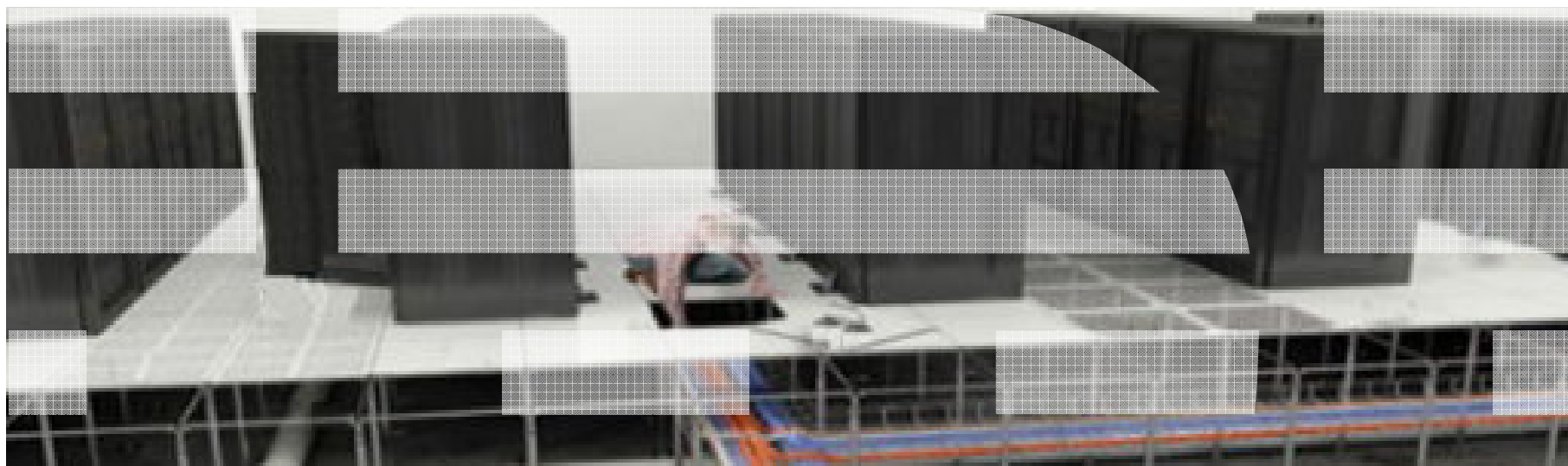


# Raised Floor, or Non-Raised Floor

-- That Is the Data Center Question



## Agenda

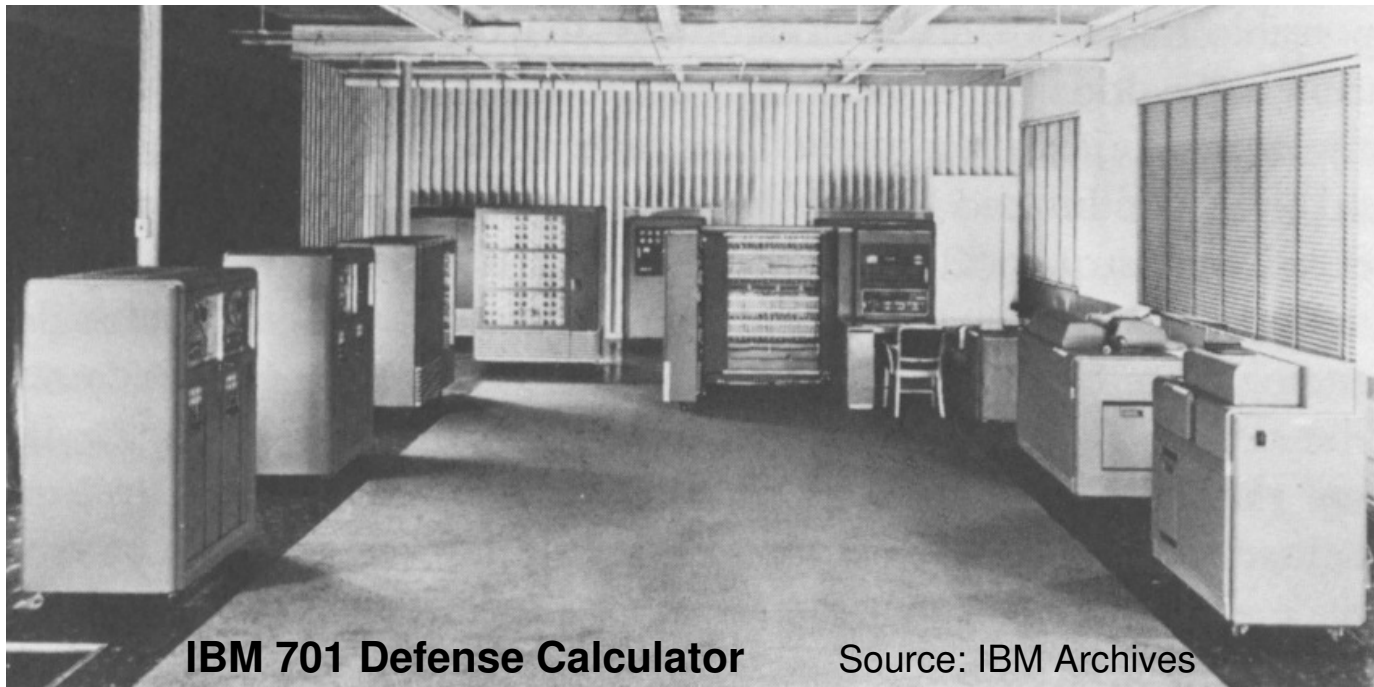
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- **Data Center Raised Floor History**
- **Raised Floor and Connectivity**
- **Access Flooring Industry**
- **Before Raised Floors**
- **Function and Purpose**
- **Historical Data Center Design Template**
- **Recent Factors**
- **Expert Opinions**
- **Pros and Cons**
- **Cost Factor**
- **Summary**
- **Reference Material**

## Data Center Raised Floor History

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- **1952: First IBM Production Computer and “Computer Room”**
  - IBM Manufactured 19 of the 701 Electron Data Processing Machines
- **1955 – 1960: 123 of the IBM 700 Series were Sold**
- **1956: First “Raised” Floor Room Appears**



**IBM 701 Defense Calculator**

Source: IBM Archives

## Raised Floor and Connectivity

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- **Growth in Commercial Computing Market**
- **IBM 700 Series System Connectivity**

- Multi-Unit Systems with Large Interconnect Cables

- Copper Interface Cables
- 300 – 500 mm Diameter
- Large Bend Radii



- **Early Raised Floor Systems Appeared 1955 - 1956**

- Innovative: Wood, Metals

- “One of a Kind” and Built Order

- Bel Aire Industries, Liskey, Washington Aluminum Company

- **Collaboration Between IBM and the Washington Aluminum Company**

## Access Flooring Industry

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- **“In the 1950’s IBM came to the Washington Aluminum Company with a problem. They had started manufacturing and selling a new piece of equipment called the mainframe computer. IBM needed someone to build a stand or platform to support the weight of this machine and create easy access for the wires and cooling of the equipment. Sitting in that room were a few people including Earnie Liskey and Jim (Bill) Irvine. This was the beginning of the access floor industry. A short time later these men created the Liskey Aluminum Company of Baltimore, Maryland and the first production access floor systems were manufactured.”**

Source: Irvine Access Floors

## Before Raised Floors:— Circa Late 1950's-Early 1960's



## Function and Purpose

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- **Physical Support for Electronic Equipment**
- **Enhance Load / Weight Distribution**
- **Access to Electrical Power, Control / Interface / Network Cabling**
- **Air Distribution and Management**
- **Liquid Cooling: Hoses/Pipes/Valves**
- **Signal Reference Ground: EMI / Electrical Noise**
- **Static Control: ESD**
- **Adaptability/Flexibility to Equipment Changes**
- **Personnel Comfort: Carpeted Floor Tiles**
- **Appearance**

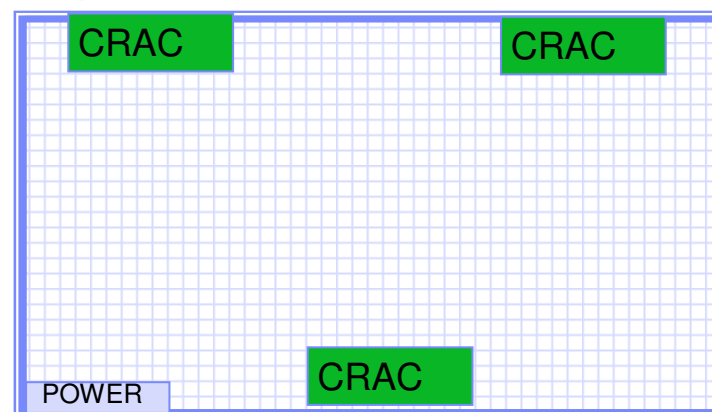


## Historical Data Center Design Template

1955      1960      1970      1980      1990      2000      2010

### ▪ Designed and Built Based on Early Design

- Large Room
- Electrical Power
- Cooling
- Raised Floor\*



### – Design Assumptions

- Hardware to be Supported
- Growth Projections
- S-M-L, “Cookie Cutter” Approach





## Recent Factors

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- **Higher Density Equipment**
  - Heavier Footprint Kg/sq m (Lbs / sq ft)
- **Connectivity/Network Complexity Trends**
  - Copper
  - Fiber
  - Power
- **Air Management Strategies**
  - Containment
  - In Row

## High Density - Weight

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Sys

## High Density – Weight Floor Tiles

**ConCore® Performance Selection Chart**

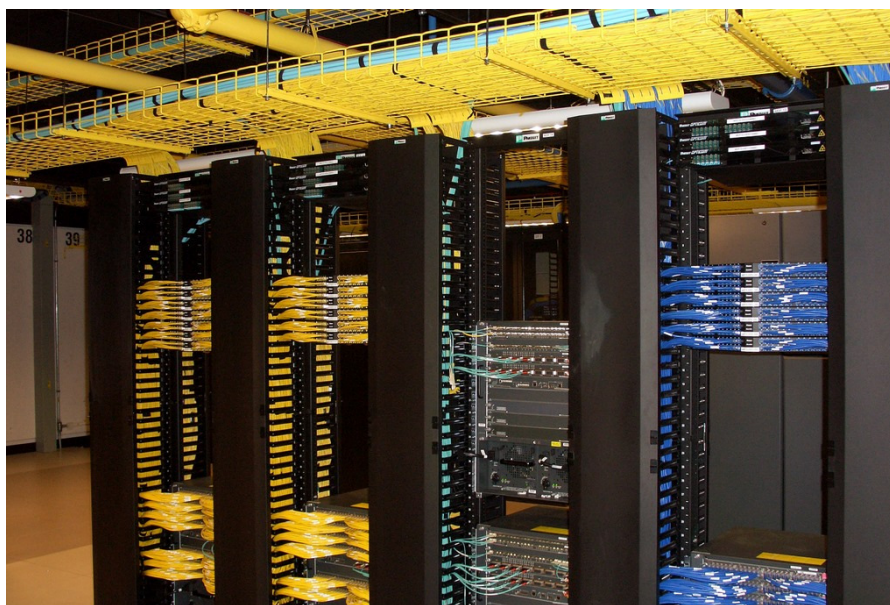
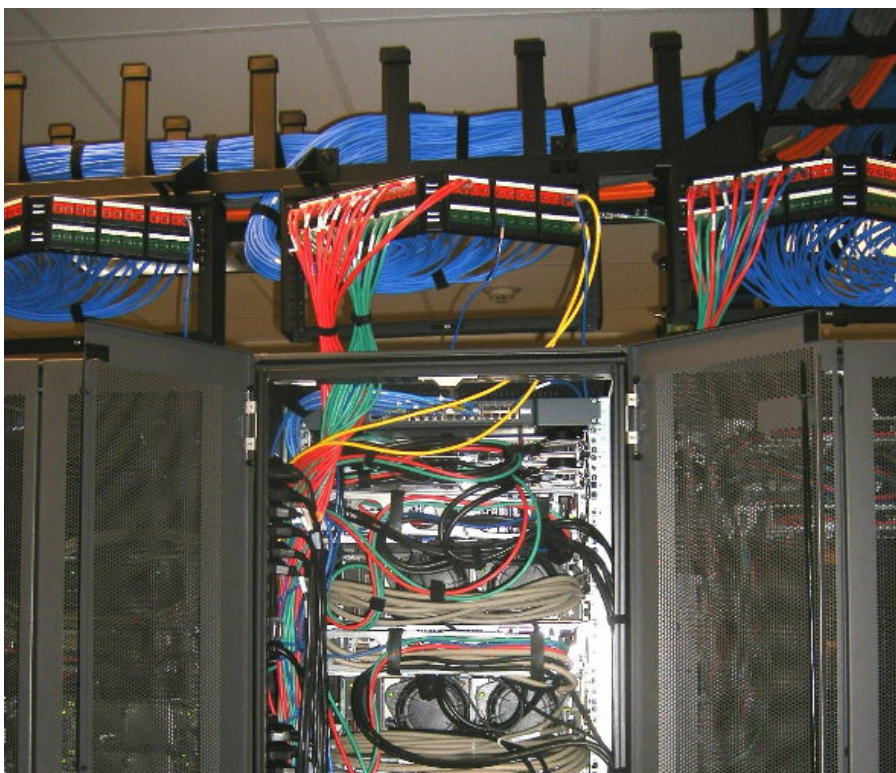
**System Performance Criteria\* (Tested on Actual Understructure)**

Panel	Understructure	System Weight (lbs/ft²)	Static Loads		Rolling Loads		Impact Loads (lbs)
			Design Loads¹ (lbs)	Safety Factors² (min 2.0)	10 Passes (lbs)	10,000 Passes (lbs)	
ConCore® 1000	PosiLock®	8.0 (39kg/m²)	<b>1000 (4.4kN)</b>	<b>PASS</b>	800 (3.6kN)	600 (2.7kN)	150 (68kg)
ConCore® 1250	PosiLock®	8.5 (42kg/m²)	<b>1250 (5.6kN)</b>	<b>PASS</b>	1125 (5.0kN)	875 (3.9kN)	150 (68kg)
ConCore® 1500	PosiLock®	9.0 (44kg/m²)	<b>1500 (6.7kN)</b>	<b>PASS</b>	1250 (5.6kN)	1000 (4.4kN)	150 (68kg)
ConCore® 1000	Bolted Stringer	9.0 (44kg/m²)	<b>1000 (4.4kN)</b>	<b>PASS</b>	800 (3.6kN)	600 (2.7kN)	150 (68kg)
ConCore® 1250	Bolted Stringer	10.0 (49kg/m²)	<b>1250 (5.6kN)</b>	<b>PASS</b>	1000 (4.4kN)	800 (3.6kN)	150 (68kg)
ConCore® 1500	Bolted Stringer	10.5 (51kg/m²)	<b>1500 (6.7kN)</b>	<b>PASS</b>	1250 (5.6kN)	1000 (4.4kN)	150 (68kg)
ConCore® 2000	Bolted Stringer	11.5 (56kg/m²)	<b>2000 (8.9kN)</b>	<b>PASS</b>	1500 (6.7kN)	1250 (5.6kN)	150 (68kg)
ConCore® 2500	Bolted Stringer	12.0 (59kg/m²)	<b>2500 (11.1kN)</b>	<b>PASS</b>	2000 (8.9kN)	2000 (8.9kN)	150 (68kg)
ConCore® 3000	Bolted Stringer	13.0 (63kg/m²)	<b>3000 (13.3kN)</b>	<b>PASS</b>	2700 (12.0kN)	2400 (10.7kN)	200 (91kg)

[http://www.tateinc.com/pdf/product\\_guide.pdf](http://www.tateinc.com/pdf/product_guide.pdf)

## Cabling Trends

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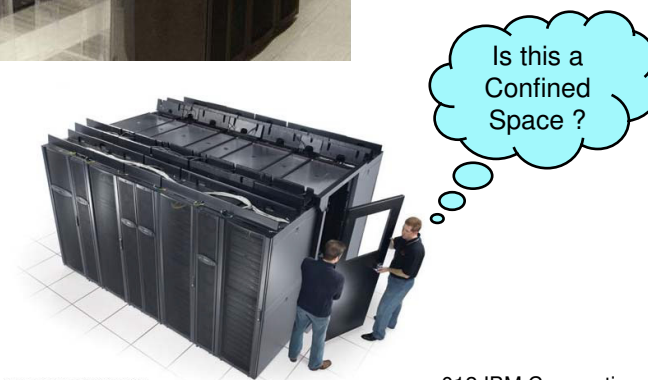


Photos courtesy of Lee Henchman



## Air Management

- **Cold Aisle – Hot Aisle**
- **Chimneys**
  - Alteration/Attachment
    - Warranty/Maintenance Impact?
- **Aisle Containment**
  - Which Is Better
  - Personnel: Heat Stress
- **Free Standing Solutions**
  - Personnel: Safety



APC Hot Aisle Containment

## Expert Opinions

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- “Anyone designing a new data center now with raised-floor cooling is being environmentally irresponsible because the method is entirely unable to accommodate changes which are already challenging operations today – not least of which dynamic power variation amongst IT equipment loads.” - [Neil Rasmussen - CTO of APC, Senior VP of Innovation for Schneider Electric](#)
- “Whilst I agree with the end of an era of “open air management” cooling systems (which mostly use raised floor cooling) I think we will still continue to see raised-floor cooling designs and for valid reasons.” – [Dr. Robert Tozer – Director of Operational Intelligence, Ltd](#)
- “However, though not efficient, the raised floor, in association with air handler units along the walls, can cool high-density loads by installing open grates rather than perforated tiles.” – [Dr. Bob Sullivan – Industry Consultant](#)

\* Source: Datacenter Dynamics 2011

## Pros and Cons

### RAISED

- Free Movement of Cabinets
- Flexible Placement of Vent Tiles
- Vent Tile Options, % Open
- Concealment of Cables
- Under or Over Cabling
- EMC Shielding/Signal Ref. Ground
- Concealment of Plumbing
- Appearance

### NON-RAISED

- Cost Saving of Flooring System
- Overhead Cabling
- Increased Floor to Ceiling Height
- Limited Floor Loading Concern
- No Under Floor Fire Protection

- Additional Cost
- Reduced Floor-Ceiling Height
- Under Floor Fire Protection

- Added Cost Ducting
- Added Cost Concrete Finishing
- Difficulty in Changing Ducting
- Appearance

**NOTE: Some IBM Machine Types REQUIRE Installation on Raised Floor**



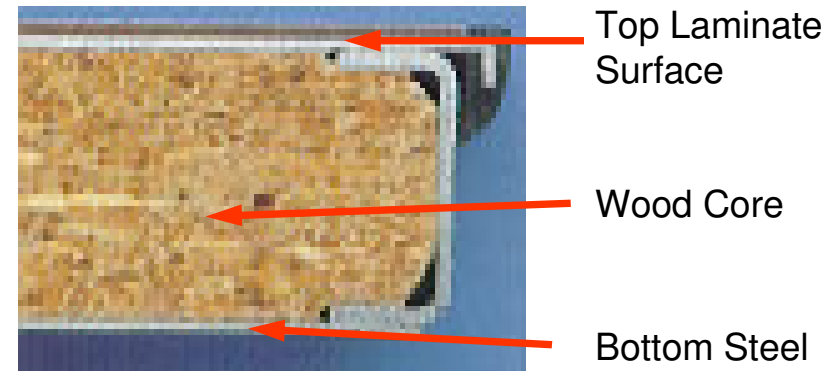
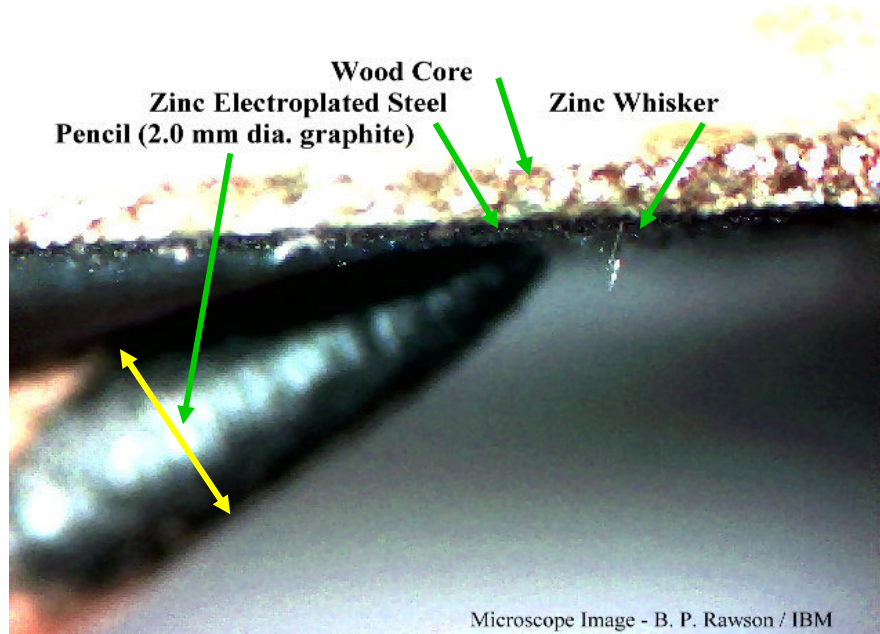
## Cost Factor

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- **Access/Raised Floor Adds \$215-430 / m<sup>2</sup> (20-40 / ft<sup>2</sup> )**
  - Engineering, Materials, Installation
  - Variables
    - Floor Tile Type / Rating
    - Floor Depth
    - Perforated / Vent Types

## Zinc Whiskers

- Reliability Factor Related to Some Raised Floors
- “Electroplated” Zinc Coating (Rust Prevention for Steel)
- Most New Production Wood Core Tiles State “Whisker Free”
  - Old Tiles are Everywhere



## How Can IBM Help

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- **IBM Experience, Knowledge and Resources**

- **GTS Offerings Database**

<https://w3-03.ibm.com/services/salesone/sosf/dyno.wss?oid=538>

- **IBM Installation Planning Representatives**

–brawson@us.ibm.com

- **IBM Site and Facility Services**

## Summary

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- **Raised Floors Have Evolved with the IT Industry**
- **Time Proven Feature with Many Benefits**
- **Changes in Density, Connectivity, Air Management Raises ?'s**
- **Extreme Views**
- **Both are Viable Options**
- **Pros and Cons**
- **Many Factor to Consider in the Planning and Decision Process**
- **IBM is Here to Help: GTS, STG**

## References

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- IBM Archives, [http://www-03.ibm.com/ibm/history/exhibits/vintage/vintage\\_intro.html](http://www-03.ibm.com/ibm/history/exhibits/vintage/vintage_intro.html)
- Irvine Access Floors, <http://www.irvineaccessfloors.com/about-us/history/>
- Data Center Dynamic, <http://www.datacenterdynamics.com/focus/archive/2011/01/cooling-without-raised-floor>
- Tate Access Flooring, [http://www.tateinc.com/pdf/product\\_guide.pdf](http://www.tateinc.com/pdf/product_guide.pdf)