THE REAL MEP NUMBERS

UNDERSTANDING MEP SYSTEMS in SQUARE FOOTAGES and BUILDING MULTIPLIERS

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Session Outline

- **Square Feet and Building Multipliers**
  - **-- Definitions and Basic Formulae**
  - **-- MEP Building (BGSF) Percentages**
- **MEP & Building Configurations**
- **Central Utility Plant**

Why it matters

- **Program sets square footage, including MEP SF assumptions**
- **Square footage sets estimated cost**

  -- very easy to be off by 10% - 15% on area

  -- very difficult to recover from bad numbers

Caveats

- Formulae and percentages are for hospitals
- All hospitals are different
- Discretion/diversity in how areas are counted; important to understand distinctions, applicability and relationships (apples to apples)
- Square footage and floor space, not height and volume (or atria), are subject of this discussion
- Square footage and cost are related but separate. Relationship is not always straightforward.

Basic Formulae

The Real MEP Numbers

NSF x A = DGSF

(NET SQUARE FEET) (DEPARTMENTAL GROSS SF)

DGSF x B = BGSF

(BUILDING GROSS SF)

NSF x AB = BGSF

NSF x 2 = BGSF

Basic Formula

DGSF x B = BGSF

B = 1.25 – 1.35

10% Range

B = DGSF/BGSF Multiplier

B Components:

- Exterior Wall
- Non-departmental horizontal circulation (public and service)
- Vertical circulation: stairs, elevators
- MEP/FP (incl. Tel/Data)

B = DGSF/BGSF Multiplier

The Real MEP Numbers

MEP/FP = 10% - 15% of BGSF

How accurate is this assumption?

What are the major contributing factors?

Process and Methodology

- Study of two projects
- Measured construction documents are the basis for the numbers

  -- measured all components

  -- rounded values for clarity
- Similar AMC owners, projects

  -- large hospitals (400,000 – 500,000 BGSF)

  -- central utility plants (for the most part)
- Same architect, different engineers

MEP Considerations

- Building (program) type, requirements
- Building Configuration

  -- location of major mechanical

  -- floorplate size
- Enclosed Mech (included in SF) or
  Exposed Mech Roof (excluded)

B = DGSF/BGSF Multiplier

The Real MEP Numbers

ALLOWANCES/ CATEGORIES	STATION/ COMMUNITY HOSPITALS	REGIONAL/ MEDICAL CENTERS
MECHANICAL	15.0%	16.0%
ELECTRICAL	3.0%	3.0%
10% - 15%	18%	19%
BLDG CIRC.	15.5%	16%
B = 1.25 – 1.35%	33.5%	35%

NOTE: Buildings with multiple floors may need additional circulation ratios for stairs, elevators, etc.

Source: Department of Defense Space Planning Criteria for Health Facilities

B = DGSF/BGSF Multiplier

The Real MEP Numbers

	Mech	Elec	Tel/ Data	P/FP	Circ.	Ext. Wall
% Range	6.8 – 9	2 – 3	0.6 - 0.7	0.5 - 1	11 - 16	1.6 – 2.6
% MEP	12% - 13%				(Incl. Tel/Data and Fire Protection; not mech shafts)	
% B	24% - 31%				(Incl. all components above*)	

*Lobbies, major circulation areas included in program (DGSF), as are mechanical/electrical support rooms for major diagnostics

B = DGSF/BGSF Multiplier

The Real MEP Numbers

MEP Components:

- **Mechanical** (6.8% - 9%)
- **Electrical** (2% - 3%)
- **Tel / Data** (0.6% - 0.7%)
- **Plumbing / Fire Protection** (0.5 - 1%)

MEP & Building Configuration

The Real MEP Numbers

1 Building 2 Ways — Models A and B

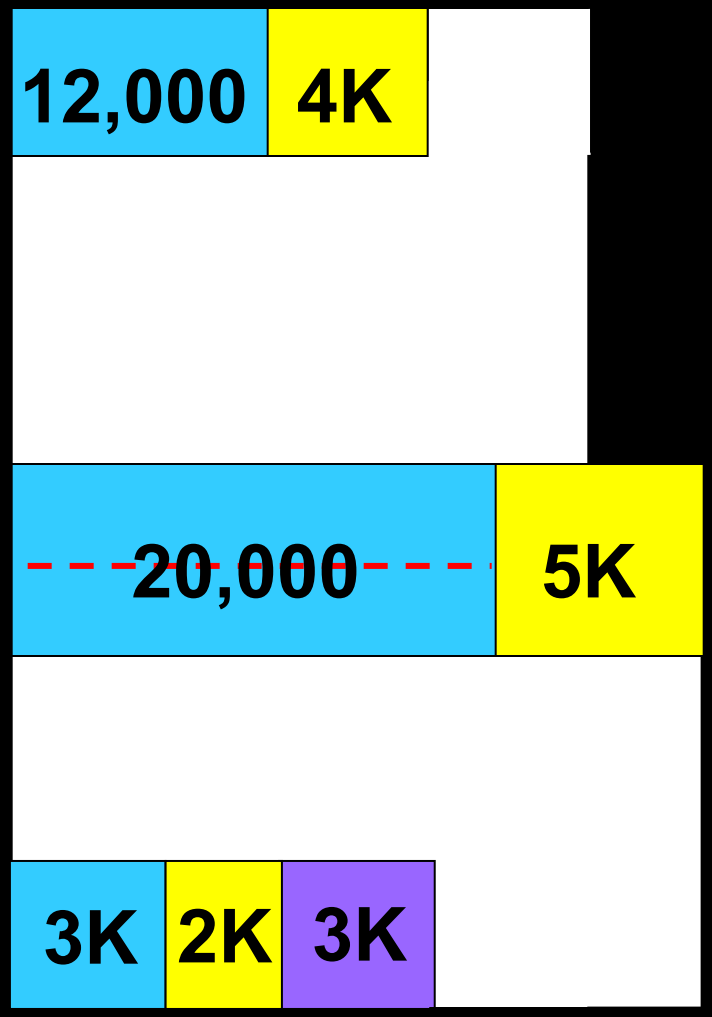
500,000 BGSF with 13 programmed floors

- **30,000 SF levels 7 - 15**
- **40,000 SF levels B - 4**

Based on Yale-New Haven Cancer Hospital

MEP & Building Configuration

The Real MEP Numbers



Section

Penthouse mech (enclosed); incl. in BGSF:
12,000 SF Mech
+ 4,000 SF Elec = 16,000 SF

Mid-level (stacked*) mech:
20,000 SF Mech
+ 5,000 SF Elec = 25,000 SF

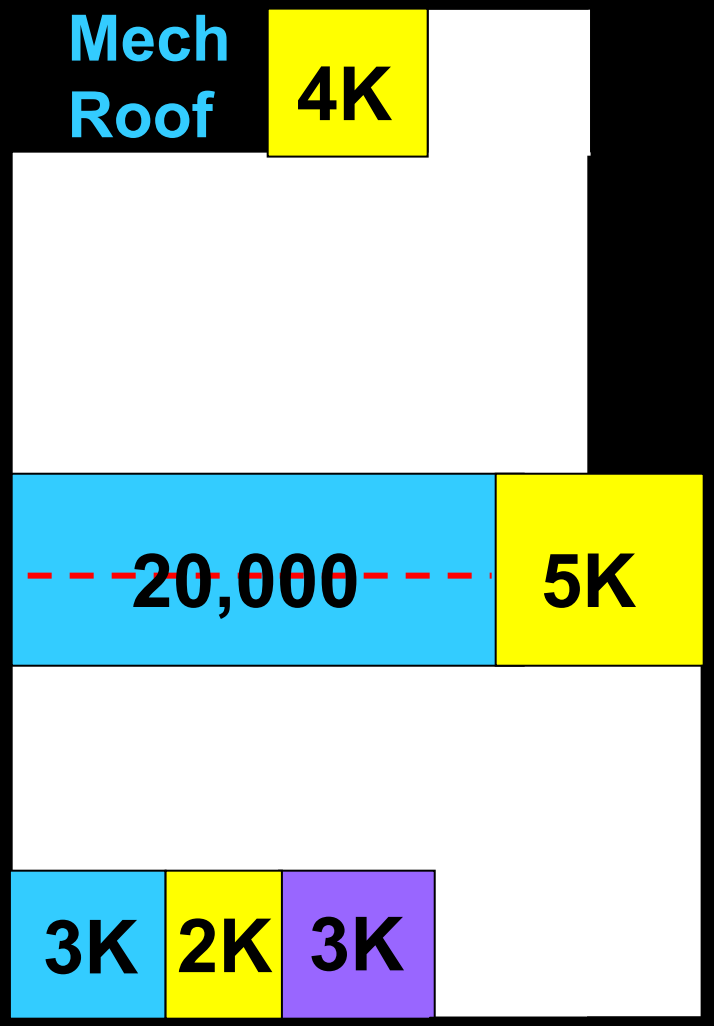
Basement mech:
3,000 SF Mech + 2,000 SF Elec
+ 2,400 Plumb + 600 Fire
Protection = 8,000 SF

Model A.1: 49,000 / 500,000 = 9.8% Major MEP

* If not stacked, would add 1.8% to major MEP

MEP & Building Configuration

The Real MEP Numbers



Section

Mech roof (exposed);
***not* incl. in BGSF:**
4,000 SF Elec = 4,000 SF

Mid-level (stacked*) mech:
20,000 SF Mech
+ 5,000 SF Elec = 25,000 SF

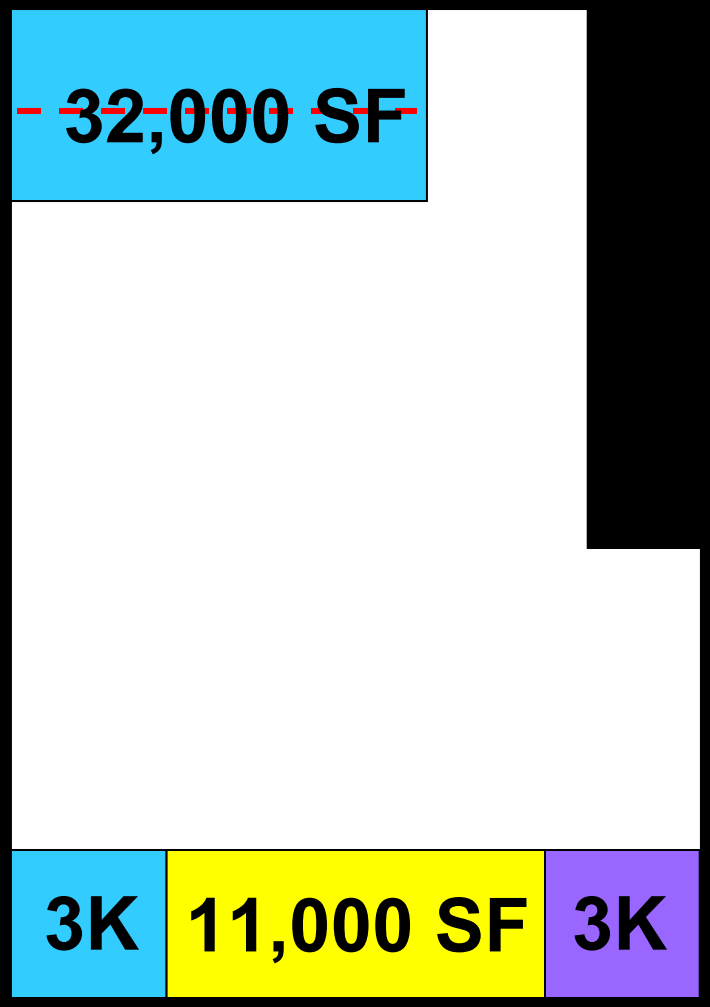
Basement mech:
3,000 SF Mech + 2,000 SF Elec
+ 2,400 Plumb + 600 Fire
Protection = 8,000 SF

Model A.2: 37,000 / 488,000 = 7.6% Major MEP

*** If not stacked, would add 1.9% to major MEP**

MEP & Building Configuration

The Real MEP Numbers



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Penthouse stacked mech (enclosed); incl. in BGSF:

32,000 SF Mech = 32,000 SF

or

16,000 SF Mech = 16,000 SF

(depending on stacking floor system of penthouse)

Basement mech:

3,000 SF Mech

+ 11,000 SF Elec

+ 2,400 Plumb

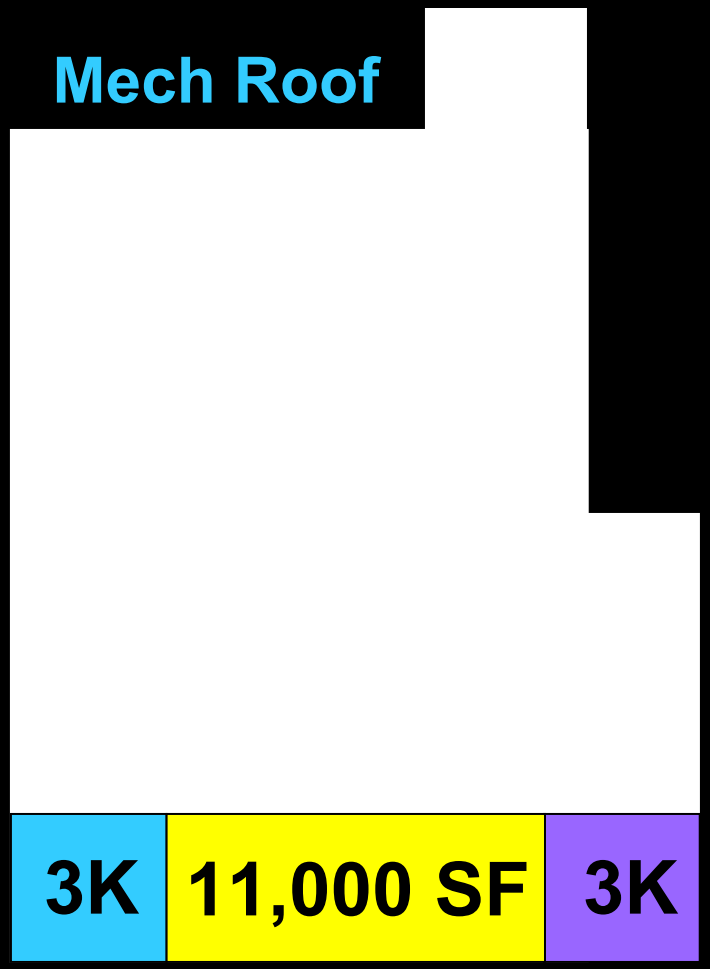
+ 600 Fire Protect = 17,000 SF

Model B.1: 49,000 / 460,000 = 10.6% Major MEP

34,000 / 444,000 = 7.7% Major MEP

MEP & Building Configuration

The Real MEP Numbers



Section

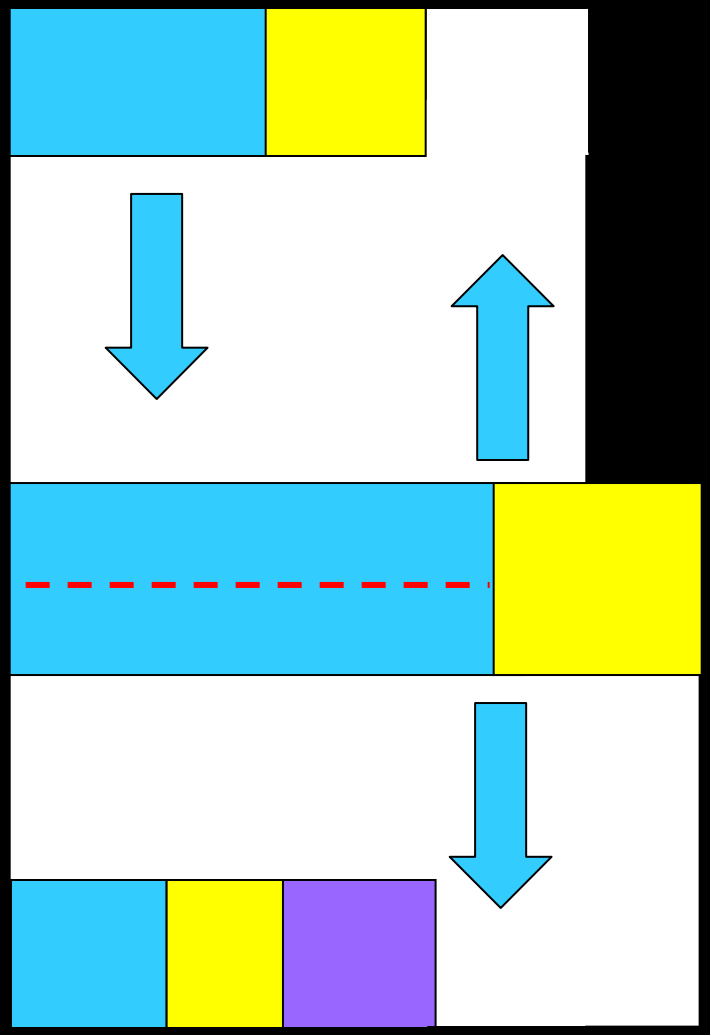
Mech roof (exposed);
***not* incl. in BGSF**
(would require stacked platforms for mechanical)

Basement mech:
3,000 SF Mech
+ 11,000 SF Elec
+ 2,400 Plumb
+ 600 Fire Protect = 17,000 SF

Model B.2: 17,000 / 428,000 = 4% Major MEP
(Cost reductions less extensive than MEP % implies)

MEP & Building Configuration

The Real MEP Numbers



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Levels 8 – 15: mech shafts
@ 765 SF = 2.6% of floor

Level 7: mech shafts
@ 700 SF = 2.3% of floor

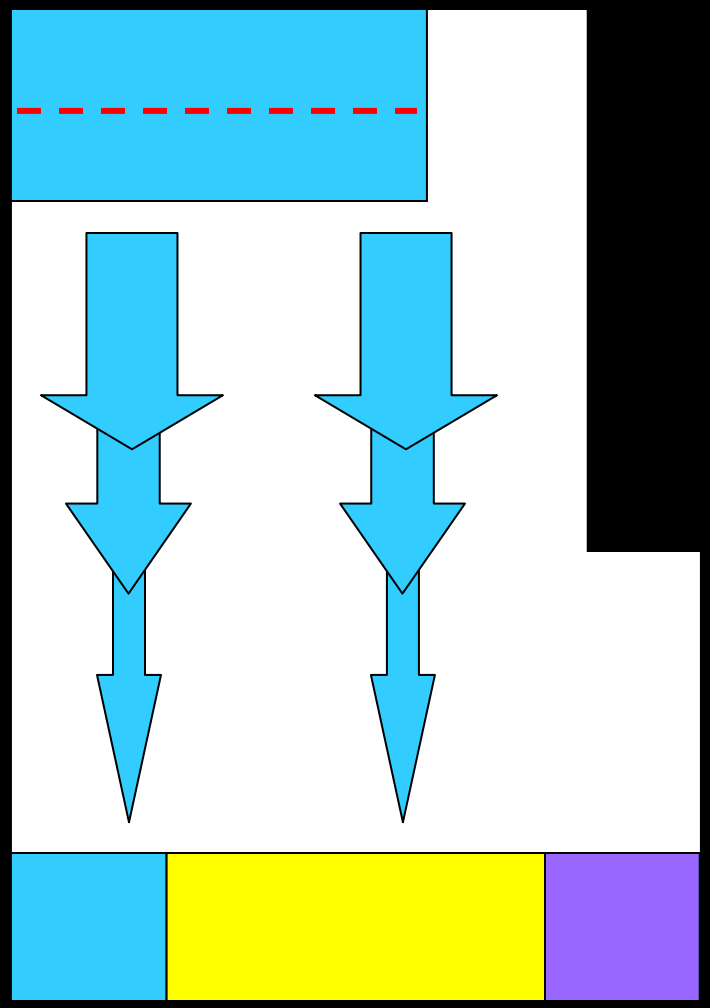
Levels 1- 4: mech shafts
@ 730 SF = 1.8% of floor

Note: Because they have no floor, shafts are not technically included in SF; shafts utilize floor area, however

Model A: Mech Shafts ≈ 10,000 SF of Floor Area

MEP & Building Configuration

The Real MEP Numbers



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Levels 9 – 12: mech shafts
@ 2,100 SF = 7% of floor

Levels 5 – 8: mech shafts
@ 1,400 SF = 4.6% of floor

Levels 1 – 4: mech shafts
@ 700 SF = 1.75% of floor

Model B: Mech Shafts = 18,000 SF Floor Area
(+8,000 SF Floor Area over Model A)

MEP & Building Configuration

The Real MEP Numbers

Another Building 2 Ways — Models C and D

400,000 BGSF with 6 programmed floors

- **60,000 SF – 74,000 SF per floor**

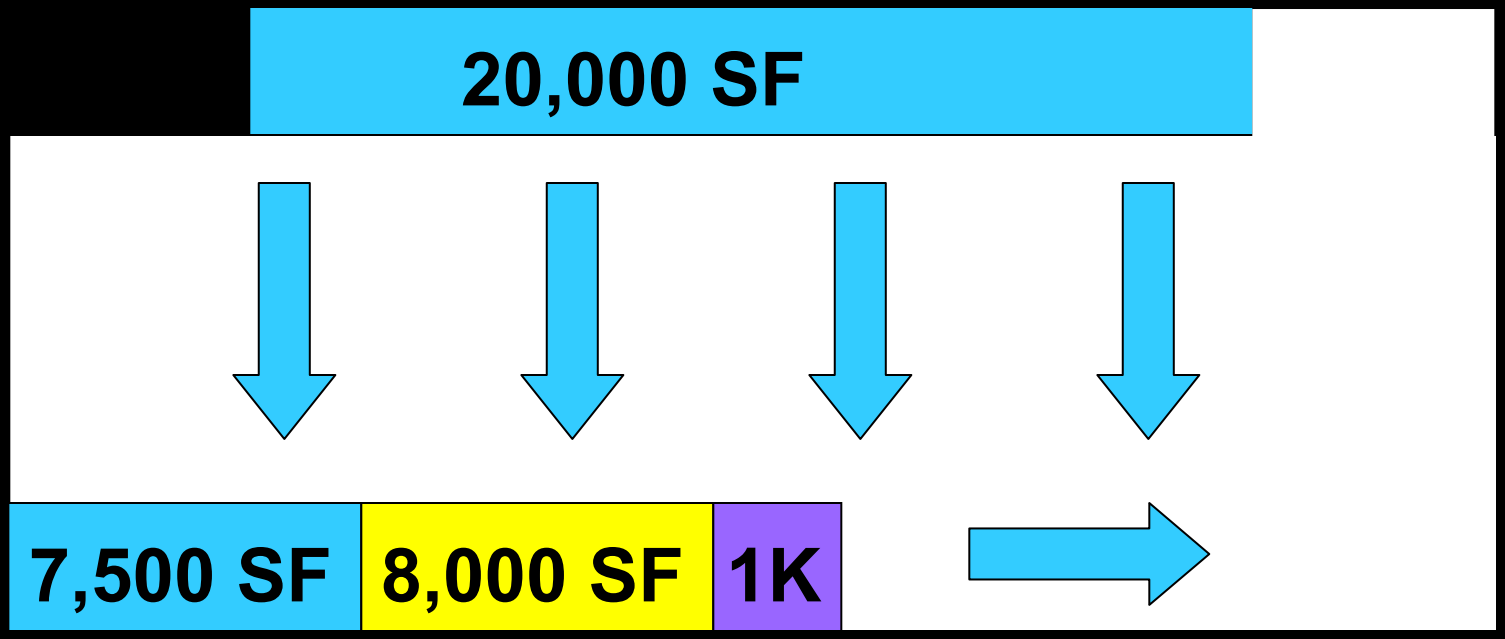
Based on the Cardiovascular Center at the University of Michigan

MEP & Building Configuration

The Real MEP Numbers

Penthouse mech (encl.); incl. in BGSF:
20,000 SF Mech
= 20,000 SF

Basement mech:
7,500 SF Mech +
8,000 SF Elec + 600 Plumb +
400 Fire Protection
= 16,500 SF



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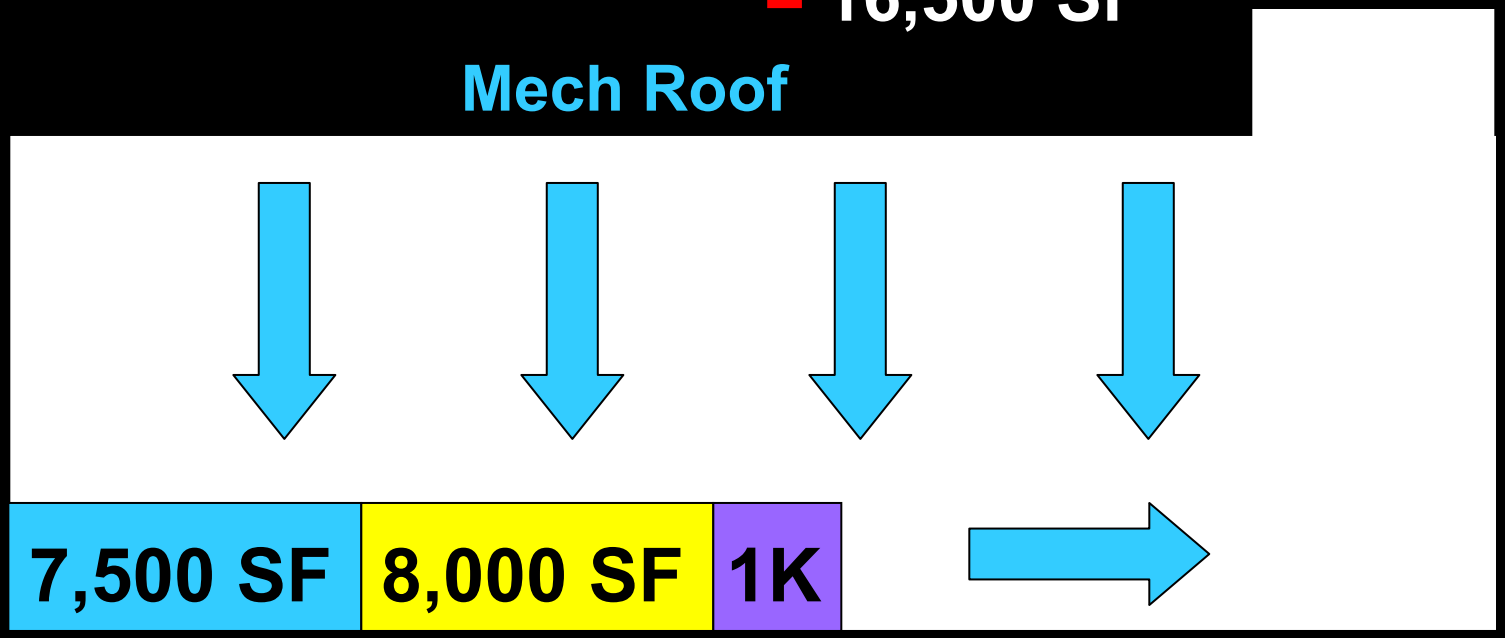
Model C.1: 36,500 / 400,000 = 9.1% Major MEP

MEP & Building Configuration

The Real MEP Numbers

Mech roof (exposed); *not* incl. in BGSF

Basement mech:
7,500 SF Mech + 8,000 SF Elec + 600 Plumb + 400 Fire Protection = 16,500 SF



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Model C.2: 16,500 / 380,000 = 4.3% Major MEP

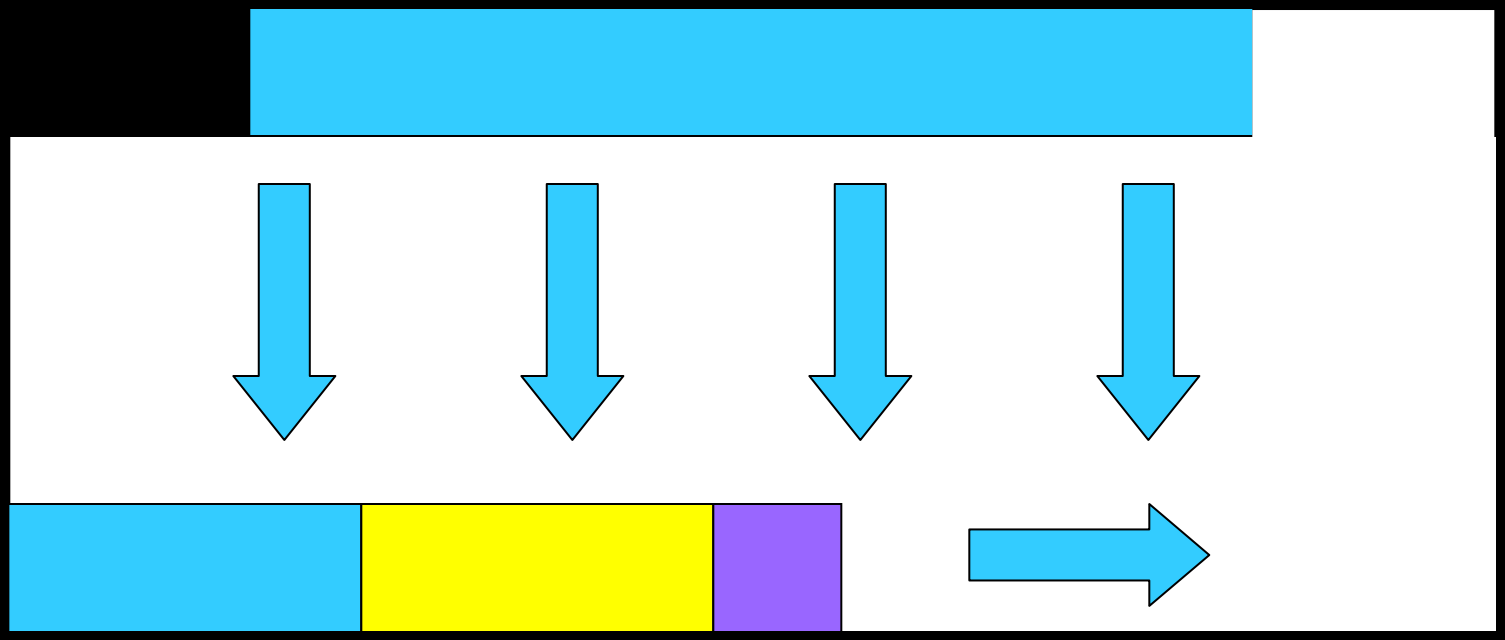
(Cost reductions less extensive than MEP % implies)

MEP & Building Configuration

The Real MEP Numbers

Levels 2A - 5: mech shafts @ 1,000 – 1,300 SF = 1.7 - 2% of floor

Level 2: mech shafts @ 450 SF = 0.75% of floor



Section

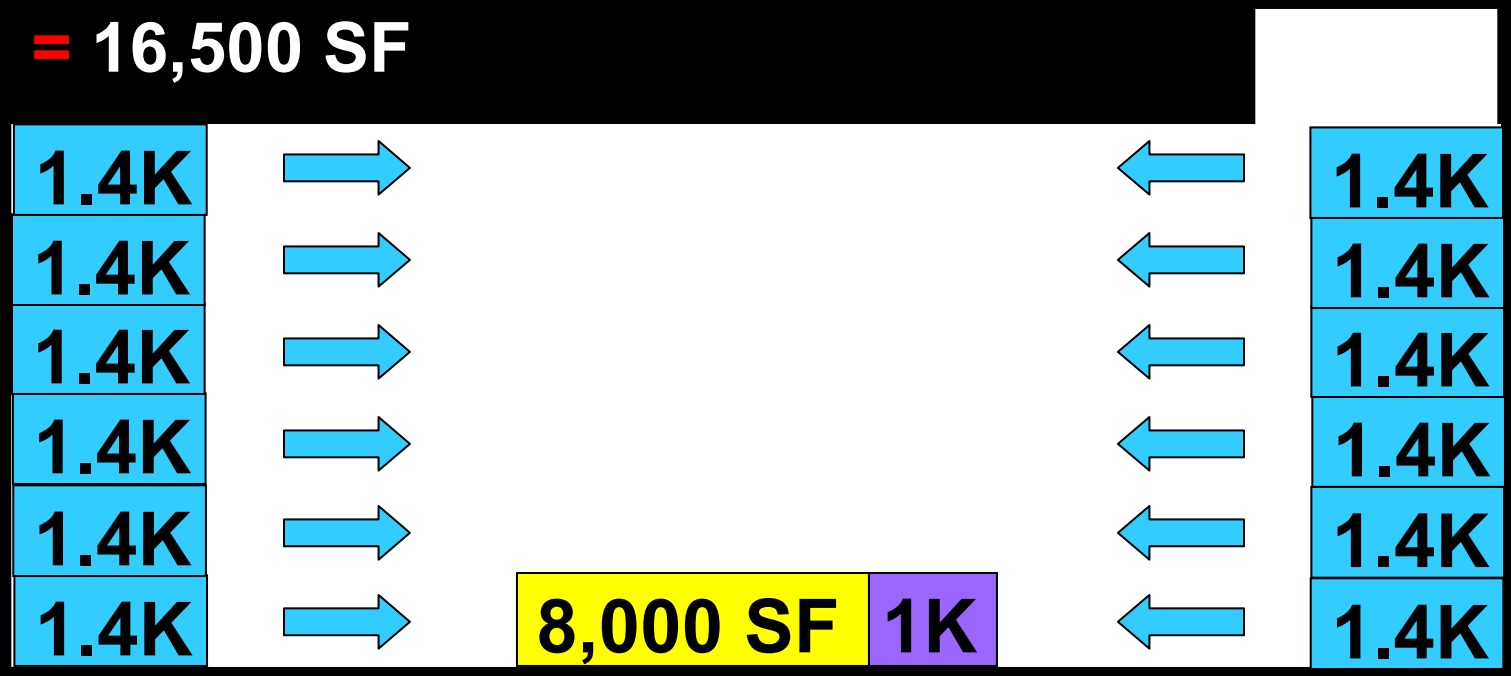
Model C: Mech shafts ≈ 5,400 SF of Floor Area

MEP & Building Configuration

The Real MEP Numbers

Distributed model: 2 AHU/floor @ 1,400 SF each = 16,800 SF

Basement level: 8,000 SF Elec + 600 Plumb + 400 Fire Protection = 16,500 SF



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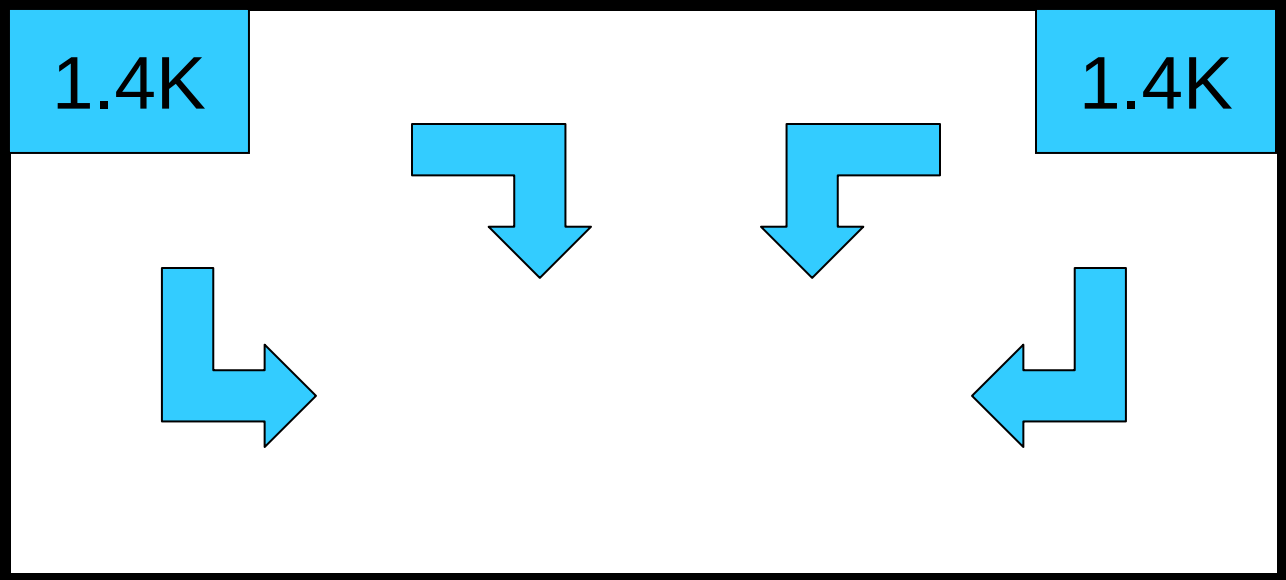
Model D.2: 33,300 / 400,000 = 8.3% Major MEP

MEP & Building Configuration

The Real MEP Numbers

Distributed model requires exterior corner access; better suited to D & T(?)

Minimal mech shaft requirements @ 200 SF/Floor



Plan

Model D.2: Mech shafts ≈ 1,200 SF of Floor Area (- 4,200 SF Floor Area required than Model C)

Central Utility Plant

- Assign ~ 10,000 SF for central plant (for 500,000 BGSF); may not all be required, but good starting point
- Height will matter; 18' clear minimum
- Portions of the plant may be included in new construction (flexibility of square footage and functional assignment)

Emerging Technologies

- **Many new technologies will most affect the size and systems of the central utility plant (many involve various heating/cooling storage functions)**
- **Other systems may reduce requirements for ductwork (building volume and efficiency)**
- **Countervailing forces include increasingly high tech/high energy equipment, isolation and air quality demands**

Summary

- General rules of thumb,

  -- MEP = 10% - 15% of BGSF

  (add for special programs)

  -- DGSF x 1.25 – 1.35 = BGSF

  are effective in this type of hospital

- Building configuration and location of MEP do matter