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Access Floor Systems in the Fermilab Computing Division Data Centers

An Overview of the Static and Dynamic Performance Specifications of the Access Floor Systems within Computer Rooms Operated by the Fermilab Computing Division

Author(s): Tim Kasza, Adam Walters

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Access Floor Systems Loading Performance Specifications Overview

This document describes an overview of the Access Floor Systems and there Loading Performance Specifications within the three main Computing Division Data Centers. As a general rule, the loading of an Access Floor System is a function of the manufacturer's load specification and the positioning of the equipment relative to the raised floor grid. The Performance Criteria of Access Floor Systems are the most important to consider because they represent the performance in a typical computer room installation. Currently, there are no industry standards for access floor loading performance. However, the Ceiling & Interiors Systems Construction Association (http://cisca.org/home) has published Recommended Test Procedures for Access Floors for concentrated, ultimate, rolling, stringer, pedestal axial and pedestal overturning moment loads.

Maximum Floor Load for Standard Rack Sizes Matrix – All Data Centers

Data Center	Standard Rack Size (height x width x depth)	Pounds per Square Foot (psf)	Rack Footprint in Square Feet	Maximum Rack Weight in lbs (kg)
GCC-TRR	47U x 24” x 42”	300 psf	7 sq ft	2,100 lbs (952.56 kg)
GCC-CRA	47U x 24” x 36”	300 psf	6 sq ft	1,800 lbs (816.48 kg)
GCC-CRB	47U x 24” x 42”	300 psf	7 sq ft	2,100 lbs (952.56 kg)
GCC-CRC	47U x 24” x 42”	300 psf	7 sq ft	2,100 lbs (952.56 kg)
LCC-107	47U x 24” x 36”	300 psf	6 sq ft	1,800 lbs (816.48 kg)
LCC-108	47U x 24” x 36”	250 psf	6 sq ft	1,500 lbs (680.4 kg)
FCC1	44U x 24” x 42”	250 psf	7 sq ft	1,750 lbs (793.8 kg)
FCC2	44U x 24” x 42”	250 psf	7 sq ft	1,750 lbs (793.8 kg)

The above Matrix is based on the recommended size configuration for standard IT/Data Rack Systems within a specific Data Center. If you have an IT/Data Rack of different dimensions, the maximum floor load for other size configurations of racks can be calculated using the following formula.

Calculating the Maximum Floor Load for IT/Data Racks of Different Dimensions

Formula

(RFP) Total IT/Data *Rack Footprint* in square feet weight

(FTPSF) *Floor Tile Pounds per Square Foot* (use the specifics Data Center's access floor system's uniform load specification or divide the concentrated loads specification by 4 – reference the Access Panel System Comparison Matrix – All Data Centers on page 4)

(TMWR) *Total Maximum Weight per Rack*

- ***RFP x FTPSF = TMWR***

Example - Data Center (FCC2), Rack Size (44U x 24''x 36")

24" width x 36" depth = 864''
864" / 144" = 6 sq ft
RFP = 6 sq ft

FTPSF = 250 psf (from Access Panel System Comparison Matrix – All Data Centers on page 4)

- ***6 (RFP) x 250 (FTPSF) = 1500 lbs (TMWR)***

Computing Division Data Centers

Access Panel System Comparison Matrix – All Data Centers

Static Loads				Dynamic Loads		
Data Center	**Concentrated Loads**	**Uniform Loads**	**Ultimate Loads**	**Rolling Loads 10 Passes**	**Rolling Loads 10,000 Passes**	**Impact Loads**
GCC-TRR **GCC-CRA** **GCC-CRC**	1250 lbs (see note 1)	300 lbs / sq ft	MIN 2.5 (see note 2)	1000 lbs (see note 3)	800 lbs (see note 3)	100 lbs
GCC-CRB	1250 lbs	xxx	3800 lbs	1000 lbs	800 lbs	150 lbs
LCC-107	1250 lbs (see note 1)	300 lbs / sq ft	MIN 2.5 (see note 2)	1000 lbs (see note 3)	800 lbs (see note 3)	100 lbs
LCC-108	1000 lbs	xxx	xxx	xxx	xxx	xxx
FCC1 **FCC2**	1000 lbs	250 lbs / sq ft	MIN 2.0 (see note 2)	400 lbs	400 lbs	100 lbs

1. Loads to be applied anywhere on panel, permanent set after application of concentrated load shall be <0.010 inch.
2. Loads applied on a one square inch area. Results above indicate weakest point of panel. Panel shall be capable of withstanding without failure the noted minimum safety factor applied to the panel's concentrated load rating.
3. Local and overall top surface deformation shall not exceed 0.040 inch.

Grid Computing Center (GCC)

- **Tape Robot Room, Computer Room A and Computer Room C Access Floor System**

ConCore CC1250 Panel-24 inch Access Floor System by Tate

General Specifications
- 24 inch module. Panel Weight: 8.0 lbs/sq ft bare
- All steel welded construction filled internally with a cementitious core material
- Protected from corrosion by an epoxy painted finish
- Class A flame spread rating
- Non-combustible material

Understructure
- 4 foot Bolted Stringer

Covering
- 1/16 inch HPL Formica (color) Cheyenne

Grid Computing Center (GCC) continued

Computer Room B Access Floor System

FS200 Standard Duty Panel System by ASM Modular Systems

General Specifications
- 24 x 24 inch module
- Welded structural steel assembly. Formulated cementitious fill and powder coated epoxy finish
- Fully immersed in a corrosion resistant bath of phosphate to protect inner and outer surfaces

Understructure
- Bolted Stringer understructure

Covering
- 1/16 inch Plastic Laminate

LCC Latice Computing Center (LCC)

Room 107 Access Floor System

ConCore CC1250 Panel-24 inch Access Floor System by Tate

General Specifications
- 24 inch module. Panel Weight: 8.0 lbs/sq ft bare
- All steel welded construction filled internally with a cementitious core material
- Protected from corrosion by an epoxy painted finish
- Class A flame spread rating
- Non-combustible material

Understructure
- 4 foot Bolted Stringer

Covering
- 1/16 inch HPL Formica (color) Cheyenne

LCC Latice Computing Center (LCC) continued

Room 108 Access Floor System

Reference FESS document # 8-2-76 Muon Laboratory 1984

General Specifications
- 24 x 24 rigid panel assemblies
- Cold rolled steel top sheet, resistance welded to a die formed steel bottom pan. All voids within panel are filled with a lightweight cementitious material
- All interior surfaces of steel is protected coated with a corrosion resistance coating

Understructure
- Galvanized steel pedestals
- 18 gauge galvanized steel snap on stringers

Covering
- .060 inch thick single sheet high pressure laminate

Feynman Computing Center (FCC)

FCC1 and FCC2 Computer Rooms Access Floor System

All Steel AS1000 Panel-24 inch Access Floor System equivalent by Tate

General Specifications
- 24 inch module. Panel Weight: 4.25 lbs/sq ft bare
- All steel welded construction
- Protected from corrosion by an epoxy painted finish
- Class A flame spread rating
- Non-combustible material

Understructure
- Snap on galvanized steel stringers

Covering
- 1/16 inch HPL Formica with integral trim

IT Computing Equipment Rack Moving Precautions

Translation of the Rolling Load Rating

An access floor system must be protected from overloads and circumstances that exceed its specifications. Movement of heavy loads and equipment may require protection of the floor system through the use of plywood or other suitable load-distributing materials.

Deployment of floor protection can only be determined by assessing the access floor panel's rolling load rating. A floor panel's rolling load rating represents its capacity to support one loaded wheel crossing it at a time. To translate the rating into actual floor loading capacity, you need to map the wheel spacing of your moving device.

Most commonly within the three main Computing Division's Data Centers, IT computing equipment racks are the type of devices being moved across an access floor system. Typical IT computing equipment racks have four-wheels which are spaced less than 24 inches wide (*but have front-to-back wheel spacing of more than 24 inches*). With this configuration the maximum rolling load capacity for an IT computing equipment rack *(with payload)*, is 2 times the floor panel's rolling load rating. This is because the front and back sets of wheels have the ability to traverse a single panel at a time. Thereby loading a panel with its rolling load rated capacity.

Example

GCC-CRB - FS200 Standard Duty Panel System by ASM Modular Systems with a rolling load rating of 800 lbs.

The maximum rolling load floor capacity for a typical IT computing equipment rack (*with payload*) on a FS200 floor is 1600 lbs. This is because the front and back sets of wheels have the ability to traverse a single panel at a time, thereby loading a panel with 800 lbs (*the floor panel's rated capacity*).

General Rule for Protection of the Access Floor System

As a general rule, when moving IT computing equipment racks (*with payload*) which exceed 800 lbs, CD Facility Operations Department will require protection of the Data Center's access floor system through the use of plywood or other suitable load-distributing materials.

Formula for Calculating the Use of Floor Protection

(R) weight of IT computing equipment rack (with accessories) = ~300 lbs (typical weight)

(CE) weight of rack mounted 1U computing equipment = ~40 lbs (typical weight)

(Q) quantity of CE

(TW) Total weight

- ***R (with accessories) + (Q x CE) = TW***

Example – No Floor Protection Required (*total weight < 800lbs*)

(R) IT computing equipment rack (*with accessories*) = 300 lbs
(CE) 1U computing equipment = ~40 lbs

- R (*300 lbs*) + Q(12) x CE (40 lbs) = TW (780 lbs)

Example – Floor Protection Required (*total weight > 800 lbs*)

(R) IT computing equipment rack (*with accessories*) = 300 lbs
(CE) 1U computing equipment = ~40 lbs

- R (*300 lbs*) + Q(20) x CE (40 lbs) = TW (1,100 lbs)

Other Factors

Other factors such as top heavy IT computing equipment racks (*unbalance load*) caused by the placement of the rack mounted computing equipment toward the top half of an IT computing equipment rack may require other safety precautions to prevent the rack from becoming unstable and tipping over during movement. For guidance, please contact Facility Operations Department Management.

Summary

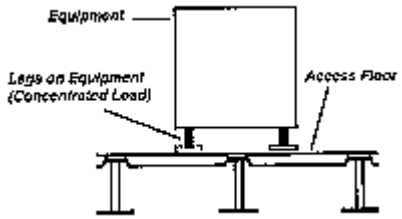
Heavy IT computing equipment rack payloads on castors and small wheels should not be run across grilles, perforated access floor panels, panels with service outlet boxes or grommets and other panels with cut-outs. The floor surface may be damaged or indented by hard wheels, castors etc. when combined with heavy loads. The use of a protective overlay material will help prevent damage to the access floor panels. When moving equipment with loads exceeding 800 lbs on an access floor system, it is mandatory that you contact Facility Operations Department Management for assistance.

Appendix A

Overview of Performance Criteria for Access Floor Systems

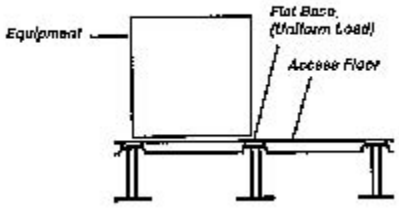
Static Loads

Concentrated



These loads are applied on a small area of the panel surface, i.e. from a deskleg or computer frame. The concentrated load is applied on a 1"x1" indentor, and deflection is measured at the top surface under the load. Permanent set (rebound) is measured after the load is removed.

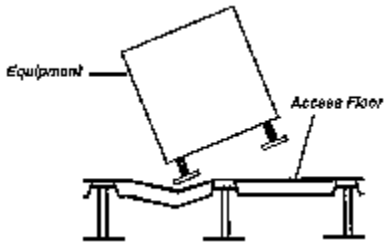
Uniform



Uniform loads, expressed in pounds per square foot, are applied over the entire surface of the panel, i.e. a file cabinet.

Static Loads (continued)

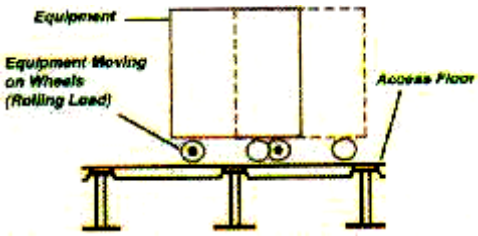
Ultimate



These loads are reached when the panel has failed structurally and cannot accept additional load.

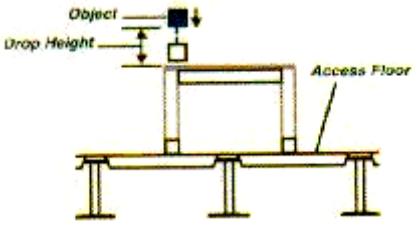
Dynamic Loads

Rolling



These loads are applied by wheeled vehicles carrying loads across the floor, i.e. chair casters, pallet jacks, and electronic mail carts. Dynamic loads are defined by wheel size and hardness, weight of vehicles, contents, and number of passes.

Impact



Impact loads are achieved by dropping objects on the floor, i.e. a box of computer paper dropped from waist height. Impact loads are defined by weight, impact surface area and distance dropped.