Crane Design Loads

The main loads make up the loading case H, while the main and additional loads together constitute the loading case HZ.

3.1 Main Loads (H)

Main loads are permanent loads as per DIN1055 Part 1, including the live loads of crane running wheels with vibrations, and in special cases, the horizontal lateral loads due to 'mass forces from drives' (refer to subclause 3.2.1.1). These occur regularly and repeatedly at a specific section of the crane-way caused by crane operations as specified by the employer (see table 19).

Refer to subclause 3.2.3.1 for restrictions on live loads from crane running wheels and to subclause 3.2.7, 2nd paragraph for the treatment of snow loads as main loads. In the case of curved crane-ways where monorail trolleys travel (trolley runways), the resulting centrifugal forces must be considered as main loads.

3.1.1 Permanent Loads

These include, in addition to those specified in DIN1055 Part 3, permanent effects of planned changes in support conditions, prestressing, and unintentional changes in support conditions if the planned ones are not restored. According to DASt Guideline 008, clause 3, these effects are disregarded when verifying safe load-bearing capacity in accordance with subclause 4.1.1, paragraph 4.

3.1.2 Live Loads of Crane Running Wheels

The most unfavorable wheel loads from the permanent load and hoist load must be taken when the crane is traveling as planned in the most unfavorable position. If more unfavorable, calculations should be made without hoist load.

For loading groups B1 to B3, wheel loads of wheels running on rails may be assumed to be in planned contact with the center of the rail head unless otherwise specified by the employer for special conditions of operation. For loading groups B4 to B6, an off-center application of the load of ±1/4 of the rail head width must be assumed generally for service

3.1.3 Vibration Coefficients

Wheel loads must be multiplied by the vibration coefficient ρ to account for the effects of vibration on the crane-way when cranes and trolleys are in motion. Its magnitude depends on crane hoisting classes H1 to H4 and must be derived from table 1 for crane-way girders and their supports or suspensions.

Table 1. Vibration coefficients φ

Structural member	Crane hoisting class			
	H 1	H 2	H 3	H 4
Girders	1,1	1,2	1,3	1,4
Supports or suspensions	1,0	1,1	1,2	1,3

When calculating stresses due to the simultaneous operation of several cranes, the vibration coefficient for the crane with the greatest value ρ*R must be used, and for the remaining cranes, the vibration coefficient for hoisting Class H1.

The following are always calculated without a vibration coefficient: Foundations, earth pressures, deformation, and stability (see also sub-clauses 3.3.1, 3.3.2, and 4.6).

3.1.4 Wheel Loads from Several Cranes

Two cranes of similar or different design specified by the employer to operate mainly as a pair must be treated as one crane. Otherwise, for load case H, the maximum wheel loads to be adopted - in each case in the most unfavorable position - are as follows: a) 2 cranes to each crane-way; b) 3 cranes to each shop bay or 3 cranes in multi-bay buildings (always having regard to condition a). Should additional cranes be under consideration, this must be specially agreed upon. For information concerning additional vertical loads of further cranes, see subclause 3.2.3.1.

3.2 Additional Load (Z)

Refer to subclause 3.2.1 for loads transverse to the runway and subclause 3.2.1.1 for crane-way girders.

Horizontal lateral loads HM due to 'mass forces from drives' or lateral loads HS and S as 'forces due to skewing' must be used according to DIN15018 Part 1 April 1974 edition, subclauses 4.1.5 and 4.2.2, choosing the most unfavorable magnitude and direction on the crane track; they must be specified by the employer (table 19).

An additional 10% may be added to lateral loads HS and S due to possible superimposition unless more accurate proof is furnished. The addition may be omitted when adopting a maximum coefficient of frictional contact f=0.3 (DIN15018 Part 1, April 1974 edition, table 3).

See subclause 3.1 for adopting lateral loads HM as main loads.

3.2.1.2 Crane-way Supports and Crane-way Suspensions

Lateral loads transmitted by structural members from crane-ways through their connection with crane-way girders or horizontal girders down to the foundations must also be assumed according to subclause 3.2.1.1.

3.2.2 Horizontal Loads L Along the Runway Due to Starting Up or Braking the Cranes

The horizontal load acting along a rail at a height of the top of the rail(SO) must be assumed to be of the order of

$$L = 1.5 * f * \sum R_{KrB} \quad (1)$$

For the crane under consideration (see subclause 3.2.3.3),
Where f is the coefficient of friction, for steel on steel f=0.2 f=0.2

$\sum R_{KrB}$ is, for cranes with individual drive, the sum of the minimum static loads and, for cranes with centralized drive, the sum of the maximum static loads of all drive or braked wheels of the unloaded crane on on runway side.

These longitudinally directed loads must be given corresponding consideration where materials other than steel on steel operate together.

Reductions of the longitudinal fores in the case of swinging suspended crane-ways may be taken into account provided they can be proved.

3.2.3.3 Loads in the Direction of the Crane-way

The effect of loads in the direction of the crane-way must be assumed from, at most, two

of the most unfavorable cranes or, if more unfavorable, from tilting forces or impact forces of only one most unfavorable crane.

3.3 Special Loading Case

3.3.1 Tilting in the case of trolleys with rigidly guided hoist loads

The wheel loads, which are altered compared with subclause 3.1.2 due to the tilting of trolleys with rigidly guided hoist loads when travelling against obstruction, must be specified by the employer(see DIN 15018 Part 1,April 1974 edition, subclause 4.3.1) and be considered without vibration coefficient(ρ=1). Moreover, only the permanent loads in accordance with subclause 3.1.1 must be used.

The permissible stresses and margins of safety for loading case HZ must be used.

3.3.2 Collision of cranes against stops-buffer end forces

The magnitude and point of application(height above SO) of the crane-way must be specified by the employer in accordance with IDN15018 and their effect on the structural members(girders, bracing, gantries, stops and buffers) must be taken into account.

Apart from this, only the main loads in accordance with subclause 3.1, and no vibration effect(ρ=1) or other horizontally applied additional loads in accordance with subclause 3.2, must be assumed.

In the case of several crane-ways in single-bay and multi-bay buildings only the impact of the most unfavourable crane in any particular case need be taken into account.

1,1 times the value of loading case HZ must be used for permissible stresses and 0.9 times the same value for the margins of safety.