Chapter 10 Self-Weight and Surcharge

[Public Notice] (Self-weight and Surcharge)

Article 20

1 Self-weight shall be appropriately set based on the unit weight of each material.

2 Surcharge load shall be appropriately set in consideration of the assumed usage conditions, etc. of the facilities.

[Interpretation]

7. Setting of Environmental Conditions

(8) Other Matters (Article 6 of the Ministerial Ordinance and the interpretation related to Article 19 and 20 of the Public Notice))

② **Self-weight and surcharge**

When setting the self-weight and surcharge to be considered in the performance verifications of facilities subject to the technical standards, appropriate consideration shall be given to the preload, weight of construction equipment, and other loads applied during construction as needed.

1 General

(1) When verifying the performance of a port facility, its self-weight and surcharge shall be considered if necessary.

(2) Self-weight and surcharge are defined respectively as follows:

① Self-weight: This refers to the weight of the facility itself.

② Surcharge: The surcharge mentioned here is classified as static loads or live loads and refers to the actions of static loads, snow loads, train loads, vehicle loads, cargo-handling equipment loads, sidewalk live loads, and other loads. When setting the surcharge, it is necessary to appropriately consider the assumed usage conditions of the facility.

The characteristic value of surcharge shall be appropriately set by considering the usage conditions of the port facility, such as the type and volume of the cargo handled, and the handling methods.

(a) Static loads

Static loads are applied by general cargo and bulk cargo loaded on aprons, sheds, warehouses, and other facilities. In regions with heavy snowfall, snow that accumulated on an apron is also regarded a type of static load, namely, a snow load. For more information, refer to Article 86 of **the Order for Enforcement of the Building Standards Act** (Cabinet Order No. 156 of 2017).

(b) Live loads

The following dynamic loads shall be considered as live loads if necessary when verifying the performance of port facilities.

1) Train load

2) Vehicle load

3) Cargo-handling equipment load

4) Sidewalk live load

(3) The self-weight and surcharge to be considered in the performance verification of a port facility must be set with consideration given to the type of actions on the facility and its loading conditions. In particular, the self-weight and surcharge have large effects on the performance verification of the circular slip failure of quaywalls and the performance verification of beams and slabs of piled piers. Therefore, sufficient care should be taken when determining the types and sizes of self-weight and surcharge.

2 Self-weight

(1) Self-weight

In the performance verification of a facility to which the technical standards apply, the self-weight must be appropriately set on the basis of the unit weight of each material.

(2) The values given in **Table 2.1.1**[1)] may be generally used as the characteristic values of the unit weights in the calculation of self-weight, except in cases wherein the unit weights can be specified in preliminary surveys or other methods.

(3) The unit weights of stone, sand, gravel, and rubble depend on the stone quality, whereas the unit weights of materials other than metals, such as steel and aluminum, vary case by case. When using these materials, the characteristic values of unit weights must be determined with care.

Table 2.1.1 Characteristic Values of Unit Weights of Materials[1)]

Material	Characteristic value of unit weight (kN/m^3)
Steel and cast steel	77.0
Cast iron	71.0
Aluminum	27.5
Reinforced concrete	24.0
Non-reinforced concrete	22.6
Timber	7.8
Asphalt concrete	22.6
Stone (granite)	26.0
Stone (sandstone)	25.0
Sand, gravel, and rubble (dry)	16.0
Sand, gravel, and rubble (wet)	18.0
Sand, gravel, and rubble (saturated)	20.0

[References]

1) Japan Port Association: Handbook of Construction of port facilities, p. 140, 1959

3 Surcharge

3.1 Static Load

(1) Static loads in permanent situations

① When determining the characteristic values of static loads in permanent situations, it is preferable to adequately consider factors such as cargo type handled, packing type, volume, handling methods, and loading time.

② Generally, in the performance verification of a facility such as an apron, a shed, or a warehouse, the mean value of the static load in an area of the facility is used. However, in the performance verification of a structural member, the static load on it is often used directly. The static load acting on an apron has a large effect on the stability verification of a mooring facility; therefore, it is necessary to consider it separately from the static loads on other facilities, such as sheds and warehouses. For an apron, the mean value of the static load per area is usually dependent on the scale of the mooring facility and the type of cargo handled, and the mean value may be determined by referring to verifications performed in the past. In the case of general-purpose wharves, the values from approximately 10 to 30 kN/m^2 are often used as the characteristic values of the static loads acting on aprons. For aprons wherein heavy cargo such as containers or steel is handled, it is preferable to determine the value of the static load on the basis of the study of usage conditions.

③ The characteristic values of unit weights for bulk cargo were obtained on the basis of surveys of past actual conditions, which are listed in **Table 3.1.1**.[1)]

Table 3.1.1 Characteristic Values of Unit Weights for Bulk Cargo[1)]

Type of cargo	Characteristic value of unit weight (kN/m^3)
Coke	4.9
Coal (lump)	8.8–9.8
Coal (fine)	9.8–11.0
Iron ore	20.0–29.0
Cement	15.0
Sand, gravel, and rubble	16.0–20.0

(2) Static loads during seismic ground motion

① It is preferable to determine the characteristic values of static loads during seismic ground motion in variable and accidental situations by adequately predicting whether static loads will act or not when the design seismic occurs in the future. The existence or nonexistence of a static load differs depending on the type of facility, such as sheds, warehouses, open storage yards, and aprons.

② For facilities such as sheds, warehouses, and open storage yards, static loads during seismic ground motion may be set according to their usage conditions. On the contrary, for facilities used as cargo-handling facilities, such as aprons, where cargo is only placed temporarily, static loads will vary considerably in terms of size and state depending on whether a ship on the berth is being loaded/unloaded. Moriya and Nagao[2)] performed field measurements to study the moment-to-moment changes in the static load of bulk cargo that was loaded on an apron and evaluated the design value of the static load during seismic ground motion. According to their results, the design value of the static load during seismic ground motion is 0 kN/m^2 when it is calculated in accordance with **ISO 2394** and **Eurocodes**, but the adoption of 0 kN/m^2 as the design value of the static load during seismic ground motion results in the underestimation of the static load.[2)] Therefore, it is preferable to calculate the static load during seismic ground motion by assuming the mean value of the static load in the permanent situation as the characteristic value and by multiplying this value by 0.5.

(3) Unevenly distributed static load

① When verifying the performance of the whole part of a facility, it is possible to calculate the characteristic value of a static load such as an apron, a shed, or a warehouse by substituting an unevenly distributed load with a uniformly distributed load in an area of the facility. However, when a large concentrated load acts on the facility, it should be considered as the concentrated load.

② Usually, it is unlikely that materials, such as cargo, are evenly loaded over the entire area. However, when steel is placed on timber pillows, it can be assumed that its weight acts as a line load. In this case, it is preferable to assume that the weight is a concentrated load, such as a line load or a point load.

③ When considering a given area, even though the mean value of the unevenly distributed load may fall within the value of the uniformly distributed load used as a substitute, it is necessary to take into account the case wherein the unevenly distributed load acts as a concentrated load. For example, in the case of a sheet pile quaywall, a dangerous situation may arise if a large concentrated load acts on the back of the quaywall. Similarly, in the case of a piled pier or a similar facility, if a concentrated load acts in the center of a slab, the slab may break. These possibilities should be considered when setting the static load.

(4) Snow load

① In snowy districts, snow that accumulated on an apron may compact under its own weight or be compacted and hardened by automobiles and the like depending on the amount of snowfall, and such snow acts as a static load. Therefore, it is preferable to set an appropriate snow load in line with the actual conditions.

② For a mooring facility where snow removal operations will be performed, it is often sufficient to determine the snow load on the basis of overnight snowfall. In this case, it is possible for engineers to determine the snow load appropriately by taking into consideration past snowfall records, general weather conditions during snowfall, snow quality, snow removal, and other conditions.

③ In most cases, the snow load is set as 1 kN/m^2. This is equivalent to a snowfall of approximately 70 to 100 cm for dry or fresh powder snow.

④ **The Railway Structure Design Standards and Commentary**[3)] shows the relationship between normal snow conditions and the unit weight of snow as shown in **Table 3.1.2**.

Table 3.1.2 Snow Conditions and Characteristic Value of Unit Weight of Snow[3)]

Snow Condition	Characteristic Value of Unit Weight (kN/m^3)
Dry powder snow compressed under its own weight	1.2
Dry powered snow subject to wind pressure	1.7
Fairly wet snow compressed under its own weight	4.5
Very wet snow compressed under its own weight	8.5

3.2 Live Loads

(1) Train Load

The live loads caused by trains are based on the Technical Regulatory Standards on Japanese Railways.

① A train load shall be applied in such a way that induces the maximum effect on a facility or its members by taking into consideration the net weights, loaded weights, and axle arrangements of the trains or cars that are generally used for the line concerned. In doing so, the train load shall be applied as a full set of multiple loads in succession without dividing it into two or more separate sets.

② According to **the Railway Structure Design Standards and Commentary**[3)], electric locomotives and diesel locomotives are mainly used for rail transport. In view of the extension of sections dedicated for electric railcar operations, EA-loads based on electric locomotives (**Fig. 3.2.1**) and M-loads based on modeled passenger trains, including electric railcars and diesel railcars (**Fig. 3.2.2**), are currently used as train loads for locomotives.

												(kN)	(kN/m)
E-10	100	100	100	100	100	100	100	100	100	100	100	100	29
E-11	110	110	110	110	110	110	110	110	110	110	110	110	32
E-12	120	120	120	120	120	120	120	120	120	120	120	120	35
E-13	130	130	130	130	130	130	130	130	130	130	130	130	38
E-14	140	140	140	140	140	140	140	140	140	140	140	140	41
E-15	150	150	150	150	150	150	150	150	150	150	150	150	44
E-16	160	160	160	160	160	160	160	160	160	160	160	160	47
E-17	170	170	170	170	170	170	170	170	170	170	170	170	50
Wheelbase (m)	2.8m	2.0	2.8	2.0	2.8	4.0	2.8	2.0	2.8	2.0	2.8	2.0	

			(kN)	
A-10	76	112	112	Axle Load (kN)
A-11	84	123	123	
A-12	92	134	134	
A-13	99	145	145	
A-14	107	156	156	
A-15	115	168	168	
A-16	122	179	179	
A-17	130	190	190	
Wheelbase (m)	1.9m	2.0		

Fig. 3.2.1 E-Loads and A-Loads in the EA-Load System3)

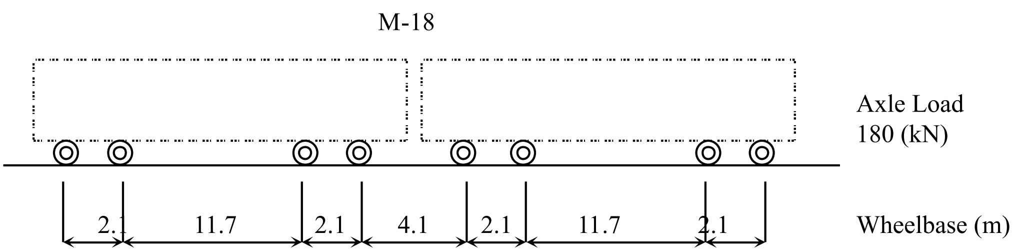


Fig. 3.2.2 M-Loads3)

(2) Vehicle Load

① For vehicle loads specified in the Appendix, refer to the **Highway Bridge Specifications and Commentary**.4)

② The **Highway Bridge Specifications and Commentary** specifies the vehicle loads. For port roads that are longer than 200 m, which are not subject to the **Highway Bridge Specifications and Commentary**, L-loads shall be set in consideration of the usage conditions of bridges.

(a) **Fig. 3.2.3** shows the T-loads.

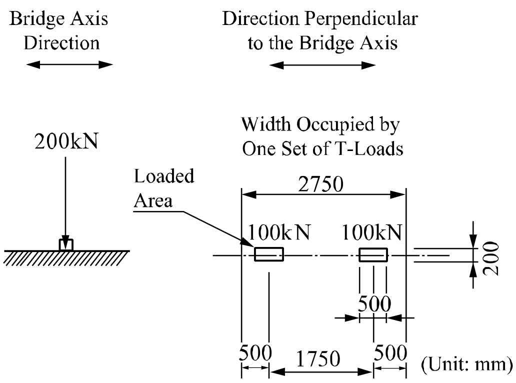


Fig. 3.2.3 T-Loads4)

(b) **Fig. 3.2.4** and **Table 3.2.1** show the L-loads for A-live loads and B-live loads.

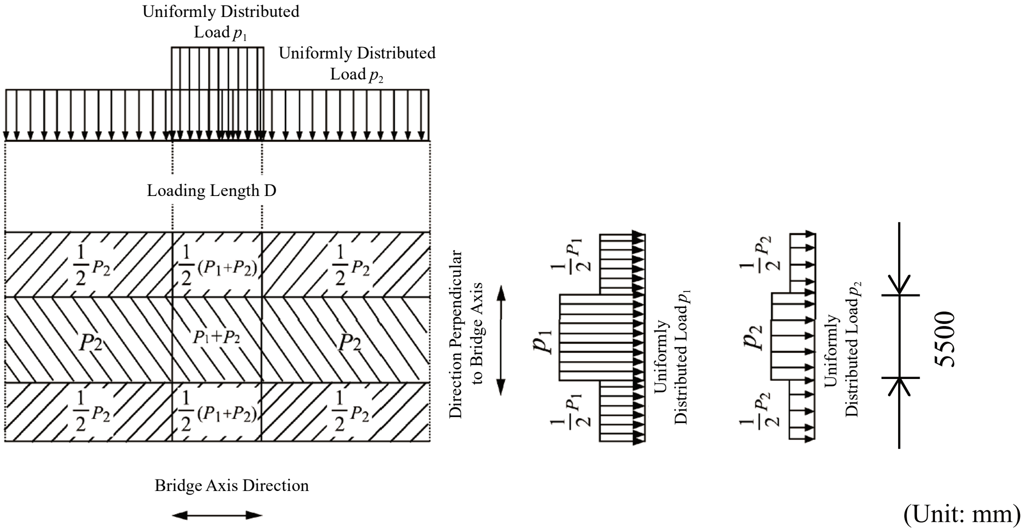


Fig. 3.2.4 L-Loads[4)]

Table 3.2.1 L-Loads[4)]

Load	Main Load (5.5 m wide)						Sub Load
	Uniformly Distributed Load p_1			Uniformly Distributed Load p_2			
	Loading Length D (m)	Load (kN/m²)		Load (kN/m²)			
		For Calculation of Bending Moment	For Calculation of Shearing	$L \leq 80$	$80 < L \leq 130$	$L > 130$	
A-live load	6	10	12	3.5	$4.3-0.01L$	3.0	50% of main load
B-live load	10						

Note) L: Span (m)

③ **Fig. 3.2.5** and **Table 3.2.2** show an example of a combination of a tractor and a trailer. They are based on a research by the Japan Association of Cargo-handling Machinery Systems and provide an example of the dimensions of tractors and trailers that are in practical use.

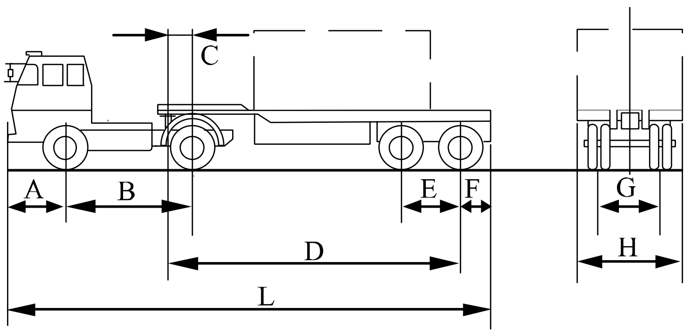


Fig. 3.2.5 Coupled Tractor and Trailer

Table 3.2.2 Example of Dimensions of Tractors and Trailers

Container Length	Dimensions: Front Overhang (A) m	Maximum Tractor Wheelbase*1 (B) m	Offset (C) m	Trailer Wheelbase*1 (D) m	Tandem Wheelbase*2 (E) m	Rear Overhang (F) m	Tread (G) m	Total Width (H) m	Overall Length (L) m	Maximum Load Capacity t	Gross Vehicle Weight*2*3 t	Load Distribution When Loaded: Fifth Wheel*4 kN	Rear Wheel kN
20 ft (within the standard)	1.4	3.18	0.54	9.95	1.55	0.82	1.85	2.49	14.87	24.0	6.54 27.9	87.6	186.0
20 ft (fully loaded ISO container)	1.4	3.18	0.54	9.51	1.32×2	0.74	1.85	2.49	14.32	30.48	6.54 35.17	107.8	237.1
40 ft (within the standard)	1.4	3.18	0.54	9.66	1.55	2.29	1.85	2.49	16.03	24.0	6.54 27.47	87.1	182.3
40 ft (fully loaded ISO container)	1.4	3.18	0.54	9.52	1.32×2	1.99	1.85	2.49	15.60	30.48	6.54 35.12	107.5	236.9
20 ft/40 ft (within the standard)	1.4	3.18	0.54	9.53	1.55	2.44	1.85	2.49	16.01	23.6	6.54 27.8	87.6	185.1
20 ft/40 ft (fully loaded ISO container)	1.4	4.37	0.18	9.51	1.31 1.32×2	1.96	1.85	2.49	16.45	30.48	8.21 35.57	111.7	237.1

Notes: *1 Maximum Tractor Wheelbase is the distance from the foremost axle to the rearmost axle, and Trailer Wheelbase is the distance from the center of the coupler to the rearmost axle.

*2 For Tandem Wheelbase and Gross Vehicle Weight, the numerical values in the upper and lower rows are for a tractor and a trailer, respectively.

*3 The Gross Vehicle Weight of a tractor is the sum of the tractor's vehicle weight and the weights of two occupants, and the Gross Vehicle Weight of a trailer is the sum of the trailer's vehicle weight and the maximum load capacity.

*4 Fifth Wheel refers to the coupling of a tractor and a trailer.

④ The international regulations concerning the dimensions and maximum gross mass of containers are indicated in **ISO 668:2005** (**Table 3.2.3**). The heights of vehicles are limited by the heights of aerial structures and traffic signals above roads. The Road Structure Ordinance specifies that the heights of aerial structures above roads shall not be lower than 4.5 m and that the total heights of vehicles shall not be higher than 3.8 m. However, for the transportation of high cube containers (with a height of 9 feet or 9 feet 6 inches), vehicles with a total height of up to 4.1 m are allowed to run only on designated roads (see **Fig. 3.2.6**).

Table 3.2.3 Standard Dimensions of Containers[5)]

Class	Length (L): mm	Allowance mm	ft in	Allowance in	Width (W): mm	Allowance mm	ft	Allowance in	Height (H): mm	Allowances mm	ft in	Allowances in	Maximum Gross Mass: kg	Lb
1EEE*3	13,716	0 -10	45	0 -3/8	2,438	0 -5	8	0 -3/16	2,896	0 -5	9 6	0 -3/16	30,480	67,200
1EEE*3									2,591		8 6			
1AAA	12,192	0 -10	40	0 -3/8	2,438	0 -5	8	0 -3/16	2,896	0 -5	9 6*1	0 -3/16	30,480*1	67,200*1
1AA									2,591*1	0 -5	8 6*	0 -3/16		
1A									2,438	0 -5	8	0 -3/16		
1AX									<2,534		<8			
1BBB*2	9,125	0 -10	29 11 1/4	0 -3/16	2,438	0 -5	8	0 -3/16	2,896*1	0 -5	9 6*1	0 -3/16	30,480*1	56,000*1
1BB									2,591*1	0 -5	8 6*1	0 -3/16		
1B									2,438	0 -5	8	0 -3/16		
1BX									<2,438		<8			

Class	Length (L)				Width (W)				Height (H)				Maximum Gross Mass	
	mm	Allowance mm	ft in	Allowance in	mm	Allowance mm	ft	Allowance in	mm	Allowances mm	ft in	Allowances in	kg	Lb
1CC[*2]	6,058	0 -6	19 10 1/2	0 -1.4	2,438	0 -58	8	0 -3/16	2,591[*1]	0 -5	8 6[*1]	0 -3/16	30,480[*1]	52,900[*1]
1C									2,438	0 -5	8	0 -3/16		
1CX									<2,438		<8			
1D	2,991	0 -5	9 9 3/4	0 -3/16	2,438	0 -5	8	0 -3/16	2,438	0 -5	8	0 -3/16	10,160[*1]	22,400[*1]
1DX									<2,438		<8			

Notes: [*1] Some countries regulate the overall height of a vehicle and a container.
[*2] On September 15, 2005, the maximum gross mass was increased from 25,400 kg for Class 1BBB and 24,000 kg for Class 1CC to 30,480 kg.
[*3] These classes were added on October 1, 2005.

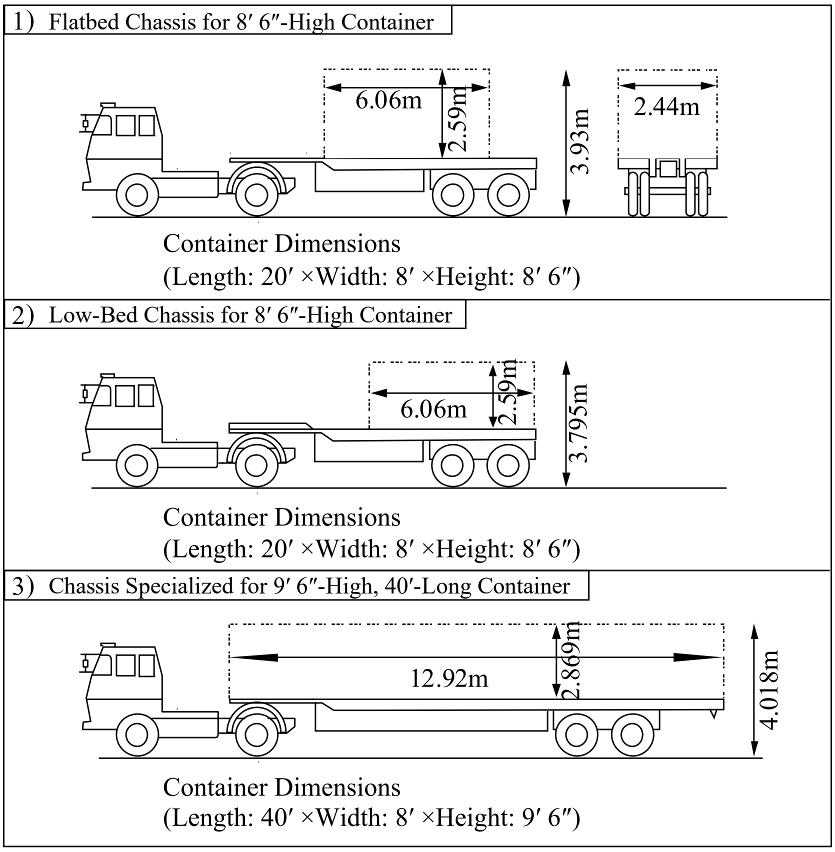


Fig. 3.2.6 Height of a Tractor Trailer Loaded with a Container

(3) Cargo Handling Equipment Load

① General

(a) Cargo handling equipment loads include the live loads of mobile cargo handling equipment, live loads of rail-mounted cargo handling equipment, and live loads of stationary cargo handling equipment, and their actions can generally be considered as follows:

1) As the characteristic value of a live load of mobile cargo handling equipment, the total weight, maximum wheel load, maximum outrigger load, or maximum crawler ground pressure of the mobile cargo-handling equipment that is expected to be used may be used.

2) As the characteristic value of a live load of rail-mounted cargo handling equipment, the maximum wheel load during an operation, during a heavy storm or during an seismic may be used. The wheel load has two components: vertical and horizontal.

3) As the characteristic value of a live load of stationary cargo handling equipment, the maximum load may be used.

(b) Cargo handling equipment continues to grow in size, and it is preferable to appropriately set the design conditions after fully studying the size of cargo handling equipment that is expected to be used in the facility concerned.

② **Live Load of Rail-Mounted Cargo Handling Equipment**

(a) Rail-mounted cargo handling equipment includes container cranes, pneumatic unloaders, double-link level-luffing cranes, and double-link unloaders. In the case of large cargo handling equipment, such as portal bridge cranes and ore unloaders, it is necessary to appropriately consider factors such as the actions of seismic movement, wind loads, and impact loads during cargo-handling to perform the performance verification on the safe side.

(b) **Fig. 3.2.7** and **Table 3.2.4** show examples[6)] of rail-mounted cargo-handling equipment.

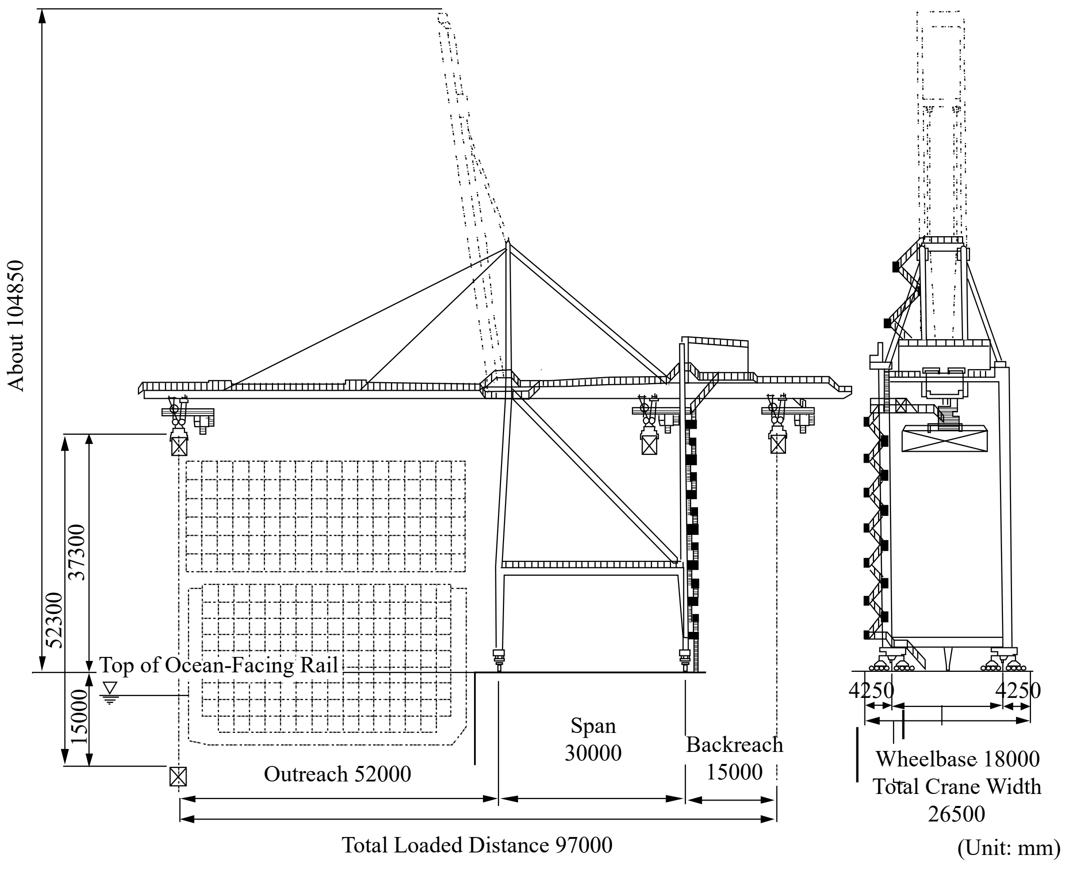


Fig. 3.2.7 Example of a Container Crane

Table 3.2.4 Examples of the Dimensions of Container Cranes

Machine Name	Handled Containers (ft)	Rated Load (kN)	Total Weight Equipped (kN)	Main Chassis Dimensions (m)						Maximum Wheel Load during Operation (kN/wheel)	Number of Wheels (Wheels/Corner)
				Outreach	Span	Backreach	Total Width	Total Height	Wheelbase		
A	20, 40	299	5,690	31.0	16.0	10.0	27.0	68.0	18.0	406	8
B	20, 40	299	6,151	31.0	16.0	9.0	28.0	72.0	18.0	314	8
C	20, 40	299	6,553	31.0	16.0	9.5	27.0	46.0	18.0	314	8
D	20, 40	299	6,229	40.0	16.0	11.0	27.0	80.5	18.0	343	8
E	20, 40	398	11,056	50.0	30.0	15.0	27.0	73.1	18.0	577	8
F	20, 40, 45	397	8,731	47.1	30.0	15.0	28.0	100.0	18.0	558	8
G	20, 40, 45	398	9,467	50.0	30.5	15.0	28.0	102.3	18.0	394	10
H	20, 40, 45	398	10,104	50.5	30.0	14.0	26.5	65.0	18.0	720	8
I	20, 40, 45	491	9,153	52.0	30.0	15.0	26.5	105.0	18.0	744	8
J	20, 40, 45	638	13,342	63.0	30.0	16.0	26.5	127.2	16.5	711	8

(c) Automated Guided Vehicles (AGVs) are unmanned load carriers that were developed for various fields of physical distribution. AGVs refer to the unmanned load carriers used for automated and remote-controlled operations in container terminals. **Fig. 3.2.8** and **Table 3.2.5** show an example of the dimensions of an AGV.

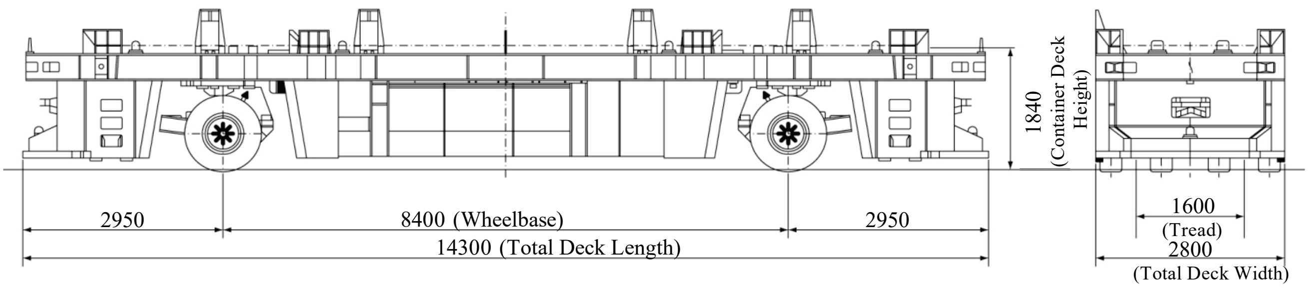


Fig. 3.2.8 Example of an AGV

Table 3.2.5 Example of the Dimensions of an AGV

Machine Name	Handled Containers (ft)	Rated Load (kN)	Total Weight Equipped (kN)	Main Chassis Dimensions (m)				Maximum Speed (km/h)	Positioning Accuracy (mm)
				Total Length	Total Width	Total Height	Wheel base		
A	20, 40, (45)	299	530	14.3	2.8	1.8	8.4	25	20

③ **Live Load of Stationary Cargo Handling Equipment**

Stationary cargo-handling equipment includes stationary jib cranes and stationary pneumatic unloaders.

④ **Live Load of Mobile Cargo Handling Equipment**

(a) Mobile cargo handling equipment includes tire-mounted multipurpose jib cranes, rough-terrain cranes, all-terrain cranes, truck cranes, crawler cranes, container handling equipment including straddle carriers, transfer cranes, front-loading forklifts and side rollers, forklifts, and log loaders. Machines with outriggers, such as tire-mounted multipurpose jib cranes and truck cranes, cause relatively large concentrated loads; therefore, it is preferable to assume the most dangerous loading arrangement in the performance verification.

(b) **Figs. 3.2.9** to **3.2.17** and **Tables 3.2.6** to **3.2.12** show examples[6)] of mobile cargo-handling equipment.

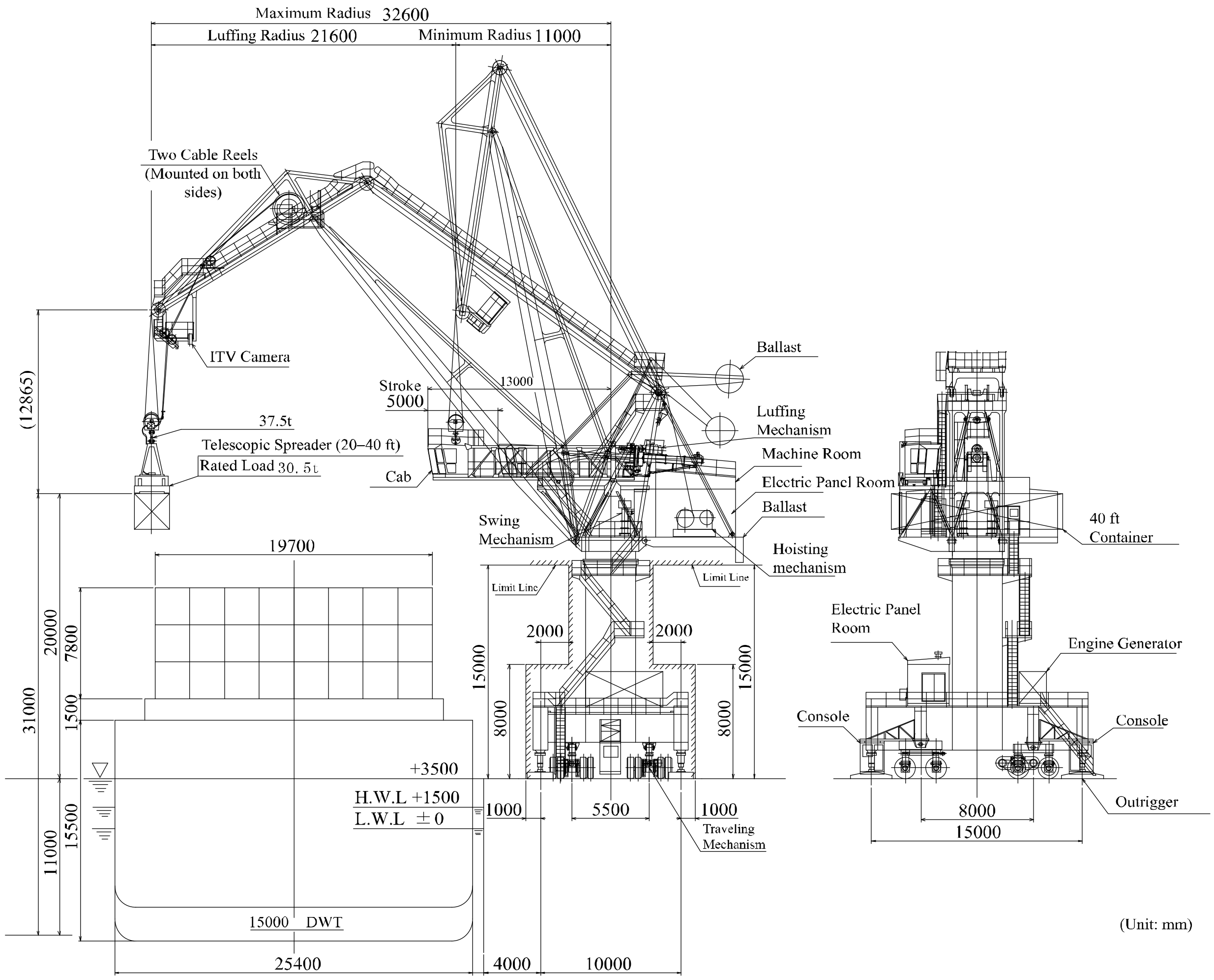


Fig. 3.2.9 Example of a Tire-Mounted Multipurpose Jib Crane

Table 3.2.6 Examples of the Dimensions of Tire-Mounted Multipurpose Jib Cranes

Type	Rated Load (kN)	Total Weight Equipped (kN)	Main Chassis Dimensions (m)					Maximum Wheel Load during Traveling (kN/wheel)	Maximum Ground Pressure during Operation*3 (kPa)
			Maximum Opera-ting Radius	Total Width*1	Wheelbase	Wheel Track	Total Height*2		
Jib Crane	334	2,835	24.0	8.8	8.0	4.0	37.5	217	527
	335	3,875	30.0	11.0	25.2	3.5	48.0	255	174
	373	3,424	32.0	11.5	8.5	3.4	51.4	147	882
	392	3,630	34.0	12.0	9.7	4.3	59.5	320 (axle load)	280
Double-Link Level-Luffing Crane	334	3,983	30.0	13.0	15.0	5.0	42.5	142	358
	335	3,944	30.0	12.8	15.0	5.0	45.0	139	301
	338	4,169	28.0	11.7	10.0	4.5	39.0	294	314
	368	4,091	32.6	12.0	8.0	5.5	52.0	139	293

Notes: *1 Total Width is the total width of the traveling chassis.
*2 Total Height is the height of the top of the jib at the smallest operating radius.
*3 Maximum Ground Pressure during Operation is the outrigger ground pressure during operation.

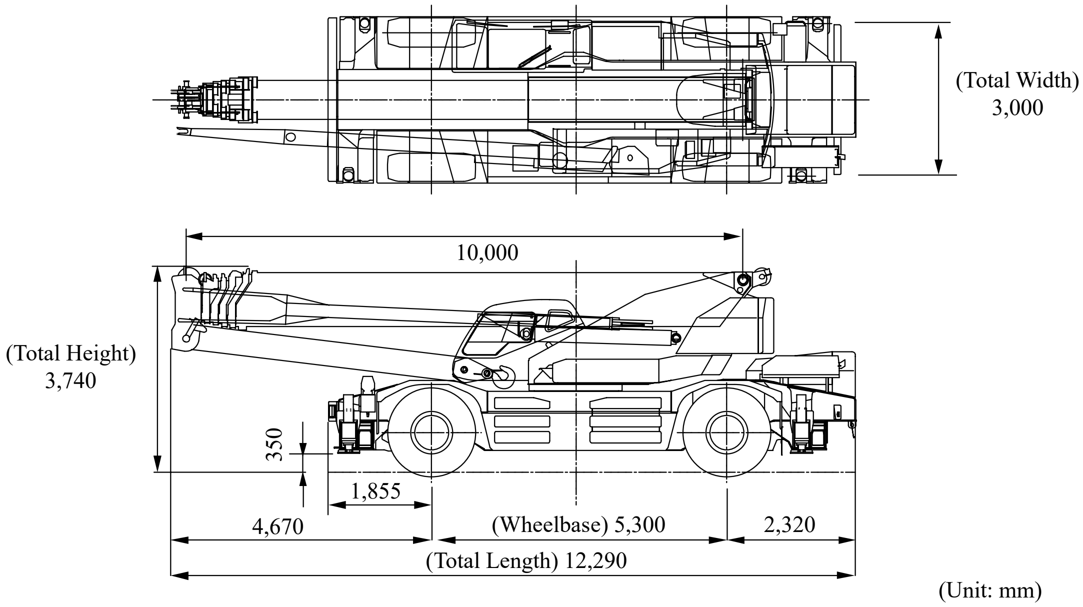


Fig. 3.2.10 Example of a Rough-Terrain Crane

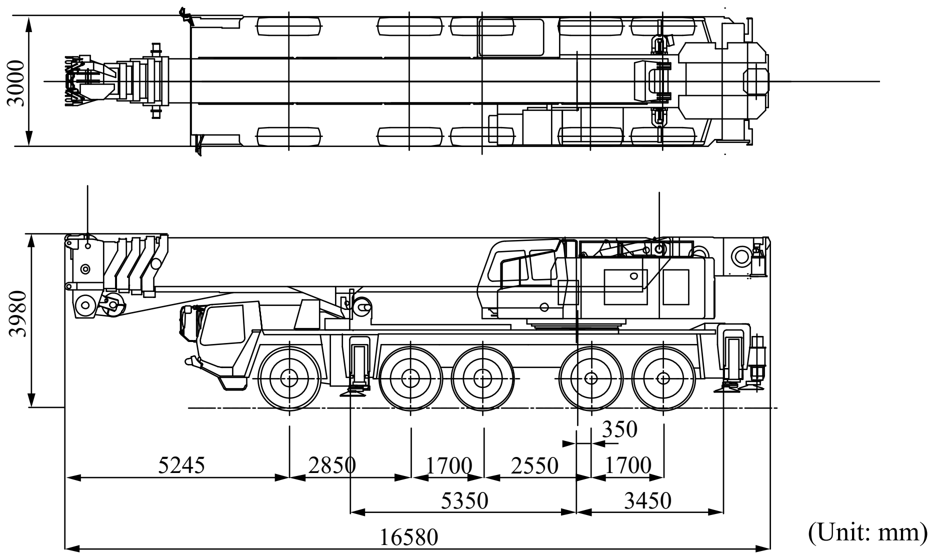


Fig. 3.2.11 Example of an All-Terrain Crane

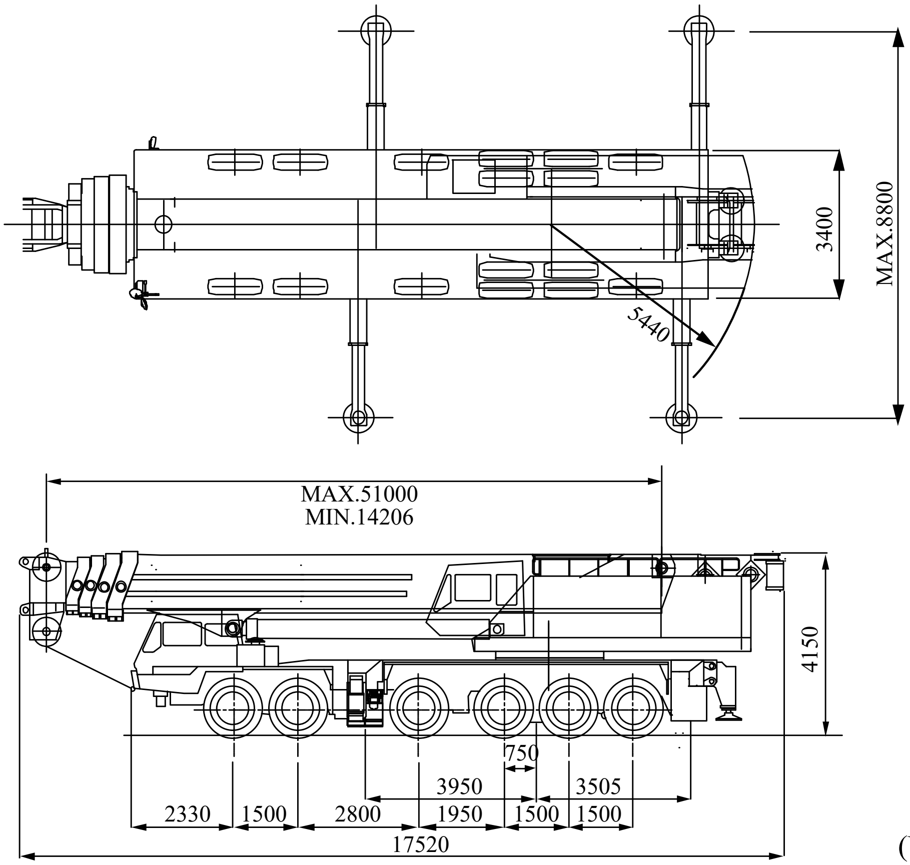


Fig. 3.2.12 Example of a Truck Crane

Table 3.2.7 Examples of the Dimensions of Rough-Terrain Cranes, All-Terrain Cranes, and Truck Cranes

Type	Maximum Lift Load (kN)	Total Weight Equipped (kN)	Main Chassis Dimensions[*1] (m)					Maximum Axle Load[*2] (kN)
			Total Length	Total Width	Total Height	Maximum Wheelbase	Wheel Track	
Rough-Terrain Crane	157	193	8.23	2.20	3.14	3.20	1.82	97.5
	245	260	11.21	2.62	3.45	3.65	2.17	131.2
	343	320	11.57	2.75	3.55	3.90	2.24	163.9
	491	371	11.85	2.96	3.71	4.85	2.38	185.3
	589	388	12.29	3.00	3.74	5.30	2.42	194.4
All-Terrain Crane	981	353	13.53	2.78	3.95	6.00	2.32	147.1
	1,570	858	16.58	3.00	3.98	8.80	2.56	171.6
	3,532	883	17.62	3.00	4.00	10.24	2.55	154.9
	3,924	1,236	18.29	3.00	4.10	11.30	2.56	179.5
	5,396	1,295	18.00	3.00	4.25	11.30	2.56	198.1
Truck Crane	1,177	929	15.38	3.40	4.00	7.38	2.76/2.52	392.8
	1,570	1,289	16.72	3.40	4.05	7.30	2.83/2.54	543.8
	3,532	1,118	17.52	3.40	4.34	9.25	2.83/2.54	297.7

Notes: [*1] Main Chassis Dimensions are the dimensions when a crane is traveling in the premises.
[*2] Maximum Axle Load is the maximum value of the axle loads when a crane is traveling in the premises.

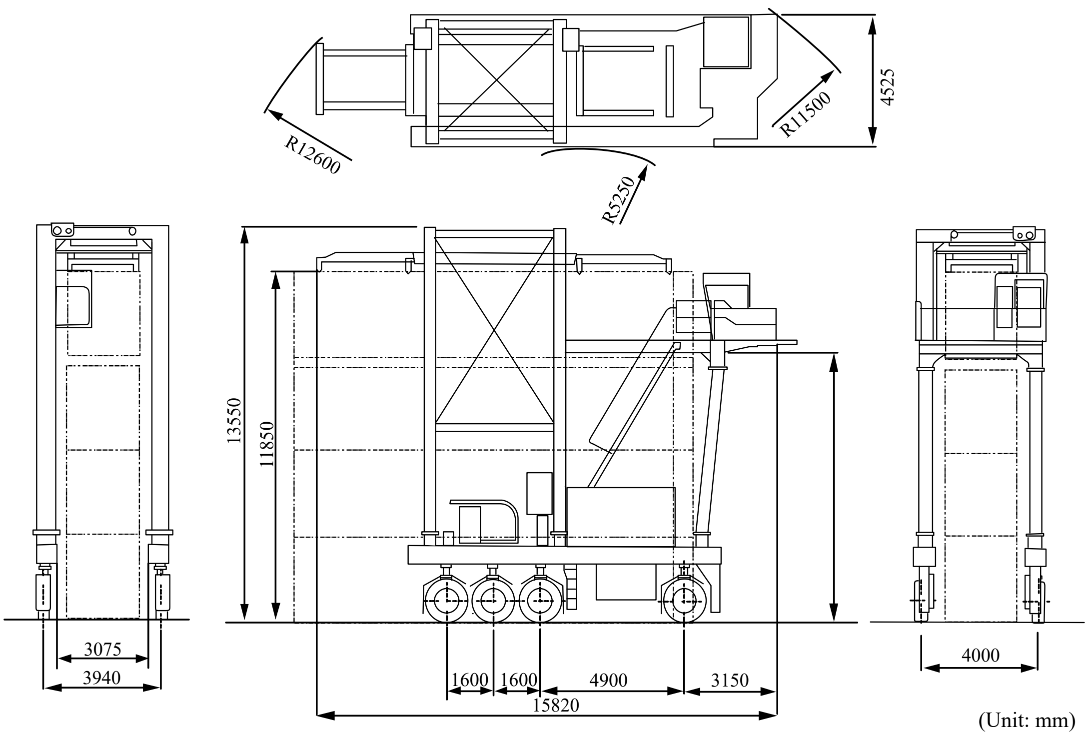


Fig. 3.2.13 Example of a Straddle Carrier

Table 3.2.8 Examples of the Dimensions of Straddle Carriers

Machine Name	Handled Containers (ft)	Rated Load (kN)	Total Weight Equipped (kN)	Main Chassis Dimensions (m)				Maximum Wheel Load during Operation (kN/wheel)
				Total Length*1	Total Width	Total Height	Wheel base	
A	20, 40	343	589	15.8	4.5	13.6	8.1	117
B	20, 40	392	579	12.2	5.3	12.6	7.4	122
C	20, 40, 45	343	579	17.4	4.5	13.7	8.0	124

Note: *1 Total Length is the total length when a crane is handling a 40 ft container.

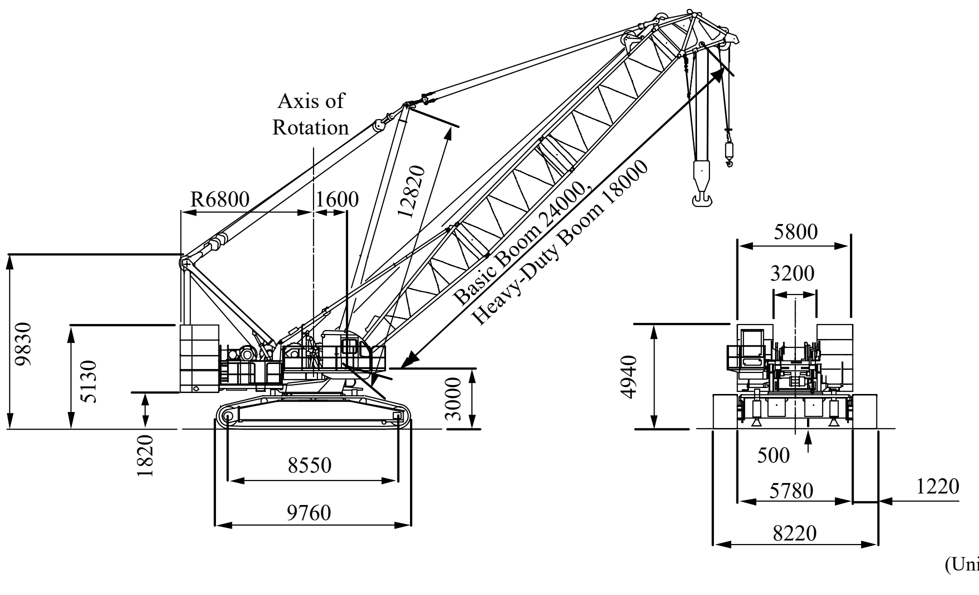


Fig. 3.2.14 Example of a Crawler Crane

Table 3.2.9 Example of the Dimensions of Crawler Cranes

Lift Load (kN)	Total Weight Equipped (kN)	Main Chassis Dimensions (m)				Crawler Ground Pressure (kPa)
		Total Height	Total Crawler Length	Total Crawler Width	Crawler Shoe Width	
294	324	4.72	4.49	3.30	0.76	54
441	441	5.12	5.40	4.30	0.76	60
491	481	5.25	5.57	4.35	0.76	61
687	697	6.18	5.99	4.83	0.80	80
785	850	6.56	6.32	4.90	0.90	86
883	834	6.64	6.40	4.90	0.85	91
981	1,197	7.92	7.88	6.17	0.92	90
1,472	1,579	8.49	8.49	7.07	1.07	89
1,962	1,893	8.49	9.18	7.07	1.07	103
2,943	2,786	9.83	9.76	8.22	1.22	127
3,434	2,884	7.82	10.14	8.79	1.29	120
4,415	3,826	10.12	11.51	9.50	1.50	122
7,848	11,674	–	14.68	12.80	2.00	127

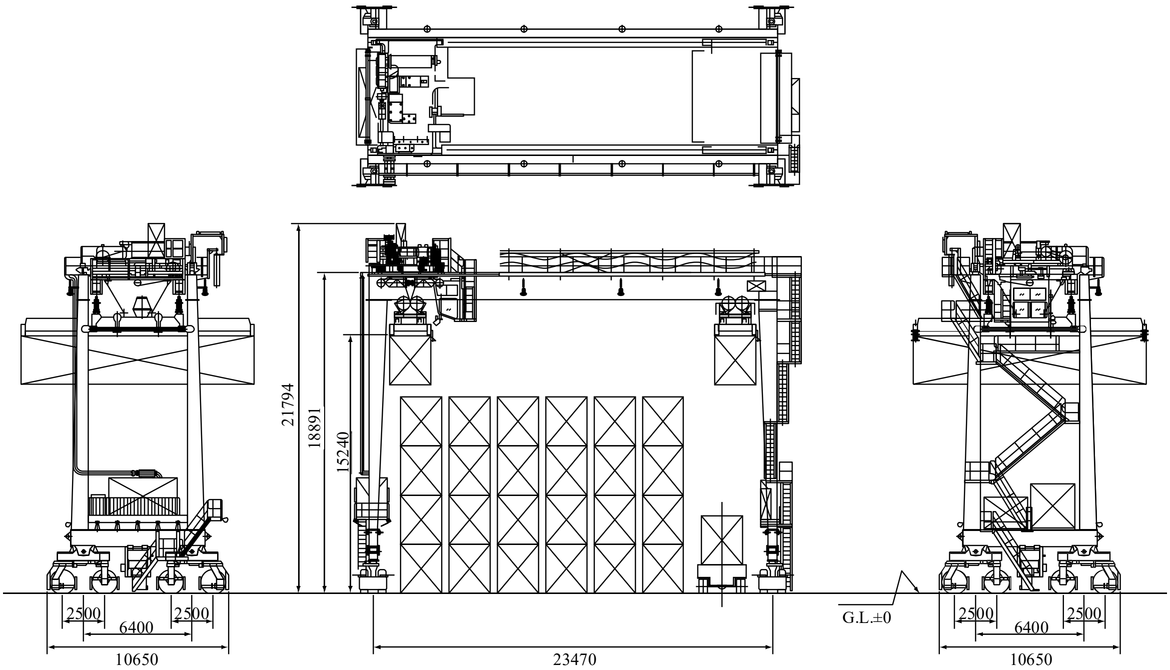


Fig. 3.2.15 Example of a Transfer Crane

Table 3.2.10 Examples of Dimensions of Transfer Cranes

Machine Name	Handled Containers (ft)	Rated Load (kN)	Total Weight Equipped (kN)	Main Chassis Dimensions (m)				Maximum Wheel Load during Operation (kN/wheel)	Number of Wheels (Wheels/ Corner)
				Total Length	Total Width	Total Height	Wheelbase		
A	20, 40	353	1,305	26.1	12.0	21.5	6.4	281	2
B	20, 40, 45	398	1,167	26.0	11.3	21.1	6.4	275	2
C	20, 40, 45	398	1,265	26.3	12.2	21.8	6.4	293	2
D	20, 40, 45	398	1,373	25.8	11.7	24.4	6.4	295	2
E	20, 40, 45	500	1,472	25.8	12.7	28.3	8.0	327	2
F	20, 40, 45	398	1,265	26.0	11.3	21.1	6.4	142	4
G	20, 40, 45	491	1,472	26.0	10.7	21.8	6.4	167	4

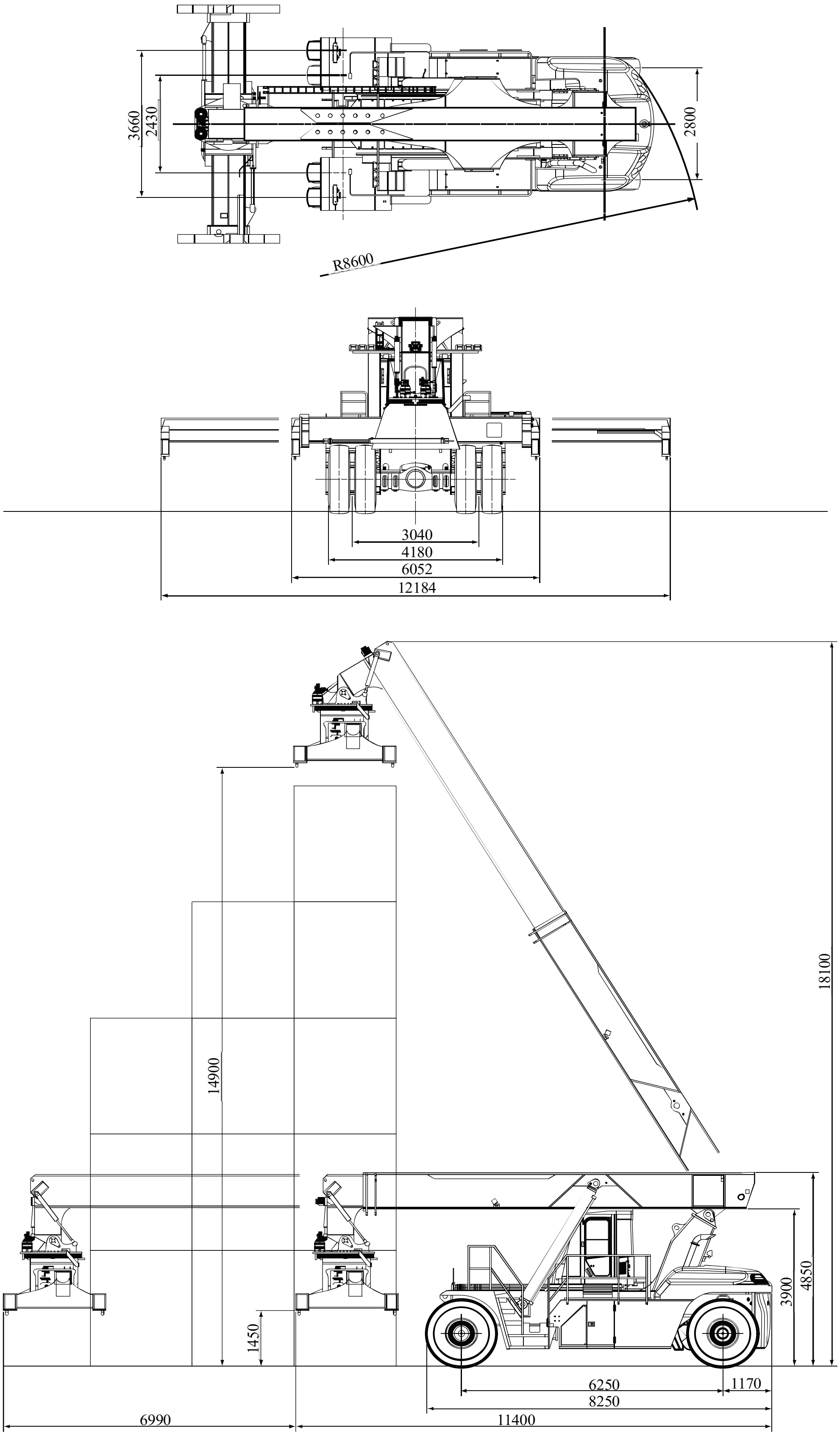
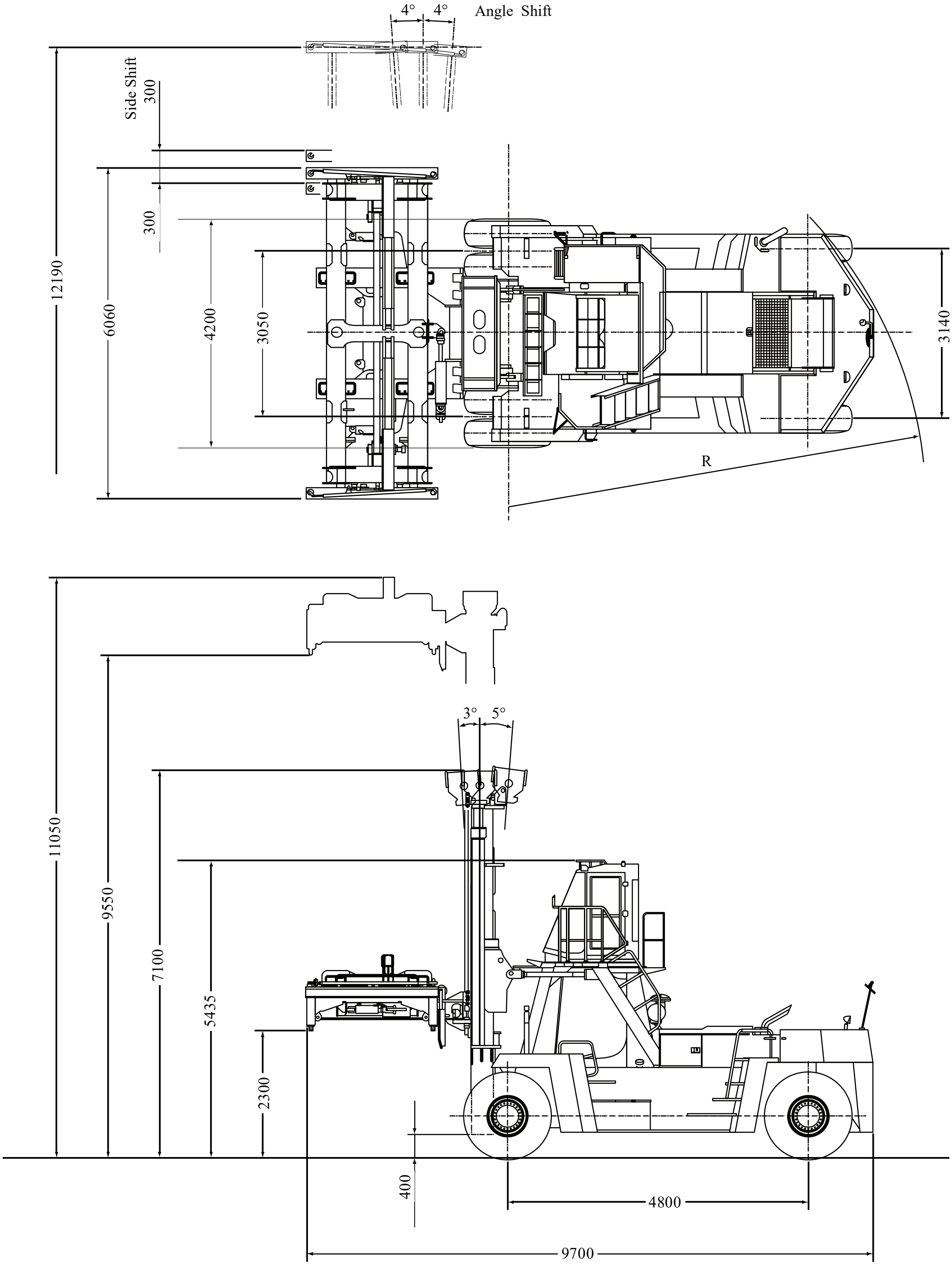


Fig. 3.2.16 Example of a Reach Stacker

Table 3.2.11 Examples of the Dimensions of Reach Stackers

Machine Name	Handled Containers (ft)	Rated Load (kN)	Total Weight Equipped (kN)	Main Chassis Dimensions (m)				Maximum Wheel Load during Operation (kN/wheel)	Number of Wheels (Wheels/ Corner)
				Total Length	Total Width	Total Height	Wheelbase		
A	20, 40, 45	441	697	11.45	4.79	4.18	6.0	254.1	2
B	20, 40, 45	441	697	11.16	4.17	4.49	6.0	251	2



(Unit: mm)

Fig. 3.2.17 Example of a Top Lift Container Handler

Table 3.2.12 Examples of the Dimensions of Top Lift Container Handlers

Machine Name	Handled Containers (ft)	Rated Load (kN)	Total Weight Equipped (kN)	Main Chassis Dimensions (m)				Maximum Wheel Load during Operation (kN/wheel)	Number of Wheels (Wheels/ Corner)
				Total Length	Total Width	Total Height	Wheelbase		
A	20, 40, 45	343	643	10.4	4.2	8.3	5.5	226.1	2
B	20, 40, 45	343	667	15.8	4.5	13.9	4.8	223.4	2
C	20, 40, 45	314	670	10.89	6.1	10.7	5.5	-	2
D	20, 40, 45	343	715	17.4	4.5	18.7	5.5	-	2

(4) Sidewalk Live Load

The characteristic value of a sidewalk live load may usually be 5 kN/m^2. However, it is preferable to appropriately set the characteristic values for special facilities by considering the usage conditions of the facilities.

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