

Integrated Structural Assessment of an Industrial Port Jetty under Vessel Upgrading in Gresik

Ifarrel Rachmanda Hariyanto^{1✉}, Raden Buyung Anugraha Affandhie²,
Adetiasyah Caesar Wahyugo³, Kohar Yudoprasetyo⁴, Moh. Fadhlhan Rosyidi⁵

^{1, 2, 3, 4, 5} Department of Civil Infrastructure Engineering, Faculty of Vocational Studies, Institut Teknologi Sepuluh Nopember, Surabaya, Indonesia

✉ **Corresponding Author** : Ifarrel Rachmanda Hariyanto (e-mail: ifarrelrh@its.ac.id)

Article Information	ABSTRACT
Article History Received : August 03, 2026 Revised : August 29, 2026 Published : October 02, 2026	Increasing the vessel class at an existing jetty can be governed by structural resistance, lateral pile response, marine equipment, or water depth. This study evaluates a 10,000 DWT pile-supported precast dry-bulk jetty at Industrial Port, Gresik, for 20,000, 30,000, and 40,000 DWT vessels. The assessment used project drawings, vessel particulars, bathymetry, borehole and SPT records, metocean data, finite element modelling, reinforced-concrete capacity checks, pile axial and lateral evaluation, fender and bollard screening, and a finite element method model. At 30,000 DWT, the maximum flexural demand-to-capacity ratios were 0.995 for beams, 0.624 for half slabs, and 0.967 for pile caps. The corresponding pile-head displacement and stress ratio were 98.96 mm and 0.97. At 40,000 DWT, the maximum ratios increased to 1.81, 1.10, and 1.03, while pile displacement and stress ratio reached 238.88 mm and 1.37. The largest feasible class is therefore 30,000 DWT, conditional on replacing the fender, dredging the berth pocket by about 2 m, and controlling operations. The in-situ dredging volume was 57,905 m ³ ; with a 1.10 bulking factor, the estimated handled volume was 63,605.5 m ³ . The static post-dredging safety factor was 1.67.
Keywords: <i>Berthing energy;</i> <i>Dry-bulk jetty;</i> <i>Pile-supported structure;</i> <i>Structural assessment;</i> <i>Vessel upgrading</i>	

INTRODUCTION

Maritime terminals are long-life assets, whereas the vessels and cargo-handling systems that use them continue to change. Dry-bulk operators may therefore seek to receive ships larger than the class adopted in the original design. The commercial benefit can be immediate, but the engineering consequences extend beyond deadweight tonnage: a larger vessel changes berth-length demand, berthing energy, mooring load, operating draft, and the horizontal actions transferred through the fender, deck, pile caps, and foundation piles. Upgrading an existing asset rather than replacing it can also support broader resource-efficiency goals. This perspective is consistent with recent Indonesian studies that promote circular material use and integrated energy-saving strategies in the built environment (Tajunnisa et al., 2024; Zuhdy et al., 2025a).

A pile-supported jetty is sensitive to interaction among these components. The concrete deck distributes crane, vehicle, and cargo loads, while the piles resist axial force and lateral deformation through the surrounding soil. Fender selection affects both energy absorption and the reaction transmitted to the structure. Dredging improves under-keel clearance but increases the exposed pile length and changes the seabed profile. For an existing structure, deterioration and the actual condition of concrete, reinforcement, and steel-pipe piles add further uncertainty. Indonesian studies on existing infrastructure have shown that inspection data and non-destructive testing can materially change the interpretation of residual capacity and maintenance priorities (Dewata et al., 2026; Yudoprasetyo et al., 2026). Recent studies also show that corrosion, cyclic

loading, and pile damage can alter high-piled-wharf response, particularly when calculated utilisation is close to its limit (Li et al., 2024; Wang et al., 2024; Xu et al., 2024; Zhao et al., 2023).

Previous studies have examined individual parts of this problem. Utomo (2018) compared alternative jetty arrangements, Utomo (2021) assessed an existing berth for mobile-crane loading, and Sulardi (2018) discussed pile repair in a marine environment. Dewata et al. (2026) more recently combined visual inspection, non-destructive testing, core drilling, underwater pile-thickness measurement, finite element modelling, and fatigue assessment for an existing container wharf under harbour-mobile-crane loading. Seismic and experimental studies have also shown the importance of soil deformation, pile response, wharf-crane interaction, berthing impact, and fender behaviour (Boyke & Nagao, 2022, 2023; Djameluddin et al., 2023; Özcebe et al., 2022; Su et al., 2020; Xie et al., 2023; Zeng et al., 2024). Numerical investigations in other structural applications likewise show that finite-element results become more credible when they are checked against experimental or measured response and when the sensitivity of structural configuration is evaluated explicitly (Hariyanto et al., 2022; Yudoprasetyo et al., 2026; Zuhdy et al., 2025b).

Most published assessments focus on one hazard or one component. A port operator, however, needs a system-level decision: the largest vessel that can use the existing berth, the component that governs the limit, and the minimum intervention required. An axial pile check alone can be misleading because vertical resistance may remain adequate after superstructure flexure, pile-head displacement, combined pile stress, fender capacity, berth geometry, or water depth has become unacceptable. This study therefore combines the principal structural, marine-facility, and bathymetric checks in one staged assessment. Accordingly, the contribution of this work is the integrated identification of the governing vessel-upgrade limit by linking member capacity, pile response, berth geometry, marine equipment, and dredging requirements within the same case-specific decision process.

The case study is an existing precast dry-bulk jetty at Industrial Port, Gresik, East Java. A 10,000 DWT vessel was used as the baseline, followed by 20,000, 30,000, and 40,000 DWT scenarios. The objectives were to identify the maximum feasible vessel class, quantify the governing structural and operational constraints, and define the interventions required before upgraded operation.

RESEARCH METHODS

The assessed facility is a 200.8 m long and 30 m wide precast dry-bulk jetty operated by PT Berlian Manyar Sejahtera at Industrial Port. The deck elevation is +5.00 m LWS and the existing seabed is approximately -10.00 m LWS. The superstructure comprises 350 mm half slabs, 500 × 850 mm beams, fender planks, and two pile-cap geometries. Concrete strength was 30 MPa and the main reinforcement yield strength was 420 MPa. The foundation consists of ASTM A252 Grade 2 steel pipe piles with an outside diameter of 812.8 mm, a nominal wall thickness of 16 mm, and a documented yield strength of 240 MPa. The source model used about 30 m embedment below the seabed and a total pile length of approximately 45 m.

Table 1. Source-derived design basis and assessment criteria

Item	Source-derived design basis
Jetty geometry	200.8 × 30 m; deck +5.00 m LWS; seabed about -10.00 m LWS
Concrete structure	f _c 30 MPa; f _y 420 MPa; half slab 350 mm; beams 500 × 850 mm
Steel pipe piles	ASTM A252 Gr. 2; D 812.8 × 16 mm; f _y 240 MPa; total length about 45 m
Vessel scenarios	Dry-bulk vessels: 10,000, 20,000, 30,000, and 40,000 DWT
Applied loads	Self-weight; UDL 3 t/m ² ; T-500; HMC 150; wind, current, wave, mooring, berthing, and earthquake

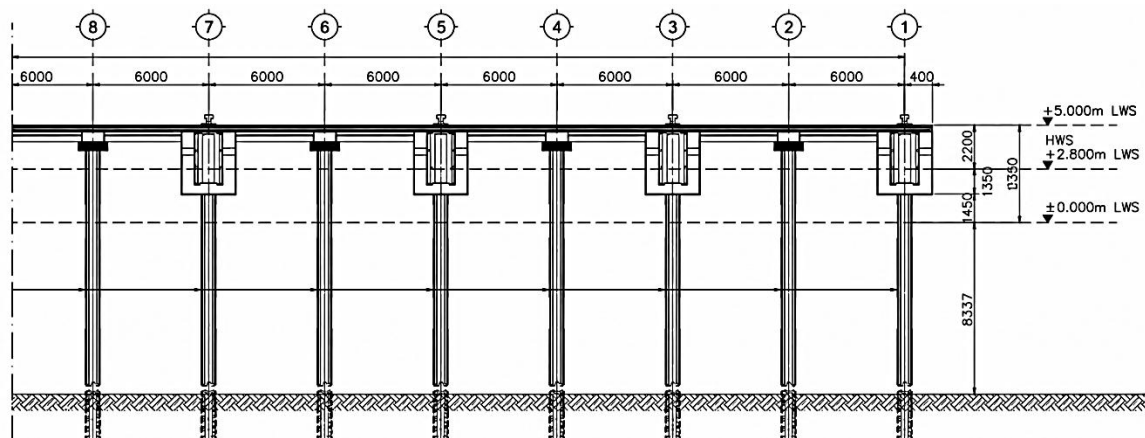


Figure 1. Representative longitudinal section and pile arrangement

The 10,000 DWT case was analysed first. Vessel-related actions were then revised for 20,000, 30,000, and 40,000 DWT while the structural geometry, material properties, and soil-spring arrangement were retained. The finite element model represented the principal deck members, pile caps, pipe piles, and depth-dependent springs derived from the borehole and N-SPT interpretation used in the source study. Vertical actions included self-weight, a 3 t/m² distributed live load, the T-500 truck model, and the project arrangement for a nominal 150-ton harbour mobile crane. Horizontal actions included mooring, berthing, wind, current, wave, earthquake, and soil-spring reactions. The analytical sequence follows the broader practice of combining global finite-element demand with independent member-capacity checks, as applied in recent Indonesian structural assessments (Hariyanto et al., 2025; Yudoprasetyo et al., 2025; Yudoprasetyo et al., 2026).

Strength and service combinations followed the project assessment basis and the Port of Long Beach Wharf Design Criteria (2015). Reinforced-concrete checks used SNI 2847:2019, while vehicle and seismic actions followed SNI 1725:2016 and SNI 2833:2016 (Badan Standardisasi Nasional, 2016a, 2016b, 2019). The allowable pile axial resistance was 427.7 tonnes. The source study adopted a 100 mm operational pile-displacement limit and a maximum pile stress ratio of 1.0. Post-dredging stability was analysed in finite element method with the Hardening Soil model. The profile consisted of a 4 m very soft clay layer over loose-to-dense sand strata, and the dredged slope was modelled at 1V:5H.

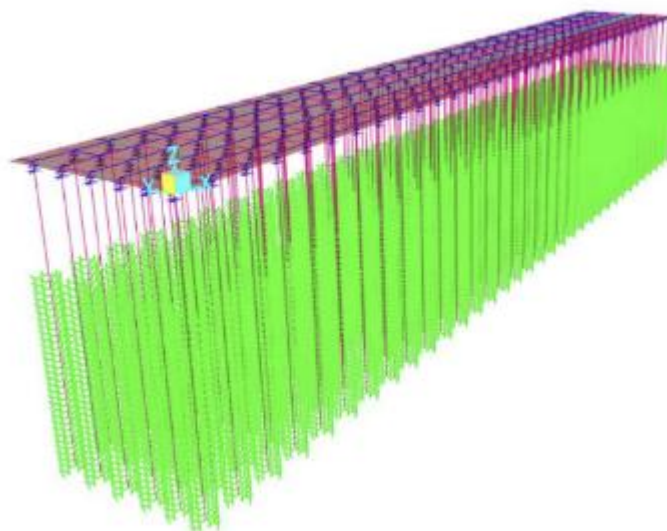


Figure 2. Three-dimensional finite element model of the existing jetty

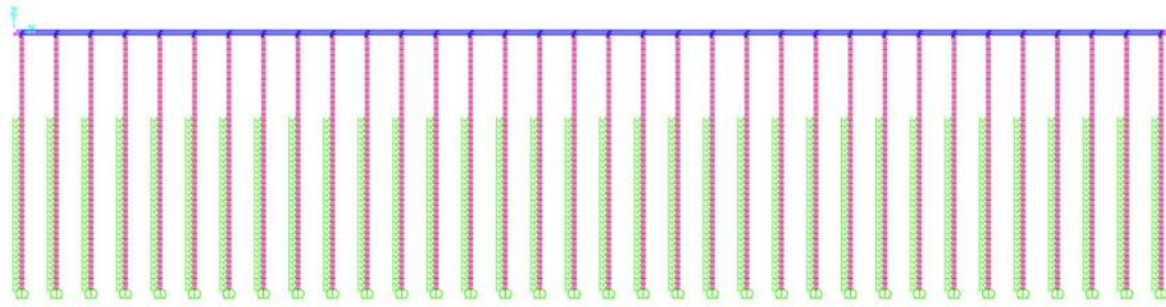


Figure 3. Longitudinal finite element representation of the deck, piles, and soil springs

The principal screening equations are given in Equations (1)-(4). For one vessel, the berth-length requirement was 1.10 times the length overall. Berthing energy was calculated from vessel mass, approach velocity, and the adopted hydrodynamic and configuration coefficients. Fender selection was screened against rated energy absorption; the final manufacturer check must also address reaction force, hull pressure, panel, chain, and anchor capacity. A scenario was accepted only when berth geometry, fender and bollard capacity, reinforced-concrete demand, pile axial and lateral response, and seabed conditions were all satisfactory or could be addressed by a defined intervention.

$$L_{req} = 1.10 LOA \quad (1)$$

$$E = 0.5 m V^2 C_m C_e C_s C_c \quad (2)$$

$$M_u / (\phi M_n) \leq 1.0 \text{ and } P_{max} / P_{allow} \leq 1.0 \quad (3)$$

$$\Delta h \leq 100 \text{ mm and stress ratio} \leq 1.0 \quad (4)$$

In these expressions, L_{req} is the required berth length; LOA is vessel length overall; E is berthing energy; m and V are vessel mass and berthing velocity; C_m , C_e , C_s , and C_c are the adopted energy coefficients; M_u is factored moment; ϕM_n is design flexural resistance; P_{max} and P_{allow} are maximum and allowable pile axial loads; and Δh is pile-head displacement. A scenario was considered feasible only when geometry, marine equipment, superstructure capacity, pile response, and seabed conditions were either acceptable or could be addressed by a defined intervention.

RESULTS AND DISCUSSION

Vessel and Marine-Facility Requirements

The berth-length check remains satisfactory through 30,000 DWT. Required lengths are 148.5, 172.7, and 193.6 m for the 10,000, 20,000, and 30,000 DWT vessels, leaving only 6.4 m of nominal reserve in the 30,000 DWT case. The 40,000 DWT vessel requires 214.5 m and exceeds the available berth before structural strength is considered. The existing 1,000 kN bollard remains above the adopted mooring demands, which range from 350 to 700 kN.

Table 2. Vessel particulars and marine-facility screening

DWT	LOA / B / T (m)	Lreq (m)	Mooring / Eberth	Required action
10,000	135 / 19.8 / 7.6	148.5	350 kN / 17.34 tonf·m	Existing V800H-2000L acceptable
20,000	157 / 23.0 / 9.2	172.7	700 kN / 18.10 tonf·m	Existing fender close to rating
30,000	176 / 26.0 / 10.3	193.6	700 kN / 26.73 tonf·m	Replace with V1000H-2000L; dredge 2 m
40,000	195 / 29.0 / 11.5	214.5	700 kN / 47.36 tonf·m	Berth extension and structural redesign required

The fender check becomes critical before the bollard check. The installed V800H-2000L fender has a rated energy absorption of 18.2 tonf·m and a rated reaction of 67.4 tonf in the source data. It is adequate at 10,000 DWT and almost fully utilised at 20,000 DWT. The 30,000 DWT

demand of 26.73 tonf·m requires the V1000H-2000L unit, rated at 28.5 tonf·m with an 85.5 tonf reaction. The 40,000 DWT demand of 47.36 tonf·m can only be matched by the screened SSCnF 1000 unit, rated at 48.4 tonf·m, but this does not resolve the berth-length and structural failures. Figure 4 shows the two service constraints together.

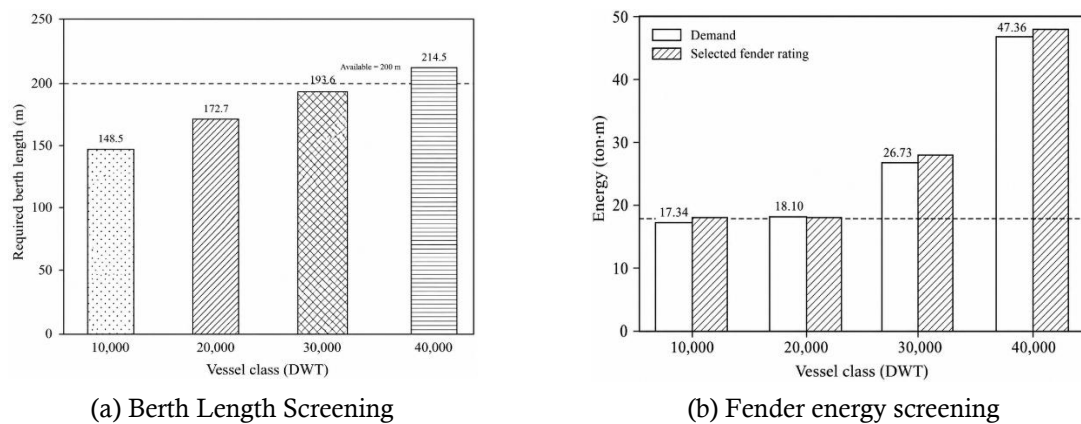


Figure 4. Berth-length and fender-energy screening for the evaluated vessel classes

Structural Response and Governing Capacity

The reinforced-concrete results provide a clearer measure of reserve than a simple OK/Not OK classification. The maximum beam flexural DCR increases from 0.71 at 10,000 DWT to 0.91 at 20,000 DWT and 0.995 at 30,000 DWT; at 40,000 DWT it reaches 1.81. The maximum half-slab DCRs are 0.59, 0.62, 0.62, and 1.10, while the corresponding pile-cap DCRs are 0.60, 0.85, 0.97, and 1.03. The fender plank remains non-governing, with a maximum DCR of only 0.23 at 40,000 DWT. Thus, the 40,000 DWT failure is concentrated in the primary beam-slab-pile-cap load path rather than in the local fender plank, as shown in Figure 5.

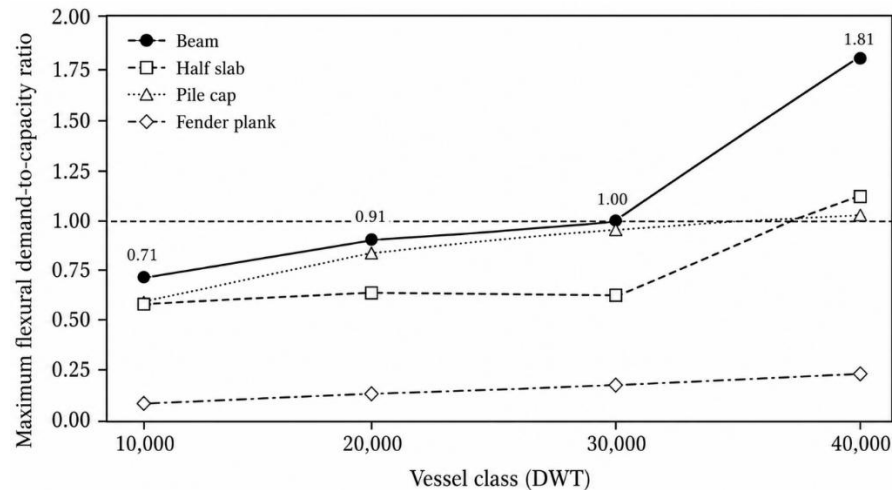


Figure 5. Maximum flexural demand-to-capacity ratio of the principal concrete components

Table 3. Source-derived structural demand and pile response

DWT	Max. flexural DCR beam / slab / pile cap	Axial op. / seismic (t)	Pile disp. (mm)	Pile stress ratio	Assessment
10,000	0.71 / 0.59 / 0.60	124.97 / 269.07	88.70	0.36	Baseline acceptable
20,000	0.91 / 0.62 / 0.85	126.29 / 270.65	92.98	0.72	Acceptable; fender near rating
30,000	0.995 / 0.62 / 0.97	127.83 / 272.25	98.96	0.97	Conditional with interventions
40,000	1.81 / 1.10 / 1.03	182.14 / 274.15	238.88	1.37	Not acceptable without redesign

Axial pile resistance does not govern, even the largest operational and seismic forces, 182.14 and 274.15 tonnes, remain below the 427.7-tonne allowable resistance. The lateral response is much more restrictive. Pile-head displacement rises from 88.70 mm at 10,000 DWT to 98.96 mm at 30,000 DWT and then to 238.88 mm at 40,000 DWT. The combined pile stress ratio follows the same trend, increasing from 0.36 to 0.97 and then 1.37. Table 3 and Figure 6 therefore show that the 30,000 DWT condition is feasible only with a narrow lateral reserve.

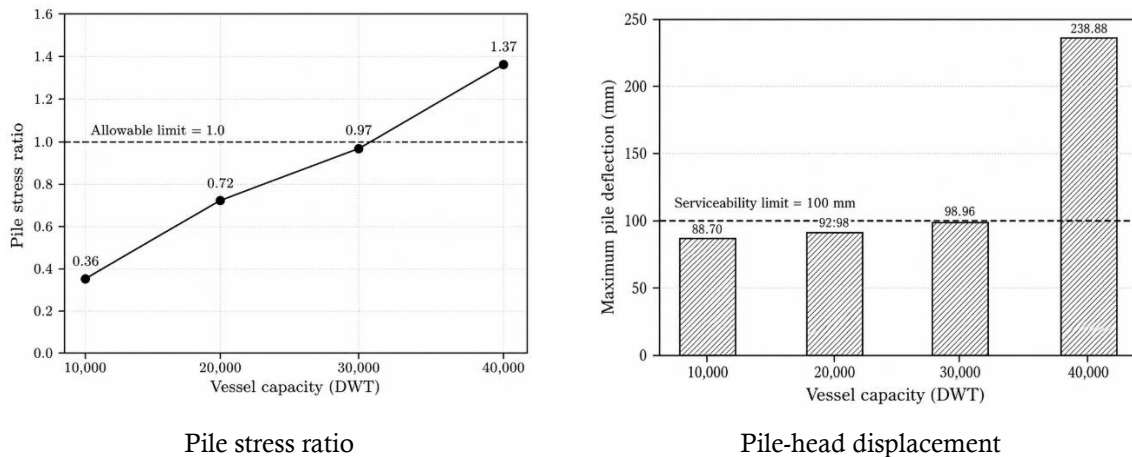


Figure 6. Pile stress ratio and maximum pile-head displacement for increasing vessel capacity

The source results show that the 30,000 DWT pile displacement is only 1.04 mm below the adopted limit and the stress ratio has a margin of 0.03. This small reserve is important because berthing energy varies with the square of approach velocity. A 10% increase in berthing speed would raise the impact energy by approximately 21%. Upgraded operation should therefore specify the permitted approach speed, tug assistance, crane position, and simultaneous live-load condition. The nominal 16 mm pile wall thickness and the condition of the pile heads, pile caps, bollard anchors, and fender support should also be verified before the higher vessel class is introduced. This recommendation is consistent with Dewata et al. (2026), who showed that the operational suitability of an existing wharf may vary by structural zone and should be tied to actual material condition, crane-load distribution, repeated-load demand, and periodic inspection. This near-limit response is consistent with experimental and numerical findings that lateral and berthing actions can govern high-piled-wharf performance even when axial pile resistance remains adequate (Wang et al., 2024; Xie et al., 2023).

The present assessment is based mainly on design documents and source-study data rather than a new condition survey. This limitation should be addressed before permanent operation at 30,000 DWT. Visual inspection alone may not reveal internal degradation, whereas combining condition ratings with UPV, rebound-hammer testing, corrosion screening, and thickness measurements provides a stronger basis for maintenance and residual-capacity decisions (Yudoprasetyo et al., 2026). Field measurements can also improve confidence in numerical model calibration and the interpretation of predicted response (Hariyanto et al., 2025). A focused verification programme should therefore include visual damage mapping, representative concrete testing, half-cell potential where corrosion is suspected, and underwater ultrasonic thickness measurements on selected steel piles.

Dredging stability and implementation conditions

The 30,000 DWT vessel has a 10.3 m design draft. The source study adopted a berth-pocket depth of approximately 12 m, so the existing -10 m LWS seabed requires a nominal 2 m cut. The associated water-area screening produced a one-way entrance-channel width of about 125 m, a minimum approach length of 1,232 m, a turning-basin diameter of about 180 m, and a berth pocket approximately 83 m wide and 220 m long. These dimensions are planning-level results and should be checked against an updated hydrographic survey and the final manoeuvring arrangement.

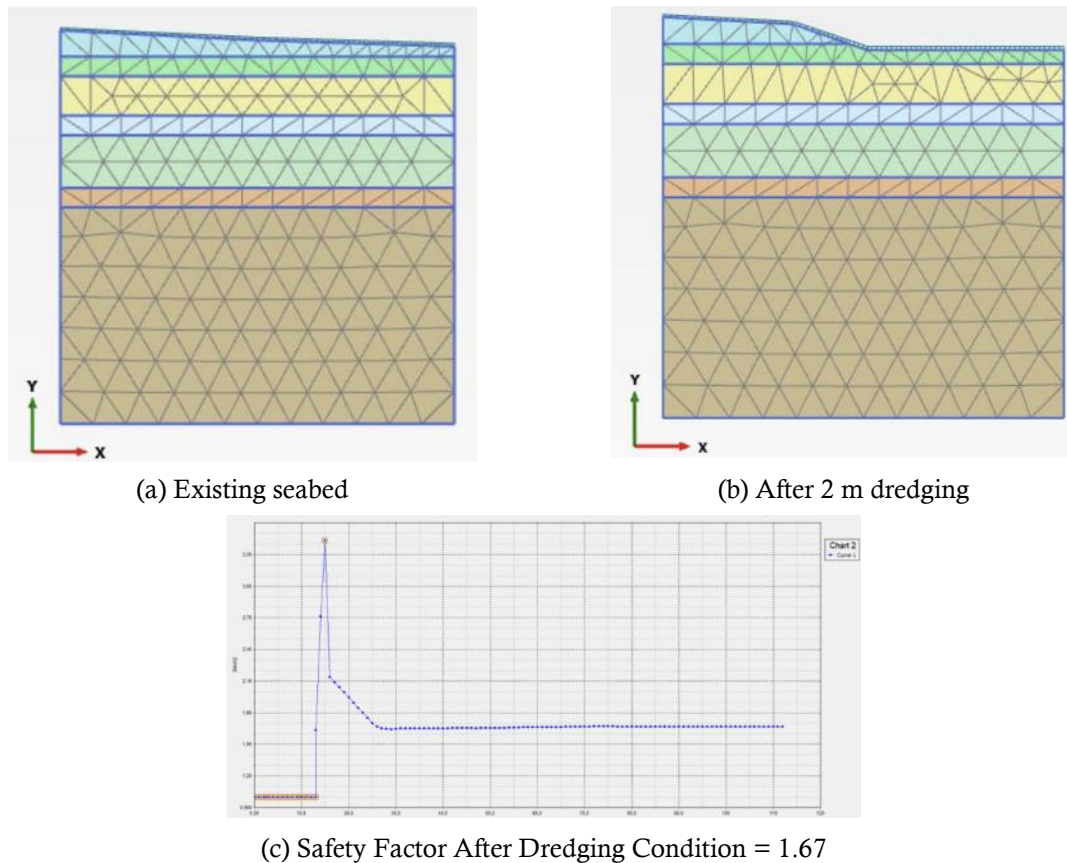


Figure 7. Finite Element Method models of the existing seabed (a), the profile after 2 m dredging (b), and safety factor after dredging (c)

The finite element model used the Hardening Soil formulation and the source borehole stratification. The upper 4 m layer was represented as very soft clay with $N\text{-SPT} = 1$, followed by sand layers ranging from very loose to dense. Dredging was modelled with a 1V:5H slope. The static strength-reduction analysis gave a post-dredging safety factor of 1.67. For the volume estimate, the dredging footprint was divided into four cross-sections; the calculated in-situ quantity was $57,905 \text{ m}^3$. Applying the source bulking factor of 1.10 produced an estimated handled volume of $63,605.5 \text{ m}^3$. This result is suitable for feasibility assessment, but the final quantity should be recalculated from pre-dredging and post-dredging surveys, side slopes, and over-dredging tolerances.

Considering all checks together, 30,000 DWT is the largest vessel class that can be supported without structural strengthening, and even this conclusion is conditional on fender replacement, dredging, verified structural condition, and controlled operation. The 40,000 DWT scenario fails four independent checks: the required berth length exceeds the available geometry, the principal concrete members exceed flexural resistance, pile-head displacement exceeds the operational criterion, and the pile stress ratio is greater than 1.0. Serving that vessel class would require berth extension, strengthening or additional piles, a revised fender system, and a new integrated analysis.

CONCLUSION

The existing precast dry-bulk jetty can accommodate a 30,000 DWT vessel only under defined technical and operational conditions. At this vessel class, the required berth length is 193.6 m, the maximum beam and pile-cap flexural DCRs are 0.995 and 0.97, pile-head displacement is 98.96 mm, and the pile stress ratio is 0.97. Axial pile resistance remains adequate. The V800H-2000L fender must be replaced by a V1000H-2000L unit or an equivalent system, and the berth pocket must be dredged by about 2 m to approximately -12 m LWS. The source calculation gives $57,905 \text{ m}^3$ in situ and $63,605.5 \text{ m}^3$ after applying the 1.10 bulking factor; the static post-dredging

safety factor is 1.67. The 40,000 DWT case is not feasible without redesign because berth length, beam and slab capacity, pile-cap capacity, pile displacement, and pile stress become unacceptable. Before upgraded operation, the actual pile thickness, concrete condition, fender and bollard anchorage, bathymetry, and operational loading envelope should be verified.

REFERENCES

- Badan Standardisasi Nasional. (2016a). *Pembebanan untuk jembatan (SNI 1725:2016)*. Badan Standardisasi Nasional.
- Badan Standardisasi Nasional. (2016b). *Perencanaan jembatan terhadap beban gempa (SNI 2833:2016)*. Badan Standardisasi Nasional.
- Badan Standardisasi Nasional. (2019). *Persyaratan beton struktural untuk bangunan gedung (SNI 2847:2019)*. Badan Standardisasi Nasional.
- Boyke, C., & Nagao, T. (2022). Seismic performance assessment of wide pile-supported wharf considering soil slope and waveform duration. *Applied Sciences*, 12(14), 7266. <https://doi.org/10.3390/app12147266>
- Boyke, C., & Nagao, T. (2023). Seismic performance assessment of pile-supported wharfs: 2D frame analysis method considering both inertial and kinematic forces. *Applied Sciences*, 13(6), 3629. <https://doi.org/10.3390/app13063629>
- Dewata, J. V., Darmawan, M. S., Refani, A. N., Rosyidi, M. F., & Yudoprasetyo, K. (2026). Evaluasi kinerja statik dan fatik dermaga peti kemas eksisting akibat operasional harbour mobile crane. *RekaRacana: Jurnal Teknik Sipil*, 12(2), 115-123. <https://doi.org/10.26760/rekaracana.v12i2.115>
- Djamaluddin, F., Fajrin, M., Ilyas, A., Kurniawan, B., & Paotonan, C. (2023). Finite element analysis and optimization of foam-filled fenders under quasi-static and dynamic loadings. *Frontiers in Mechanical Engineering*, 9, 1091345. <https://doi.org/10.3389/fmech.2023.1091345>
- Fotopoulou, S., Karafagka, S., Karatzetzou, A., & Pitilakis, K. (2022). System-wide seismic risk assessment of port facilities: Application to the Port of Thessaloniki, Greece. *Sustainability*, 14(3), 1424. <https://doi.org/10.3390/su14031424>
- Hariyanto, I. R., Suswanto, B., & Habieb, A. B. (2022). Analisis numerik vertical shear link (VSL) secara sub-assemblage menggunakan program bantu ABAQUS. *Jurnal Aplikasi Teknik Sipil*, 20(3), 333-342. <https://doi.org/10.12962/j2579-891X.v20i3.13298>
- Hariyanto, I. R., Suswanto, B., Habieb, A. B., & Raka, I. G. P. (2025). Studi analisis perkuatan struktur gedung 5 lantai di Surabaya akibat beban dinamis menggunakan shearwall. *Bangunan: Teori, Praktik, Penelitian, dan Pengajaran Teknik Bangunan*, 30(2), 153-168. <https://doi.org/10.17977/um071v30i22025p153-168>
- He, X., Qin, X., Huang, M., Xie, X., Du, C., & Fan, W. (2024). A new type of wharf and a study of its mechanical properties by finite-element and experimental methods. *Buildings*, 14(7), 2067. <https://doi.org/10.3390/buildings14072067>
- Li, P., Li, J., Li, L., Zhou, P., & Liu, G. (2024). Overall structural degradation of a high-piled wharf under chloride invasion and the impact force of ship berthing. *Ocean Engineering*, 312, 119320. <https://doi.org/10.1016/j.oceaneng.2024.119320>
- Port of Long Beach. (2015). *Port of Long Beach wharf design criteria (Version 4.0)*. Port of Long Beach.
- Su, L., Wan, H. P., Luo, Y., Dong, Y., Niu, F., Lu, J., Ling, X. Z., Elgamal, A., & Arulmoli, A. K. (2020). Seismic performance assessment of a pile-supported wharf retrofitted with different slope strengthening strategies. *Soil Dynamics and Earthquake Engineering*, 129, 105903. <https://doi.org/10.1016/j.soildyn.2019.105903>
- Sulardi. (2018). Perbaikan dan proteksi pondasi tiang dermaga dengan metode pile encapsulation. *Borneo Engineering: Jurnal Teknik Sipil*, 2(1), 14-21. <https://doi.org/10.35334/be.v2i1.608>
- Tajunnisa, Y., Cahyani, A. A., Masrafat, H., Hariyanto, I. R., Wibowo, Y. N., Alfayet, M. R., & Halisah, V. N. (2024). FABAKO: Program pemanfaatan limbah fly ash dan bottom ash

- (FABA) sebagai paving jalan untuk meningkatkan UMKM masyarakat Paiton. *Sewagati*, 8(5), 2205-2217. <https://doi.org/10.12962/j26139960.v8i5.2186>
- Utomo, E. (2018). Perbandingan desain dermaga terapung pada sistem konstruksi melintang dan memanjang: Studi kasus Dermaga Pelabuhan Tideng Pale Kabupaten Tana Tidung. *Borneo Engineering: Jurnal Teknik Sipil*, 2(1), 1-13. <https://doi.org/10.35334/be.v2i1.607>
- Utomo, E. (2021). Analisis kelayakan struktur Dermaga IV Pelabuhan Malundung Kota Tarakan untuk kapasitas mobil crane bongkar muat. *Borneo Engineering: Jurnal Teknik Sipil*, 5(1), 103-116. <https://doi.org/10.35334/be.v5i1.1655>
- Wang, J., Su, L., Xie, L., & Ling, X. (2024). Quasi-static model test of pile-supported wharf under cyclic lateral loading. *Journal of Marine Science and Engineering*, 12(1), 115. <https://doi.org/10.3390/jmse12010115>
- Wang, Z., Liu, K., Liu, J., Meng, Q., Qiu, W., & Zong, S. (2024). Experimental and simulation studies on protective structures in floating dock. *Journal of Marine Science and Engineering*, 12(8), 1311. <https://doi.org/10.3390/jmse12081311>
- Xie, L., Su, L., Wan, H. P., Wang, J., Bi, J., & Ling, X. (2023). Experimental study on dynamic response of pile-supported wharf under wave and ship berthing collision. *Applied Ocean Research*, 135, 103561. <https://doi.org/10.1016/j.apor.2023.103561>
- Xu, X., Di, X., Zheng, Y., Liu, A., Hou, C., & Lan, X. (2024). Dynamic response characteristics and pile damage identification of high-piled wharves under dynamic loading. *Applied Sciences*, 14(20), 9250. <https://doi.org/10.3390/app14209250>
- Yudoprasetyo, K., Darmawan, M. S., Hariyanto, I. R., & Rahman, R. A. (2026). Modifikasi Jembatan Jurug-B dengan Box Girder Beton Prategang Balanced Cantilever. *Composite: Journal of Civil Engineering*, 5(1), 41–52. <https://doi.org/10.26905/cjce.v5i1.17264>
- Yudoprasetyo, K., Prasetya, A. D., Rosyidi, M. F., Hariyanto, I. R., Wibowo, Y. N., Affandhie, R. B. A., Mansur, M. S., Ashara, K. F., Darmawan, M. S., Alrasyidi, M. A., & Wahyudi, H. (2025). Upaya penguatan keselamatan prasarana sekolah melalui evaluasi teknis struktur kolom pada bangunan pendidikan di Bojonegoro. *Inovasi Jurnal Pengabdian Masyarakat*, 3(3), 255-266. <https://doi.org/10.54082/ijpm.1063>
- Yudoprasetyo, K., Rosyidi, M. F., Hariyanto, I. R., Wibowo, Y. N., Mansur, M. S., Wahyudi, H., & Prasetya, A. D. (2026). Integrasi Bridge Management System (BMS) dan Non-Destructive Testing (NDT) untuk prediksi umur jembatan pada ruas jalan Jawa Timur. *Jurnal Sainstek STT Pekanbaru*, 14(1), 50-60. <https://doi.org/10.35583/js.v14i1.432>
- Zeng, H., Zhu, R., Wang, Q., & Zou, J. (2024). High-accuracy and fast calculation framework for berthing collision force of docks based on surrogate models. *Journal of Marine Science and Engineering*, 12(6), 898. <https://doi.org/10.3390/jmse12060898>
- Zhao, X., Liao, X., Hu, Z., Li, X., Nie, Y., Liu, J., & Xu, Y. (2023). Seismic fragility analysis of steel pipe pile wharves with random pitting corrosion. *Buildings*, 13(10), 2619. <https://doi.org/10.3390/buildings13102619>
- Zuhdy, A. Y., Firdausi, N., Hariyanto, I. R., & Alrasyidi, M. A. (2025a). Identification of factors influencing indoor electricity consumption in Surabaya and energy saving strategies in tropical climate. *Smart Cities and Regional Development Journal*, 9(4), 93-104.
- Zuhdy, A. Y., Hariyanto, I. R., & Firdausi, N. (2025b). Optimalisasi desain scaffolding: Studi pengaruh scaffolding dengan penambahan outrigger. *Jurnal Aplikasi Teknik Sipil*, 23(1), 31-38.
- Özcebe, A. G., Bozzoni, F., & Borzi, B. (2022). Seismic vulnerability assessment of critical port infrastructure components by modelling the soil-wharf-crane interaction. *Infrastructures*, 7(8), 102. <https://doi.org/10.3390/infrastructures7080102>