary in Bantul, Yogyakarta. These waters have a dynamic nature with a variety of physical and chemical factors are high. Opak in estuarine waters are mangroves with muddy base substrate, and the open waters immediately adjacent to the sea has a substrate category muddy waters, sandy and a little rocky [32].

Coastal region of Bantul, generally has a sandy beach typology. Rocky beach located on a small coverage area of Bantul, but do not look at a map scale of 1: 25,000. Rocky beach is in the majority most of the coast in the district of Gunung Kidul. Some species on the rocky coast rocky like mussels and oysters are a source of food for coastal communities. Lots of rocky beach in the tropics consisting of coral or other type of limestone rocks that have holes and gaps [33].

Typology rocky beach located on the coastal area of Bantul little coverage. The location is in the rocky coast of the eastern border of the coastal Bantul. Typology rocky beach located on Parangendog Coast region. Parangendog has main constituent material in the form of limestone reefs. Gap of bluff contained in Coastal waterfall Parangendog allow annual found in the region. Reason waterfall named as an annual because of the waterfall appear only once a year during the rainy season. Origin of the word Parangendog name taken from the local language. Parang means stone and endog means eggs. If interpreted as a whole, Parangendog can be interpreted as a stone that resembles an egg. Characters Parangendog Coast has rugged relief with a little sand. The composition of sand is less than the rock.

4.2. The relationship between typology and Shoreline Changes in Bantul

Each beach has a unique typology and peculiarities. The ability to withstand the blow of a wave is affected by the material making up the region. According to local regulations Yogyakarta Special Region No. 16 of 2011 explains that the direction of the management of coastal border to Bantul at least 200 meters [34]. The regulation is based on the condition of the southern waters has waves and a strong current. In addition to the currents and the waves, the material making up the region is dominated by sandy material.

Sandy material has a structure unravel so easily eroded. The existence of the southern coast as an open coastal waves and currents cause the condition has great energy. Serves as a medium flow and sediment transport as erosion agent. Flow is affected by the pounding waves. Waves coming towards the shore can cause beach currents (nearshore current) that can affect the process of sedimentation or erosion on the beach [35].

The sequence of events always hit coastal abrasion Bantul, despite that the coastal state has its own peculiarities. Uniqueness is happening on the South Shore Bantul visible from the time of accretion. Does not need a long time to experience the accretion. Accretion is a change in the shoreline towards sedimentation. If traced between the hours of erosion in September 2013, accretion that occurred at the same location in November 2013. The time required for the recovery of the region for two months after the event [15]. Accretion that occurred in Bantul can be seen in Figure 2.
Typology muddy beach is in Opak River estuary area and Progo River estuary area. Shoreline changes also take place periodically in the estuary area. Characteristics of the river mouth facilitates the pounding waves landward with the runoff from rivers and the sea. Substrate mud that comes from river runoff does not dominate the region. Sandy material is also available on the Bantul Coastal mangrove areas. Beaches in mangrove areas have greater power to retain its shoreline compared with the typology of sandy beaches. Plant material is accompanied by a muddy mangrove stronger against the pounding waves that hit coastal areas.

Typology rocky beach located on the coastal Parangendog shorelines are relatively stable. Pounding waves directly hit the rocks along the coast. The structure of the solid rock cause cannot rewind the pounding waves of the beach in a short span of time. Characterized rocky beach has a rugged relief with composing materials such as limestone reefs. Coastal disasters that often occur on the rocky shoreline with rugged relief is landslides. Typology rocky beach has a smaller risk to the tsunami and abrasion at risk compared with the sandy and muddy coastal typology.

5. Conclusions
There are three typologies of coastal in Bantul, i.e. the sandy beach typology, typology muddy and rocky beach typologies. Sandy typology has two kinds, they are the coastal comes from karst areas and coastal that come from volcanoes. Muddy typology is located in the estuary Opak-Progo River Estuary. The base substrate muddy beach is sandy mud. Typology of rocky beach in Bantul are on the small coverage Bantul. Parangendog rocky beach located on the side of the easternmost district of Bantul. Rocky beach is characterized by the main material in the form of limestone reefs.

Every typology beach in Bantul have a vulnerability to changes in the shoreline. Changes caused by shoreline erosion and sedimentation beach. Beaches that have higher susceptibility to changing shoreline is sandy beach typology then muddy, and rocky. Typology of sandy beaches have the highest vulnerability to changes in the shoreline because it has a material unravel. Open beach conditions resulting in larger waves and currents. Relief sloping sandy beach on the typology of the more trigger the vulnerability to changes in the shoreline.

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