CHAPTER V

RESULT AND DISCUSSION

5.1 Model Validation

The results of the pull-out laboratory test on geotextile B with normal stress (σ_n) of 33 kPa conducted by Prashanth et al. (2016) is used as a reference for validating the pull-out model in Plaxis 2D. The result of numerical simulation using Plaxis 2D is shown in Figure 5.1.

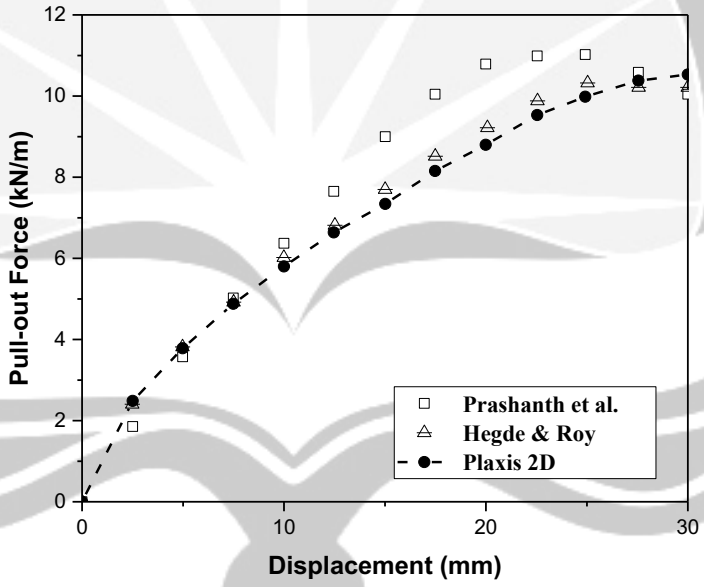


Figure 5.1 Validation result in Plaxis 2D

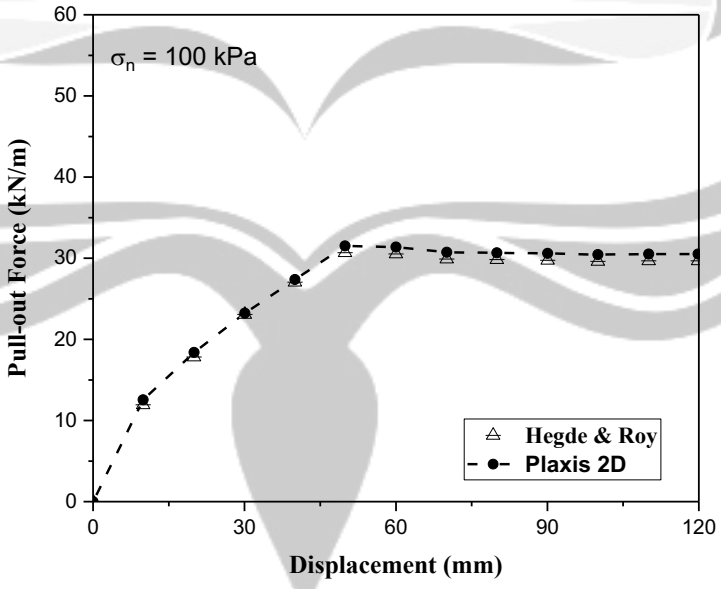
Numerical results in 2D Plaxis show results that are match and consistent with the laboratory results conducted by Prashanth et al. (2016). The results also show good correlation with modelling conducted by Hegde & Roy (2018). When the numerical

model has been successfully completed, the validated model is used to carry out a pull-out simulation test conducted by Hegde & Roy (2018).

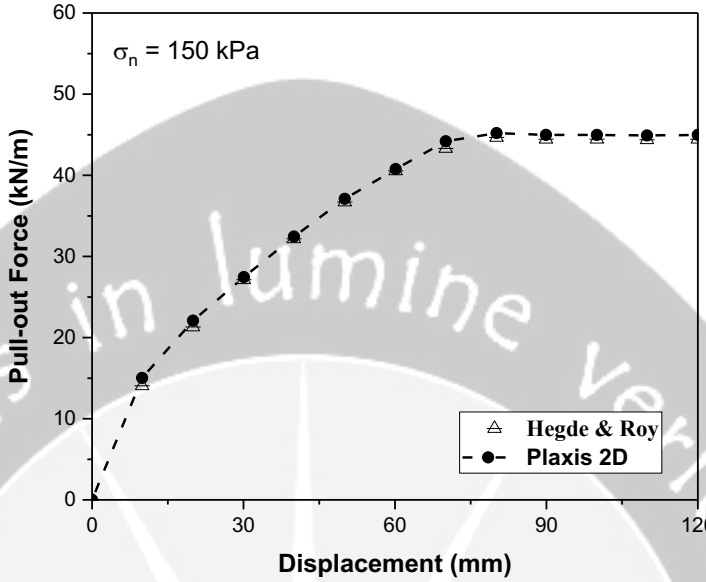
5.2 Pull-out

Pull-out tests are carried out using three different types of sand named sand A, B, and C. Each model is given the same normal stress (100 kPa, 150 kPa, and 200 kPa) and displacement. The pull-out results will be compared with the results obtained by Hegde & Roy (2018). The smaller the gap, the more accurate the results obtained.

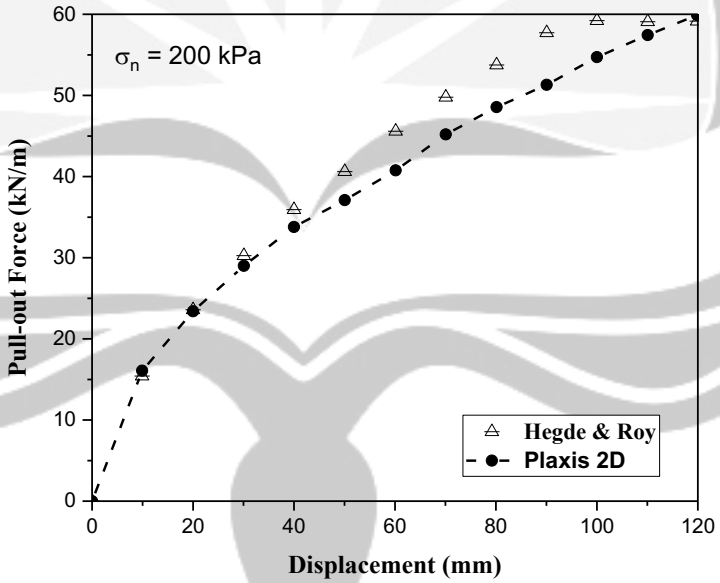
Figure 5.2 shows the pull-out result on Plaxis 2D for sand A. The results obtained show a match for each normal stress given.



(a)



(b)

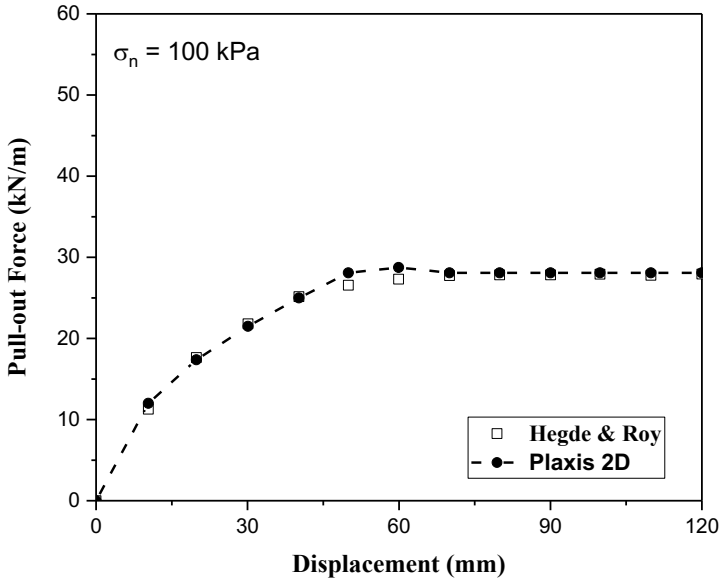


(c)

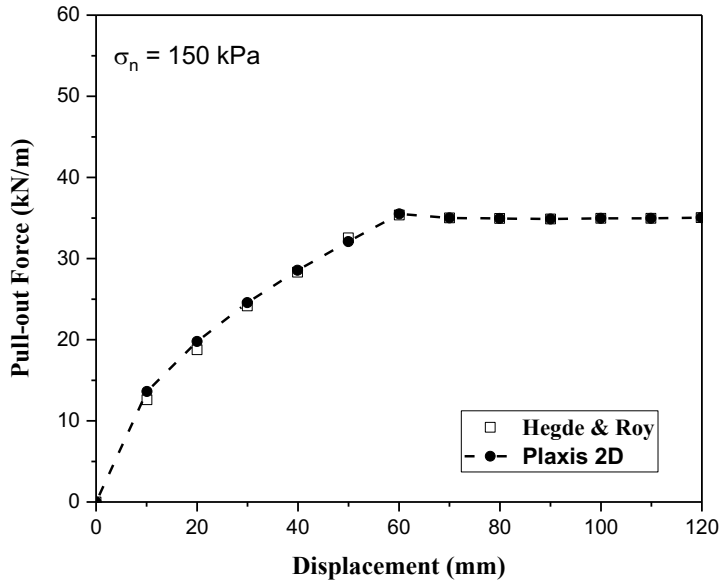
Figure 5.2 Pull-out Result for Sand A in Different Normal Stress

(a) 100 kPa, (b) 150 kPa, (c) 200 kPa.

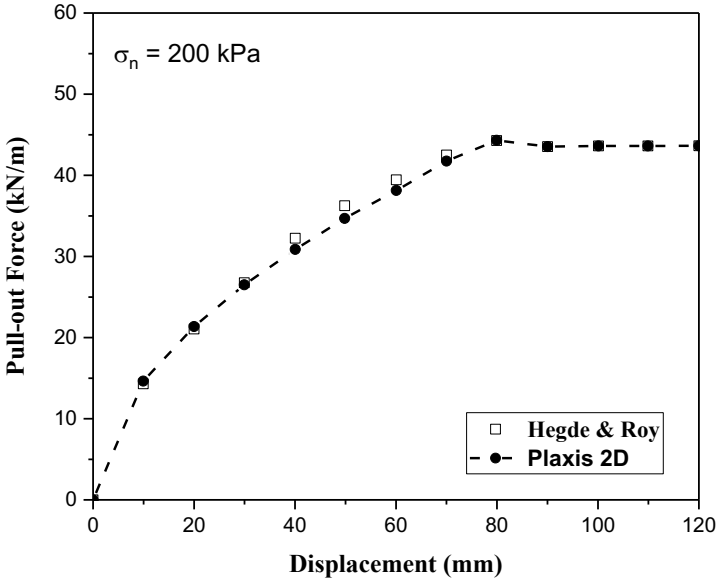
Figure 5.3 shows the pull-out result of sand B, the result has a good match with the numerical result conducted by Hegde & Roy (2018). From this graph, we can see that the peak pull-out force is lower than the peak on the soil A.



(a)



(b)

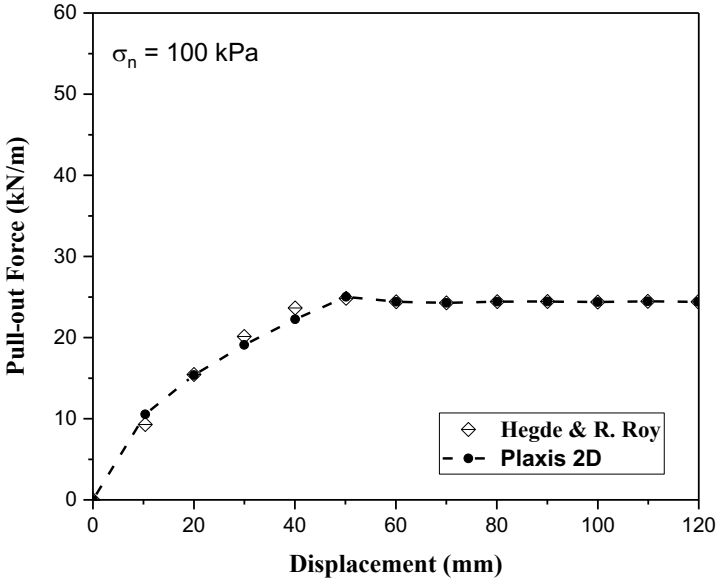


(c)

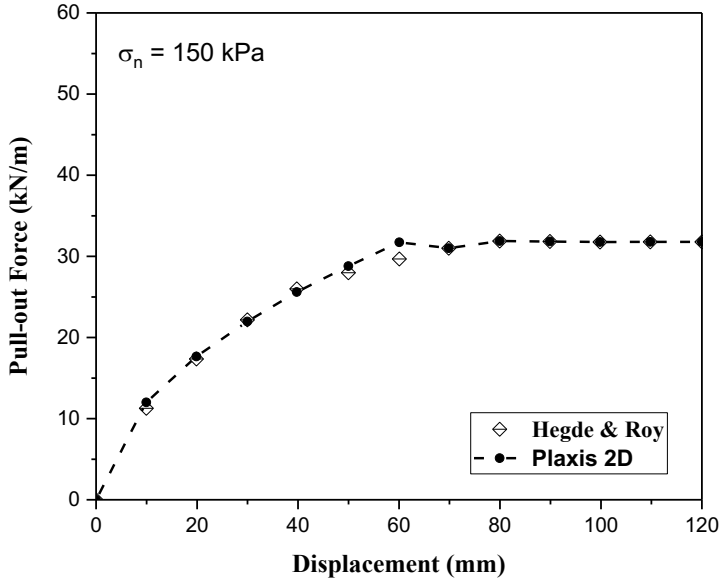
Figure 5.3 Pull-out Result for Sand B in Different Normal Stress

(a) 100 kPa, (b) 150 kPa, (c) 200 kPa.

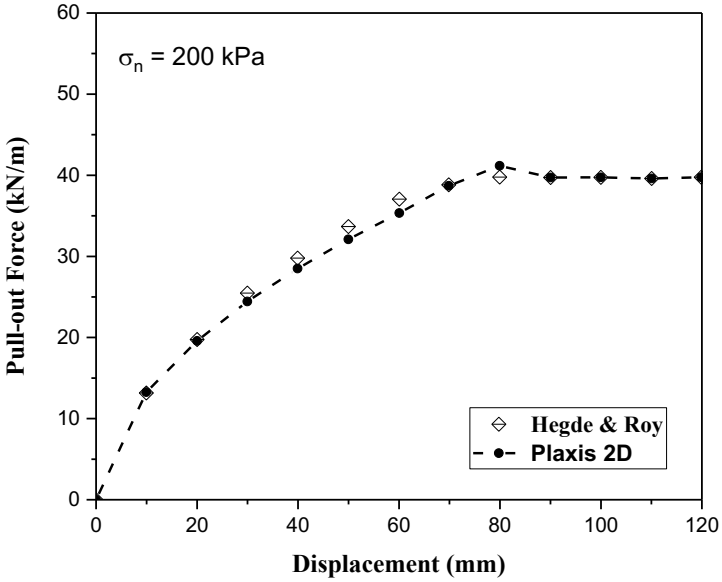
For sand C, with higher content of fines, the maximum pull-out forces are also decreasing compare with the sand A and sand B. Maximal pull-out force reached for this sand is only around 40 kN/m when it was loaded with 200 kPa. Here we can see the significant effect of fines in sand when we do the pull-out test. The result for sand C also has a good agreement with the result from Hegde & Roy (2018). The result of sand C can be seen on Figure 5.4.


σn = 100 kPa
Pull-out Force (kN/m)
Displacement (mm)
Hegde & R. Roy
Plaxis 2D
0
10
20
30
40
50
60
0
20
40
60
80
100
120

(a)


σn = 150 kPa
Pull-out Force (kN/m)
Displacement (mm)
Hegde & Roy
Plaxis 2D
0
10
20
30
40
50
60
0
20
40
60
80
100
120

(b)



(c)

Figure 5.4 Pull-out Result for Sand C in Different Normal Stress

(a) 100 kPa, (b) 150 kPa, (c) 200 kPa.

All results obtained from numerical simulation from Plaxis 2D show a match. The results show a decrease in pull-out force when the fines content in the sand increases. At some point, the pull-out force become constant. It indicates that the model has reached its maximum pull-out force. To summarize the pull-out results for sand A, B, and C, Figure 5.5 shows a summary of the pull-out results for each sand tested. The graph shows the relationship between normal stresses that was given with the maximum pull-out test value obtained from each sand. From the graph, there is almost no gap between the results of Plaxis 2D and the results obtained by Hegde & Roy (2018). With the results shown, the numerical simulation that has been done has a fairly high accuracy.

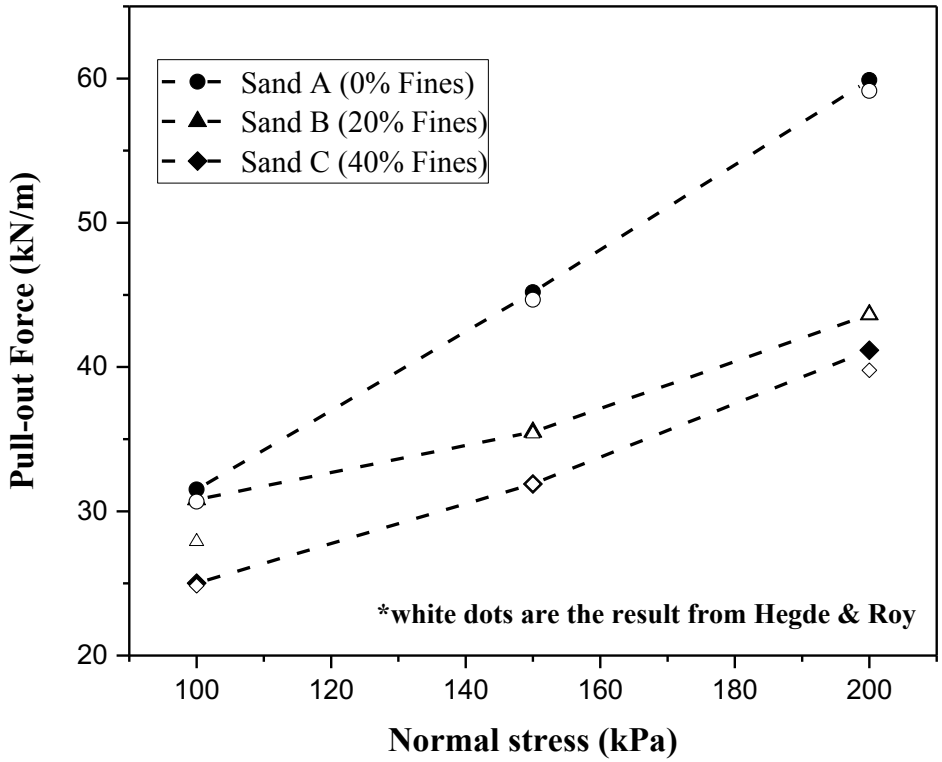


Figure 5.5 Summarize of pull-out results for sand A, sand B, and sand C.

5.3 Discussion

All numerical simulations that have been performed show a match, the results of Plaxis 2D have results that are almost similar to the results obtained by Hegde & Roy. From the results of the pull-out carried out numerically, it can be seen that the peak pull-out force is at a displacement of 60 and 100 mm. Pull-out force increases progressively as the normal stress increases. Non-uniform displacement along the geotextile causes an increase in the pull-out force. The relative displacement between sand and geotextile also causes non-linear distribution of the shear stress

obtained. It leads the development of failure mechanisms at the interface. The presence of fines in sand can reduce pull-out resistance between sand and geotextile. The maximum pull-out force is found in sand A, where this sand has no fines content. This means that sand A has good tensile strength mobilization. On sand B, it shows a decrease in pull-out force, even though sand A and B have the same friction angle. The maximum pull-out force obtained on sand B is lesser than sand A. Sand C shows the same behavior when sand contains fines. With the highest fines content among other sands, sand C gets the lowest maximum pull-out force. The fines content really affects the pull-out resistance in case of sand B and C.