TCVN 2737-1995

(The second revision)

LOADS AND ACTIONS

DESIGN STANDARD

CONSTRUCTION PUBLISHING HOUSE
Hanoi-1996

Foreword

TCVN 2737-1995 replaces TCVN 2737-1990

TCVN 2737-1995 was compiled by Institute of Construction Technology Sciences- Ministry of Construction, proposed by Department of Science and Technology and set up by Ministry of Construction.

MINISTRY OF CONSTRUCTION
No: 345 BXD/KHCN

THE SOCIALIST REPUBLIC OF VIETNAM
Freedom-Independence-Happiness

Hanoi, December 19th 1995

MINISTER OF CONSTRUCTION

Decision regulating the issue of Vietnamese Standards

MINISTER OF CONSTRUCTION

Pursuant to the Decree No 15/CP of the Government regulating functions, duties, powers and framework of organization of Ministry of Construction dated March 4th 1994;

Pursuant to the Decree No 177/CP of the Government issuing the promulgation of construction and investment management regulations dated October 20th 1994;

Pursuant to the Decision No 1940-KG of the Council of Ministers regulating the approval and issue of TCVN standards of capital construction;

At the proposal of the Department of Science and Technology- Ministry of Construction,

Decrees:

Article 1: To issue together with this Decision 01 Vietnamese Standard.
Loads and Actions- Design standard (the second revision). TCVN 2737-1995

Article 2: This standard replaces TCVN 2737-1990 and is completely compulsory applied for construction industry.

Article 3: This standard takes effect after its signing.

On behalf of the Minister of Construction
Deputy Minister

Prof. Nguyen Manh Kiem

CONTENTS

LOADS AND ACTIONS - DESIGN STANDARD

1. Scope

1.1. This standard specifies loads and effects to be used in designing construction structures and foundation of building works and house.

1.2. Loads and effects due to road and rail transport, sea wave, current flow, goods loading and unloading, earthquake, whirlwind, temperature, dynamic components of production equipment and means of transport… which are not provided in this standard can be specified under other relevant standards issued by the State.

1.3. When repairing works, calculated/design loads is defined based on the results from actual site survey.

1.4. The atmospheric effect conforms to the standard climatic data applicable to the current construction design or to the statistics from the General Department of Hydrometeorology.

1.5.. This standard does not refer to the loads in especially important projects, it shall be decided upon by the relevant authorities.

1.6 With regards to specific projects (such as transport, irrigation, electricity, and post-office…), based on these standards, it is necessary to set up suitable professional standards.

2. Basic principles

2.1. General requirements

2.1.1. When designing house and building, it must take into account the loads arisen from the use, construction as well as manufacturing, preservation and transportation of structures.

2.1.2. Standard quantities given in this standard are basic characteristics of loads.
Design loads are the product of standard loads and loads reliability coefficient. This coefficient refers to the possibility of adverse difference of loads that might appear in comparison with standard value, and determined depending on the calculated limit states.

2.1.3. When suitable statistics and grounds are available, design loads can be directly determined according to the prior given overloaded probability.

2.1.4. When simultaneously influenced by two or more live loads, the designing of foundation and structure according to the first group and the second group of limit states must be carried out under the most disadvantageous load combinations or corresponding to their internal forces.

Load combinations are established from the simultaneous effects of different loads, including the possibility to change the loads effect diagram.
In the calculation of load combinations or corresponding internal force, it must be multiplied with combination coefficient.

2.2. Reliability coefficient γ (overloaded coefficient)

2.2.1. In calculation of structure and foundation, reliability coefficient must be taken as follows:

2.2.1.1. In calculation of intensity and stability, according to Clauses and items 3.2, 4.2.2, 4.3.3, 4.4.2, 5.8, 6.3, 6.17.

2.2.1.2. In calculation, the fatigue strength equal to 1 is adopted. For the bridge crane girder it shall be in accordance with instructions in Clause 5.16.

2.2.1.3. In calculation according to deformation and transposition it shall be equal to 1 if the foundation and structure design standards do not give other values.

2.2.1.4. In calculation according to other limit states not shown in Clauses 2.2.1.1; 2.2.1.2; 2.2.1.3, it shall comply with the foundation and structure design standards.

Notes:
1, In calculation of structure and foundation according to the loads arising during construction period, the design value of wind load reduced by 20%.
2, In calculation of intensity and stability in the context of touching effects of bridge crane and suspension crane on rail stopper, the reliability coefficient is equal to 1 for all kinds of loads.

2.3. Classification of loads

2.3.1. Loads are divided into permanent loads and live loads (long-term, short-term and special) depending on their time of effect.

2.3.2. Permanent loads (standard or design) are constantly influencing loads in during the construction and operation of the works. Live loads are loads that may not exist for a while during the construction and operation stage.

2.3.3. Permanent loads:

2.3.3.1. Weights of building and house, including the weight of load bearing structures and shielding structures;

2.3.3.2. Weights and pressure of soil (filling and embanking), pressure due to mining activities;

Note: *Self-made stress or existing stresses in structure or foundation (including pre-stress) must be considered in calculation as stress due to permanent loads.*

2.3.4. Long-term live loads:

2.3.4.1. Temporary partition weight, weights of soil and concrete buffered equipment;

2.3.4.2. Weights of fixed equipment: mainframe, motor, container, pipe including accessories, cushion, partition, belt-conveyer, fixed lifting machine including cable and controlling device, weight of liquids and solids in the equipment during operation.

2.3.4.3. Gas pressure, liquids and loose material in container and pipe in use, surplus pressure and air pressure reduction when ventilating pit and other places;

2.3.4.4. Loads on floor due to materials and equipment platform in rooms, storage, cold storage and seed storage;

2.3.4.5. Heat effect due to fixed equipment;

2.3.4.6. Weight of water layers on insulating roofs by water;

2.3.4.7. Weight of dust layers coherent to structure;

2.3.4.8. Vertical loads due to a bridge crane or suspension crane in a span of houses multiplying with a coefficient of:

0,5- for bridge crane in normal working conditions
0,6- for bridge crane in heavy working conditions
0,6 - for bridge crane in extremely heavy working conditions.
2.3.4.9. Loads on floor in dwelling houses, communal houses, production houses and agricultural houses are given in column 5 of table 3;

2.3.4.10. The effects of floor deformation is not followed by the change in soil structure;

2.3.4.11. Effects due to changes of humidity, shrinkage and magnetization of materials;

2.3.5. Short-term live loads:

2.3.5.1. Weight of man, repair materials, accessories, instruments and fixtures involved in service provision and repair to the equipment;

2.3.5.2. Loads arisen from manufacturing, transporting and building construction structures, in assembling and delivery of equipment including loads due to weight of component and temporary stored materials (excluding loads in positions previously selected to be used as warehouse or place to preserve materials), live loads due to borrow material;

2.3.5.3. Loads produced by equipment at the stage of start, construction, transition and testing the machine including position altering or equipment replacing;

2.3.5.4. Loads arisen due to the moving of shifting and lifting equipment (bridge crane, suspension crane, electric hoist, loading machine….) during construction and use periods, loads due to unloading activities in storage and cold storage;

2.3.5.5. Loads on floor of dwelling houses, communal houses, production places and agricultural houses given in column 4 of table 3;

2.3.5.6. Wind loads;

2.3.6. Special loads:

2.3.6.1. Earthquake load

2.3.6.2. Load due to explosion

2.3.6.3. Load due to fatal breach of technology process, due to temporary break down of the equipment;

2.3.6.4. Effects of floor deformation caused by a change in soil structure (for example, deforming due to landslide, subsidence and settlement), effects due to deformation of ground surface in area having cracks, affected by mining activities and cave phenomenon…;

2.4. Combinations of loads

2.4.1. Depending on composition of loads concerned, the combinations of loads consist of basic combination and special combination.

2.4.1.1. Basic combinations of load consist of permanent loads, long-term and short-term live loads.

2.4.1.2. Special combinations of load consist of permanent loads, long-term live loads and short-term live loads that may happen and one of special loads.

Special combinations of load due to effects from explosion or hit of traffic vehicles against parts of the building may differ from the short-term live loads specified in Clause 2.3.5.
Special combinations of load due to earthquake effects do not include wind load. Combinations of load used for designing the fire-resistance ability of structure is a special combination.

2.4.2. If the basic combinations of load consist of only one live load, the whole value of this live load is adopted.

2.4.3. Basic combinations of load that have more than one live loads, the calculating value of such live loads or their respective internal forces must be multiplied with the following coefficient of combinations:

2.4.3.1. Long-term live load and short-term live load multiply with the coefficient $\varphi = 0,9$;

2.4.3.2. If it is possible to analyze separate effects of each short-term live load on internal force, transposition in structures and foundations, the most effective load shall remains unchanged, the second shall multiply with the coefficient of 0.8, other remaining loads shall multiply with the coefficient of 0.6.

2.4.4. Special combinations of load consist of one live load, the whole value of this live load is adopted.

2.4.5. When special combinations of load consist of more than one live loads, the value of special load remains unchanged, the design value of live load or their corresponding internal force shall multiply with the following coefficient of combinations: long-term live load multiplies with coefficient $\varphi_1 = 0.95$, short-term live load multiplies with coefficient $\varphi_2 = 0.8$, except for cases clearly specified in design standard for projects in earthquake region or other design standards for structure and foundation.

2.4.6. In designing structure or foundation according to intensity and stability with basic combinations of loads and especially in case of simultaneous effects of at least two live loads (short-term or long-term), the design internal force can be used complying with instructions in Annex A.

2.4.7. The design of mobile load of equipment in the combination with other loads is specified according to the design standards on machine foundation or strength bearing structures of houses or buildings where the equipment is located causing mobile load.

3. Weights of structure and soil.

3.1. The standard load due to the weight of structures is defined according to the standard and catalogue or design dimension and the weight of material volume, including actual humidity during the construction and use of house and building.

3.2. Reliability coefficient for loads due to the weight of construction structure and soil is defined in table 1.

Table 1: Reliability coefficient for loads due to the weight of construction structure and soil

Structures and soil	Reliability coefficient
1. Reinforcement	1.05
2. Concrete with specific weight more than 1,600 kg/m^3, reinforced concrete, brick and stone, brick and stone with reinforcement and wood.	1.1
3. Concrete with specific weight less than 1,600 kg/m^3, partition materials, plastering and finishing layers (sheet, cover, rolled materials, covering, lining mortar layer …) depending on production conditions :	
- In factory	1.2
- At site	1.3
4. Original soil	1.1
5. Backfill soil	1.15

Notes:

1, When testing the stability to prevent overturning, if weight of structure and soil reduces it may result in a more disadvantageous operation of the structure, reliability coefficient shall be 0.9;

2, In determining the ground load affecting the building, it should take in to account the effects of actual humidity, loads of stored materials, and that by the equipment and traffic vehicles on the ground;

3, For steel structure, if stress due to specific weight exceeds 50% of common stress, the reliability coefficient shall be 1.1

4. Loads due to equipment, human, and stockpiled materials and products

4.1. This section reflexes the standard values of loads due to human beings, animals, equipment, products, materials, temporary partitions influencing on the floors of dwelling houses, communal houses, and houses for agricultural production.
Loading methods of such loads on the floor must be taken according to anticipated conditions prior to the actual construction and use. In designing stage, if data about these conditions are not enough, in designing structure and foundation, it is necessary to consider the following measures to load on the specific floor:

4.1.1. Without live load on floor;

4.1.2. Place disadvantageous load partially on the floor when designing structure and foundation;

4.1.3. Place loads to fully cover the floor by the selected loads;
When the partially disadvantageous loads are placed, total loads on multi-floor building must not exceed the anticipated load including coefficient φ_n calculated according to formula in Clause 4.3.5 when loads fully cover floor.

4.2. Determination of loads due to equipment and stored material

4.2.1. Loads due to equipment, materials, stored products and means of transport defined according to design tasks must be that in the most adverse case, which points out:

The possible equipment arrangement sketch; position of temporary container and storage of materials, products; number and position of transport vehicles on each floor. In the sketch, it is necessary to note down the dimension of space required for the equipment and transport vehicles, dimension of material storage, the possible moving of equipment in use or rearrangement of plan and other loading conditions (dimension of each equipment, distance between them).

4.2.2. Values of standard load and reliability coefficient shall comply with instructions of this standard. For machine producing mobile load, the standard value, reliability coefficient of inertia and other necessary characteristics shall conform to the requirements of standard documents used for defining mobile load.

4.2.3. When replacing actual load on floor by the equivalent uniformly distributed loads, this equivalent load need to be defined by separately calculating for each component of floor (floor slab, auxiliary beam and main beam). When designing with the equivalent load, it must be sure that the bearing ability as well as rigidity of the structure must be the same as that in designing with actual load. The smallest equivalent uniformly distributed load for industrial house and warehouse are as follows: for floor slab and auxiliary beam not smaller than 300 daN/m^2; for main beams, columns and foundation not smaller than 200 daN/m^2.

4.2.4. Weight of equipment (including conduction pipe) is determined according to standards and catalogue. For non-standards equipment, weight shall be determined according to data in the machine certificate or construction drawing.

4.2.4.1. Load due to weight of equipment consists of its-own weight (including conducting wire, fixture and platform); weight of partition layer; weight of the possible container in equipment when using; weight of the heaviest processing parts; goods transported according to nominal lifting capacity …

4.2.4.2. The load of equipment must be taken based on its placing condition for use. Solutions should be foreseen to avoid consolidation to the bearing structure while equipment is moving at the time of assembling and use.

4.2.4.3. In designing different components, the loading machine and assembling equipment should be available at the same time, and the floor plan layout is taken according to design tasks.

4.2.4.4. Effects of vertical load due to loading machine or vehicles are can be calculated by multiplying static standard load with dynamic coefficient 1.2.
4.2.3. Reliability coefficient for loads by weight of equipment is given in table 2

Table 2: Reliability coefficient for loads by weight of equipment

Type of loads	*Reliability coefficient (γ)*
1. Weight of fixed equipment	1.05
2. Weight of partition in fixed equipment	1.2
3. Weight of container in equipment, tank and conduit	
a/ Liquids	1.0
b/ Suspendsoid, residue, and loose material	1.1
4, Loads due to weight of loading machine and vehicles	1.2
5. Loads due to water absorptive materials (cotton, cloth, fibre, sponge, foodstuff…)	1.3

4.3 Uniformly distributed loads

4.3.1. Standard load evenly distributed on floors and stairs is shown in table 3

Table 3: Uniformly distributed standard loads on floors and stairs

Type of room	Type of house and works	Scale loads (DaN/m²)	
		Full	Long-term
1. Bedrooms	a, Hotels, hospitals, prisons b, Apartment buildings, kindergartens, boarding schools, rest-home, houses for the retired, sanatoria…	200 150	70 30
2. Dining rooms, living rooms, toilets, bathrooms, Bida rooms	a, Apartment buildings, b, Kindergartens, schools, guest-houses, houses for the retired, sanatoria, hotels, hospitals, prisons, main offices, factories	150 200	30 70
3. Kitchens, laundries	a, Apartment buildings, b, Kindergartens, schools, guest-houses, houses for the retired, sanatoria, hotels, hospitals, prisons, factories	150 300	130 100
4. Offices, laboratories	Main offices, schools, hospitals, banks, scientific research basis	200	100
5. Boiler rooms, motor rooms, fan rooms…including engine mass	Multistory dwelling-houses, offices, schools, guest-houses, houses for the retired, sanatoria, hotels, hospitals, prisons, scientific research basis	750	750
6. Reading rooms	a, With book-shelves b, Without book-shelves	400 200	140 70
7. Restaurants	a, Eating and drinking b, Exhibitions, displays, shops	300 400	100 140
8. Assembly rooms, dance rooms, communal lounges, audience rooms, concert-halls, sports rooms, grandstands	a, With fixed seating b, Without fixed seating	400 500	140 180

Table 3 (continued)

9. Stage		750	270
10. Storage / filing rooms	Loads for 1 meter in height of stored materials;		
	a, Packed book storage (books or documents densely arranged)	480/1m	480/1m
	b, book storage in libraries	240/1m	240/1m
	c, paper storage	400/1m	400/1m
	d, cold storage	500/1m	500/1m
11. Class-rooms	School	200	70
12. Workshop	a, Cast workshop	2000	-
	b, Repair and maintenance workshop for vehicles with the weight ≤ 2500 kg	500	-
	c, Big rooms with machines, passing way	400	-
13. Rooms close to roof	Types of house	70	-
14. Balconies and loggia rooms	a, Loads evenly distributed on each strip of 0,8 m along the corridors, balconies and loggia rooms	400	140
	b, Loads evenly distributed on the whole balcony area and loggia rooms are concerned if its effects are more adverse than item a.	200	70
15. Drawing-rooms, foyers, stairs, hallways	a, Bedrooms, offices, laboratories, kitchens, laundries, toilets, technique rooms	300	100
	b, Reading rooms, restaurants, conference rooms, dance rooms, public lounges, audience rooms, concert-halls, sports-rooms, warehouse, balconies, loggia rooms	400	140
	c, Stage	500	180
16. Mezzanine/ entresol		75	-

Table 3 (continued)

Type of room	Type of house and works	Scale loads DaN/m^2	
		Full	Long-term
17. Breeding-farms	a, Small cattle b, Big cattle	≥ 200 ≥500	≥70 ≥180
18. Flat roofs with uses	a, Roof parts able to contain many people (go out from production rooms, lecture-rooms, big rooms) b, Roof parts for taking a rest c, Other parts	400 150 50	140 50 -
19. Roofs without uses	a, Tile roofs, asbestos roofs, metal sheet roofs and the like, straw lime naked roofs, in situ concrete roofs without goers but repairers, excluding water, electricity and ventilating equipment b, Flat roofs, reinforced concrete sloping roofs, pitched roofs or eaves-trough roofs, precast concrete slab roof without goers but repairers, excluding water, electricity and ventilating equipment	30 75	- -
20. Station floor and underground station		400	140
21. Garage	Vehicle carriage way, ramp road for use of car, passenger bus and light lorries with total weight ≤ 2500kg	500	180

Notes:

1. Loads mentioned in Clause 3 of table 3 are on the area without equipment and materials;

2. Loads mentioned in Clause 4 of table 3 are used for designing the bearing structures of balconies, loggias. When designing foundation, column and wall structures supporting the balconies and loggias, loads on balconies and loggias are equal to loads of adjacent main rooms and are reduced according to instructions of Clause 4.3.5;

3. Cantilever eaves roofs and gutter are designed with vertical concentrated loads on the outside edges. Standard value of concentrated loads is 75 daN /m along the wall. For eaves roofs and gutter along the wall less than 1m in length, the concentrated load is still 75 daN. Reliability coefficient for this concentrated load is 1.3. After calculation using this concentrated load, uniformly distributed load must be checked. Standard value of uniformly distributed load shall be that given in Clause 19b of table 3;

4. Values of long-term loads of houses and rooms as mentioned above in Clauses 12,13,16,17,18c and 19 of table 3 shall be determined according to technology design;

5. Value of loads to the breeding-farms mentioned in Clause 17 of table 3 should be determined according to technology design.

4.3.2. Loads due to weights of temporary partition wall must be established according to design, position, leaning character on floor and hung up against the wall. In designing different parts, this load can be defined:

4.3.2.1 According to the actual effects;
4.3.2.2 As other uniformly distributed load. This auxiliary load is established by calculation according to partition wall arrangement layout and shall not less than 75 daN/m^2.

4.3.3 Reliability coefficient for uniformly distributed loads on floor and stairs is 1.3 when standard load is less than 200 daN/m^2, and 1.2 when standard load is more than 200 daN/m^2. Reliability coefficient for load due to the weight of temporary partition walls shall be according to Clause 3.2.

4.3.4 When designing main and auxiliary beams, slab, column and foundation, the full load in table 3 can be reduced as follows:

4.3.4.1 For rooms stated in Clauses 1,2,3,4,5 of table 3 multiply with coefficient ψ_{A1}
($A>A_1=9m^2$)

$$\psi_{A1}=0.4+\frac{0,6}{\sqrt{A/A_1}} \qquad (1)$$

Where A: loaded area, dimension in square meter

4.3.4.2 For rooms referred in Clauses 6,7,8,10,12,14 of table 3 multiply with coefficient ψ_{A2}
($A>A_2=36m^2$)

$$\psi_{A2}=0.5+\frac{0,5}{\sqrt{A/A_2}} \qquad (2)$$

Notes:

1. When designing load bearing wall of one floor, load value may be reduced depending on loaded area A of the structure (slabs, beams) leaned against the wall;

2. In warehouse, garage and production building, loads can be reduced according to instruction of respective processes.

4.3.5. For determination of longitudinal force to design column, wall and foundation bearing load equal to and more than 2 floors, loads in table 3 may be reduced by multiplying with coefficient φ_n:

4.3.5.1. For rooms stated in Clauses 1,2,3,4,5 of table 3:

$$\psi_{n1}=0.4+\frac{\psi_{A1}-0.4}{\sqrt{n}} \qquad (3)$$

4.3.5.2 For rooms stated in Clauses 6,7,8,10,12,14 of table 3:

$$\psi_{n2}=0.5+\frac{\psi_{A1}-0.5}{\sqrt{n}} \qquad (4)$$

Where

* ψ_{A1}, ψ_{A2} are determined according to Clause 4.3.4, respectively

n- number of slabs with load on the cross section under consideration needed in design.

Note: *For determination bending moment in wall and column, it is necessary to reduce load according to Clause 4.3.4 in main beams, secondary beams leaning against that column and wall.*

4.4. Concentrated load and load on banister

4.4.1. The concentrated load bearing strength of all floor, roof, corridor, balcony, and loggia need to be checked vertically convention imposed on a component at an adverse position, on a square area with its edge not exceeding 10 cm (when without other live loads).
If the design does not specify a higher value of standard concentrated load, they will be:

4.4.1.1. 150 daN for slab and corridor;

4.4.1.2. 100 daN for basement roof slab, roof, terrace and balcony;

4.4.1.3. 50 daN for roofs climbed by ladder closely leaned against the wall;
Parts including partial load likely to happen due to the operation of equipment and transport vehicles may not be checked according to concentrated loads as above-mentioned.

4.4.2. Horizontal standard load influencing on handrail, balcony and loggia is:

4.4.2.1. 30 daN/m for dwelling-house, kindergarten, rest-home, sanatorium, hospital and other disease treatment basis;

4.4.2..2. 150 daN/m for sports room and grandstand;

4.4.2.3. 80 daN/m for house and room with special requirements;

For working platform, access route to the height or cantilever roof shall be preserved for use of some people, horizontal standard load focusing its effect on the handrail and roof retaining wall shall be 30 daN (at any point along the handrail) if the design do not require a higher load.
Reliability coefficient for loads in Clauses 4.4.1 and 4.4.2 is 1.2.

5. Loads due to bridge crane and suspension crane

5.1. Loads due to bridge crane and suspension crane are determined by their working regimes given in Annex B

5.2. Vertical scale loads transmitting through crane wheels to runway beam and other data necessary for calculation shall comply with the State's standard for bridge crane and suspension crane; and with the manufacturer's certificate for non-standard ones.

Note: *"runway" term means either 2 supporting girders for one bridge crane, or all supporting girders of one suspension crane (2 girders for single-span suspension crane, 3 girders for double-span suspension crane, ...)*

5.3. Horizontal scale loads along the bridge crane girder due to the crane braking force is equal to 0.1 of vertical standard loads, influencing on the concerned braking wheel.

5.4. Horizontal scale loads perpendicular to the bridge crane girder caused by electric winch braking is equal to 0.05 of the total of nominal lifting force and the weight of the winch for soft-hook bridge crane; to 0.1 of that total for hard hook crane.

These loads shall be determined when calculating the horizontal building frame and crane girder uniformly distributed for all crane wheels on one crane beam and heading in or out of the concerned span.

5.5. Horizontal scale loads perpendicular to runway caused by electric crane deflection and by the crane rail not being parallel to each wheel (deviation force) are equal to 0.1 of vertical scale loads against the wheel. These loads are taken into account only when calculating beam strength and stability, and its links to the columns of buildings where the heavy-duty and extremely heavy-duty cranes are working. In that case, the loads influencing on runway beam caused by all wheels present together at the same side could face in or out of the involved span. The loads described in Clause 5.4 shall not be mentioned at the same time with deviation force.

5.6. Horizontal loads is the deviation force due to crane and winch travelling stopper provided at the contact position of crane wheels and rails.

5.7. Horizontal standard loads along the crane girder caused by the impact of crane to the stopper at the end of railway are determined in accordance with Annex C. These loads shall be taken into account only when calculating for the stopper and its links to the crane beams.

5.8. Reliability coefficient for loads due to jib crane is 1.1.

Note:

1). When calculating the durability of crane beam due to local effects and dynamic of vertically concentrated loads on each wheel of the crane, the standard value of these loads is multiplied with secondary factor γ_l being:

1.6 – with extremely heavy-duty crane having hard hook;
1.4 – with heavy-duty crane having hard hook;
1.3 – with heavy-duty crane;
1.1 – with other cranes

2). When examining the local stability of crane beam beneath $\gamma_l = 1.1$

5.9. When calculating the crane beam durability and stability and its connection to bearing structures:

5.9.1. Vertical design load due to cranes shall be multiplied with dynamic factor equal to:

-When the column span is less than 12m:
1.2 - with extremely heavy-duty crane;
1.1 - with cranes having mean heavy-duty, heavy-duty and suspension crane working regimes.

-When the column span is more than 12 m: 1.1 with extremely heavy-duty cranes

5.9.2. Horizontal design loads shall be multiplied with the dynamic factor equal to 1.1 with extremely heavy-duty cranes.

5.9.3. For the other cases, the dynamic factor is 1.

5.9.4. When calculating structure strength, crane beam sag, column displacement and local effects of loads concentrating vertically on each wheel, the dynamic factor shall not be taken into account.

5.10. When calculating strength and stability of the crane girder, it should consider the vertical loads due to two bridge cranes or the most disadvantageous effect of suspension cranes.

5.11. In order to calculate the durability and stability of frame, column, ground and foundation of the building having cranes at some spans (there is only one floor at one span), on each runway, vertical loads due to two bridge cranes at the most disadvantageous effect shall be adopted. When calculating the combinations of cranes at different spans, the vertical loads due to 4 bridge cranes at the most disadvantageous effect should be chosen.

5.12. In order to calculate the durability and stability of frame, columns, trusses, truss supporting structures, ground and foundation of buildings having suspension crane at one or more spans, the vertical loads due to 2 suspension cranes at the most disadvantageous effect must be selected on each runway. When considering the combination of different suspension cranes at different spans, the vertical loads are determined as:

- due to 2 suspension cranes: for columns, truss support structures, ground and foundation of edge ranges when there are 2 runways inside the span.
- due to 4 suspension cranes:

 + for columns, truss support structures, ground and foundation of central ranges

 + for columns, truss support structures, ground and foundation of edge ranges when there are 3 crane runways inside the span.

 + for trussed structures when there are 2 or 3 crane runways inside span.

5.13. The number of cranes necessary for calculate the durability and stability caused by horizontal and vertical loads when 2 or 3 runways are arranged in one span, when bridge crane and suspension crane move at the same time in the span, or when using the suspension cranes to carry objects from one crane to another by small cranes, shall be determined according to the design tasks.

5.14. When calculating the durability and stability of the travelling crane beams, columns, frame, trusses, truss support structures, ground and foundation, the determination of horizontal loads is made under the most disadvantageous effects of less than 2 cranes which have been arranged in one runway or in different runways in a line. Then only one horizontal load shall be taken into account (either longitudinal or perpendicular) for one crane.

5.15. When determining the vertical and horizontal sag of the jib crane beams and the column's horizontal displacement, only one effect of the most disadvantageous crane shall be taken into account.

5.16. In the calculation with one jib crane, the full value of the vertical and horizontal loads shall be applied without being reduced.
When the calculation is made with 2 cranes, these loads must multiply with the combination coefficient:
$n_{th} = 0.85$ for cranes in light and average working duty
$n_{th} = 0.95$ for crane in heavy-duty and extremely heavy working duty
When the calculation is made with 4 cranes, these loads shall multiply with the combination coefficient:
$n_{th} = 0.7$ for cranes in light and average working duty
$n_{th} = 0.8$ for crane in heavy-duty and extremely heavy working duty

5.17. In the case when there is only one crane working in a runway, the second crane is not working during the use of the building, at that time the load due to one crane should be taken into account.

5.18. When calculating the fatigue strength of jib crane's girder and its connection to the bearing structures, the scale load shall be reduced in accordance with Clause 2.3.4.8. When examining the fatigue at the girder's bottom in the influenced area of vertical concentrated loads induced by one crane's wheel, the standard value of vertical pressure reduced above should be increased by multiplying with the coefficient given in the notes to Clause 5.8.

Working regimes of jib cranes when calculating the fatigue strength of structures must be specified by the structure's design standards.

6. Wind loads

6.1. Wind loads on the building comprise normal pressure W_e, friction force W_f and normal pressure W_i. Wind loads on buildings can be converted into 2 normal pressures W_x and W_y

6.1.1. Normal pressure W_e is imposed on the external surface of buildings or components

6.1.2. Frictional force W_f directs along the tangent with the external surface and is in direct proportion to horizontal projected area (with corrugated saw-tooth roof and roof with clerestory) and to vertical projected area (loggia wall and similar structures)

6.1.3. Normal pressure W_i is imposed on the internal surface of buildings having unbound fence-wall with opened-closed openings or frequent openings.

6.1.4. Normal pressure W_x; W_y are calculated with resistance surface of buildings in the direction of axes x and y. The resistance surface of the building is the building's projection on surfaces perpendicular to the corresponding axes.

6.2. Wind loads consist to static part and dynamic part

When determining internal surface pressure W_i as well as calculating the multi-floor buildings with height less than 40m and industrial single-story buildings under 36 m with the height/span ratio is less than 1.5, constructed in terrain categories A and B, dynamic part of wind loads is negligible.

6.3. Standard value for static part of wind loads W at the height Z in comparison with standard landmark can be calculated using the formula:

$$W = W_o \times k \times c \qquad (5)$$

Where:
W_o: Wind pressure value given in Map of Wind Pressure Regions (Annex D) and Clause 6.4
k: Coefficient for wind pressure variations by height, as shown in Table 5
c: aerodynamic coefficient as shown in Table 6

Reliability coefficient of wind loads γ is 1.2

6.4. Wind pressure value W_o given in Table 4

Wind pressure regions in Vietnam are given in Annex D. The bold dash dot line is the border between storm influenced areas estimated weak or strong (region code is enclosed with symbol A or B).

Wind pressure regions are zoned according to administrative places as shown in Annex E.

Calculated wind pressure values from some meteorological monitoring stations located in mountainous or island regions with usage-time supposed for different buildings can be obtained from Annex F.

Table 4. Wind pressure values on Map of wind pressure regions in Vietnam

Wind pressure regions on the Map	I	II	III	IV	V
W_o (daN/m^2)	65	95	125	155	185

6.4.1. In regions of weak storm influence (Annex D), wind pressure value W_o is reduced 10 daN/m^2 in region I-A, 12 daN/m^2 in region II-A and 15 daN/m^2 in region III-A.

6.4.2. In region I, wind pressures W_o given in table 4 are applied to design houses and buildings to be constructed in mountain, hill, plain and valley regions.
For complicated topographical zones, it shall be that described in Clause 6.4.4

6.4.3. For houses and buildings constructed in mountainous and island regions having the same altitude, topographical categories and nearby the meteorological monitoring stations given in Annex F, the design wind pressures with different supposed lifetimes shall be the independent values provided by those stations (Table F_1 and F_2 in Annex F).

6.4.4. For houses and buildings constructed in complicated terrain (defiles, way between two parallel mountain ranges, mountain pass opening,..) wind pressure W_o must be based on data provided by General Department of Meteorology and Hydrology or processed result from field investigation with regard to the experience of building usage. Then, the wind pressures W_o shall be calculated using the formula:

$$W_o = 0.0613 \times V_o^2 \qquad (6)$$

Where:
V_o: Wind speed at 10m height above the standard landmark (average speed in 3 seconds has been passed once every twenty years on the average) corresponding to the terrain type B, measurement is in metres per second.

6.5. The values of factor k including the wind pressure variations at height above the standard landmark and by topography shall be calculated according to Table 5.

Terrain type A is an exposed, open terrain on which there is few or no obstructions having height not exceeding 1.5 m (airy coasts, big lake and river surfaces, salt fields, fields without tall trees,....)

Terrain type B is a relative open terrain on which there is a few of sparse obstructions not exceeding 10 m in height (thinly populated suburbs, towns, villages, light forests or sapling forests, ...).

Terrain type C is the rather covered terrain with numerous obstructions close to each other with height greater than 10 m (in cities, thick forests,...).

A building considered belonging to a classified terrain if its topographic properties do not change in 30 h when h ≤ 60m and distance of 2 km when h>60 m from wind facing surface of the building, h is the height of the building.

Table 5. Factor k refer to wind pressure variations by height and by topographic categories

topographic categories / Height Z,m	A	B	C
3	1.00	0.80	0.47
5	1.07	0.88	0.54
10	1.18	1.00	0.66
15	1.24	1.08	0.74
20	1.29	1.13	0.80
30	1.37	1.22	0.89
40	1.43	1.28	0.97
50	1.47	1.34	1.03
60	1.51	1.38	1.08
80	1.57	1.45	1.18
100	1.62	1.51	1.25
150	1.72	1.63	1.40
200	1.79	1.71	1.52
250	1.84	1.78	1.62
300	1.84	1.84	1.70
350	1.84	1.84	1.78
≥400	1.84	1.84	1.84

Note:

1) *With intermediate heights, value k can be determined by linear interpolation from values given in Table 5.*
2) *When determining wind pressure for a building, for different wind directions there it can exist different terrain categories.*

6.6. When the ground surface around house and building is uneven, the standard landmark for height calculation is determined in accordance with Annex G.

6.7. Diagram for wind loads distribution on houses, buildings or structures and aerodynamic coefficient c are determined by instructions given in Table 6. The intermediate values can be determined using linear interpolation method.

The arrow in Table 6 points out wind direction on house, building or structures. Aerodynamic coefficients then shall be calculated as follow:

6.7.1. With an individual side or point of houses and buildings, it shall be the same as pressure factor given from Diagram 1 to Diagram 33 of Table 6.

The aerodynamic coefficient's positive value means the wind pressure toward the building surface, the negative value means wind pressure-facing outward of the building.

6.7.2. For structures and components (from Diagram 34 to Diagram 43 of table 6), it shall be the same as the direct resistance coefficient c_x and c_y when determining the object's overall resistance affected down the wind and perpendicular to the wind direction, corresponding to projected area on the surface perpendicular to the wind current; it is equal to lifting force factor c_z when determining the vertical composition of the object's overall resistance force corresponding to projected area on horizontal surface.

6.7.3. For a structure having an angle α between the wind facing surface and the direction of the wind stream, it shall be the same as factors c_n and c_t when determining the object's general resistance components in its axial direction corresponding to the area of wind facing surface.

For other cases not mentioned in Table 6 (other house and building categories, other wind directions, general resistance components of object in other directions), the aerodynamic coefficient shall be based on experiment data or special instructions.

6.8. For houses and buildings having door openings (windows, doors, air ventilation and light holes) as described from Diagram 2 to Diagram 26 of Table 6, which are evenly distributed along the perimeter or having walls made of asbestos cement and other wind passing-though materials (independent from the exist of door openings), when calculating the structures of external wall, column, wind resistance beam, and glass-door transom, the aerodynamic coefficients for external walls shall be:

$c = +1$ when the pressure is positive
$c = -0.8$ when the pressure is negative

Design wind loads for the internal walls is equal to $0.4W_o$ and for the light partitions having weight not exceeding 100 daN/m^2 shall be $0.2W_o$ but not less than 10 daN/m^2.

6.9. When calculating the horizontal frame of house having longitudinal or zenith clerestories with $a > 4h$ (Diagram 9, 10, 25 of Table 6), it is indispensable to consider the wind loads imposing on frame columns in wind facing and wind sheltering directions as well as the horizontal wind loads imposing on clerestory.

For the house with a saw-toothed roof (in Diagram 24 of Table 6) or the zenith clerestory with a ≤ 4h, it should take into account the friction force W_f replacing the horizontal force components affecting on the second clerestory and the followings from the wind facing direction. The friction force W_f is calculated using the Formula:

$$W_f = W_o \times c_f \times k \times S \quad (7)$$

Where

W_o: wind pressure in accordance with Table 4, in deca newton per square metre;

c_f: Friction factor given in Table 6;

k: factor given in Table 5

S: horizontal projected area (with saw-tooth, corrugated and skylight roofs) or vertical projected area (for wall having loggia and similar structures), measurement in square metres.

Table 6: Instruction for determining the aerodynamic coefficients (seen at the end of this document)

6.10. At the neighboring region of roof edges, ridge edges and roof foot, continuous edges between cross wall and longitudinal wall, if external pressure in negative value, it is necessary to adopt partial pressure (figure 1)

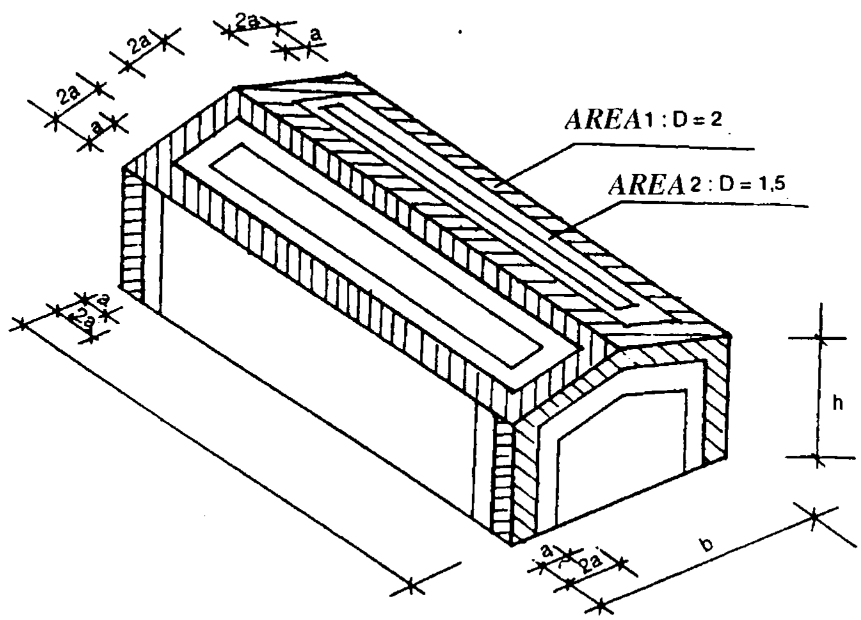


Figure 1: Partial pressure bearing regions on roof

Partial pressure coefficient D according to table 7 can be accepted

Table 7: Partial pressure coefficient D

Regions with partial pressure	Coefficient D
Region 1: With the width a from roof edges, ridge edges and roof foot and wall corner	2
Region 2: With the width a adjoining region 1	1.5

Notes:

1, In the area suffered from partial pressure, aerodynamic coefficient c should multiply with partial pressure coefficient D;

2, In designing the general force on one project, one wall or one roof system, this partial pressure coefficient shall not be used;

3, The width a shall be the smallest among 3 values: 0.1b; 0.1l and 0.1h but not greater than 1.5m. Please refer to figure 1 for dimension of b, l, h;

4, Partial pressure coefficient shall be applied only for houses having slope roof $\alpha > 10^0$*;*

5, In case of cantilever roof, roof area shall include cantilever roof. Pressure on cantilever roof shall be equal to that imposed on the wall's parts adjoining cantilever roof.

6.11. Dynamic component of wind load must be included in designing pillar, tower, chimney, electric pole, columnar equipment, conveyor corridor, expose frame…, multi-floor houses with height above 40m, cross frames of single floor, 1 span industrial houses with height greater than 36m, height/span ratio shall be more than 1.5.

6.12. For high buildings and flexible structure (chimney, pillar, tower…) inspection of aerodynamic instability should be carried out.
Design instructions and solutions to reduce oscillation of those structures are established by specific researches based on data of aerodynamic testing.

6.13. The standard value of dynamic component of wind load W_p at the height z is determined as follows:

6.13.1. For building and structure components having basic specific oscillation frequency f_1(Hz) more than the limit value of specific oscillation frequency f_L specified in Clause 6.14 shall be determined using the following formula:

$$W_p = W \times \zeta \times \nu \qquad (8)$$

Where:

W- Static component standard value of wind load at the design height as determined in Clause 6.3;
ζ - Dynamic pressure coefficient of wind load at the height of z according to table 8;
v- Correlative coefficient of dynamic pressure space of wind load as determined according to Clause 6.15.

Table 8 Dynamic pressure coefficient of wind load ζ

Height Z, m	Dynamic pressure coefficient for different topographical types		
	A	B	C
≤5	0.318	0.517	0.754
10	0.303	0.486	0.684
20	0.289	0.457	0.621
40	0.275	0.429	0.563
60	0.267	0.414	0.532
80	0.262	0.403	0.511
100	0.258	0.395	0.496
150	0.251	0.381	0.468
200	0.246	0.371	0.450
250	0.242	0.364	0.436
300	0.239	0.358	0.425
350	0.236	0.353	0.416
≥480	0.231	0.343	0.398

6.13.2 For building (and its structure parts) with design diagram of one free degree (transverse frame of single-floor industrial house, elevated water tower,...) when $f_1<f_L$, are determined using the formula:

$$W_p = W \times \zeta \times \xi \times \nu \qquad (9)$$

Where:

ξ - Dynamic coefficient determined by diagram in figure 2, depending on parameter ε and logarithm reduction degree of oscillation

$$\varepsilon = \frac{\sqrt{\gamma \times W_o}}{940 \times f_1} \qquad (10)$$

γ - Reliability coefficient of wind load equal to 1.2

W_o –Value of wind pressure (N/m2), as determined according to 6.4

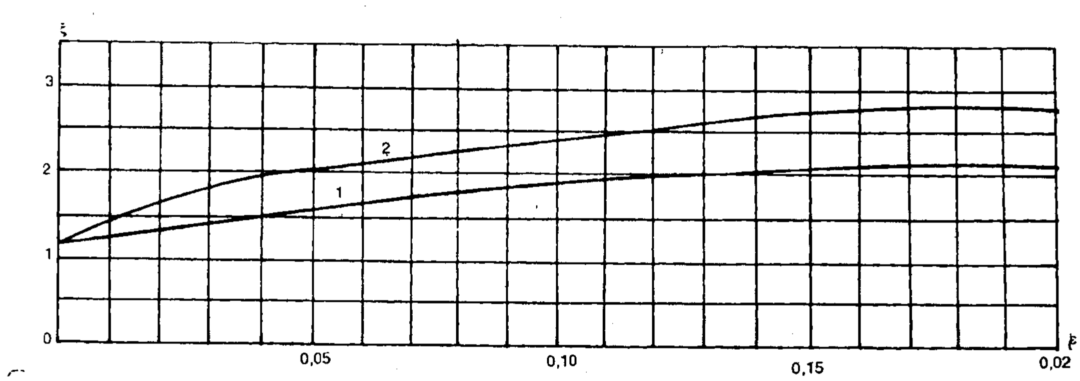


Figure 2: Dynamic coefficient ξ

Curve 1: For reinforced concrete and stone and brick buildings including steel frame building with covering structure (δ=0.3)

Curve 2: Towers, steel pillars, chimney, columnar equipment with reinforced concrete base (δ=0.15)

6.13.3. Houses with symmetric ground having $f_1<f_L$ and all buildings having $f_1<f_L<f_2$, f_2 is the second specific oscillation frequency of the building, as determined using the formula:

$$W_p = m \times \xi \times \psi \times y \qquad (11)$$

Where:

m- weight of building with the center of gravity at the height z.

ξ - Dynamic coefficient, please see in Clause 6.13.2

y- Cross displacement of building at the height z corresponding to the first specific oscillation (for house with symmetric ground, it is allowed to adopt y equal to displacing caused by static uniformly distributed transverse load)

ψ- Coefficient determined by dividing the building into r parts, on each part the wind load is unchanged.

$$\psi = \frac{\sum_{k=1}^{r} y_k \times W_{pk}}{\sum_{k=1}^{r} y_k^2 \times M_k} \qquad (12)$$

Where:

M_k- weight of the part k of building

y_k- Cross displacement of center of gravity of the part k in accordance with the first specific oscillation form.

W_{pk} - Uniformly distributed dynamic component of wind load in the part k of the building, determined according to the formula (8)

For multi-floor house with hardness, weight and surface of wind facing area not vary according to height, the dynamic component standard value of wind load at the height z can be determined using the formula:

$$W_p = 1.4 \times \frac{z}{h} \times \xi \times W_{ph} \qquad (13)$$

Where:

W_{ph} - dynamic component standard value of wind load at the height h of the top of the building, as determined according to formula (8)

6.14. Limit value of specific oscillation frequency f_L (H_z) neglects the calculation of design inertia force arisen when the building is oscillating according to the corresponding specific oscillation form, as determined according to table 9 depending on reduction degree value δ of oscillation.

6.14.1. For reinforced concrete and stone brick buildings, steel frame building having covering structure, δ=0.3.

6.14.2. Towers, pillars, steel chimney, steel columnar equipment have reinforced concrete bases, δ=0.15

Table 9: Limit value of specific oscillation frequency f_L

Regions of wind pressure	f_L (Hz)	
	δ=0.3	δ=0.15
I	1.1	3.4
II	1.3	4.1
III	1.6	5.0
IV	1.7	5.6
V	1.9	5.9

For pillar structures when $f_l < f_L$, it is necessary to inspect the aerodynamic instability.

6.15. Space correlative coefficient of dynamic component of wind pressure ν is established according to design surface of the works on which dynamic correlation is determined.

Design surface includes wind facing and wind shield wall surface, side wall, roof and the like through which the wind pressure is imposed on structures of the building

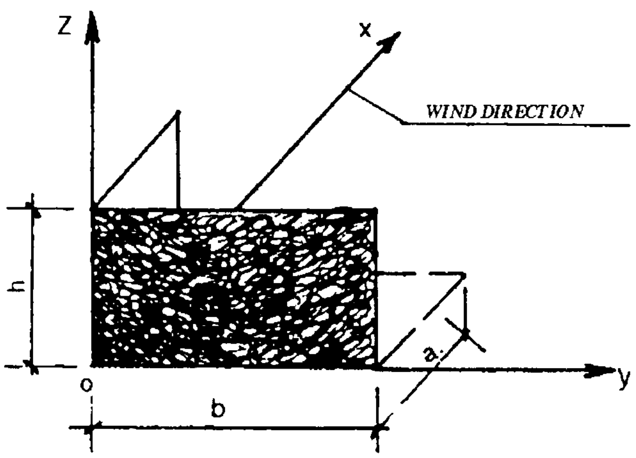


Figure 3: Coordinates system when defining correlation coefficient ν

If the design surface of the building is in rectangular shape and oriented in parallel with basic axle (pls. see in figure 3), then the coefficient ν as determined according to table 10 shall depend on parameters ρ and χ. Parameters ρ and χ are determined according to table 11.

Table 10: Space correlative coefficient of dynamic pressure of wind load ν

ρ, m	Coefficient ν when χ (m) equal to						
	5	10	20	40	80	160	350
0.1	0.95	0.92	0.88	0.83	0.76	0.67	0.56
5	0.89	0.87	0.84	0.80	0.73	0.65	0.54
10	0.85	0.84	0.81	0.77	0.71	0.64	0.53
20	0.80	0.78	0.76	0.73	0.68	0.61	0.51
40	0.72	0.72	0.70	0.67	0.63	0.57	0.48
80	0.63	0.63	0.61	0.59	0.56	0.51	0.44
160	0.53	0.53	0.52	0.50	0.47	0.44	0.38

Table 11: Parameters ρ and χ

Basic coordinate plane parallels design surface	ρ	χ
Zoy	b	h
Zox	0.4a	h
Xoy	b	a

6.16. For building having $f_s<f_L$ it needs to calculate the motive force including s the first oscillation forms, s is determined from the condition:

$f_s<f_L<f_{s+1}$

6.17. Reliability coefficient γ for wind load shall be 1.2 corresponding to house and building in a supposed 50- year time of use. When the supposed using time changes, the design value of wind load must change by multiplying with the coefficient given in table 12

Table 12: Adjust coefficient of wind load in different supposed time of use

Supposed using time, in years	5	10	20	30	40	50
Wind load adjust coefficient	0.61	0.72	0.83	0.91	0.96	1

ANNEX A

METHODS TO DEFINE DESIGN INTERNAL FORCES IN BASIC AND SPECIAL COMBINATIONS OF LOAD

A.1. When simultaneously concerning at least 2 loads in basic combinations, total value of design internal force X due to those loads (bending moment or torque moment, longitudinal force or cutting force) is defined according to the following formula:

$$X=\sum_{i=1}^{m} X_{tci}+\sqrt{\sum_{i=1}^{m} X_{tci}^{2}\times(\gamma_i-1)^2} \qquad (A.1)$$

X_{tci}- Internal force defined according to standard values of each load, including combinations coefficient correlative with the requirements concerned in clause 2.4.3;

γ_i - Reliability coefficient of each load;

m- The number of load simultaneously acted

A.2. If load creates 2 or 3 different internal forces (X,Y,Z) simultaneously concerned in calculation (for example normal internal force and one or two directions bending moment), in each combinations of load when having 3 internal forces it must be taken into account 3 ways of calculation internal forces (X, $\bar{Y}$, $\bar{Z}$), (Y, $\bar{Z}$, $\bar{X}$) and (Z, $\bar{X}$, $\bar{Y}$); when having 2 internal forces it must be taken into account 2 ways (X, Y), (Y, X).

For (X, $\bar{Y}$, $\bar{Z}$), these internal forces are defined according to:

$$X=\sum_{i=1}^{m} X_{tci}\pm\sqrt{\sum_{i=1}^{m} X_{tci}^{2}\times(\gamma_i-1)^2} \qquad (A.2)$$

$$\bar{Y}=\sum_{i=1}^{m} Y_{tci}\pm\frac{\sum_{i=1}^{m} X_{tci}^{2}\times Y_{tci}\times(\gamma_i-1)^2}{\sqrt{\sum_{i=1}^{m} X_{tci}^{2}\times(\gamma_i-1)^2}} \qquad (A.3)$$

$$\bar{Z}=\sum_{i=1}^{m} Z_{tci}\pm\frac{\sum_{i=1}^{m} X_{tci}\times Z_{tci}\times(\gamma_i-1)^2}{\sqrt{\sum_{i=1}^{m} X_{tci}^{2}\div\times(y_i-1)^2}} \qquad (A.4)$$

$(X, \bar{Y}, \bar{Z})$- the gross design internal force causing when bearing simultaneous action of live loads.

X_{tci} , Y_{tci}, Z_{tci}- internal forces defined according to standard value of each load including coefficient of load combinations, for short-term loads according to clauses 1,4,3; in case of concerning dynamic component of wind load need to be defined according to clause 5.13.

m, γ_i – as in the formula (A.1).

For $(Y, \bar{Z}, \bar{X})$ and $(Z, \bar{X}, \bar{Y})$, internal forces are defined according to formulas (A.2), (A.3) and (A.4) with cyclic permutation of symbol X,Y,Z.

In formula (A.2), (A.3) and (A.4), subtractive sign taken in cases of reducing absolute values of internal force, defined according to (A.2) is dangerous, at that time all 3 formulas must take the same sign.

When setting calculation combinations, in case of live load defined in such a way as to ensure appearance in extremum value section of one of internal forces and other internal forces gained as the corollary of this calculus, the extremum calculation internal force should be defined according to (A.2) and the internal force corresponding to it is defined according to (A.3) and (A.4). For example, when setting combination (N_{min}, M corresponding), N_{min} should be defined according to (A.2) and M corresponding according to (A.3).

Note: *Depending on form of combination in order to add internal forces due to continuos load with reliability coefficient bigger or smaller than unit (seen clause 3.2).*

ANNEX B

MODEL LIST OF CRANES WITH DIFFERENT WORKING CONDITIONS

Working conditions of crane	*List of electric cranes*	*Workshops normally use cranes with the above working conditions*
Light	With the pattern of goods suspender	Workshops for repairing, machine compartment of thermo-electric factory
Normal	With the pattern of goods suspender including cranes using	Mechanical and assembly workshops of factories with medium-sized mass production, mechanical repairing workshop, goods loading space
Heavy	With the pattern of goods suspender, patterns used for casting, forging and tempering metal	Workshops of factories with big-size mass production, bulk goods loading space, workshops of metallurgy factories
Extremely heavy	With the pattern of grab, electromagnet, grab having lever, materials by magnetic grab to prop casting block, pattern for smashing materials to pieces	Workshops of metallurgy factories

Note: *Electric suspension crane with normal working conditions, manual suspension crane with light working conditions.*

ANNEX C

LOAD DUE TO IMPACT OF CRANE INTO THE LAST RAILING-CHAIR

Standard cross load P_y (10 KN) along rail of crane causing by impact of crane into the last railing-chair is defined according to the following formula:

$$P_y = \frac{m \times v^2}{f} \qquad \text{(C.1)}$$

Where:

v- velocity of crane at the time of impact is equal to 1/2 normal velocity by m/s;

f- the possible largest sinkage of buffer set, equals to 1 for crane with flexible string and lifting capacity under 500 KN of light, medium and heavy working conditions, equals to 0,2 m for the other;

m- change mass of crane calculated in tons (10 KN), defined according to the following formula:

$$m = \frac{1}{g} \times \frac{P_M}{2} + (P_T + KQ) \times \frac{L_K - 1}{L_K} \qquad \text{(C.2)}$$

Where

g- gravitation field acceleration, equal to 9,81 m/s^2 ;

P_M-necessary weight of crane, calculated in tons (10 KN);

P_T- weight of winch, calculated in tons (10 KN);

Q- lifting capacity of crane, calculated in tons (10 KN);

k- coefficient is equal to 0 for crane with flexible string and equal 1 for crane with hard string;

L_k- aperture of crane, calculated in m;

l- distance from winch to leaning pillow, calculated in m;

Design value of load including reliability coefficient according to clause 5.8 is taken not bigger than values in the following table C.1:

Table C.1

Characteristics of crane	Critical load, 10 KN
1. Electric or manual suspension crane	1
2. Versatile electric crane, normal and heavy working conditions with crane used for casting workshop	15
3. Versatile electric crane, light working conditions	5
4. Electric crane, extremely heavy working conditions (for casting industry and special duty)	
-With flexible hook	25
-With hard hook	50

ANNEX E

WIND PRESSURES REGIONS DISPOSED BY ADMINISTRATIVE LOCATIONS

Location	Region	Location	Region
1. Ha noi capital		- Cho Moi district	I.A
- Hanoi urban	II.B	- Phu Tan district	I.A
- Dong Anh district	II.B	- Tan Chau district	I.A
- Gia Lam district	II.B	- Tinh Bien district	I.A
- Soc Son district	II.B	- Thoai Son district	I.A
- Thanh Tri district	II.B	- Tri Ton district	I.A
- Tu Liem district	II.B		
		5. Ba Ria - Vung Tau province	
2. Ho Chi Minh city		- Vung Tau city	II.A
- Ho Chi Minh urban	II.A	- Chau Thanh district	II.A
- Binh Chanh district	II.A	- Con Dao district	III.A
- Can Gio district	II.A	- Long Dat district	II.A
- Cu Chi district	I.A	- Xuyen Moc district	II.A
- Hoc Mon district	II.A		
- Nha Be district	II.A	**6. Bac Thai province**	
- Thu Duc district	II.A	- Thai Nguyen city	II.B
		- Bac Can town	I.A
3. Hai Phong city		- Song Cong town	II.B
- Hai Phong urban	IV.B	- Cho Don district	I.A
- Do Son town	IV.B	- Bach Thong district	I.A
- Kien An town	IV.B	- Dai Tu district	II.A
- An Hai district	IV.B	- Dinh Hoa district	I.A
- An Lao district	IV.B	- Dong Hy district	I.A
- Cat Hai district	IV.B	- Na Ri district	I.A
- Dao Bach Long Vi district	V.B	- Pho Yen district	II.B
- Kien Thuy district	IV.B	- Phu Binh district	II.B
- Thuy Nguyen district	III.B	- Phu Luong district	I.A
- Tien Lang district	IV.B	- Vo Nhai district	I.A
- Vinh Bao district	IV.B		
		7. Ben Tre province	
4. An Giang province		- Ben Tre town	II.A
- Long Xuyen town	I.A	- Ba Tri district	II.A
- Chau Doc town	I.A	- Binh Dai district	II.A
- An Phu district	I.A	- Chau Thanh district	II.A
- Chau Thanh district	I.A	- Cho Lach district	II.A
- Chau Phu district	I.A	- Giong Trom district	II.A

Location	region	Location	region
- Mo Cay district	II.A	**11. Can Tho province**	
- Thanh Phu district	II.A	- Can Tho city	II.A
		- Chau Thanh district	II.A
8. Binh Dinh province		- Long My district	II.A
- Quy Nhon city	III.B	- O Mon district	II.A(I.A)
- An Nhon district	III.B	- Phung Hiep district	II.A
- An Lao district	II.B(I.A)	- Thot Not district	I.A
- Hoai An district	II.B	- Vi Thanh district	II.A
- Hoai Nhon district	III.B		
- Phu Cat district	III.B	**12. Dac Lac province**	
- Phu My district	III.B	- Buon Ma Thuot town	I.A
- Tay Son district	II.B(I.A)	- Cu Giut district	I.A
- Tuy Phuoc district	III.B	- Cu M'ga district	I.A
- Van Canh district	II.B	- Dac Min district	I.A
- Vinh Thanh district	I.A	- Dac Nong district	I.A
		- Dac Rlap district	I.A
9. Binh Thuan province		- Ea Ca district	I.A
- Phan Thiet town	II.A	- Ea H'leo district	I.A
- Bac Binh district	II.A(I.A)	- Ea Sup district	I.A
- Duc Linh district	I.A	- Krong Ana district	I.A
- Ham Tan district	II.A	- Krong Bong district	I.A
- South Ham Thuan district	II.A	- Krong Buc district	I.A
- North Ham Tuan district	I.A(II.A)	- Krong Nang district	I.A
- Phu Quy district	III.A	- Krong No district	I.A
- Tan Linh district	I.A	- Krong Pac district	I.A
- Tuy Phong district	II.A	- Lac district	I.A
		- Mo Drac district	I.A
10. Cao Bang province			
- Cao Bang town	I.A	**13. Dong Nai province**	
- Ba Be district	I.A	- Bien Hoa city	I.A
- Bao Lac district	I.A	- Vinh An town	I.A
- Ha Quang district	I.A	- Dinh Quan district	I.A
- Ha Lang district	I.A	- Long Khanh district	I.A(II.A)
- Hoa An district	I.A	- Long Thanh district	II.A
- Ngan Son district	I.A	- Tan Phu district	I.A
- Nguyen Binh district	I.A	- Thong Nhat district	I.A
- Quang Hoa district	I.A	- Xuan Loc district	I.A
- Thach An district	I.A		
- Thong Nong district	I.A	14. Dong Thap province	
- Tra Linh district	I.A	- Cao Lanh town	I.A
- Trung Khanh district	I.A	- Cao Lanh district	I.A

Location	region	Location	region
- Chau Thanh district	II.A	**17. Ha Giang province**	
- Hong Ngu district	I.A	- Ha Giang town	I.A
- Lai Vung district	I.A	- Bac Me district	I.A
- Tam Nong district	I.A	- Bac Quang district	I.A
- Tan Hong district	I.A	- Dong Van district	I.A
- Thanh Binh district	I.A	- Hoang Su Phi district	I.A
- Thanh Hung district	I.A	- Meo Vac district	I.A
- Thap Muoi district	I.A	- Quan Ba district	I.A
		- Vi Xuyen district	I.A
15. Gia Lai province		- Xin Man district	I.A
- Playku town	I.A	- Yen Minh district	I.A
- A Dun Pa district	I.A		
- An Khe district	I.A	**18. Ha Tay province**	
- Chu Pa district	I.A	- Ha Dong town	II.B
- Chu Prong district	I.A	- Son Tay town	II.B
- Chu Se district	I.A	- Ba Vi district	II.B
- Duc Co district	I.A	- Chuong My district	II.B
- K Bang district	I.A	- Dan Phuong district	II.B
- Krong Chro district	I.A	- Hoai Duc district	II.B
- Krong Pa district	I.A	- My Duc district	II.B
- Mang Giang district	I.A	- Phu Xuyen district	II.B
		- Phuc Tho district	II.B
16. Ha Bac province		- Quoc Oai district	II.B
- Bac Giang town	II.B	- Thach That district	II.B
- Bac Ninh town	II.B	- Thanh Oai district	II.B
- Gia Luong district	II.B	- Thuong Tin district	II.B
- Hiep Hoa district	II.B	- Ung Hoa district	II.B
- Lang Giang district	II.B		
- Luc Nam district	II.B	**19. Ha Tinh province**	
- Luc Ngan district	II.B	- Ha Tinh town	IV.B
- Que Vo district	II.B	- Hong Linh town	IV.B
- Son Dong district	II.B	- Can Loc district	IV.B
- Tan Yen district	II.B	- Cam Xuyen district	III.B(IV.B)
- Tien Son district	II.B	- Duc Tho district	II.B
- Thuan Thanh district	II.B	- Huong Khe district	I.A(II.B)
- Viet Yen district	II.B	- Huong Son district	I.A(II.B)
- Yen Dung district	II.B	- Ky Anh district	III.B(IV.B)
- Yen Phong district	II.B	- Nghi Xuan district	IV.B
- Yen The district	I.A	- Thach Ha district	IV.B

Location	region	Location	region
20. Hai Hung province		- Go Quao district	II.A
- Hai Duong town	III.B	- Ha Tien district	I.A
- Hung Yen town	III.B	- Hon Dat district	I.A
- Cam Binh district	III.B	- Kien Hai district	II.A
- Chau Giang district	II.B	- Phu Quoc district	III.A
- Kim Mon district	II.B	- Tan Hiep district	I.A
- Kim Thi district	III.B		
- My Van district	II.B	**24. Kon Tum**	
- Chi Linh district	II.B	- Kon Tum town	I.A
- Nam Thanh district	III.B	- Dac Glay district	I.A
- Ninh Thanh district	III.B	- Vinh Thuan district	II.A
- Phu Tien district	III.B	- Dac To district	I.A
- Tu Loc district	III.B	- Kon Plong district	I.A
		- Ngoc Hoi district	I.A
21. Hoa Binh province		- Sa Thay district	I.A
- Hoa Binh town	I.A		
- Da Bac district	I.A	**25. Lai Chau province**	
- Kim Boi district	II.B	- Dien Bien Phu town	I.A
- Ky Son district	I.A	- Lai Chau town	I.A
- Lac Thuy district	II.B	- Dien Bien district	I.A
- Lac Son district	II.B	- Muong Lay district	I.A
- Luong Son district	II.B	- Muong Te district	I.A
- Mai Chau district	I.A	- Phong Tho district	I.A
- Tan Lac district	I.A	- Tua Chua district	I.A
- Yen Thuy district	II.B	- Thuan Gia district	I.A
		- Sin Ho district	I.A
22. Khanh Hoa province			
- Nha Trang city	II.A	**26. Lam Dong**	
- Cam Ranh district	II.A	- Da Lat city	I.A
- Dien Khanh district	II.A	- Bao Loc district	I.A
- Khanh Son district	I.A	- Cat Tien district	I.A
- Khanh Vinh district	I.A	- Di Linh district	I.A
- Ninh Hoa district	II.A	- Da Hoai district	I.A
- Truong Sa	III.B	- Da Te district	I.A
		- Don Duong district	I.A
23. Kien Giang province		- Duc Trong district	I.A
- Rach Gia town	I.A	- Lac Duong district	I.A
- An Bien district	I.A	- Lam Ha district	I.A
- An Minh district	I.A		
- Chau Thanh district	I.A		
- Giong Rieng district	II.A		

location	region	location	region
27. Lang Son		- Cai Nuoc district	II.A
- Lang Son town	I.A	- Dam Doi district	II.A
- Bac Son district	I.A	- Gia Lai district	II.A
- Binh Gia district	I.A	- Hong Dan district	II.A
- Cao Loc district	I.A	- Ngoc Hien district	II.A
- Chi Lang district	I.A	- Thoi Binh district	II.A
- Dinh Lap district	I.A	- Tran Van Thoi district	II.A
- Huu Lung district	I.A	- U Minh district	II.A
- Loc Binh district	I.A	- Vinh Loi	II.A
- Trang Dinh district	I.A		
- Van Lang district	I.A	**31. Nam Ha**	
- Van Quan district	I.A	- Nam Dinh city	IV.B
		- Ha Nam town	III.B
28. Lao Cai		- Binh Luc district	III.B(IV.B)
- Lao Cai town	I.A	- Duy Tien	III.B
- Bac Ha district	I.A	- Hai Hau district	IV.B
- Bao Thang district	I.A	- Kim Bang district	III.B
- Bao Yen district	I.A	- Ly Nhan district	III.B
- Bat Xat district	I.A	- Nam Ninh district	IV.B
- Muong Khuong district	I.A	- Nghia Hung district	IV.B
- Sa Pa district	I.A	- Thanh Liem district	III.B
- Than Uyen district	I.A	- Vu Ban district	IV.B
- Van Ban district	I.A	- Xuan Thuy district	IV.B
		- Y Yen district	IV.B
29. Long An			
- Tan An town	II.A	**32. Nghe An**	
- Ben Luc district	II.A	- Vinh city	III.B
- Can Duoc district	II.A	- Anh Son district	I.A
- Can Giuoc district	II.A	- Con Cuong district	I.A
- Chau Thanh district	II.A	- Dien Chau district	III.B
- Duc Hoa district	I.A	- Do Luong district	II.B
- Duc Hue district	I.A	- Hung Nguyen district	III.B
- Moc Hoa district	I.A	- Ky Son district	I.A
- Tan Thanh district	I.A	- Nam Dan district	II.B
- Tan Tru district	II.A	- Nghi Loc district	III.B
- Thach Hoa district	I.A	- Nghia Dan district	II.B
- Thu Thua district	II.A	- Que Phong district	I.A
- Vinh Hung district	I.A	- Quy Chau district	I.A
		- Quy Hop district	I.A
30. Minh Hai province		- Quynh Luu district	III.B
- Bac Lieu town	II.A	- Tan Ky district	I.A
- Ca Mau district		- Thanh Chuong district	II.B

location	Region
- Tuong Duong district	I.A
- Yen Thanh district	II.B
33. Ninh Binh province	
- Ninh Binh town	IV.B
- Tam Diep town	IV.B
- Gia Vien district	III.B
- Hoa Lu district	III.B
- Hoang Long district	III.B
- Kinh Son district	IV.B
- Tam Diep district	IV.B
34. Ninh Thuan province	
- Phan Rang - Thap Cham town	II.A
- Ninh Hai district	
- Ninh Phuoc district	II.A
- Ninh Son district	II.A
	I.A
35. Phu Yen	
- Tuy Hoa town	
- Dong Xuan district	III.B
- Cau River district	II.B
- Hinh River district	III.B
- Son Hoa district	I.A
- Tuy An district	I.A
- Tuy Hoa district	III.B
	II.B(III.B)
36. Quang Binh	
- Dong Hoi town	III.B
- Bo Trach district	I.A(II.B)
- Le Thuy district	I.A(II.B, III.B)
- Minh Hoa district	I.A
- Quang Ninh district	I.A(II.B, III.B)
- Quang Trach district	III.B
- Tuyen Hoa district	II.B
37. Quang Nam - Da Nang province	
- Da Nang city	II.B
- Tam Ky town	II.B
- Hoi An town	III.B
- Duy Xuyen district	II.B
- Dai Loc district	II.B
- Dien Ban district	II.B
- Giang district	I.A
- Hien district	I.A

location	region
- Hiep Duc district	II.B
- Hoang Sa district	V.B
- Hoa Vang district	II.B
- Nui Thanh district	III.B
- Phuoc Son district	I.A
- Que Son district	II.B
- Tien Phuoc district	II.B
- Thang Binh district	III.B
- Tra My district	I.A
38. Quang Ngai	
- Quang Ngai town	III.B
- Ba To district	I.A
- Binh Son district	III.B
- Duc Pho district	III.B
- Minh Long district	II.B
- Mo Duc district	III.B
- Nghia Hanh district	II.B
- Son Ha district	I.A
- Son Tinh district	II.B
- Tra Bong district	I.A
- Tu Nghia district	II.B
39. Quang Ninh	
- Cam Pha town	III.B
- Hon Gai town	III.B
- Uong Bi town	II.B
- Ba Che district	II.B
- Binh Lieu district	II.B
- Cam Pha district	IV.B
- Dong Trieu district	II.B
- Hai Ninh district	III.B
- Hoanh Bo district	II.B
- Quang Ha district	III.B
- Tien Yen district	II.B
- Yen Hung district	IV.B
40. Quang Tri province	
- Dong Ha town	II.B
- Quang Tri town	II.B
- Cam Lo district	II.B
- Gio Linh district	II.B
- Hai Lang district	II.B
- Huong Hoa district	I.B

location	region	location	region
- Trieu Phong district	III.B	- Tan Bien district	I.A
- Vinh Linh district	II.B	- Tan Chau district	I.A
		- Trang Bang district	I.A
41. Soc Trang province			
- Soc Trang town	II.A	**45. Thai Binh province**	
- Ke Sach district	II.A	- Thai Binh town	IV.B
- Long Phu district	II.A	- Dong Hung district	IV.B
- My Tu district	II.A	- Kien Xuong district	IV.B
- My Xuyen district	II.A	- Hung Ha district	IV.B
- Thach Tri district	II.A	- Quynh Phu district	IV.B
- Vinh Chau district	II.A	- Thai Thuy district	IV.B
		- Tien Hai district	IV.B
42. Song Be		- Vu Thu district	IV.B
- Thu Dau Mot town	I.A		
- Ben Cat district	I.A	**46. Thanh Hoa province**	
- Binh Long district	I.A	- Bim Son town	IV.B
- Bu Dang district	I.A	- Thanh Hoa town	III.B
- Dong Phu district	I.A	- Sam Son town	IV.B
- Loc Ninh district	I.A	- Ba Thuoc district	II.B
- Phuoc Long district	I.A	- Cam Thuy district	II.B
- Tan Uyen district	I.A	- Dong Son district	III.B
- Thuan An district	I.A	- Ha Trung district	III.B
		- Hau Loc district	IV.B
43. Son La		- Hoang Hoa district	IV.B
- Son La town	I.A	- Lang Chanh district	II.B
- Bac Yen district	I.A	- Nga Son district	IV.B
- Mai Son district	I.A	- Ngoc Lac district	II.B
- Moc Chau district	I.A	- Nong Cong district	III.B
- Muong La district	I.A	- Nhu Xuan district	II.B
- Phu Yen district	I.A	- Quan Hoa district	I.B
- Quynh Nhai district	I.A	- Quang Xuong district	III.B
- Thuan Chau district	I.A	- Tinh Gia district	III.B
- Song Ma district	I.A	- Thach Thanh district	III.B
- Yen Chau district	I.A	- Trieu Yen district	III.B
		- Tho Xuan district	II.B
44. Tay Ninh		- Thuong Xuan district	II.B
- Tay Ninh town	I.A	- Trieu Son district	II.B
- Ben Cau district	I.A	- Vinh Loc district	III.B
- Chau Thanh district	I.A		
- Duong Minh Chau district	I.A	**47. Thua Thien - Hue province**	
- Go Dau district	I.A	- Hue city	II.B
- Hoa Thanh district	I.A	- A Luoi city	I.A

location	region	location	region
- Huong Tra district	II.B	- Tra On district	II.A
- Huong Thuy district	II.B	- Vinh Liem district	II.A
- Nam Dong district	I.A		
- Phong Dien district	III.B	**52. Vinh Phu province**	
- Phu Loc district	II.B	- Viet Tri city	II.A
- Phu Vang district	III.B	- Phu Tho town	II.A
- Quang Dien district	III.B	- Vinh Yen town	II.B
		- Doan Hung district	I.A
48. Tien Giang province		- Me Linh district	II.B
- My Tho city	II.A	- Lap Thach district	II.A
- Go Cong town	II.A	- Phong Chau district	II.A
- Cai Lay district	II.A	- Song Thao district	I.A
- Cai Be district	II.A	- Tam Dao district	II.B
- Chau Thanh district	II.A	- Tam Thanh district	II.B
- Cho Gao district	II.A	- Thanh Hoa district	I.A
- East Go Cong district	II.A	- Thanh Son district	I.A
- West Go Cong district	II.A	- Vinh Lac district	II.B
		- Yen Lap district	I.A
49. Tra Vinh			
- Tra Vinh town	II.A	**53. Yen Bai province**	
- Cang Long district	II.A	- Yen Bai town	I.A
- Cau Ke district	II.A	- Luc Yen district	I.A
- Cau Ngang district	II.A	- Mu Cang Chai district	I.A
- Chau Thanh district	II.A	- Tram Tau district	I.A
- Duyen Hai district	II.A	- Tran Yen district	I.A
- Tieu Can district	II.A	- Van Chan district	I.A
- Tra Cu district	II.A	- Van Yen district	I.A
		- Yen Binh district	I.A
50. Tuyen Quang province			
- Tuyen Quang town	I.A		
- Chiem Hoa district	I.A		
- Ham Yen district	I.A		
- Na Hang district	I.A		
- Son Duong district	I.A		
- Yen Son district	I.A		
51. Vinh Long province			
- Vinh Long town	II.A		
- Binh Minh district	II.A		
- Long Ho district	II.A		
- Mang Thit district	II.A		
- Tam Binh district	II.A		

Note: *Districts belong to two or three wind regions (in bracket), when defining value Wo to design, it is necessary to consult opinions of standards compilation agency to select exact region.*

ANNEX F

WIND PRESSURES FOR METEOROLOGICAL MONITORING STATIONS INSTALLED IN MOUNTAIN AND ISLAND REGIONS.

Independent values provided by meteorological monitoring stations given in Annex F (Table F1 and F2) are calculated wind pressures with building supposed lifetime varying from 5 years, 10 years, 20 years to 50 years.

Table F1: Calculated wind pressures provided by some meteorological monitoring stations installed in mountain region, applied to Clause 6.4.3

Meteorological monitoring stations	Wind pressures corresponding to			
	5 years	10 years	20 years	50 years
1. An Khe	59	69	80	95
2. Bac Can	67	78	90	107
3. Bac Son	49	57	65	76
4. Bao Loc	45	52	59	69
5. Chiem Hoa	60	70	81	97
6. Con Cuong	42	47	54	63
7. Da Lat	47	53	60	70
8. Dac Nong	48	54	60	69
9. Ha Giang	58	68	79	94
10. Hoa Binh	55	65	74	88
11. Hoi Xuan	57	66	76	91
12. Huong Khe	58	67	77	91
13. Kon Tum	40	46	53	61
14. Lac Son	59	69	79	94
15. Luc Ngan	70	83	97	117
16. Luc Yen	65	76	88	104
17. M'Drac	70	81	93	109
18. Playku	61	70	79	93
19. Phu Ho	60	69	79	92
20. Sinh Ho	64	75	87	104
21. Tua Chua	41	47	53	62
22. Than Uyen	62	73	85	102
23. That Khe	60	73	87	107
24. Tuyen Hoa	62	72	83	98
25. Tuong Duong	52	61	71	86
26. Yen Bai	58	68	77	91

Table F2: Calculated wind pressures provided by some meteorological monitoring stations installed in insland region, applied for clause 6.4.3

Meteorological monitoring stations	**Wind load corresponding to repeat cycles , daN/m²**			
	5 years	10 years	20 years	50 years
1. Bach Long Vi	147	173	201	241
2. Co To	130	153	177	213
3.Con Co	95	114	135	165
4. Con Son	81	94	108	128
5. Hon Dau	131	154	178	214
6. Hon Ngu	94	110	128	153
7. Hoang Sa	86	102	120	145
8. Phu Quoc	103	123	145	175
9. Phu Quy	83	97	110	130
10. Truong Sa	103	119	136	160

ANNEX G

METHODS TO DETERMINE BASE MARK FOR DEFINING HEIGHT OF HOUSE AND WORKS

When determining coefficient k in table 5, if the ground surface around house and works is not flat, base mark for defining height z is determined as follows:

G.1. If the ground surface has slope smaller in comparison with horizontal direction $i \leq 0,3$, height z is included from ground surface setting house and works to the point needs to be considered.

G.2. If the ground surface has slope $0,3 < i < 2$, height z is included from the convention height top surface of works Zo smaller than actual ground surface to the point needs to be considered.

Convention height top surface of works Zo is defined according to the figure 1

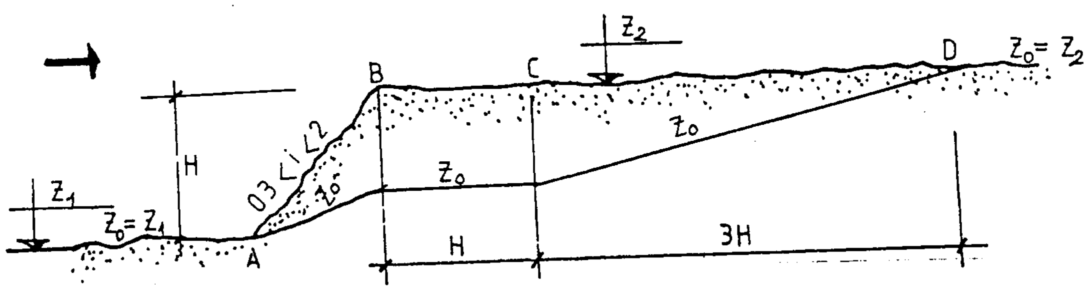


Figure G1.

On the left of A: Zo= Z1
On section BC: Zo= H(2-i)/1,7
On the right of D: Zo= Z2
On section AB and CD: define Zo by linear interpolate method

G.3. If ground surface has big slope $i \geq 2$, convention height surface of works Zo for defining height z smaller than actual ground surface is determined according to figure G2.

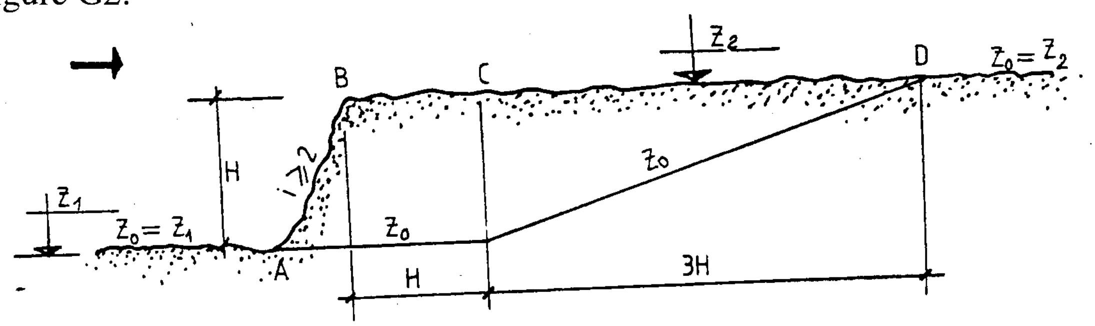


Figure G 2

On the left of C: Zo= Z1
On the right of D: Zo= Z2
On section CD: define Zo by linear interpolate method

MEASUREMENT UNITS CONVERSION

1. Multiple and aliquote of the system of units SI

Name	Symbol	Factor	Explanation
giga	G	10^9	1.000.000.000
mega	M	10^6	1.000.000
kilo	k	10^3	1.000
hecto	h	10^2	100
deca	da	10	10
deci	d	10^{-1}	0,1
centi	d	10^{-2}	0,01
mili	m	10^{-3}	0,001
micro	µ	10^{-6}	0,000.001
nano	n	10^{-9}	0,000.000.001

2. Normal units conversion

Quantity	Name	Symbol	Conversion
Length	kilometre metre decimetre centimetre milimetre	km m dm cm mm	= 1000dm 1m = 10dm = 100cm = 1000mm = 0,1m = 0,01m = 0,001m
Area	square kilometre hectare square metre square decimetre square centimetre	km^2 ha m^2 dm^2 cm^2	= 1.000.000m^2 = 100ha = 10.000a = 10.000m^2 = 100a = 100dm^2 = 100cm^2 = 100mm^2
Volume	cubic metre decimetre hectolitre decalitre litre	m^3 dm^3 hl dal l	= 1.000dm3=1.000.000cm^3=1000litre = 1litre = 10dal = 100litre = 10litre
Velocity	kilometre/hour metre/second	km/h m/s	= 0,278 m/s
Mass	ton kilogram gram miligram	T kg g mg	= 1.000kg = 1.000.000g = 1.000g = 1.000mg = 0,001g

Force mass and acceleration	mega newton kilo newton newton	MN kN N	= 1.000.000N = 1000N; 1Tf = 9,81KN ≈ 10KN 1kgf = 9,82n ≈ 10N = 1kg.m/s^2
Pressure, stress/area	pascal atmosphere	Pa atm	= 1N/m^2; 1kgf/cm^2 = 9,81.10^{4}N/m^2 ≈ 0,1MN/m^2; 1kgf/m^2 = 9,81N/m^2 = 9,81 Pa ≈ 10N/m^2 = 1daN/m^2 = 1kgf/cm^2 = 10Tf/m^2
Volumic mass			1kgf/m^3 = 9,81N/m^3 ≈ 10N/m^3 1Tf/m^3 = 9,81KN/m^3 ≈ 10KN/m^3
Temperature	Kelvin Celsius	°K °C	 = 273,15 °K
Energy	megajoule kilojoule joule milijoule kilocalo	MJ kJ J mJ Kcal	= 1.000.000J = 1.000 J = 0,239 Kcal = 1 Nm = 0,001 J = 427 kgm = 1,1636Wh; 1MJ/h = 270.000kgm = 632 Kcal
Power, Energy/time	megawatt kilowatt horsepower watt miliwatt	MW kW hp W mW	= 1.000.000 W = 1000W = 1000J/s = 1,36 horsepower = 0,239 Kcal/s = 1 J/s = 0,001W
Frequency	hertz	Hz	= 1s^{-1}

3. British units conversion into SI

Quantity	Name	Symbol	Conversion
Length	mile yard foot inch	mile yd ft in	= 1609m = 0,9144m = 0,3048m = 2,54cm
Area	square mile acre square yard square foot	sq.mile ac sq.yd sq.ft	= 259ha = 2590000m^2 = 4047m^2 = 0,836m^2 = 0,0929m^2
Volume	cubic yard cubic foot cubic inch	cu.yd cu.ft cu.in	= 0,7646m^3 = 28,32dm^3 = 16,387cm^3
Mass	long ton short ton pound ounce	tn.lg tn.sh lb oz	= 1016kg = 907,2kg = 0,545kg = 28,350g

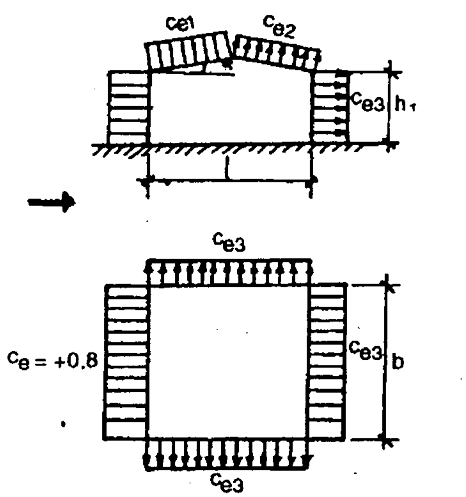
Table 6. Instructions for determining aerodynamic coefficient

House, buildings and members Diagrams and wind loads Diagrams	*Instructions for determining aerodynamic coefficient*	*Note*
1. a) Vertical surfaces - windward - leeward	 c= + 0.8 c = - 0.6	
b) Verical surfaces or with a ptich of 15° and less from the vertical direction, in houses having numerous skylights or other complicated surfaces (if there is no corresponding outline in this Table): - Raising edge or intermediate surfaces Windward Leeward - Other intermediate surfaces Windward Leeward	 c = + 0.7 c = - 0.6 c = - 0.5 c = - 0.5	

Table 6 (continued)

House, buildings and members Diagrams and wind loads Diagrams	*Instructions for determining aerodynamic coefficient*	*Legend*

2. Ridge roof



plan

Coefficient	α degree	h_1/l			
		0	0.5	1	≥ 2
c_{e1}	0 20 40 60	0 + 0.2 + 0.4 + 0.8	− 0.6 − 0.6 + 0.3 + 0.8	− 0.7 − 0.7 − 0.2 + 0.8	− 0.8 − 0.8 − 0.4 + 0.8
c_{e2}	≤ 60	− 0.4	− 0.4	− 0.5	− 0.8

b/l	c_{e3} value when h_1/l is		
	≤ 0.5	1	≥ 2
≤ 1	− 0.4	− 0.5	− 0.6
≥ 2	− 0.5	− 0.6	− 0.6

-When the wind blows in the gable, on all roof surfaces, there shall be $c_e = -0.7$

- When the coefficient v is determined in accordance with Clause 6.15, then $h = h_1 + 0.2 \times l \times tg\alpha$

Table 6 (continued)

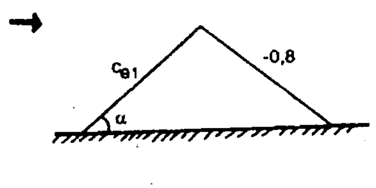
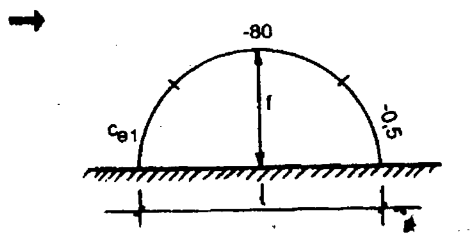
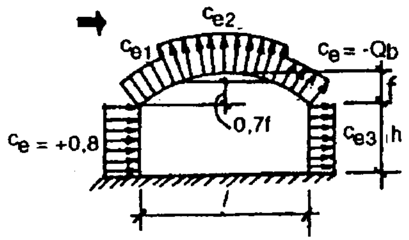
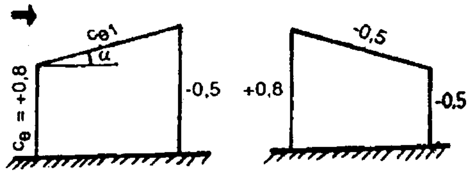
<table>
<tr><th>House, buildings and members Diagrams and wind loads Diagrams</th><th>Instructions for determining aerodynamic coefficient</th><th>Legend</th></tr>
<tr><td>3. Ridge roof facing down ground

</td><td><table><tr><td>α</td><td>0°</td><td>30°</td><td>≥60°</td></tr><tr><td>c_{e1}</td><td>0</td><td>+0.2</td><td>+0.8</td></tr></table></td><td></td></tr>
<tr><td>4. Vault roof facing down ground

</td><td><table><tr><th>f/l</th><th>C_{e1}</th></tr><tr><td>0.1
0.2
0.5</td><td>+ 0.1
+ 0.2
+ 0.6</td></tr></table></td><td></td></tr>
</table>

Table 6 (continued)

House, buildings and members Diagrams and wind loads Diagrams	*Instructions for determining aerodynamic coefficient*	*Legend*
5. Vault or nearly resembling roofs (e.g roof on the arch shaped frames) 	(see sub-table 5 below) c_{e3} is determined according to diagram 2	- For determining the coefficient v in accordance with Clause 6.15, $h = h_1 + 0.7.f$
6. Enclosed buildings with single pitch roof 	(see sub-table 6 below)	

Sub-table 5:

coefficient	h_1/l	f/l 0.1	0.2	0.3	0.4	0.5
c_{e1}	0	+ 0.1	+ 0.2	+ 0.4	+ 0.6	+ 0.7
	0.2	– 0.2	– 0.1	+ 0.2	+ 0.5	+ 0.7
	≥1	– 0.8	– 0.7	– 0.3	+ 0.3	+ 0.7
c_{e2}		– 0.8	– 0.9	– 1	– 1.1	– 1.2

c_{e3} is determined according to diagram 2

Sub-table 6:

α	c_{e1}
≤ 15°	– 0.6
30°	0
≥ 60°	+ 0.8

Table 6 (Continued)

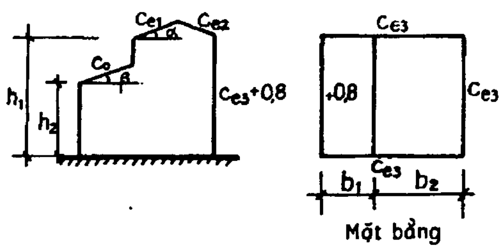
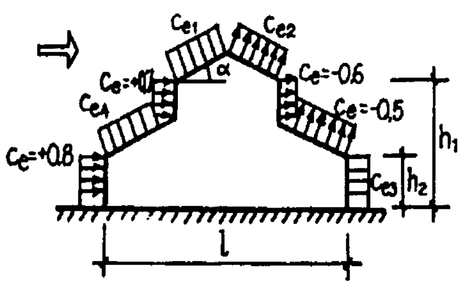
<table>
<tr>
<td>7. Enclosed building with semi roof

</td>
<td><table><tr><th>h_1/h_2</th><th>c_o</th></tr><tr><td>1.2</td><td>– 0.5</td></tr><tr><td>1.4</td><td>– 0.3</td></tr><tr><td>1.6</td><td>– 0.1</td></tr><tr><td>1.8</td><td>10</td></tr><tr><td>2.0</td><td>+ 0.2</td></tr><tr><td>2.5</td><td>+ 0.4</td></tr><tr><td>3.0</td><td>+ 0.6</td></tr><tr><td>≥ 4.0</td><td>+ 0.8</td></tr></table></td>
<td>- When $b_1 \le b_2$ and $0 \le \beta \le 30^o$, c_o given in this table can be accepted.
- When $b_1 > b_2$, c_o shall be calculated in accordance with Diagram 2
- C_{e1}, C_{e2}, C_{e3} are determined according to Diagram 2</td>
</tr>
<tr>
<td>8. Single span house with skylights along the length

</td>
<td>- C_{e1}, C_{e2}, C_{e3} are determined according to Diagram 2
- Aerodynamic coefficient at skylight surfaces is equal to – 0.6
- Aerodynamic coefficient at the windward skylight surfaces when roof's slope angle less than 20^o is equal to – 0.8</td>
<td>-When calculating the horizontal frame of buildings having skylights given in Diagram 8 and wind shield panels, the total aerodynamic coefficient on "skylight-wind shield panels" system is equal to 1.4
- To calculate coefficient v in accordance with Clause 6.15, $h = h_1$</td>
</tr>
</table>

Table 6 (Continued)

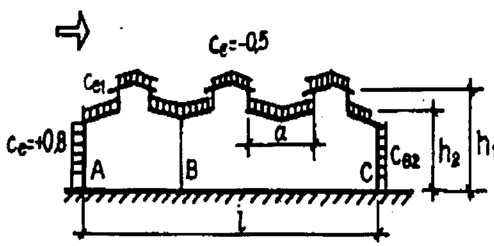
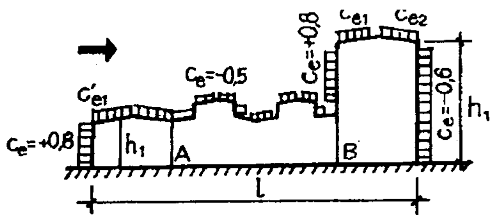
Houses, buildings and members Diagrams and wind loads Diagrams	*Instructions for determining aerodynamic coefficient*	*Legend*
9. Multi-span buildings with skylights along the length 	- See the instructions for aerodynamic coefficient given in Diagram 8 - For roof in the section AB, c_e is calculated according to Diagram 8 - For skylights in section BC, when $\lambda \le 2$, $c_x = 0.2$ when $2 \le \lambda \le 8$, $c_x = 0.1\lambda$ when $\lambda > 8$, $c_x = 0.8$ When $\lambda = a/(h_1 - h_2)$ - For the rest roof sections, $c_e = -0.5$	- For windward, leeward and any walls, the aerodynamic coefficient is determined according to Diagram 2 - When determining coefficient v in accordance with Clause 6.15, h shall be equal to h_1
10. Multi-span buildings with skylights along the length and different elevations 	- See the instructions for aerodynamic coefficient given in Diagram 8 - c'_{e1}, c''_{e1}, c_{e2} in Diagram 2 shall be applied for calculating c_{e1} following h_1 (height of wall against the wind). - On the section AB, c_e shall be determined the same as the section BC mentioned in Diagram 9 when the skylight's height is $(h_1 - h_2)$	- see the Legend in Diagram 9

Table 6 (continued)

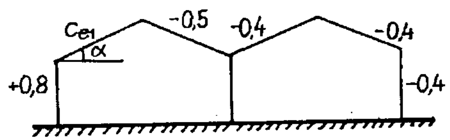
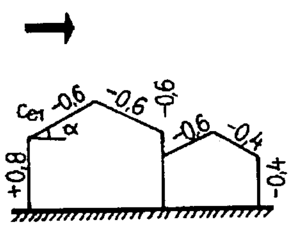
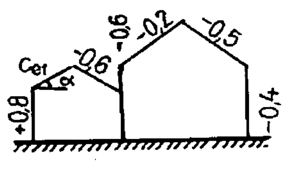
Houses, buildings and members Diagrams and wind loads Diagrams	*Instructions for determining aerodynamic coefficient*	*Legend*
11. Two-span and ridge roof enclosed buildings 	- c_{e1} is obtained from Diagram 2	
12. Two-span and ridge roof enclosed buildings with different elevations  	- c_{e1} is obtained from Diagram 2	

Table 6 (continued)

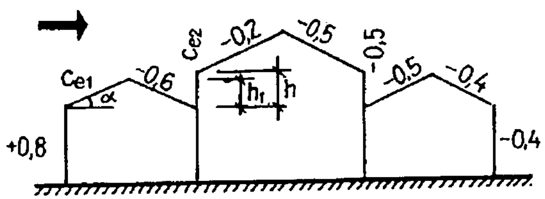
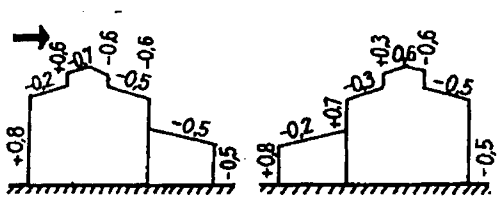
Houses, buildings and members Diagrams and wind loads Diagrams	*Instructions for determining aerodynamic coefficient*	*Legend*
13. Three-span and ridge roof enclosed buildings with different elevations 	- c_{e1} is obtained from Diagram 2 - c_{e2} shall be calculated using formula: $c_{e2} = 0.6 \times (1 - 2h_1/h)$. If $h_1 > h$, $c_{e2} = -0.6$	
14. Enclosed buildings having skylights and a semi roof 	Pls see the beside Diagram for aerodynamic coefficient	

Table 6 (continued)

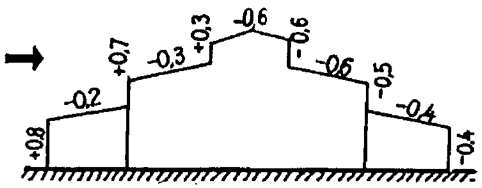
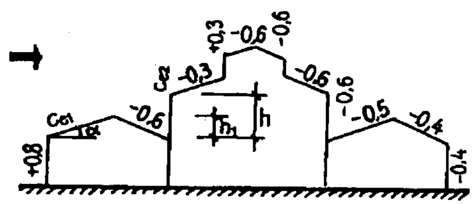
Houses, buildings and members Diagrams and wind loads Diagrams	*Instructions for determining aerodynamic coefficient*	*Legend*
15. Enclosed buildings having skylights and 2 semi roof sections 	Pls see the beside Diagram for aerodynamic coefficient	
16. Three-span enclosed buildings with skylights along the length in the center 	- c_{e1} is obtained from Diagram 2 - c_{e2} is calculated using formula: $c_{e2} = 0.6 \times (1-2h_1/h)$. If $h_1 > h$, $c_{e2} = -0.6$	

Table 6 (continued)

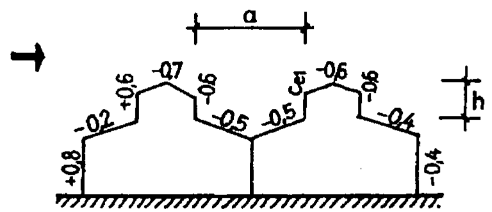
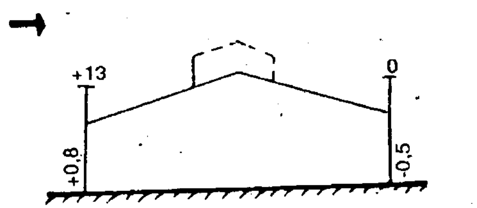
Houses, buildings and members Diagrams and wind loads Diagrams	*Instructions for determining aerodynamic coefficient*	*Legend*
17. Two-span enclosed buildings with skylights along the length 	c_{e1} shall be: if $a \le 4h$, $c_{e1} = +0.2$ if $a > 4h$, $c_{e1} = +0.6$	
18. Ridge roof and enclosed buildings with female wall 	Pls see the beside Diagram for aerodynamic coefficient	

Table 6 (continued)

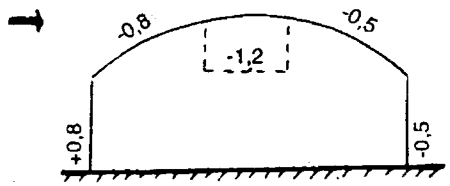
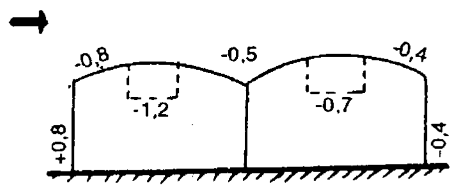
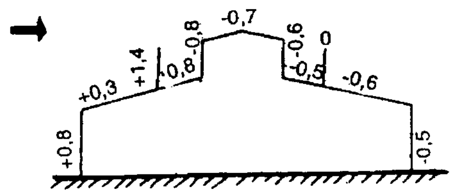
Houses, buildings and members Diagrams and wind loads Diagrams	*Instructions for determining aerodynamic coefficient*	*Legend*
19. Vault roof and enclosed buildings with inside skylight 	Pls see the beside Diagram for aerodynamic coefficient	
20. Two-span, vault roof and enclosed buildings with inside skylight 	Pls see the beside Diagram for aerodynamic coefficient	
21. Single-span enclosed buildings with skylights and wind shield 	Pls see the beside Diagram for aerodynamic coefficient	

Table 6 (continued)

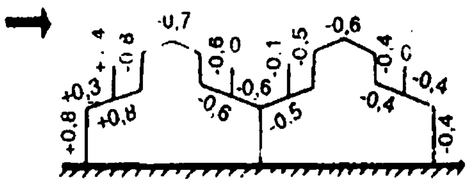
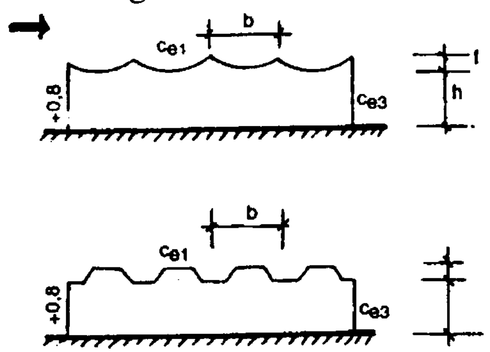
Houses, buildings and members Diagrams and wind loads Diagrams	*Instructions for determining aerodynamic coefficient*	*Legend*
22. Two-span enclosed buildings with skylights and wind shield 	Pls see the beside Diagram for aerodynamic coefficient	
23. Enclosed buildings with a thin roof and corrugated or folded roof 	c_{e1}; c_{e2} are obtained from: - Diagram 2 if f/b ≤ 0.25 - Diagram 9 if f/b > 0.25	

Table 6 (continued)

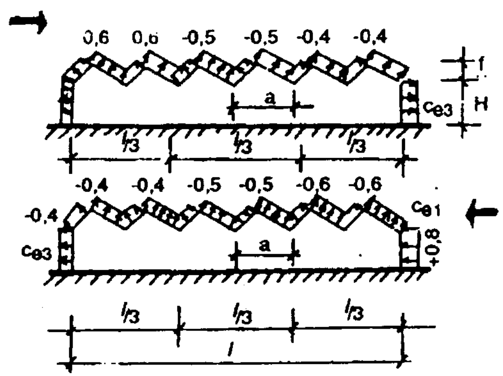
Houses, buildings and members Diagrams and wind loads Diagrams	*Instructions for determining aerodynamic coefficient*	*Legend*
24. Saw-tooth roof building 	- c_{e1}; c_{e2} are obtained from Diagram 2 - The friction force W_f shall be applied when the wind is in the arrow direction as well perpendicular to the the drawing surface	- The friction force in wind direction shall be $c_f = 0.04$ - See the Diagram 9 Legend.

Table 6 (continued)

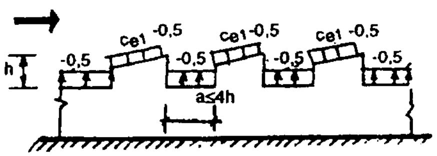
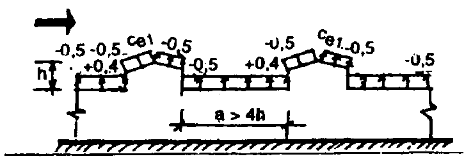
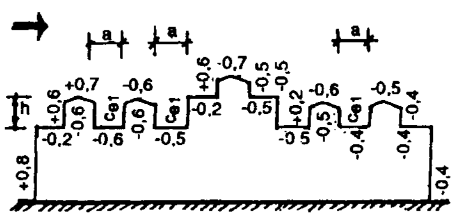
Houses, buildings and members Diagrams and wind loads Diagrams	*Instructions for determining aerodynamic coefficient*	*Legend*
25. Zenith skylight houses  	- c_{e1}; c_{e2} are obtained from Diagram 2 - The friction W_f is calculated as Diagram 24	See Diargram 9 Legend
26. Complicated multi-span enclosed buildings 	c_{e1} is calculated as follow: When a ≤ 4h, c_{e1} = + 0.2 When a > 4h, c_{e1} = + 0.6	

Table 6 (continued)

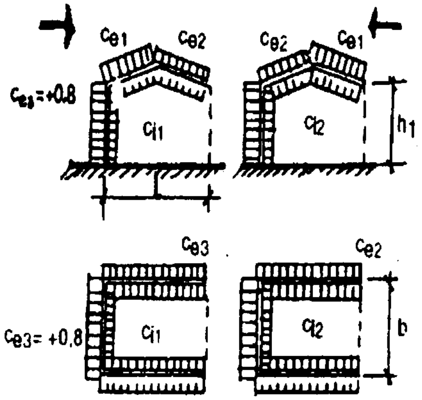
Houses, buildings and members Diagrams and wind loads Diagrams	*Instructions for determining aerodynamic coefficient*	*Legend*
27. Houses having a permanent opening (fully or partly opened)  - Mặt bằng	μ is the wind permeability of the wall, determined by opening/wall surface ratio - when $\mu \le 5\%$, then $c_{i1} = c_{i2} = \pm 0.2$ depending on the windward or leeward direction - $\mu \ge 30\%$, $c_{i1} = c_{e3}$, determined in accordance with Diagram 2, and $c_{i2} = + 0.8$ - In case one side is fully opened, calculattion shall be the same as that when $\mu \ge 30\%$	- c_e coefficient is obtained from Diagram 2 - For enclosed building, c_i=0. With buildings mentioned in Clause 6.1.2, the standard value of external pressure on the light partition (when their surface densities less than 100 kg/cm^2) is equal to 0.2W_o, but not less than 10kg/m^2. - With each wall, the sign + or – of c_{i1} when $\mu \le 5\%$ is determined from field experimentation with the most disavantageous load modes.

Table 6 (continued)

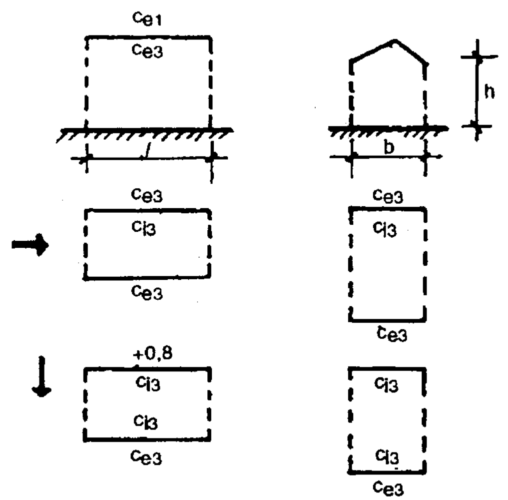
Houses, buildings and members Diagrams and wind loads Diagrams	*Instructions for determining aerodynamic coefficient*	*Legend*
28. Houses with two opposite side open 	- c_{e1}; c_{e2} are obtained from Diagram 2	

Table 6 (continued)

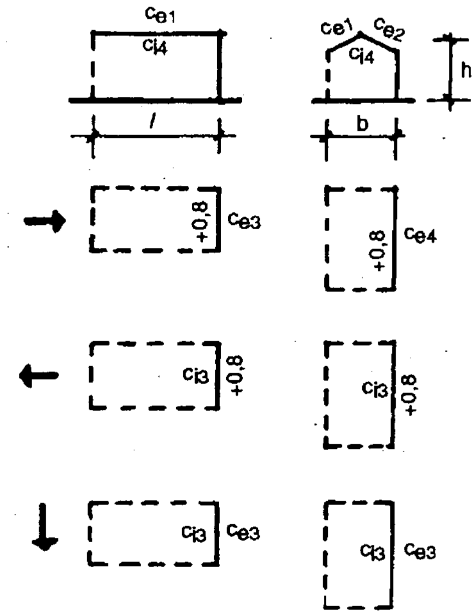
Houses, buildings and members Diagrams and wind loads Diagrams	*Instructions for determining aerodynamic coefficient*	*Legend*
29. Houses with three sides opened 	- c_{e1}; c_{e2} are obtained from Diagram 2 - c_{e4} = + 0.8 at windward direction, $c_{e4} = c_{e3}$ at leeward direction	

Table 6 (continued)

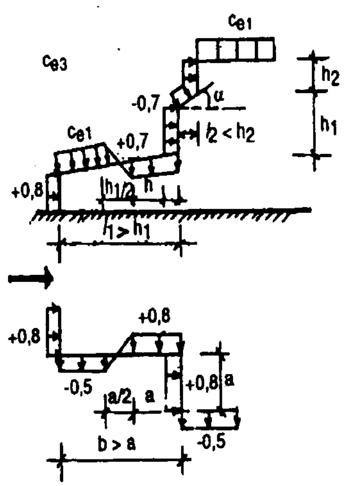
Houses, buildings and members Diagrams and wind loads Diagrams	*Instructions for determining aerodynamic coefficient*	*Legend*
30. Multi-benched building 		- For horizontal or sloping roof part ($\alpha < 15^o$), the aerodynamic coefficients at the height h_1 and h_2 shall be the same as those on vertical section. - When $l_1 > h_1$, the length of section turning into negative pressure shall be $h_1/2$ - The aerodynamic coefficients on surface of concave angle (along section a) acting parallel to the wind direction shall be the same as those on the windward edge. - When b > a, lengh of section turning into negative pressure shall be a/2.

Table 6 (continued)

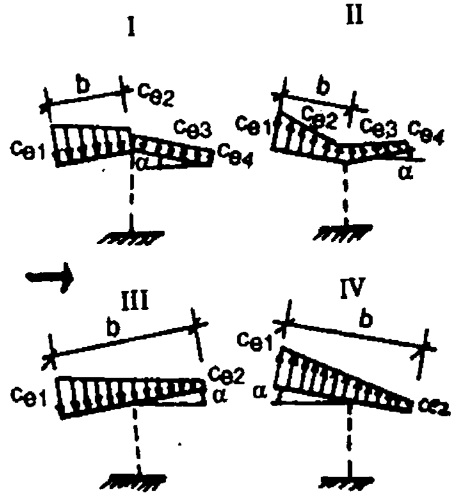
Houses, buildings and members Diagrams and wind loads Diagrams	*Instructions for determining aerodynamic coefficient*						*Legend*
31. Awnings 	Diagram type	α (degree)	c_{e1}	c_{e2}	c_{e3}	c_{e4}	- The values of c_{e1}, c_{e2}, c_{e3}, c_{e4}, shall be used to calculate the total pressure upside and underside of awnings. - For negative values of c_{e1}, c_{e2}, c_{e3}, c_{e4}, the pressure direction in the Diagrams shall be reversed. - With corrugated roofs, if the wind direction is along the roof, the friction force W_f shall be applied with $c_f = 0.04$
	I	10	0.5	−1.3	−1.1	0	
		20	1.1	0	0	−0.4	
		30	2.1	0.9	0.6	0	
	II	10	0	−1.1	−1.5	0	
		20	1.5	0.5	0	0	
		30	2	0.8	0.4	0.4	
	III	10	1.4	0.4			
		20	1.8	0.5			
		30	2.2	0.6			
	IV	10	1.3	0.2			
		20	1.4	0.3			
		30	1.6	0.4			

Table 6 (continued)

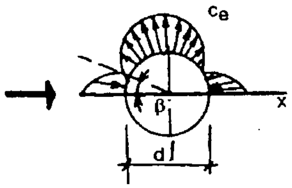
<table>
<tr><th>Houses, buildings and members Diagrams and wind loads Diagrams</th><th>Instructions for determining aerodynamic coefficient</th><th>Legend</th></tr>
<tr><td>32. Sphere block

</td><td>
<table>
<tr><td>β (degree)</td><td>0</td><td>15</td><td>30</td><td>45</td><td>60</td><td>75</td><td>90</td></tr>
<tr><td>c_e</td><td>+1.0</td><td>+0.8</td><td>+0.4</td><td>−0.2</td><td>−0.8</td><td>−1.2</td><td>−1.25</td></tr>
<tr><td>β (degree)</td><td>105</td><td>120</td><td>135</td><td>150</td><td>175</td><td>180</td><td></td></tr>
<tr><td>c_e</td><td>−1.0</td><td>−0.6</td><td>−0.2</td><td>+0.2</td><td>+0.3</td><td>+0.4</td><td></td></tr>
</table>
$c_x = 1.3$ when $Re < 10^5$
$c_x = 0.6$ when $2 \times 10^5 \le Re \le 3 \times 10^5$
$c_x = 0.2$ when $4 \times 10^5 > Re$
With $Re = 0.88 \times d \times \sqrt{Wo \times k(z) \times y} \times 10^5$ is Reynolds numbers
d: sphere diameter (m)
W_o: wind pressure given in Table 4 (daN/m^2)
k(z): variable coefficient of dynamic pressure by heights (Table 5)
γ: Reliability coefficient as per Clause 6.3</td><td>- Coefficient c_e shall be applied when $Re > 4 \times 10^5$
- When determining coefficient v in accordance with Clause 6.15, b = h = 0.7 × d</td></tr>
</table>

Table 6 (continued)

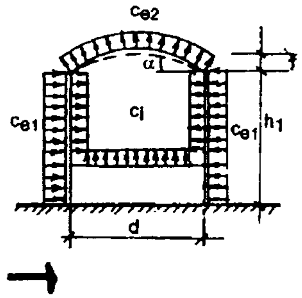
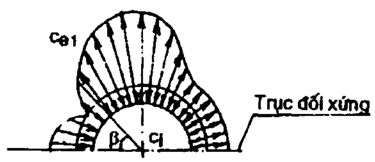
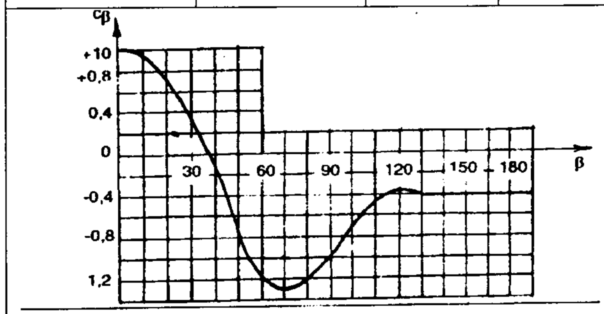
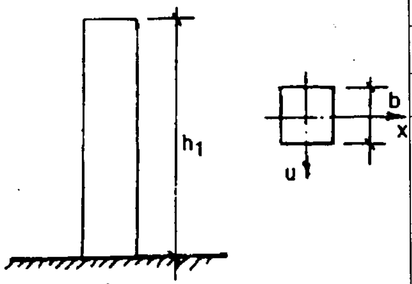
<table>
<tr>
<td>33. Rounded cylindrical shape buildings
(tanks, cooling silos, chimney) with or without roof
– Mặt bằng</td>
<td>
<table>
<tr><td colspan="8">$c_{e1} = k_1 \times c_\beta$ with $k_1 = 1$ when $c_\beta > 0$</td></tr>
<tr><td>h_1/d</td><td>0.2</td><td>0.5</td><td>1</td><td>2</td><td>5</td><td>10</td><td>25</td></tr>
<tr><td>k_1 with $c_\beta < 0$</td><td>0.8</td><td>0.9</td><td>0.95</td><td>1.0</td><td>1.1</td><td>1.15</td><td>1.2</td></tr>
<tr><td colspan="8">c_β is used when $Re > 4 \times 10^5$ according to the diagram below:</td></tr>
</table>
<table>
<tr><td rowspan="2"><u>Roof types</u></td><td colspan="5">c_{e2} value when h_1/d equal to</td></tr>
<tr><td colspan="2">1/6</td><td colspan="2">1/3</td><td>≥ 1</td></tr>
<tr><td>flat, cone when α 5°
ball when $f/d \leq 0.1$</td><td colspan="2">– 0.5</td><td colspan="2">– 0.6</td><td>– 0.8</td></tr>
<tr><td>h_1/d</td><td>1/6</td><td>1/4</td><td>1/2</td><td>1</td><td>2</td><td>≥ 5</td></tr>
<tr><td>c_1</td><td>– 0.5</td><td>– 0.55</td><td>– 0.7</td><td>– 0.8</td><td>– 0.9</td><td>– 1.05</td></tr>
</table>
</td>
<td>- Coefficient Re is determined using Equation given in Diagram 32 with $z = h_1$
- Coefficient c_1 is applied either with opened roof or without roof
- When determining coefficient v as per Clause 6.15, apply b = 0.7d and $h = h_1 + o.7f$</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
</table>

Table 6 (continued)

Houses, buildings and members Diagrams and wind loads Diagrams	*Instructions for determining aerodynamic coefficient*	*Legend*
34. Prismatic building with square and polygonal plan	Drag force coefficients c_x and c_v are obtained using Formula: $c_x = k \times c_{x\infty}$; $c_v = k \times c_{v\infty}$	-When the wind direction is parallel to the loggia wall c_f = 0.1; to the corrugated roof c_f = 0.04 - For rectangular shape buildings (Table 6.3), when *l*/b=0.1÷0.5 and β = 40°÷50°, $c_{v\infty}$ = 0.75; when evenly distributed wind load is at point 0, the offset coefficient e = 0.15b -Coefficient Re is determined using Formula given in Diagram 32, with z = h_1 and d is circumscribed circle



- Mặt bằng

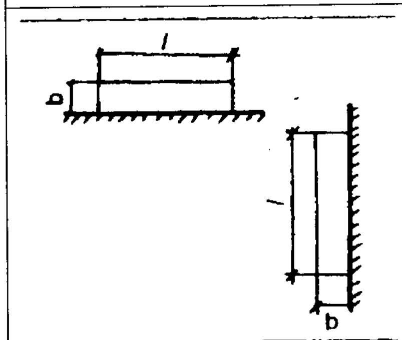
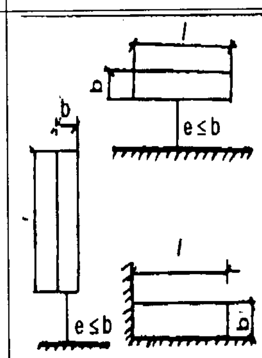
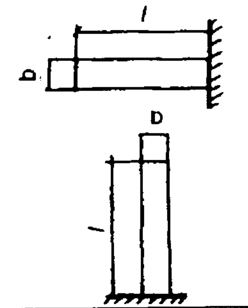
plan

Table 6.1

λe	5	10	20	35	50	100	∞
k	0.6	0.65	0.75	0.85	0.9	0.95	1

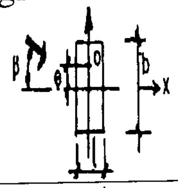
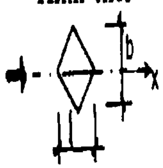
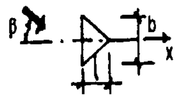
λe is determined as per Table 6.2. In Table 6.2, λ= *l*/b with *l*, b corresponding to the biggest and smallest dimensions of the buildings or its elements in plan ⊥ to wind direction

Table 6.2

λe = λ/2	λe = λ	λe = 2λ
		

Continue Diagram 34

Table 6.3

Section-wind direction	β (degree)	l/b	$c_{x\infty}$
Rectangle 	0 40 ÷ 50	≤ 1.5 ≥ 3 ≤ 0.2 ≥ 0.5	2.1 1.6 2.0 1.7
Lozenge 	0	≤ 0.5 1 ≥ 2	1.9 1.6 1.1
Equilateral triangle 	0 180		2 1.2

- To detemine the coefficient v in accordance with Clause 6.12, h is overall height, b is the dimension of building y axis.

Table 6.4

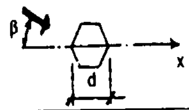
Section-Wind direction	β (degree)	n (side numbers)	C_∞ when Re> 4×10^5
Regular polygon 	any	5 6 ÷8 10 12	1.8 1.5 1.2 1.0

Table 6 (continued)

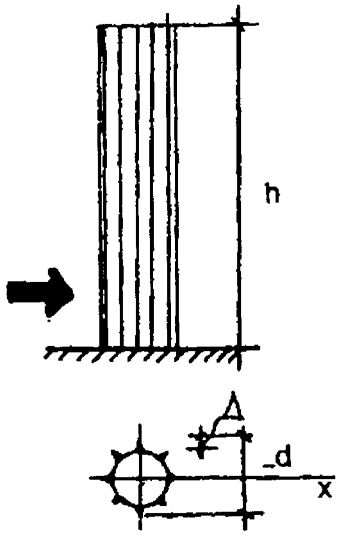
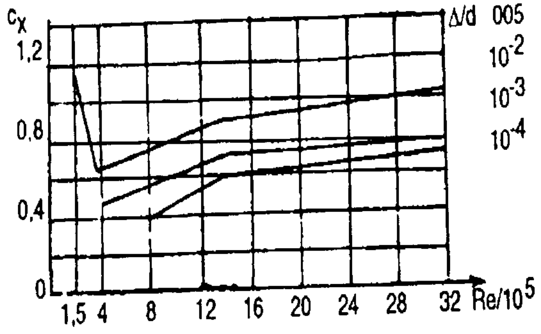
Houses, buildings and members Diagrams and wind loads Diagrams	*Instructions for determining aerodynamic coefficient*	*Legend*
35. Rounded cylindrical shape buildings (tanks, cooling silos, chimneys), with cables, conducting wires and closed pipe shape components **plan**  Mặt bằng	$C_x = k \times c_{x\infty}$ Where: k is determined according to Table 6.1 of Diagram 34 $c_{x\infty}$ is determined by the below chart at the rough surfaces (made by concrete, steel, timber materials...) 	- Coefficient Re is determined using Formula given in Diagram 32, with z = h and d is the diameter of the building. - Value Δ: for timber structure Δ = 0.005m, for brick masonry Δ = 0.01m, for concrete and reinforced concrete Δ = 0.005m, for steel structure Δ = 0.001m, for conducting wires and cables having the diameter d Δ = 0.01d, for surfaces having side height b Δ = b. - For corrugated roof $c_f = 0.04$ - For electric wires, value c_x shall be for conducting wires and cables with diameter ≥ 20 mm, c_x can be reduced by 10%

Table 6 (continued)

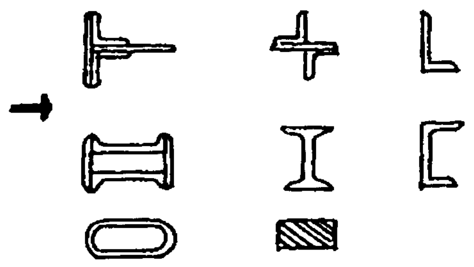
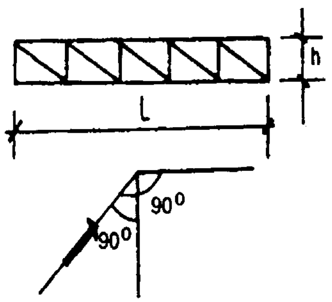
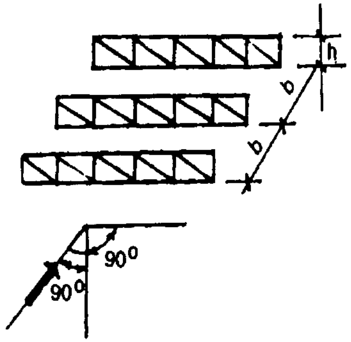
Houses, buildings and members Diagrams and wind loads Diagrams	*Instructions for determining aerodynamic coefficient*	*Legend*
36. Figured steels with different sections of hollow structures 	When the wind direction is normal to the member's axis, c_x= 1.4	
37. One independent flat truss 	$c_x = \frac{1}{A}\sum c_{xi}A_i$ Where: c_{xi} is the aerodynamic coefficient of component numbered i; for figured steels, c_{xi} = 1.4; for tubular structures, c_{xi} is obtained from Diagram 35 with $\lambda e = \lambda$ (Table 6.2 of Diagram 34) A_i is projected area of component numbered i to the windward surface of truss A is the area limited by external border of truss	- The aerodynamic coefficients of Diagram 34, 38, 40 are used for trussed structures having any external border types and : $\varphi = \frac{\sum A_i}{A} \le 0.8$ - Wind loads depend on the area limited by external border A. - The x-axis direction coincides with the wind direction and perpendicular to the truss's surface.

Table 6 (continued)

Houses, buildings and members Diagrams and wind loads Diagrams	*Instructions for determining aerodynamic coefficient*	*Legend*
38. A range of parallel flat trusses 	- For a range of parallel flat trusses, the fisrt windward truss has c_{xi} given in Diagram 37 - The second and the followings have $c_{x2} = c_{x1} \times \eta$ - For steel tube frame, when Re ≥ 4 × n 10^5, $\eta = 0.95$	- pls see Diagram 37 Legend - Re is determined using Formula of Diagram 32 with d being the average tube diameter, z being the distance from ground to the upper bar of truss - In building layout, h is the dimension of the shortest side. For rectangular and polygonal trusses, h is the length of the shortest side; for cicular truss, h is external diameter; for ellipse truss and the like, h is the length of the smallest axis; b is distance between the adjacent trusses

φ	Value η for figured steel and tube steel trusses when Re < 4 × 10^5 and b/h is equal to				
	1/2	1	2	4	6
0.1	0.93	0.99	1	1	1
0.2	0.75	0.81	0.87	0.9	0.93
0.3	0.56	0.65	0.73	0.78	0.83
0.4	0.38	0.48	0.59	0.65	0.72
0.5	0.19	0.32	0.44	0.52	0.61
≥0.6	0	0.15	0.3	0.4	0.5

Table 6 (continued)

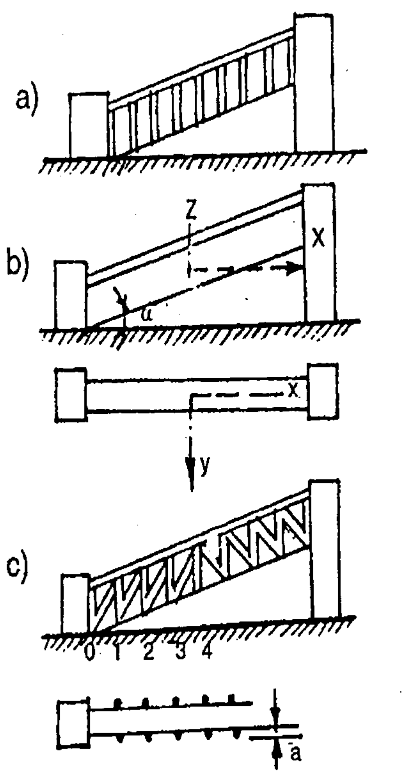
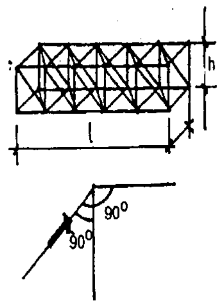
Houses, buildings and members Diagrams and wind loads Diagrams	*Instructions for determining aerodynamic coefficient*	*Legend*
39. Conveyor belt bridge 	a) The blank and smooth external wall: application conditions $\alpha \leq 20^o$ - in the direction y: determined as per Diagram 2 - in the direction x: of 5% of wind loads in direction y b) Open divided external walls with close roof and floor: - in the direction y: determined as per Diagram 38. - in the direction x: on wind facing part of beam or lower bar_within the conveyor belt bridge length, coefficient c = 1.2 for tubular steel components; c = 1.4 for figured steel components, where the area of bar $F = \sum fi$ and the area of the beam $F = \Sigma a \times b$. c) Blank divided external wall: to be used if conveyor belt bridge having bearing structures (column, beam, slanting beam) provided outside the blank wall: - in the direction y: as per Diagram 2 - in the direction x: it shall be highest values given in items a and b d) External wall opened at one side: coefficient c is obtained from Diagram 27	- For belt conveyor bridge entirely close from all directions, the affectig force in the direction z can be ignored. - For the belt conveyor bridge partially opened, the coefficient c is determined as per Diagram 27

Table 6 (continued)

Houses, buildings and members Diagrams and wind loads Diagrams	*Instructions for determining aerodynamic coefficient*	*Legend*
40. Space truss and hollow tower 	The front drag force coefficient is obtained from Formula: $c_t = c_x \times (1+\eta) \times k_1$ c_x is determined as per Diagram 37; η is determined as per Diagram 38; k_1 is calculated according to table below:	- Pls see the Diagram 37 Legend - In all case, c_t is calculated supposing that the wind direction is normal to the windward surface of truss or tower - When the wind goes diagonally with the square plan tower, c_t shall be multiplied by the follow coefficients: 0.9 for single component steel tower ; 1.1 for wooden tower made of grouped elements

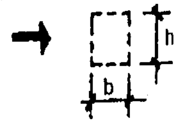
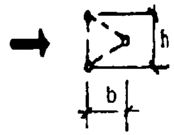
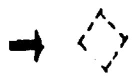
Cross sections and wind directions	k_1
	1.0
	0.9
	1.2

Table 6 (continued)

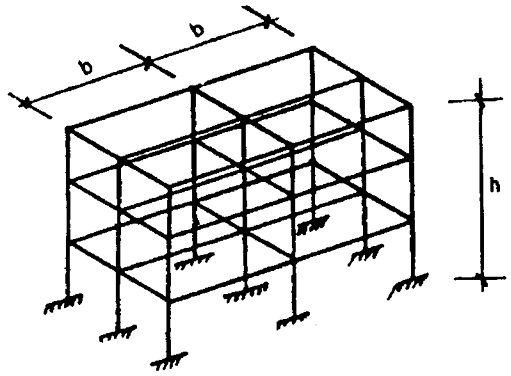
Houses, buildings and members Diagrams and wind loads Diagrams	*Instructions for determining aerodynamic coefficient*	*Legend*
41. Associated multistage truss 	This diagram is used for associated multistage truss, without wall or parts of construction building inside Coefficient c shall comply with Diagram 38	

Table 6 (continued)

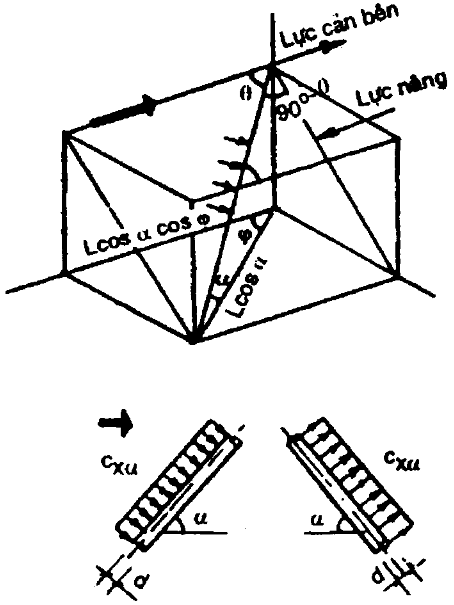
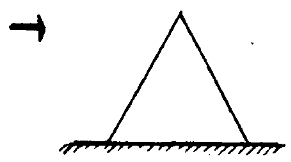
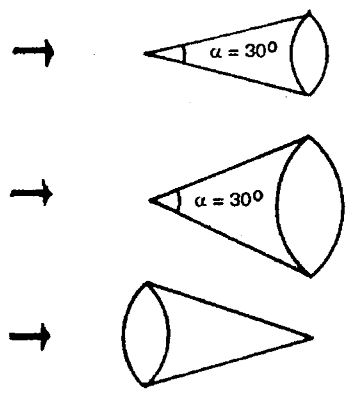
Houses, buildings and members Diagrams and wind loads Diagrams	*Instructions for determining aerodynamic coefficient*	*Legend*
42. Binding wires and tubular component sloping on plane of windstream 	$c_{x\alpha} = c_x \times \sin^2\alpha$ c_x is determined according to data given in Diagram 35	

Table 6 (continued)

43. Conical and prismatic buildings with rounded bottom 1. Conical and prismatic buildings with rounded bottom setting on the ground  2. Conical and prismatic buildings setting on space 	1- Conical and prismatic buildings with rounded bottom setting on the ground - Conical: $c_x = 0.7$; $c_z = -0.3$ 2- - Prismatic with rounded bottom setting on the ground: $c_x = 1.2$; $c_z = -0.3$ 2. Conical buildings setting on space a/ When the crest is at windward direction: - Cone without bottom when $\alpha = 30^0$; $c_x = 0.35$ - Cone without bottom when : $\alpha = 60^0$; $c_x = 0.5$ b/ When the crest is at leeward direction: The below values c_x can be used when $Re > 10^5$ - Cone without bottom: $c_x = 1.4$ - Cone with bottom: $c_x = 1.2$	