INTISARI

Mekanisme dan proses gerusan akibat tsunami berbeda dengan gerusan di sungai. Proses gerusan di sekitar bangunan akibat tsunami sangat cepat. Oleh sebab itu proses pembentukan kedalaman maksimum gerusan atau kedalaman gerusan saat fase equilibrium terbatas. Simulasi model fisik gerusan di sekitar bangunan akibat tsunami terbatas. Salah satu kendala yang dihadapi adalah ukuran fasilitas laboratorium terbatas untuk memodelkan *run-up* tsunami sekaligus juga digunakan untuk mengamati gerusan lokal. Proses gerusan di sekitar bangunan akibat tsunami dipengaruhi oleh run-up dan run-down tsunami. Kedalaman dan kecepatan aliran adalah variabel yang mempengaruhi sedimen di sekitar dasar bangunan. kedua variabel dapat digunakan untuk menformulasikan kedalaman gerusan loka akibat tsunami. Tujuan penelitian ini adalah mengembangkan metode pembangkitan *run-up* tsunami dengan saluran relatip pendek, memformulasikan proses, serta kedalaman gerusan akibat tsunami di sekitar silinder, mengembangkan model matematik angkutan sedimen dan gerusan lokal di sekitar silinder akibat tsunami.

Simulasi model fisik dilaksanakan di laboratorium Hidraulika and Hidrologi Pusat Studi Ilmu Teknik Universitas Gadjah Mada (UGM). Ukuran saluran terbuka yang digunakan dalam penelitian ini adalah 20,7 m x 1,43 m x 1,5 m. Model pantai terbuat dari pasir lepas berdiameter D_{50} adalah 0,19 cm dengan kemiringan dasar 1:20. Silinder dibuat dari beton dan diletakkan pada jarak 2 m dari model garis pantai. Metode untuk membangkitkan run-up tsunami dengan *dam break* sistem 2 pintu. Kedalaman air dan kecepatan aliran tsunami diukur dengan tilting sensor. Bentuk dan kedalaman gerusan di sekitar silinder diukur dengan 3D laser scanner. Simulasi model matematik di dalam penelitian ini digunakan untuk melengkapi pengukuran yang tdiak dapat dilakukan dengan seimulasi model fisik. Seperti simulasi model run-up tsunami menggunakan *dam break* sistem 2 pintu dengan variasi bukaan pintu, simulasi model tsunami mirip gelombang soliter dan simulasi angkutan sedimen dan gerusan di sekitar silinder. Simulasi model matematik karakteristik run up tsunami menggunakan DualSPHysics. Hasil dari simulasi ini menjadi input untuk model matematik angkutan sedimen dan gerusan di sekitar silinder dengan metode finite difference.

Metode dam break sistem 2 pintu mampu merepresentasikan run up tsunami menjalar di perairan pantai dan di daratan. Bentuk run-up tsunami yang dibangkitkan dari metode ini mirip dengan bentuk run-up tsunami seperti gelombang soliter. Parameter kedalaman relatip aliran terhadap diameter silinder dan angka Froude aliran tsunami di sekitar silinder digunakan untuk menformulasikan persamaan gerusan di sekitar silinder. Persamaan gerusan di sekitar silinder akibat tsunami adalah $\frac{d_{s,akhir}}{b} = 0{,}1745\left(\frac{d}{b}\right)^{0{,}199}(F_r)^{0.757}$. Jumlah konsentrasi dan angkutan sedimen melayang mengubah bentuk dasar di sekitar bangunan serta pengaruh kecepatan endap sedimen terhadap perubahan kecepatan aliran tsunami adalah pendekatan yang dikembangkan untuk menyimulasikan model matematik proses gerusan di sekitar silinder akibat tsunami. Hasil simulasi model matematik dapat menjelaskan pola dan kedalaman gerusan saat awal tsunami, kedalaman maksimum gerusan, serta pola dan kedalaman akhir gerusan di sekitar silinder..

Kata kunci: *run-up* dan *run-down* tsunami, *dam break* sistem 2 pintu, mekanisme gerusan akibat tsunami

ABSTRACT

The mechanism and process of scouring due to tsunami can be differed from river's scour. Scouring due to tsunamis usually occurs so rapidly where the mechanism for the formation of maximum depth of scour or scour depth in the equilibrium phase has not been much discussed yet. Since limitation at the physical simulation model, the tsunami wave is considered as solitary wave requiring a large flume. This model is difficult to be conducted due to inadequate flume facilities. Therefore, the tsunami run-up model is generated using a flume of limited length. The scouring process due to tsunami at around the structure is known triggered by tsunami run-up and run-down. The flow depth and velocity are rated as the most influenced variables to figure out sediment traits at base of structure. The objectives of this research are composed for developing a method of run-up tsunami model by using a short relative channel, generating formulation from the process and the scouring depth due to tsunami located around the cylinder structure, and generating mathematical model of sediment transport for local scouring simulation at around the cylinder structure.

This research is conducted at Hydraulic and Hydrology Laboratory of Research Centre for Engineering Science, Universitas Gadjah Mada through a physical model test. The open channel flume used in this research has dimension by long, width and height of 20.7 m x 1.43 m x 1.5 m, respectively. The bed slope of coastal model is set at 1:20 with sand materials used is D50 or equal to 19 cm. The cylinder material made by concrete is set at distance interval for every 2 m from the shoreline. The tsunami run-up is generated by 2-gates dambreak system. The water level and the tsunami flow velocity are measured by using tilting censor. The scouring paatern and depth are measured by 3-dimensional laser scan. The mathematical models developed in this research are such as tsunami run-up simulation model with 2 gates dambreak syatem and tsunami run-up simulation model as solitary wave. These both types of model are simulated with DualSPHysics. By utilizing a difference finite element method, the result of this simulation then used as an input for the mathematical model of sediment transport and scouring at around the cylinder structure.

This research develop method for generating tsunami run-up using a flume of limited length by 2-gates dambreak system. Its generated tsunami run up similar tsunami run-up alike solitary wave. The equation of local scour is generated from relative depth scour parameter toward cylinder diameter and tsunami Froude's number. The local scouring equation due to tsunami could be written as follows; $\frac{d_{s,\,final}}{b} = 0{,}1745\left(\frac{d}{b}\right)^{0{,}199}(F_r)^{0.757}$. Development of sediment transport and scouring mathematical model could explain the scouring process due to tsunami. A largest initial scouring process created when run-up occurred and gradually decreased along with velocity changed until run-down generates. The transformation of such scouring is dominantly occurred during run-down phase as the maximum scouring depth and sedimentation at scouring holes take place.

Keywords: tsunami run-up and run-down, 2-gates system of dam break method, scour mechanism due to tsunami