

# structural layout – 45 mins

- NO LATERAL LOADS considered:
- **THIS IS ONLY A PROBLEM TO RESOLVE VERTICAL LOADS, IN 1 DIRECTION ==> DOWN**
- be careful :
  - PROGRAM MAY LIMIT MAX SPANS OF STRUCTURAL MEMBERS
  - SHOW ALL COLUMNS FROM 2<sup>ND</sup> FLOOR IN 1<sup>ST</sup> FLR PLAN
  - **DRAW DECKING**

draw in this order: (start at high roof and then work down)

1. decking
2. joists
3. beams
4. columns or bearing walls

all **DECK** AREA must be supported at ALL PERIMETER WALLS  
via **joists, beams or bearing walls**

all **JOIST** ENDS (continuous length) must be supported  
via **beams or bearing walls**

all **BEAM** ENDS must be supported  
via **columns or bearing walls**

## JOISTS

### Spans < 30' long

- Joist depths (if req'd) will be ½ span in inches (ie 20ft span = 10 inches joist depth).
- It is less expensive to use longer joists than long spans of beams – see Dorf's solution example.
- The maximum span of roof decking determines joist spacing.

## BEAMS

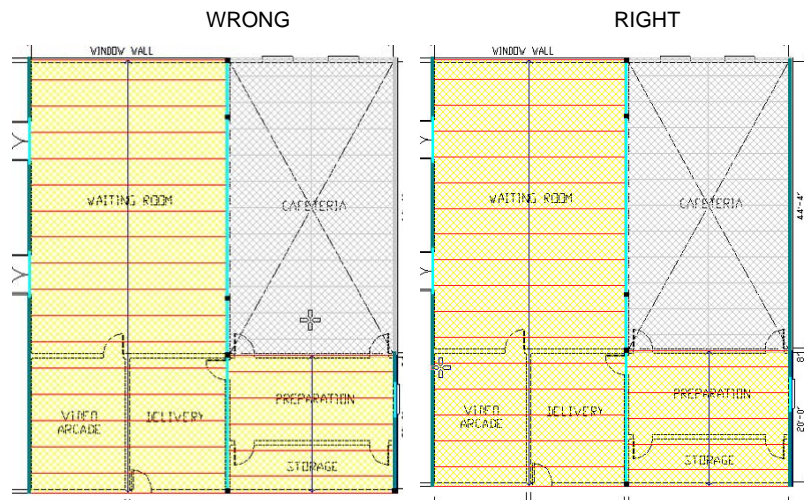
### Spans btwn 20' to 40'

- Serve as :
  - a) support for ends of joists
  - b) lintel over a max 6 ft door opening in that wall (ie. do not use to support a bearing wall that is placed over an opening greater than 6')
- Can be drawn continuously over columns

## CLERESTORY

### Must be supported from below WITH A BEAM (b/c clerestory CANNOT span an opening)

- If joists need support over clerestory, then a beam would be required over the clerestory.
- If the joists are running parallel to clerestory, then a joist is enough – no beam needed on upper floor.



# exit door / ramp / accessibility – 45 mins

- **START WITH PLACING THE CORRIDOR WALL & DOOR -- Don't forget**
- **PUT IN ALL SPOT ELEVATIONS -- Don't forget**
- **THE CODE YOU GET WITH YOUR TEST MAY VARY FROM THE CODE PROVIDED WITH THE NCARB PRACTICE PROBLEMS! FOLLOWING THE EXAM'S CODE IS KEY TO PASSING THIS EXAM.**
- Do not make any component larger than it needs to be b/c economy is an issue -- overbuilding may result in a downgrade.
- Keep changes of direction from entry door to hallway door to minimum

## DOORS

- Swing in direction of egress travel
- Should not obstruct stair or ramp travel
- Show adequate clearances

## HANDRAILS

- Show on BOTH SIDES of ramp & stairs
- May or may not be part of req'd ramp width –
  - Look for the wording "*clear between handrails*". If it doesn't say that, then the handrails can protrude into the required width
- Extend 12" top and bottom
- To get 12" handrail extensions, simply move/adjust (i.e. "stretch") handrail to edge of riser. Read the length of handrail at bottom of screen (say 5'-11"). Then, stretch another foot (ie. 6'-11").
- Stair railing on wall should **turn** 12" into corridor, so as not to reduce the width of the existing corridor

## LANDINGS

- Should be a **5' X 5'** UNobstructed spaces at top and bottom of ramp – RAILING CANNOT project into this space unless they are continuous or attached to a wall
- **The least dimension of landings shall not be less than the width of the stairs or ramps ==>**  
***ie, 8ft stair requires 8' landing***
- You need a landing at the top of your stair and ramp b/c no part of the ramp or stair shall encroach on the existing building. The top landing is considered a part of the ramp or stair
- The corridor must empty its full width into the adjoining space. Any element built *within* the limits of the corridor would be considered to be reducing the egress width of the corridor with the exception of railings no more than 4" off the wall.

**Therefore a landing the full width of the corridor must be provided.**

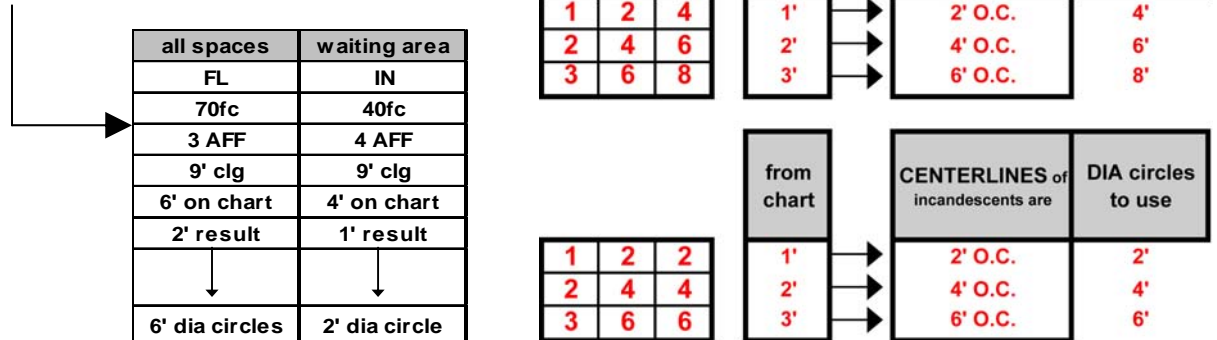
## RAMP

- Use 1:12 slope
- **Keep the width of the ramps either consistent or getting wider in the direction of exit**
- Ramps should run 48" min. to avoid trip hazard.
- Try to minimize segments of ramp (i.e. fewer landings).

# mechanical / electrical plan – 60 mins

## STEPS:

1. CREATE A CHART (this is an example only):



2. TURN OFF LAYERS:  
AREA FLOOR PLAN / MECHANICAL / STRUCTURE / DIMENSIONS
3. DRAW **X'S** IN EACH ROOM for centerpoints (ie, Sketch diagonals across each room to establish centers before drawing grids)
4. DRAW CIRCLES (refer to Dorf's book) –  
Make sure you realize the difference between drawing radii and the resultant diameters (don't confuse them – easy to do when you are in a hurry)
5. LAYOUT LIGHT FIXTURES & CENTER W/ **X'S** ==> Move circles over to the next room after drawing a room
6. DRAW GRIDS – ALL AT THE SAME TIME (faster that way) – Remember that you can rotate for better positioning.
7. USE MOVE TOOL TO CENTER THEM W/ LIGHTS
8. HIDE ALL SKETCH ELEMENTS
9. ID EACH ROOM AND **LAYOUT DIFFUSERS AND RETURN GRILLES (TOUCHING 3 SIDES OF GRID!)** based on sq ftg's
  - Keep supply and return diffusers **at least 4' apart**.
  - 1 SUPPLY Diffuser FOR EVERY 144 sf
10. TURN OFF ALL LAYERS EXCEPT MECHANICAL + STRUCTURAL
11. LAYOUT RIGID DUCTS + FIRE DAMPERS (in fire-rated walls)
12. MOVE, TWEAK AND ADJUST PLANS, etc, UNTIL ALL DONE
13. HIDE ALL LAYERS AND CHECK ALL (ie clearances btwn diffusers & return grilles [ $>4'$ ])

## LIGHT FIXTURES -- REFER TO DIAGRAM ABOVE :

### FLUORESCENT LIGHTS

- SPACE 2', 4', 6' 8' APART (**BTWN EDGES**)
- Keep 1'-3' from walls – MAX 4' from wall

### INCANDESCENT LIGHTS

- SPACE 2', 4', 6' 8' APART (**AT CENTERLINES**)
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## SUPPLY / RETURN DUCTS / FLEX DUCTS **CAN cross over lights**

### RETURN DUCTS

- Length of rigid duct from the plenum to return duct should be **1' - 2'**

### SUPPLY

- RIGID DUCT should be **1' FROM BEAM**

### FLEX DUCTS

- Should be Max. 10'-0" long from duct to center of diffuser

### EXIT SIGNS

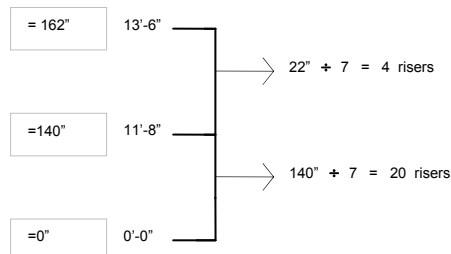
- If required, show at all egress doors

# stair design – 60 mins

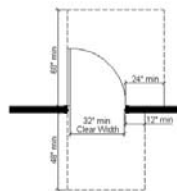
STEPS: 1. DRAW a CHART (this is an example only):

	ELEVATIONS	OCC.LOAD	# EXITS	OCCUP		WIDTH
SECOND	13'-6"	440	2	220	X .3 =	66
STORAGE	11'-8"	5	1	5	X .3 =	15
GROUND	0'-0"	540	3	180	X .3 =	54

2. DO a HEIGHT DIAGRAM



3. SKETCH DOOR CODES:



4. SKETCH DOORS FROM GROUND FLOOR / OTHER FLOORS (with correct swings)

5. SWITCH TO UPPER / HIGHEST FLOOR

6. DRAW LANDINGS – **START AT DOOR FACE – NOT WALL**  
 – Be aware of clearances for handrails

7. DRAW TREADS AND SKETCH UNTIL SOLVED  
 Note – The landing is considered a tread  
 ID to check riser heights / you draw stairs 2 at a time so less clicking

8. SHOW ALL ELEVATIONS

9. CHECK FOR CLEARANCES ON DOORS BELOW / HEADROOM  
 – **The area in which headroom is an issue is set by the width of the ground stair with the path in a straight line to the exit.**

10. ID EVERYTHING AT THE END to check that your treads and risers are ok

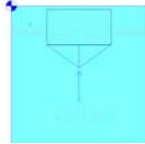
- Do not make any component larger than it needs to be b/c economy is an issue -- overbuilding may result in a downgrade.
- **DOORS:** DO NOT REDUCE REQ'D LANDING WIDTHS BY MORE THAN ½ OF THEIR REQ'D WIDTH
- **MINIMUM STAIR WIDTH governed by one out of these 3:**
  1. OCCUPANT LOAD –  
 (total occupancy ÷ by # exits) × (0.3)
  2. MIN. STAIR WIDTH BY CODE
  3. REQ'D CLEARANCE BTWN RAILINGS BY CODE (Area of Refuge)
- **AREA OF REFUGE**
  - One 30"x48" space is required **FOR EACH 200 OCCUPANTS** (4<sup>th</sup> column in chart above)  
**# OF OCCUPANTS = (total occupancy ÷ by # exits)**  
 IF # > 200 (ie 220) you need 2 AOR's, not one
  - If A.O.R. is required, then USUALLY (check code you get on the exam) the minimum stair clear width = 48" (+ 4" handrail + 4" handrail = 56" = 4'-8" total width).
- For final run of stairs (or any other stairs below top level) :  
 Occupancy level on that fir will determine stair width to grade (if larger than widths above)
- Look for wording "**clear between handrails**". If it doesn't say that, then the handrails can protrude into the required width.
- WATCH OUT FOR **DEVIANCES IN CODE on exam**, ie: Door pull side clearance of 24 instead of 18" / 8'-0 door

# roof plan – 45 mins – p1

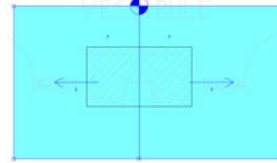
STEPS:


1. Draw ROOFS with NODES at all intersections with the other roof
2. Use CHECK tool for intersections
3. Add FLASHING
  - Draw ONLY at intersections of low roofs & upper roofs (ie, only at the dotted lines!)
  - Draw around all 4 sides of chimney (except if at roof edge – omit that side)
4. Add CRICKET
  - Length of the ridge of the cricket will be half the length of the chimney

cricket needed here:



cricket not needed here:



5. Add CLERESTORY
  - Make sure that you place the clerestory in the right direction!!!!!!!
  - Show clerestory on inside of flashing at higher roof
  - If it says a “continuous” clerestory, extend it all the way to both ends (to the limits of the software) – even if it extends beyond intersection of the two roofs
6. Add GUTTERS and DOWNSPOUTS – *see next page for tips on modifying gutters*
  - Do not put gutters at edge of chimney coinciding w/ roof edge
  - Keep at least 3 ft from skylights
  - Should not conflict with doors, columns, windows or clerestory
  - Gutters > 40' or more should receive a third downspout
  - Leave 8 inches between high point of lower roof and low point of upper roof for gutter and downspout
7. CHECK window / column clearance with downspouts
8. Add SKYLIGHTS
  - Note that skylights may have exceptions for placement (ie not in corridors or closets) → read the program
  - Rotate the skylights so that the long side is running with the slope
9. Add VENTS / check if they can be shared between rooms or not
  - Exhaust fan vent 
    - Locate within the space above the toilet or fixture(sink) unless shared between two spaces -- then they are located within the shared wall
  - Plumbing vent stacks 
    - Usually shared
    - Locate within the wall except they may be offset to miss a ridge
10. To prepare for HVAC placement, Draw a 5' DIA circle & locate on correct rooftop AWAY FROM clerestory view
11. Put HVAC unit in center of circle
  - Avoid putting over occupied rooms (vibrating) – put in unoccupied spaces (ie hallway)
12. MOST IMPORTANT: Check that roofs are all round #'s because of the software glitch
  - (ie, a roof that you set as 10'-0" could, because of software problems, could turn into 9'11". if it becomes incorrect, correct it and keep it shown there!)

# roof plan – 45 mins – p2

## THE GUTTER MOVING PROBLEM:

OK, a lot of people find it hard to move / erase gutters.

I found the one thing that works for me at least, and I hope works for others so that there is one less stupid NCARB glitch that we have to worry 'bout:

#1) to adjust, move, erase a gutter, DO NOT click on the inside of the gutter or at the short ends (where you think you can move it). you have to remember which side you started to draw the gutter on. then you have to move your cursor to align EXACTLY on the line and then can move it.

simply, click on one of the long sides of the gutter, if one does not work, click on the other side. then you can move it. clicking on it anywhere else does not seem to work.

ALSO, you should click on a CORNER of the gutter (on the side that you can move) and you can move the gutter that way. Remember it is a corner of the rectangle and a side of the gutter, not in the middle.

#2) now if the gutter is aligned with a roof edge, it is not going to allow you to pick it (unless you get lucky and one of your 100 clicks "catches" it).

the only thing that worked here, as mentioned by a former poster, is to make a new node on the roof, move it. then pick on one of the edges of the gutter and start # 1 over again. once you are done, move the node back to the edge of the roof.

