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What is a live load

Live loads are loads produced from the use and occupancy of a building. They include the loads from human occupancy, furniture, vehicles, anticipated rare events such as the gathering of people and stacking of materials, moveable machines and equipment, storage, maintenance activities, etc. The values of live load for each type of building are usually defined by the codes of practice, and that is why the use of any structure must be defined before the design is commenced.Live loads on floors of buildings are defined by a uniformly distributed load, line load, and concentrated load, which, however, must not be applied simultaneously. The uniformly distributed load is used for all global verifications and general designs, while the concentrated load is usually adopted for local verifications. Floor loadings which are made up of live loads and dead loads are combined for the design of slabs and floors.Live loads are measured in pounds per square foot (psf) in the United States of America, while they are typically measured in kilo Newtons per square meter (kN/m2) in the UK and much of Europe. Sometimes, environmental loads, such as wind loads, are treated separately from live loads.According to EN 1991-1-1:2002, imposed loads should be taken into account as quasi-static actions. However, dynamic effects may be included in the load models if there is no risk of resonance or other significant dynamic response from the structure. If resonance effects from the synchronised rhythmic movement of people or dancing or jumping may be expected, the load model should be determined for special dynamic analysis.
Typical live loads on the floor of a public buildingTo determine the imposed loads, floor and roof areas in buildings should be divided into categories according to their use (see Table 1). Areas in residential, social, commercial and administrative buildings shall be divided into categories according to the types of uses shown in Table 6.
EN 1991-1-1:2002,CategorySpecific UseExampleAreas for domestic and residential activities:Rooms in residential buildings and houses; bedrooms in wards in hospitals; bedrooms in hotels;BOffices:Areas where people may congregate (with the exception of areas defined under categories A, B, and D.C1: Areas with tables, etc. e.g. offices, schools, cafés, restaurants, dining halls, reading rooms, and receptions.C2: Areas with fixed seats, e.g. areas in churches, theatres or cinemas, conference rooms, lecture halls, assembly halls, waiting rooms, and railway waiting rooms.C3: Areas without obstacles for moving people, e.g. areas in museums, exhibition rooms, etc. and access areas in public and administrative buildings, hotels, hospitals, and railway station storesC4: Areas with possible physical activities, e.g. dance malls, gymnastic rooms, and stages.C5: Areas susceptible to large crowds, e.g. in buildings for public events like concert halls, sports halls including stands, terraces and access areas and railway platforms.
DShopping areasD1: Areas in general retail shops
D2: Areas in department storesEStorage areasE1: Areas susceptible to accumulation of goods, including access areasE2: Industrial areasTable 1: Different categories of building areas (Source: EN 1991-1-1:2002)The values of live loads for category A buildings (areas for domestic and residential activities) are provided in Table 2. Sub-categoryExample qk (kN/m2) Qk (kN)A1All usages within self-contained dwelling units (a unit occupied by a single family or a modular student accommodation unit with a secure door and comprising not more than six single bedrooms and an internal corridor) Communal areas (including kitchens) in blocks of flats with limited use (see Note 1). For communal areas in other blocks of flats, see A5, A6 and C31.52,0A2Bedrooms and dormitories except those in self-contained single-family dwelling units and in hotels and motels1.52,0A3Bedrooms in hotels and motels; hospital wards; toilet areas2.02,0A4Billiard/snooker rooms2.02,7A5Balconies in single-family dwelling units and communal areas in blocks of flats with limited use (see Note 1)2.52,0A6Communal areas in hotels, residential clubs and communal areas in blocks of flats except those covered by Note 1 (Same as the rooms to which give access but with a minimum of 3.02.0 (combined at the edge)7)Communal in hotels and motelsSame as the rooms to which they give access but with a minimum of 4.02.0 (combined at the outer edge)Table 2: The load values for domestic and residential buildings (Source: EN 1991-1-1:2002)Typical single family dwellingThe values of live loads for category B buildings (office areas) are provided in Table 3. Sub-categoryExample qk (kN/m2) Qk (kN)B1General use other than in B22.52,7B2A or below ground floor level3.02,7Table 3: Live load values for office buildings (Source: EN 1991-1-1:2002)Typical office workThe values of live loads for category C buildings (areas where people may congregate) are provided in Table 4. Sub-category Example qk (kN/m2) Qk (kN)C1Areas with tables2.0 + 3.03.0 + 4.0C11Public, institutional and communal dining rooms and lounges, cafes and restaurants (see Note 2)2.03,0C12Reading rooms with no book storage2.54,0C13Classrooms3.03,6C2Areas with fixed seats3.0 + 4.02.5 + 7.0C21Assembly areas with fixed seating (see Note 3)4.06,2C22Places of worship3.02,7C3Areas without obstacles for moving people3.0 + 5.04.0 + 7.0C31Corridors, hallways, aisles in institutional-type buildings not subjected to crowds or wheeled vehicles, hostels, guest houses, residential clubs, and communal areas in blocks of flats not covered by Note 13.04,5C32Stairs, landings in institutional-type buildings not subjected to crowds or wheeled vehicles, hostels, guest houses, residential clubs, and communal areas in blocks of flats not covered by Note 13.04,5C33Corridors, hallways, aisles in all buildings not covered by C31 and C32, including hotels and motels and institutional buildings subjected to crowds4.04,5C34Corridors, hallways, aisles in all buildings not covered by C31 and C32, including hotels and motels and institutional buildings subjected to crowds4.04,5C35Walkways – Light duty (access suitable for one person, walkway width approx 600 mm)3.04,5C37Walkways – General duty (regular two-way pedestrian traffic)3.03,6C38Walkways – Heavy duty (high-density pedestrian including escape routes)7.54,9C39Museum floors and art galleries for exhibition purposes5.5 + 03.5 – 7.0C41Dance halls and studios, gymnasiums, stages (see Note 1)3.56,2C42Dance halls and drill rooms (see Note 1)3.56,2C43Atriums, foyers, lobbies, waiting areas, and other areas where people may congregate (see Note 1)3.04,5C44Areas with fixed seatsThe values of live loads for category D buildings (shopping areas) are provided in Table 5; Sub-category Example qk (kN/m2) Qk (kN)D1Areas in general retail shops4.03,6D2Areas in department stores4.03,6Table 5: Live load values for shopping areas (Source: EN 1991-1-1:2002)NOTE 1: Communal areas in blocks of flats with limited use are blocks of flats not more than three storeys in height and with not more than four self-contained dwelling units per floor accessible from one main staircase.NOTE 2: Where the areas described by C11 might be subjected to loads due to physical activities or overcrowding, e.g. a hotel dining room used as a dance floor, imposed loads should be based on C4 or C5 as appropriate. Reference should also be made to Note 5.NOTE 3: Fixed seating is seating where its removal and the use of the space for other purposes is improbable.NOTE 4: For grandstands and stadia, reference should be made to the requirements of the appropriate certifying authority.NOTE 5: For structures that might be susceptible to resonance effects, reference should be made to NA.2.1. of NA to BS EN 1991-1-1:2002.Stadiums require dynamic analysisThe values of live loads for category E buildings (storage and industrial buildings) are provided in Table 6;Sub-categoryExamples qk (kN/m2)Qk (kN) E11General areas for static equipment not specified elsewhere (institutional and public buildings)2.01,8E12Reading rooms with book storage, e.g. libraries4.04,5E13General storage other than those specified (see Note)2.4 per metre of the storage height7.0E14File rooms, filing and storage space (offices)5.04,5E15Stack rooms (books)2.4 per metre of storage height but with a minimum of 6.57,0E16Paper storage for printing and publishing (books)2.4 per metre of the storage height7.0E17Dense book storage (books)2.4 per metre of storage height but with a minimum of 15.09,0E2See PE 6688 for imposed loads on floors for areas of industrial use Table 6: Live load values for storage areas (Source: EN 1991-1-1:2002)However, the recommended value for imposed load due to storage is specified as 7.5 kN/m2 in clause 6.3.2 of EN 1991-1-1:2002. The equivalent concentrated load is 7.0 kN.Typical storage buildingFor garages and vehicle traffic areas, the imposed load for vehicles weighing less than 30 kN (about 3000 kg), q = 2.5 kN/m2, and Qk = 7.0 kN. For vehicles weighing more than 30 kN but less than 160 kN, q = 5 kN/m2 while the concentrated load should be specially determined. The uniformly distributed load and the concentrated load should not be applied simultaneously. In structural design, understanding the difference between a live load and a dead load is crucial for ensuring the integrity and stability of buildings and infrastructure. These two types of loads play a significant role in structural engineering, and it is essential to have a clear understanding of their distinctions and implications. Let’s explore the definitions and importance of live load and dead load in structural design. Key Takeaways: A live load consists of transient or moving loads on a structure, such as people, furniture, or vehicles, whereas a dead load includes the permanent and stationary weight of the structure itself and its components. Live loads are dynamic and can vary over time, while dead loads remain constant. Structural load calculations involve considering both live and dead loads to determine the strength and stability requirements of a structure. Understanding the difference between dynamic load and static load is crucial in building design, as dynamic loads can exert more force on a structure due to their varying nature. Designing for live and dead loads requires careful consideration of the intended use of the structure and the potential loads it may experience during its lifespan. Now that we have explored the difference between a live load and a dead load, let’s delve into their importance in structural engineering. It becomes evident that these factors play a vital role in ensuring the overall safety and longevity of buildings and infrastructure. Importance of Live Load and Dead Load in Structural Engineering When it comes to structural engineering, the importance of considering both live load and dead load cannot be understated. These two types of loads play a vital role in determining the strength and stability requirements of a structure. Understanding the difference and significance of live load and dead load is essential for designing safe and reliable structures. Live loads, also known as imposed loads, are temporary loads that a structure may experience during its lifespan. These loads include the weight of people, furniture, equipment, and any other movable objects. In structural load calculations, live loads are typically considered dynamic loads as they can vary in magnitude and location. It is crucial to account for live loads accurately to ensure that the structure can handle the expected weight and movement. On the other hand, dead loads are the permanent loads that a structure must support throughout its life. These loads include the weight of the building materials, such as walls, floors, roofs, and any fixed objects within the structure. Dead loads are considered static loads as they remain constant over time. Properly calculating dead loads is paramount for designing the structural components and foundations to ensure their stability and durability. Don’t miss out on the best discounts and top-rated products available right now! Shop Now and Save Big Today! *As an Amazon Associate, I earn from qualifying purchases. Comparison of Live Load and Dead Load Load Type Characteristics Live Load Temporary and variable Dead Load Permanent and constant The interaction between live load and dead load is critical for structural engineers to assess the overall strength and stability of a structure. By properly designing for live and dead loads, engineers can ensure that the structure can withstand the expected forces and maintain its integrity over time. Structural load calculations are performed to determine the most efficient structural systems and materials to meet the design requirements and ensure the safety of occupants. In conclusion, the careful consideration of live load and dead load in structural engineering is essential for designing reliable, safe, and durable structures. By understanding the characteristics and differences between these loads, engineers can make informed decisions during the design process and ensure the long-term performance of the structure. Types of Loads in Building Design In building design, engineers must consider various types of loads to ensure the structural integrity and safety of the structure. These loads can be broadly categorized into two main types: static loads and dynamic loads. Understanding the difference between dynamic load and static load is essential for designing structures that can withstand the forces they will encounter. Static Loads Static loads are forces that remain constant and do not change over time. These include dead loads and live loads. Dead loads refer to the weight of permanent elements of the structure, such as the weight of the building materials, walls, floors, and fixed installations. On the other hand, live loads are temporary or movable loads that are not permanently attached to the structure, such as people, furniture, and vehicles. Dynamic Loads Dynamic loads, also known as live loads, are forces that are constantly changing or moving. These loads result from the movement or vibration of people, vehicles, or environmental conditions such as wind or earthquakes. Dynamic loads can exert additional stresses on structures, and engineers must consider their magnitude and frequency when designing to ensure the structure’s stability. Type of Load Definition Examples Static Load Constant force that does not change over time Weight of the building materials, walls, floors, fixed installations Dynamic Load Force that is constantly changing or moving Movement or vibration of people, vehicles, wind, earthquakes By considering both static and dynamic loads in the design process, engineers can ensure that structures are built to withstand the forces they will experience throughout their lifespan. This involves calculating the maximum expected loads and designing elements such as beams, columns, and foundations to handle these loads without compromising the safety and integrity of the structure. Don’t miss out on the best discounts and top-rated products available right now! Shop Now and Save Big Today! *As an Amazon Associate, I earn from qualifying purchases. Structural Load Calculations in Design Process Structural load calculations play a critical role in the design process of any structure. These calculations are essential for determining the strength, stability, and safety requirements of a building or infrastructure. By accurately analyzing the forces and loads that a structure will experience, engineers can ensure that the design can withstand these pressures without failure. When it comes to designing for live and dead loads, structural load calculations are crucial. Live loads refer to the temporary or moving loads that a structure may experience over its lifetime, such as people, furniture, or environmental forces. Dead loads, on the other hand, are the permanent or stationary loads, including the weight of the structure itself, fixtures, and non-moving elements. By accurately estimating and calculating the live and dead loads, engineers can determine the required strength of various structural elements, such as beams, columns, or foundations. This information helps architects and designers make informed decisions on materials, dimensions, and overall structural configuration. Overall, structural load calculations in the design process ensure the structural integrity and safety of buildings and infrastructure. They allow engineers to optimize the design, minimize material usage, and ensure that the structure can withstand the expected loads throughout its lifetime. By designing for live and dead loads, engineers can create structures that are not only aesthetically pleasing but also structurally sound and safe. A live load refers to the weight that is not permanently fixed in a structure, such as people, furniture, or vehicles. Dead load, on the other hand, refers to the weight of the structure itself and any permanently attached elements, like walls, floors, and roofs. Understanding the difference between live load and dead load is crucial for ensuring the structural integrity and stability of buildings and infrastructure. By accurately calculating these loads, engineers can design structures that can safely support the anticipated weight and forces they will experience throughout their lifespan. Don’t miss out on the best discounts and top-rated products available right now! Shop Now and Save Big Today! *As an Amazon Associate, I earn from qualifying purchases. Structural Load Calculations in Design Process Structural load calculations play a critical role in the design process of any structure. These calculations are essential for determining the strength, stability, and safety requirements of a building or infrastructure. By accurately analyzing the forces and loads that a structure will experience and ensuring that the structure can withstand these forces without failure. By accurately calculating the live load and dead load, engineers can design structures that are safe, stable, and meet the necessary strength requirements. In modular construction, the structural integrity of buildings is one of the most important considerations. To make sure a structure is safe, engineers focus on understanding the different types of loads that a building might bear. Live loads are one such type. In this article, we will define ‘live load’, show some examples of it, and contrast it with ‘dead load.’What Does ‘Live Load’ Mean?The term ‘live load’ refers to the temporary or moving forces that a structure bears during its lifetime. These loads can change in magnitude and location over time, depending on how the building is used, or who or what occupies it. For example, occupancy, or the people and their furniture and equipment, can affect the live load of a building. Engineers must account for the fact that the weight of people can vary at separate parts of the building at different times.What’s a ‘Dead Load’? Then?A dead load is, in contrast, the permanent or static weight of the structure itself. This includes materials and any fixed parts of installations, such as doors, roofs, flooring, etc.Examples of Live LoadsOccupancy Loads: This includes people, furniture, and equipment. A residential building, for example, will have different occupancy loads than a commercial office space.Environmental Loads: Accumulated snow, rain, and even wind fall under this category.Dynamic Loads: This includes moving machinery, vehicles on a bridge, and elevators. They can create extra stress on the structure because of their movement.Live loads are important in modular building design because they account for the forces that change throughout the structure’s use. Because this can vary so much, engineers must pay careful attention to what might happen to buildings under various conditions.The Bottom LineIn any building, understanding live loads and managing them correctly is of the highest importance. In the modular construction industry, it is always necessary to incorporate accurate live load calculations into the design process so that structures remain both strong and safe.Ready to optimize your space while ensuring structural safety? Contact the experts at Allied Modular today to get a free quote on our custom modular buildings and mezzanines. Live loads or otherwise called super imposed loads are one important type of loading. To be considered by the engineer while designing a structure to ensure their safe design. Loads are the forces that may cause stresses, deformations, displacement and accelerations on a building. A structure or building component may be subject to various types of loads. The nature of which will depend on its structural design, the location, and other factors. For building structures and other built assets like tunnels, bridges, and dams, engineers include assessing loads in their structural design calculations.Live loads, also known as imposed loads, are variable forces that are applied to a structure. Unlike dead loads, which are permanent and fixed, live loads can change in magnitude and location over the lifetime of a structure.Properly accounting for live loads is crucial for civil engineers to design safe and serviceable structures. In this comprehensive guide, we will cover everything you need to know about live loads, including definitions, types, examples, calculations, and more.The maximum loads that a structure must be able to resist are typically used to specify design requirements. Loads mainly come under two categories, one is gravity loads and other is lateral loads.A live load is defined as a non-permanent load that is applied to a structure and likely to change over its lifetime. Live loads are generally produced by the use and occupancy of a structure, rather than the structure’s own weight.In other words, live loads are forces that are “living” or actively applied on a structure, as opposed to dead loads which are permanently fixed forces that do not change over time. Live loads can vary in magnitude, direction, location, and duration.People and furnishingsVehicles like cars, trucks, or trainsWind and snowFluid pressure from water or tanksMachinery and equipmentCentrifugal forceProperly accounting for live loads is a critical responsibility for civil engineers. Underestimating live loads can lead to catastrophic failures, while overestimating can lead to inefficient and costly design.Live loads are temporary, variable forces that act on a structure. Examples include:Occupancy loads: People, furniture, and equipment in buildings like offices, homes, and schoolsVehicle loads: Cars, trucks, and trains on bridges, parking garages, and highwaysSnow loads: Accumulated snow on roofs, especially in colder climatesWind loads: Pressure from wind on buildings, bridges, and other tall structuresSeismic loads: Forces induced by earthquakes on buildings and infrastructureCrane and machinery loads: Heavy equipment used during construction or in industrial settingsImpact loads: Collisions from vehicles or falling objectsVibration loads: Rhythmic forces from equipment, crowds, or adjacent constructionWater loads: Forces from waves, currents, and hydrostatic pressure on dams, levees, and underwater structuresDesigners must accurately estimate and account for live loads to ensure structures remain safe and serviceable throughout their lifetimes.Life maintenance loads are the necessary everyday actions and responsibilities that keep our lives running smoothly. These include tasks like grocery shopping, cooking, cleaning, laundry, paying bills, and maintaining our health through exercise and self-care. While often routine and mundane, these loads are essential for maintaining order and balance in our lives.However, the cumulative weight of these daily tasks can be overwhelming, leading to stress and burnout.It’s important to find strategies to manage life maintenance loads, such as delegating tasks, simplifying routines, and setting realistic expectations.By developing a sustainable approach to handling these loads, we can create more space for the activities and relationships that truly matter to us.There are several ways to categorize live loads based on how they are applied to a structure:A concentrated load acts on a structure at a distinct point or area. Examples include a vehicle traveling over a bridge or the weight of heavy machinery. Concentrated loads are applied as point loads in structural analysis.See also RCC Beam Design by Example and Theory Behind IIA distributed load acts over an area rather than a single point. Wind pressure on a wall or the self-weight of a beam are examples of distributed loads. These are typically applied as uniform loads or linearly varying loads in analysis.Impact loads involve a mass colliding with a structure, introducing dynamic and vibratory forces. For example, a pile driver striking a pile or a vehicle abruptly braking on a bridge. Impact loads are usually accounted for by increasing the live load by a dynamic load allowance factor.A moving or transit load is a live load that moves across a structure, like vehicles traveling over a bridge. Special analysis methods are required to determine the maximum effects as the load position changes.Environmental loads are produced by the natural environment, like wind, snow, rain, waves, or earthquakes. 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Though sometimes classified separately, these are technically live loads as they actively vary over time.During construction, structures must resist loads from workers, materials, and construction equipment. Falsework must also be designed to support loads before the permanent structure is completed.Here are some common examples of live loads civil engineers may encounter:People: weight of people occupying a building. A typical loading is 40 psf (pounds per square foot) for office areas, 100 psf for public assembly areas.Furniture: weight of furniture, partitions, and other movable objects in a building. Usually around 15-40 psf depending on space usage.Vehicles: weight of vehicles crossing a bridge. Dynamic allowance accounts for impact of moving vehicles. AASHTO LRFD Bridge Design Specifications provide standard truck & lane loadings.Trains: for railroads, Cooper E loading provides standard train live load model of rail car weights and axle configurations.Fluid Pressure: hydrostatic pressure on walls of tanks and dams. Varying liquid level produces changing lateral forces.Snow: snow drifting produces non-uniform loading dependent on roof geometry. ASCE 7 provides ground snow loads by location which are converted to roof loads.Wind: pressure on exterior surfaces of structures depends on wind speed, exposure category, and building geometry. Governed by wind load provisions like ASCE 7.Machinery: localized forces from vibration or support reactions of heavy equipment like cranes or generators.Construction loads: temporary loads during placement of materials or erection activities before a structure is completed.The entire process of designing and assessing the loads on a structure is called structural analysis. Properly accounting for live loads is a critical responsibility for civil engineers. Underestimating live loads can lead to catastrophic failures, while overestimating can lead to inefficient and costly design.Live loads are temporary, variable forces that act on a structure. Examples include:Occupancy loads: People, furniture, and equipment in buildings like offices, homes, and schoolsVehicle loads: Cars, trucks, and trains on bridges, parking garages, and highwaysSnow loads: Accumulated snow on roofs, especially in colder climatesWind loads: Pressure from wind on buildings, bridges, and other tall structuresSeismic loads: Forces induced by earthquakes on buildings and infrastructureCrane and machinery loads: Heavy equipment used during construction or in industrial settingsImpact loads: Collisions from vehicles or falling objectsVibration loads: Rhythmic forces from equipment, crowds, or adjacent constructionWater loads: Forces from waves, currents, and hydrostatic pressure on dams, levees, and underwater structuresDesigners must accurately estimate and account for live loads to ensure structures remain safe and serviceable throughout their lifetimes.Life maintenance loads are the necessary everyday actions and responsibilities that keep our lives running smoothly. 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