FACULTY WORKSHOPS DEVELOPMENT PROJECT

AGENDA

- Current Situation
- Findings on Current Situation
- Workshop Development Objectives
- Development Consideration.

COURSES – WORKSHOP MATRIX

MAINSTREAM & MANF

Courses	No. of Students	No. of Lab.	Turning	Milling	Drilling	Shaping	Grinding	Filling	Welding	Forgoing	Foundry	Carpentry	Forming	Polymers	Sand Lab	CNC	Measure Lab	Non Conventional
Production Engineering	**2000**	**2**	X	X	X	X	X	X	X	X	X	X	X					
Manufacturing Tech (1) 1st Year Mech.	**460**	**3**	X	X	X	X	X			X			X					
Manufacturing Tech (2) 2nd Year Mech.	**400**	**2**							X		X				X			
Manufacturing Tech (3) 3rd Year Prod.	**70**	**4**	X	X	X	X	X											
Machine Tools Design 3rd Year Prod.	**70**	**2**	X	X	X	X	X						X	X				
Theory of Metal Forming 3rd Year Prod.	**70**	**2**											X					
Mechanical measurement 3rd Year Prod.	**70**	**4**															X	
Theory of Metal Cutting 3rd Year Prod	**70**	**2**																
CNC 4th Year Prod.	**70**	**2**	X													X		
Metrology 4th Year Prod.	**70**	**4**	X	X	X		X										X	
Production Engineering	**700**	**1.5**	X	X	X	X	X	X	X	X	X	X	X					
Numerical Control Machines	**20**	**3**														X		
Metal Forming Processes	**20**	**2**								X			X					
Non-Conventional Material Fabrication and **Heat Treatment Processes**	**20**	**3**									X							
Non-Conventional Machining	**20**	**2**																X

TYPES MACHINERY AT THE WORKSHOP

Prep Machining Workshop	Prep Welding Workshop	Prep Carpentry Workshop	Prep Forming Workshop	Old Welding Workshop	Old Machining Workshop		Foundry
مخرطة	ماكينة لحام نقطة	رابوه	مقص يد	ماكينة لحام كهربى SMAW	فريزة عامة مقاسات مختلفه	ماكينة التجليخ الإسطوانى الداخلى	فرن صهر يعمل بنظرية الحث الكهربى
حجر جلخ	ماكينة لحام كهربائى	منشار	مقص رجل	ماكينة لحام كهربى GMAW	فريزة لفتح التروس	ماكينة التجليخ الإسطوانى الخارجى	فرن صهر أرضى يعمل بالسولار
فريزة عامة		منشار رأسى	ماكينة نجارة	ماكينة لحام كهربى GTAW	مخرطة مركزية مقاسات مختلفه	ماكينة التجليخ السطحى	أفران صهر صغيرة تعمل بالمقاومة الكهربية
فريزة رأسية		ماكينة صنفرة	ماكينة تنى حديد	ماكينة لحام كهربى PAC	ماكينة هوب لفتح التروس	ماكينة التجليخ العائم	تجهيزات معمل إختبار رمل السباكة
جلخ سطحى		رابوه بتخانة	مكبس هيدروليكى	ماكينة لحام كهربى RSW	مخرطة كابستن	ماكينة سن العدة	
جلخ اسطوانى		حلية	مقص كهربائى	إسطوانات للحام والقطع بلهب الأكسى أسيتيلين	منشار ترددى	المقشطة العربة	
طقم ماكينة خط الومنيوم 10 ماكينات		مخرطة خشب	تناية		منشار شريط	المقشطة النطاحة	
مقشطة		تخانة	لف صاج		فريزة رأسية	المقشطة الرأسية	
منشار ترددى كبير		ماكينة لحام شريط	مكبس هوائى		فريزة أفقية	مثقاب شجرة	
صاروخ قطعية		ماكينة سن شريط	مكبس مطرقة			مثقاب دف	
منشار شريط حدادى		ماكينة سن تزجة	مكبس				
مثقاب تزجة		ماكينة سن	ماكينة قلوظة مواسير				
مثقاب شجرة		منشار شريط خشب					

CURRENT MECHANICAL WORKSHOP

The Current Mechanical Workshop Machinery is divided in two Location:

1) Old Workshop occupies ≈ 1000 m^2
2) Preparatory Year Workshop ≈ 400 m^2

Total Area = 1400 m^2

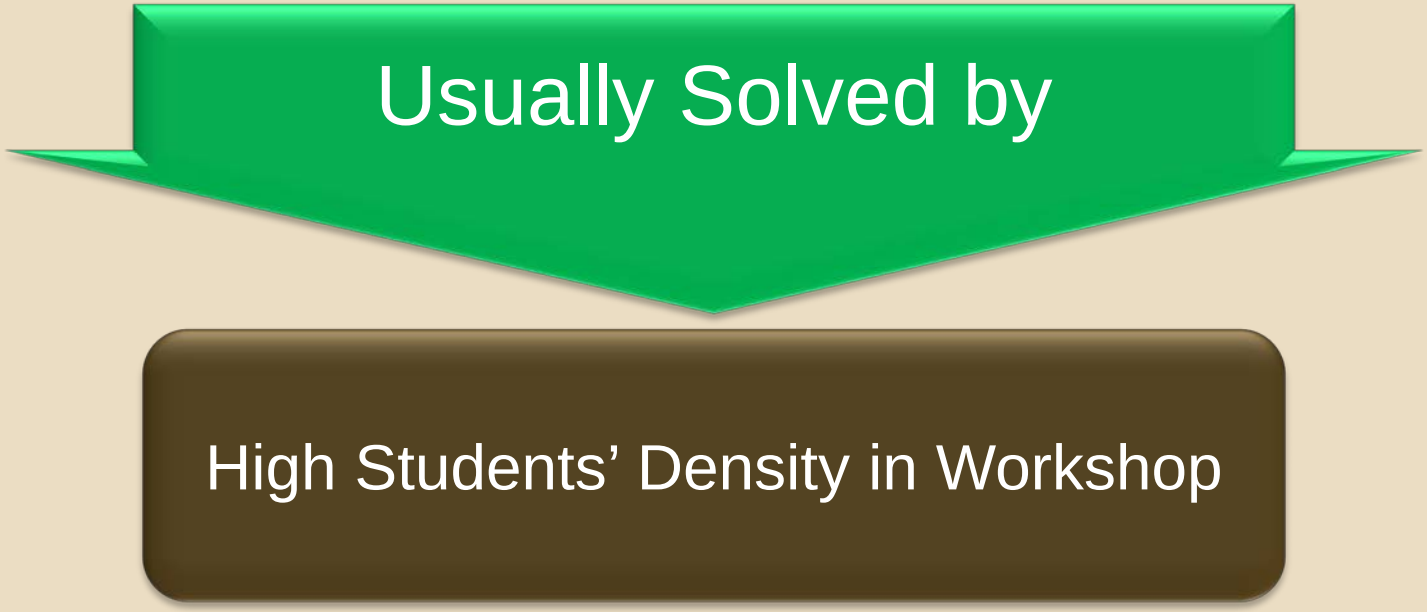
FINDINGS ON CURRENT SITUATION

- The Workshop serves 19 courses.
- Total 8330 students hours per week.
- Different courses need the same machine (i.e. 5 courses need the shaping machines).
- The Workshop includes 52 different types of machinery.
- The Mechanical Workshop includes 21 different types of machinery.
- The machines serve not only teaching but also course projects, graduation projects and research.
- Available teaching slots are limited.
- No qualified technicians/trainers are available.

FINDINGS ON CURRENT SITUATION

Previous Findings caused the following:

- Most of the machines serve more than one course, which in turn caused high probability of Clashes between courses on the machines.



WORKSHOP DEVELOPMENT OBJECTIVES

- Modernize the Workshop.
- Develop the human resources working at the workshop.
- Design New layout for the workshop satisfying the following:
  - Serving all courses with the highest possible quality.
  - Improve the machines utilization.
  - Maximum area utilization.
  - Workshop Safety precautions.

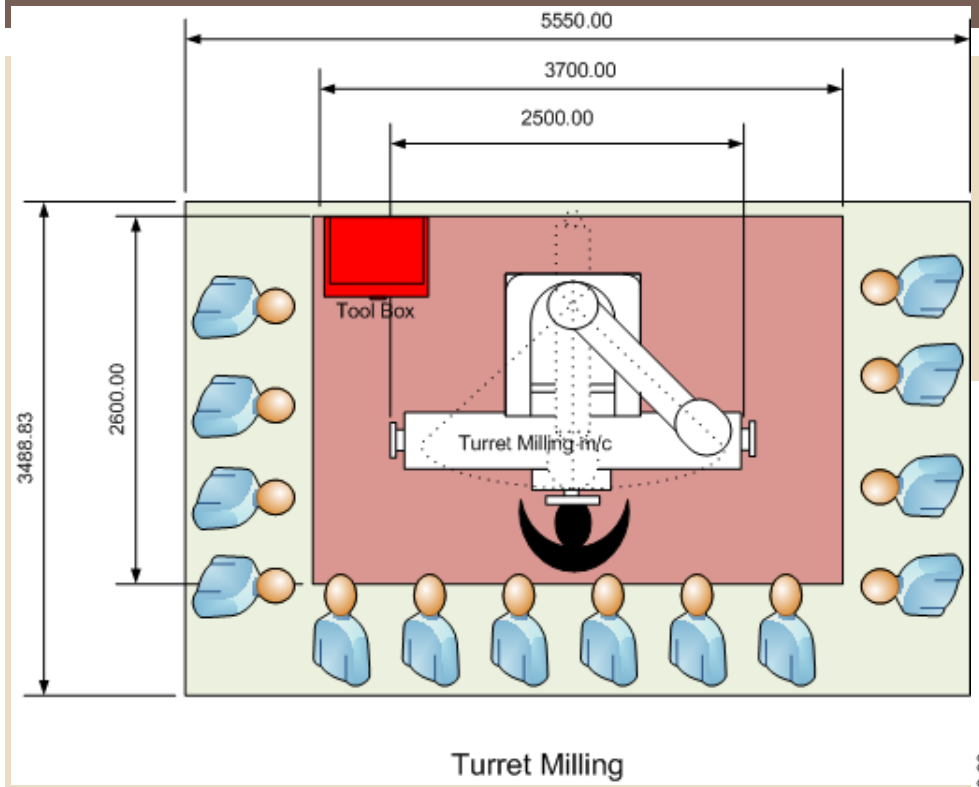
NEW LAYOUT DESIGN CONSIDERATION

1. Courses Considerations:
    1. Course Coincidence Factor: The ratio of courses that need the workshop each semester.
    2. Course Rotation Cycle: The number of weeks that certain machine will be needed for a specific course each semester.
    3. Scheduling Flexibility Factor: The probability that for specific course the workshop content schedule can be made to float over the semester.
    4. Students Activities at the workshop (observing, recording, sketching and/or hands-on).
    5. Number of students that attend the workshop for each machine.
    6. Number of Students registered in the course.
    7. Number of students per section in the course.

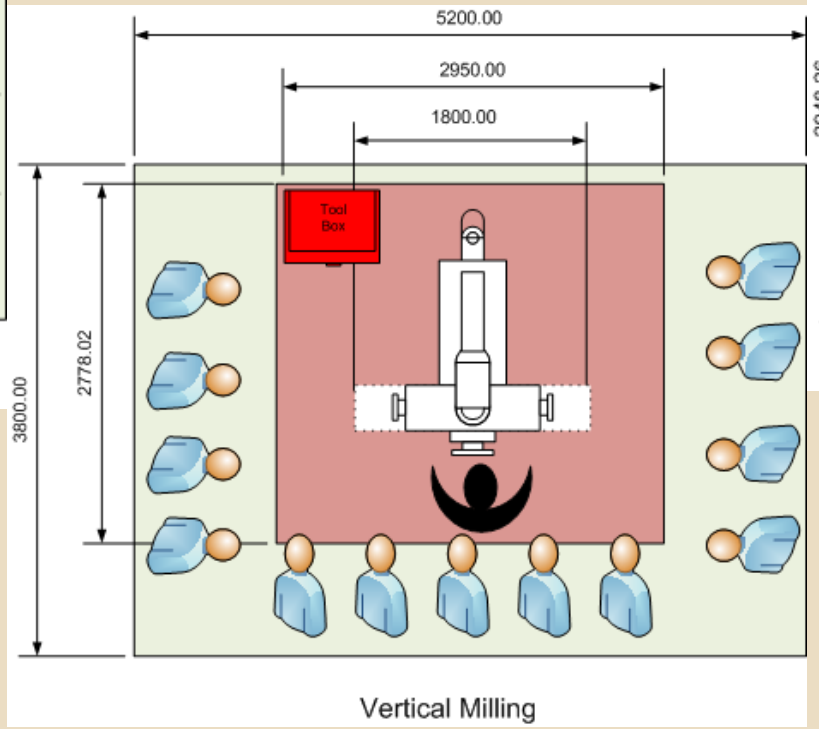
NEW LAYOUT DESIGN CONSIDERATION

2. Workstation Considerations:
    1. Machine dimensions.
    2. Machine working area.
    3. Maintenance area.
    4. Operator’s working area.
    5. Working bench(s).
    6. Maximum number of students in the workstation area.
    7. Share of Aisles.

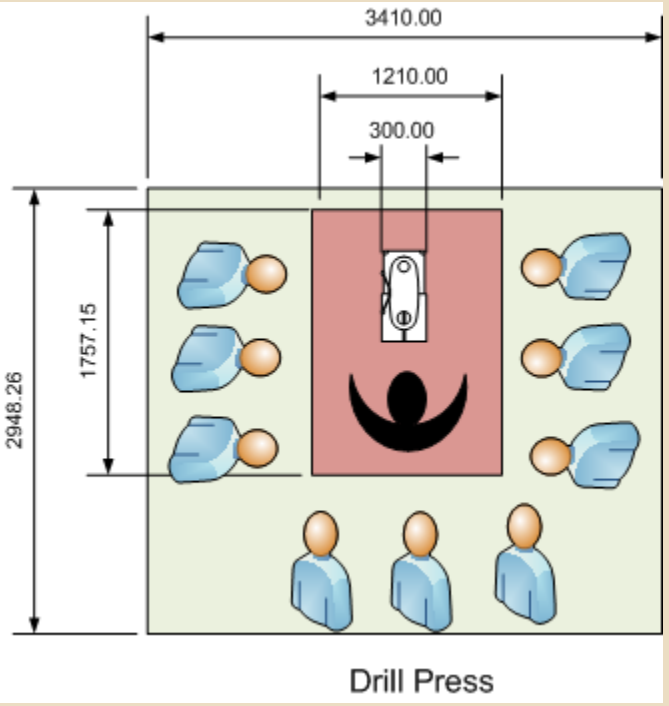
DESIGN OF MACHINE WORK STATIONS



Turret Milling

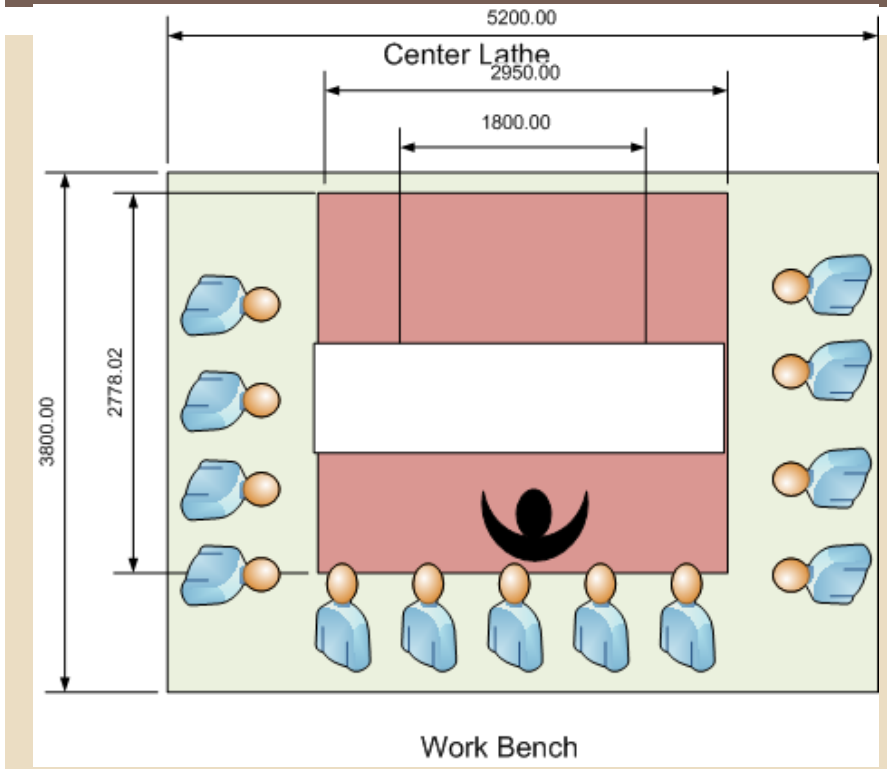


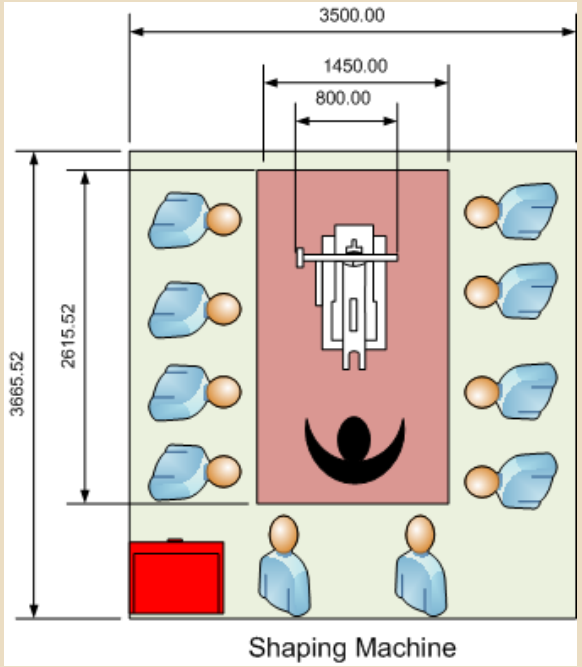
Vertical Milling

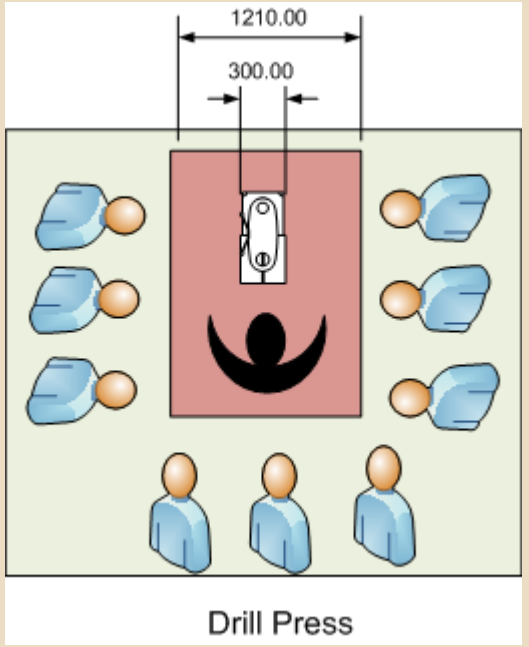


Drill Press

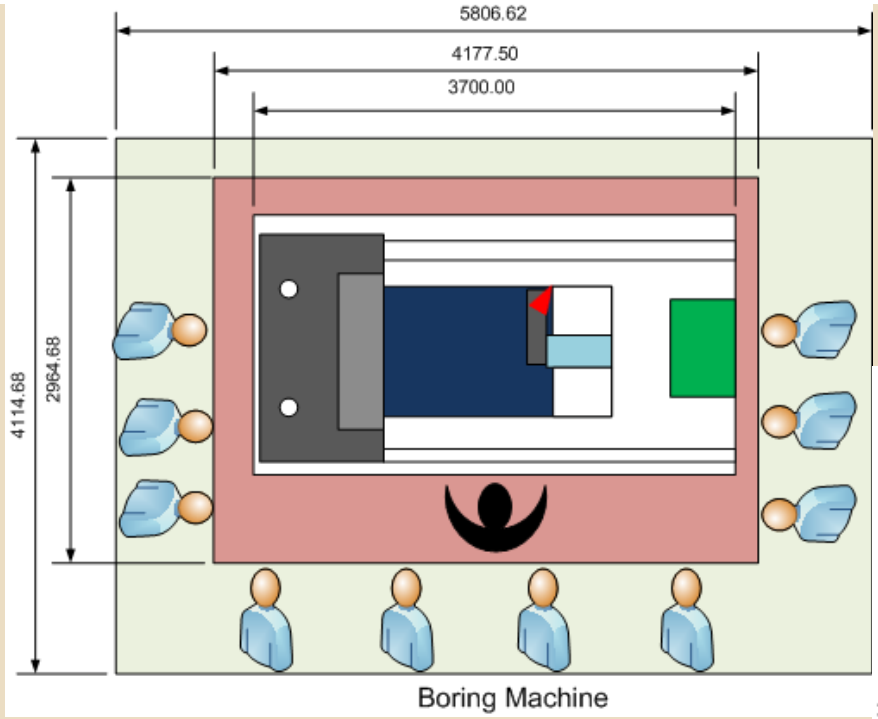
DESIGN OF MACHINE WORK STATIONS



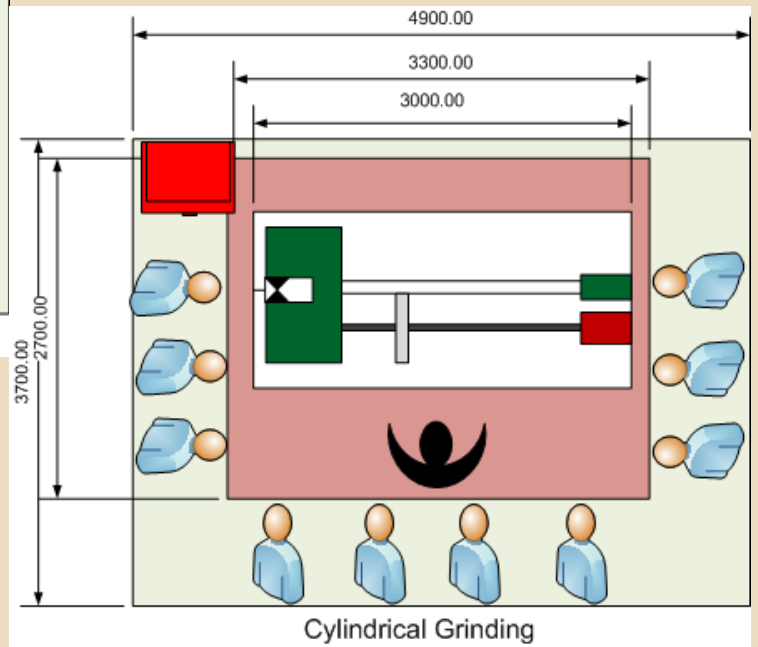




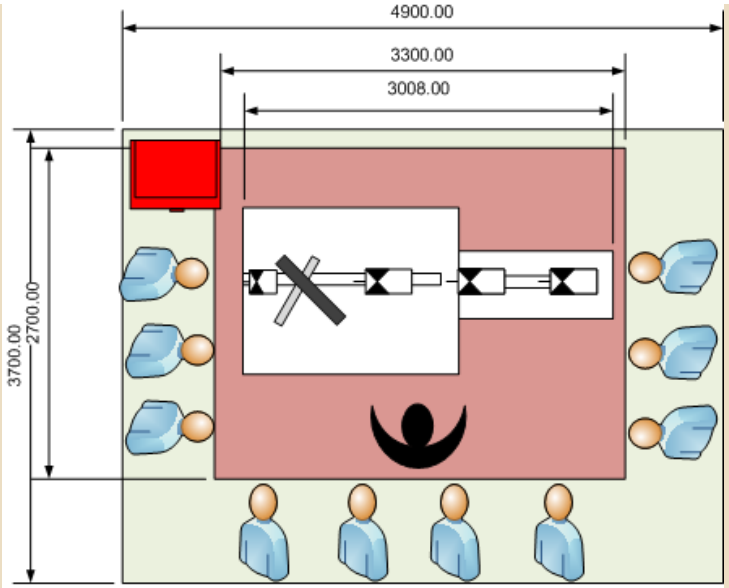
DESIGN OF MACHINE WORK STATIONS



Boring Machine

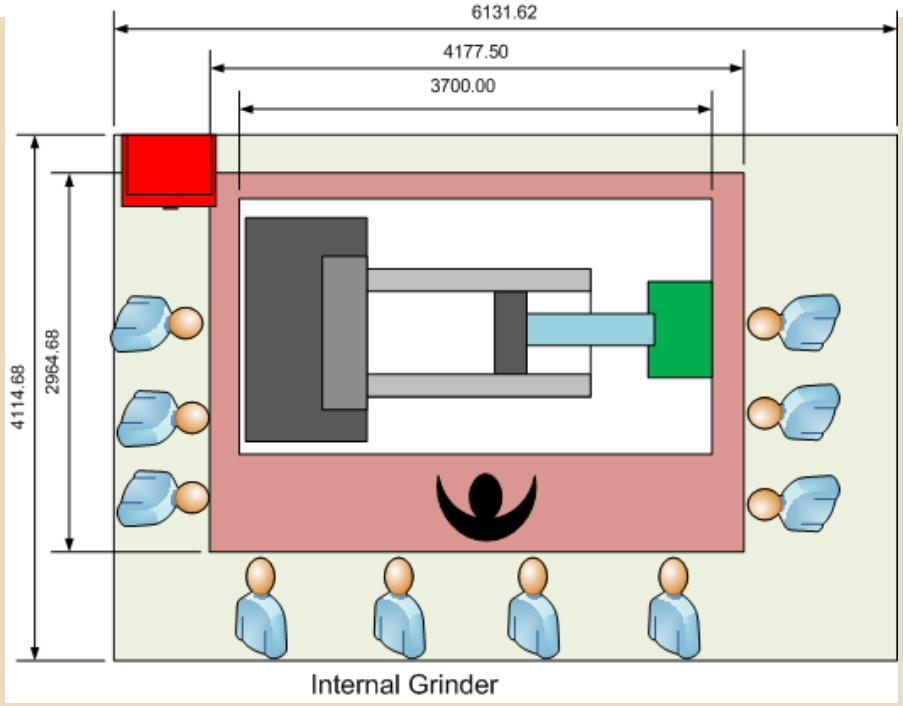


Cylindrical Grinding

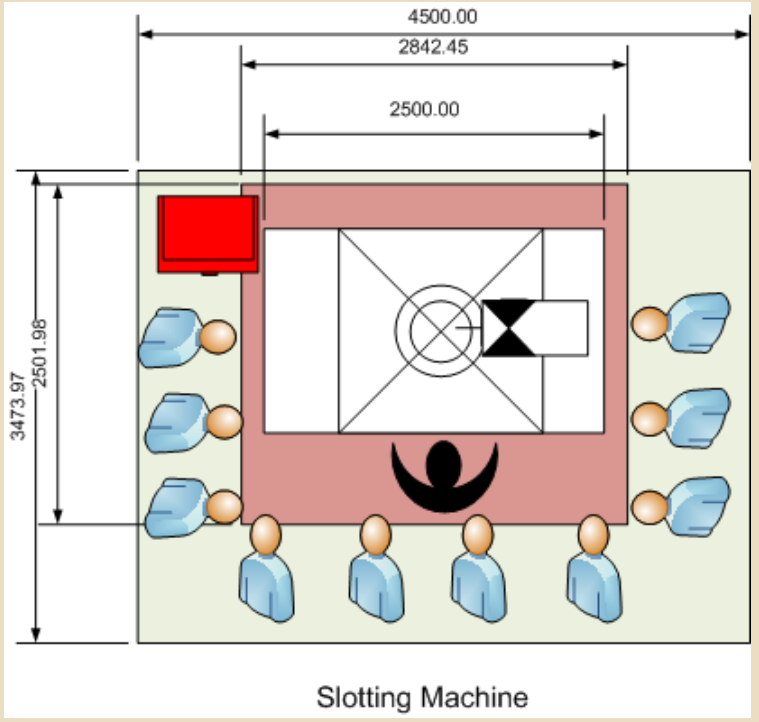


Center less Grinder

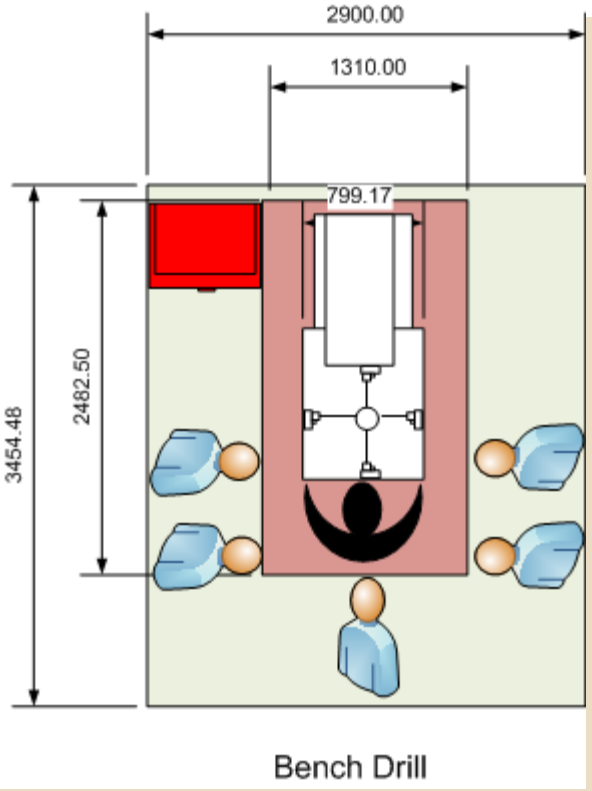
DESIGN OF MACHINE WORK STATIONS



Internal Grinder



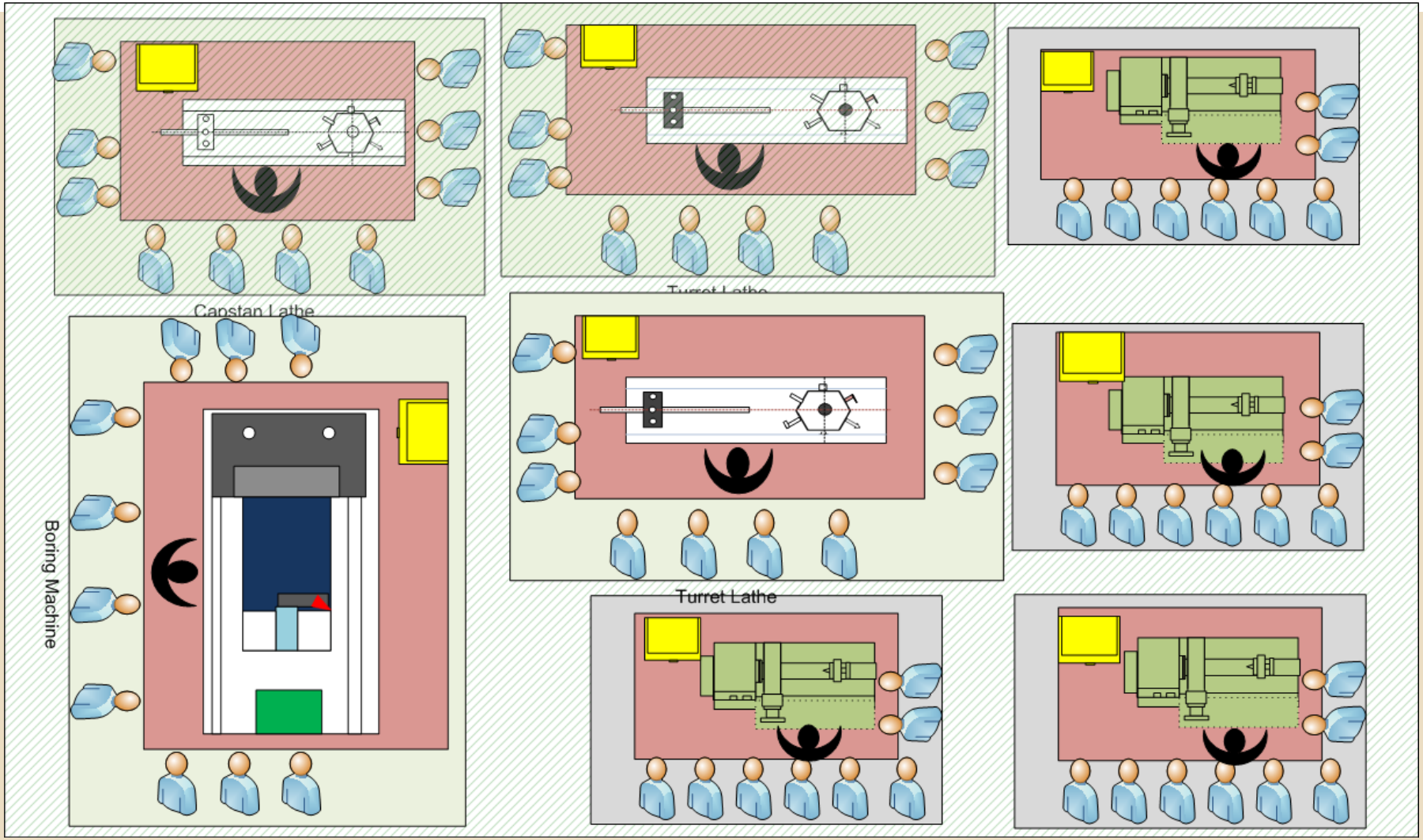
Slotting Machine



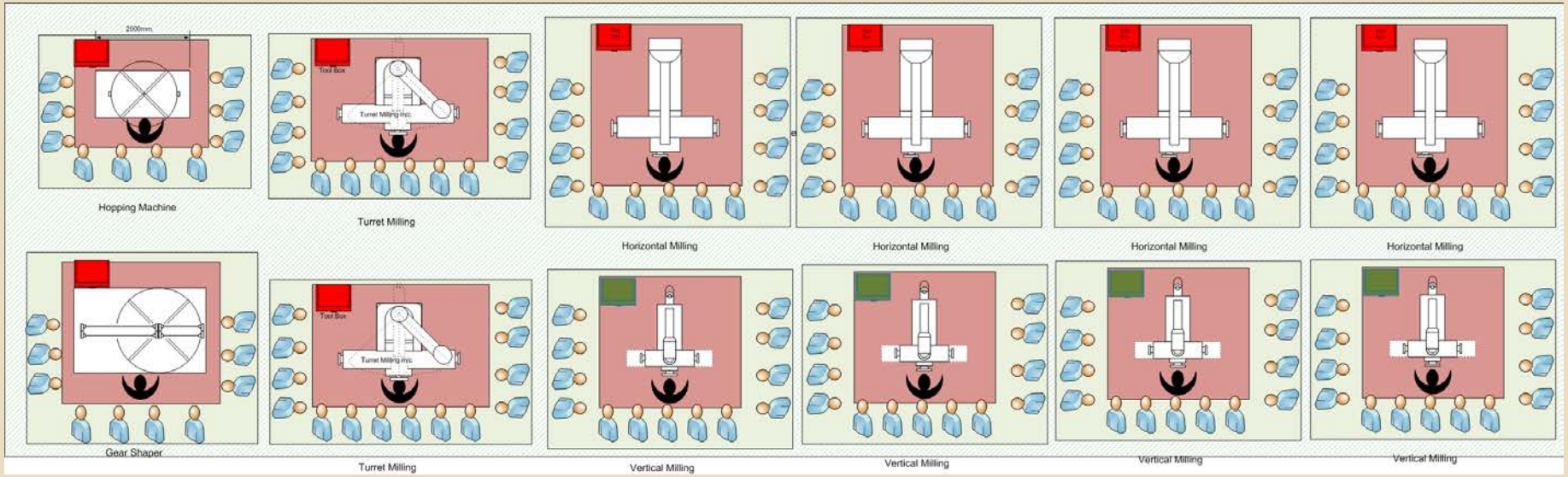
Bench Drill

DEPARTMENTS' LAYOUT

Turing Department



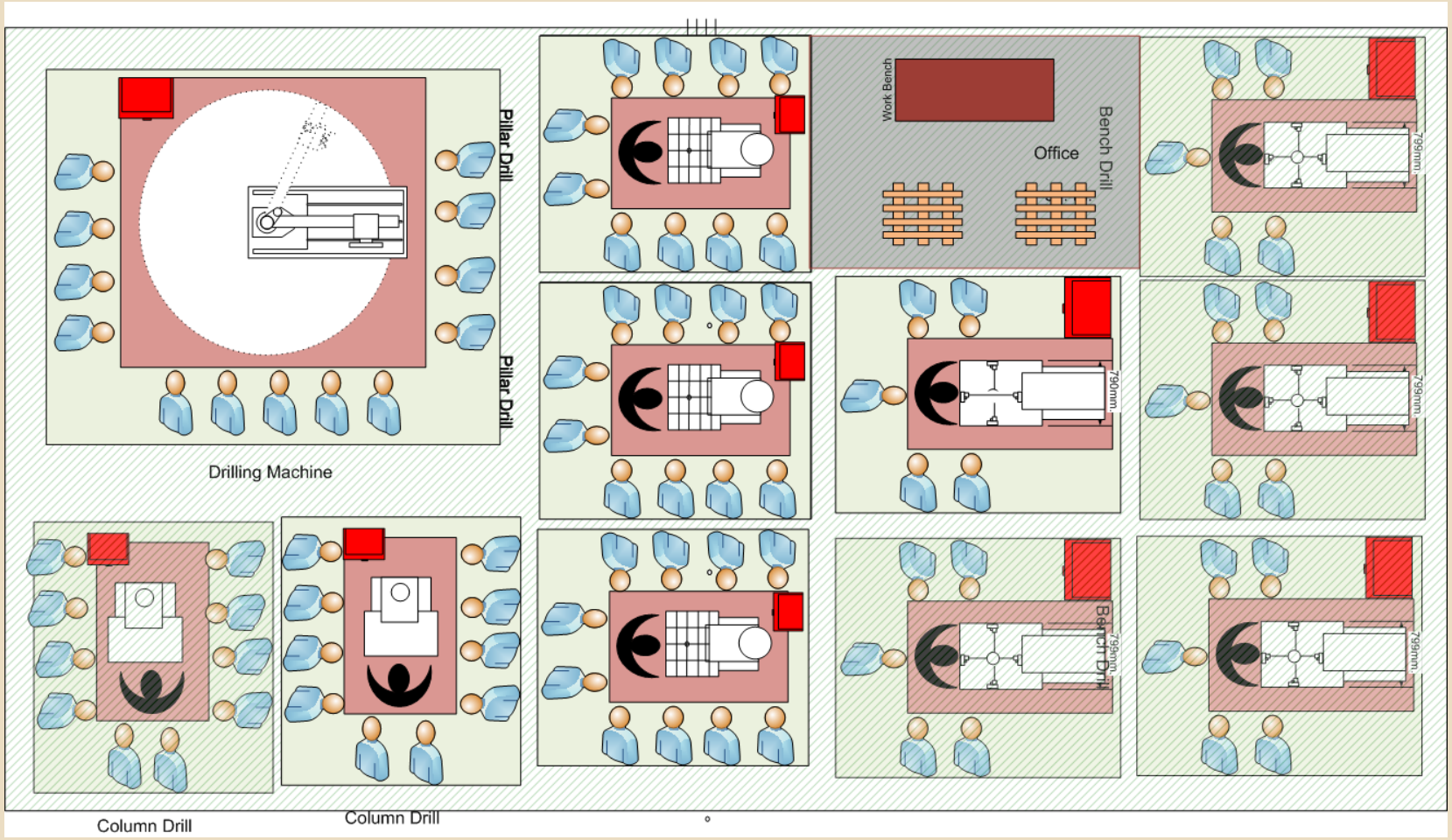
DEPARTMENTS' LAYOUT



Milling Department

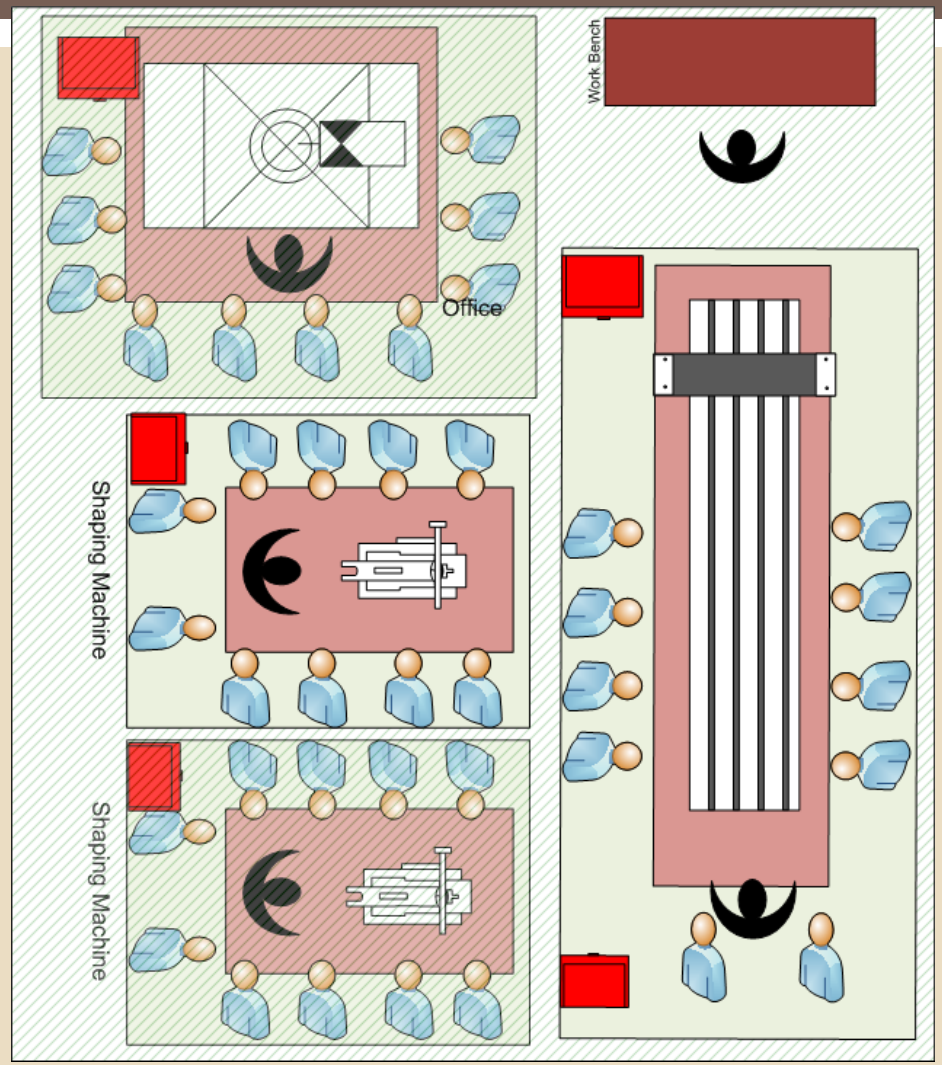
DEPARTMENTS' LAYOUT

Drilling Department



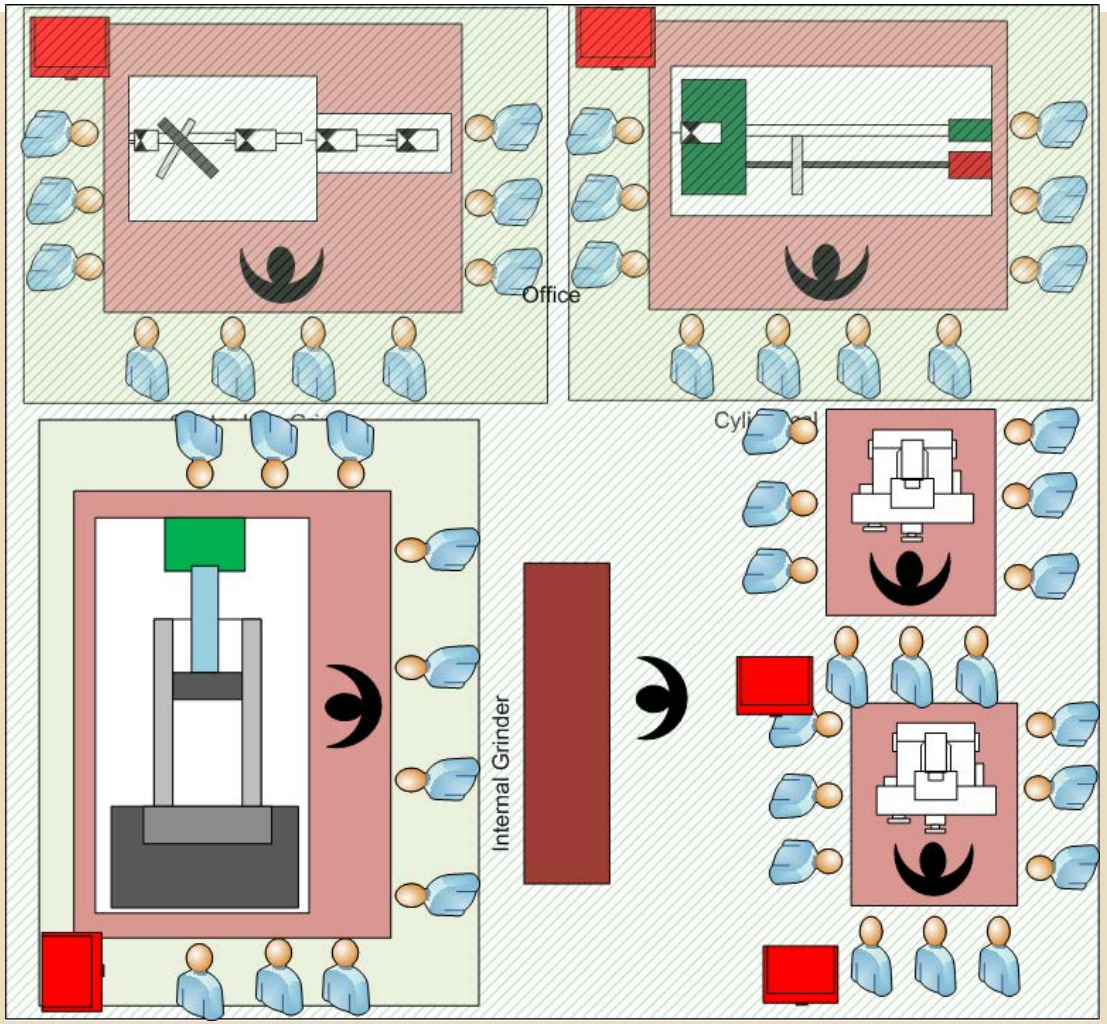
DEPARTMENTS' LAYOUT

Shaping Department



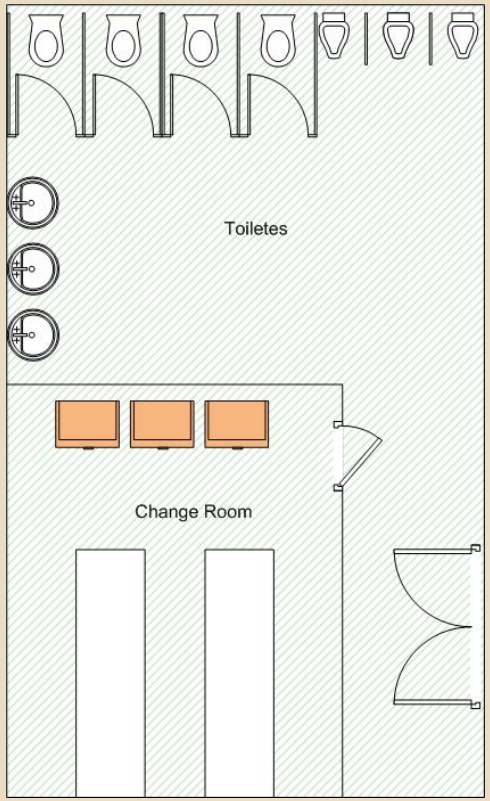
DEPARTMENTS' LAYOUT

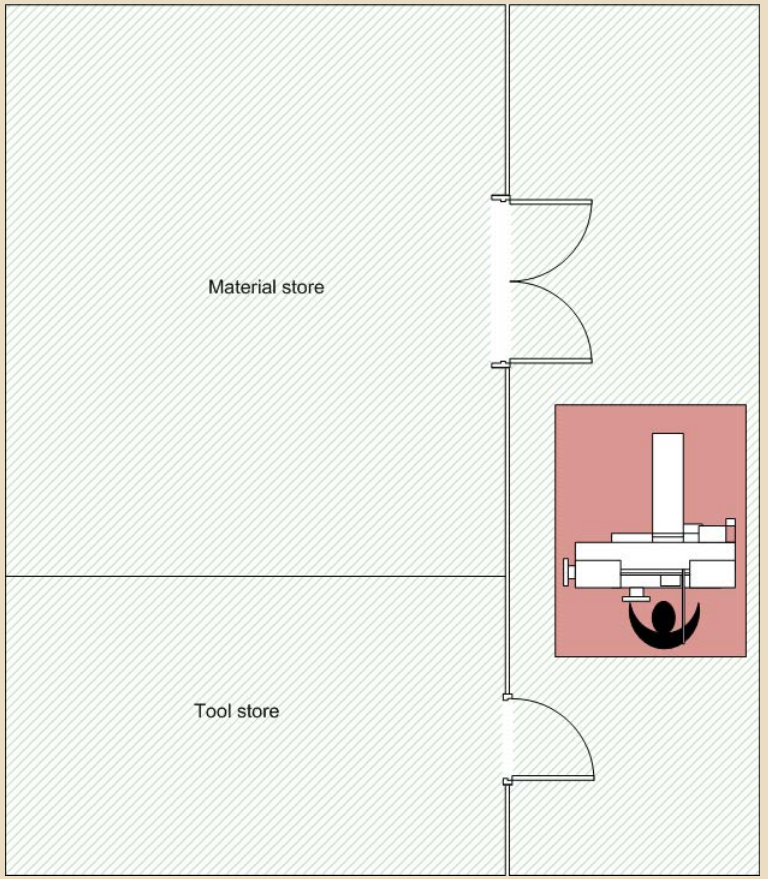
Grinding Department



DEPARTMENTS' LAYOUT

Service Departments





ACTIVITY RELATIONSHIP DIAGRAM

		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26
1	Raw Material Stores (Metallic materials)	X	X	I	E	I	I	I	I	I	O	O	I	I	X	X	X	I	I	I	O	O	O	O	O	O	X
2	Raw Material Stores (Timber and wood logs)		X	O	X	X	X	X	X	X	X	X	X	X	A	A	A	X	X	X	O	O	O	U	U	O	X
3	Tools store			X	E	E	E	E	E	O	O	O	O	O	I	I	I	I	E	E	O	O	O	O	O	I	X
4	Conventional Turning machinery				X	E	E	E	E	U	U	U	O	U	U	U	U	O	I	I	U	O	O	I	I	I	X
5	Conventional Milling machinery					X	E	E	E	X	X	X	O	X	X	X	X	O	I	I	O	O	O	I	I	I	X
6	conventional Drilling machinery						X	E	E	X	X	X	O	O	U	U	U	O	I	I	O	O	O	I	I	I	X
7	Conventional Shapping machinery							X	E	U	U	U	U	U	X	X	X	O	I	I	O	O	O	I	I	I	X
8	Grinding machinery								X	O	U	X	O	O	X	X	X	O	O	O	O	O	O	I	I	I	X
9	Forging machinery									X	O	U	U	O	X	X	X	O	U	U	O	O	O	I	I	O	X
10	Casting machinery										X	A	X	X	X	X	X	O	O	O	I	I	I	I	I	U	X
11	Sand lab											X	X	X	X	X	X	X	X	X	X	O	O	I	I	U	X
12	Sheet metal machinery												X	E	X	X	X	I	O	O	O	O	O	I	I	I	X
13	Mechanical presses													X	X	X	X	U	U	U	U	O	O	I	I	O	X
14	Wood cutting														X	A	A	X	X	X	O	O	O	I	I	O	U
15	Wood surface preparation machinery															X	A	X	X	X	O	O	O	I	I	O	X
16	Wood forming machinery																X	X	X	X	O	O	O	I	I	O	X
17	Welding machinery																	X	O	O	O	O	O	I	I	I	X
18	Mon-convential machinery																		X	E	O	O	O	I	I	O	X
19	CNC machinery																			X	O	O	O	I	I	O	X
20	Technicians toilets and change room																				X	O	O	U	U	O	X
21	Workers Toilets																					X	O	U	U	O	X
22	Custodial services																						x	U	O	O	X
23	First aid																							X	I	O	O
24	Wokshop management																								X	U	O
25	Filling and assembly area																									X	O
																											X

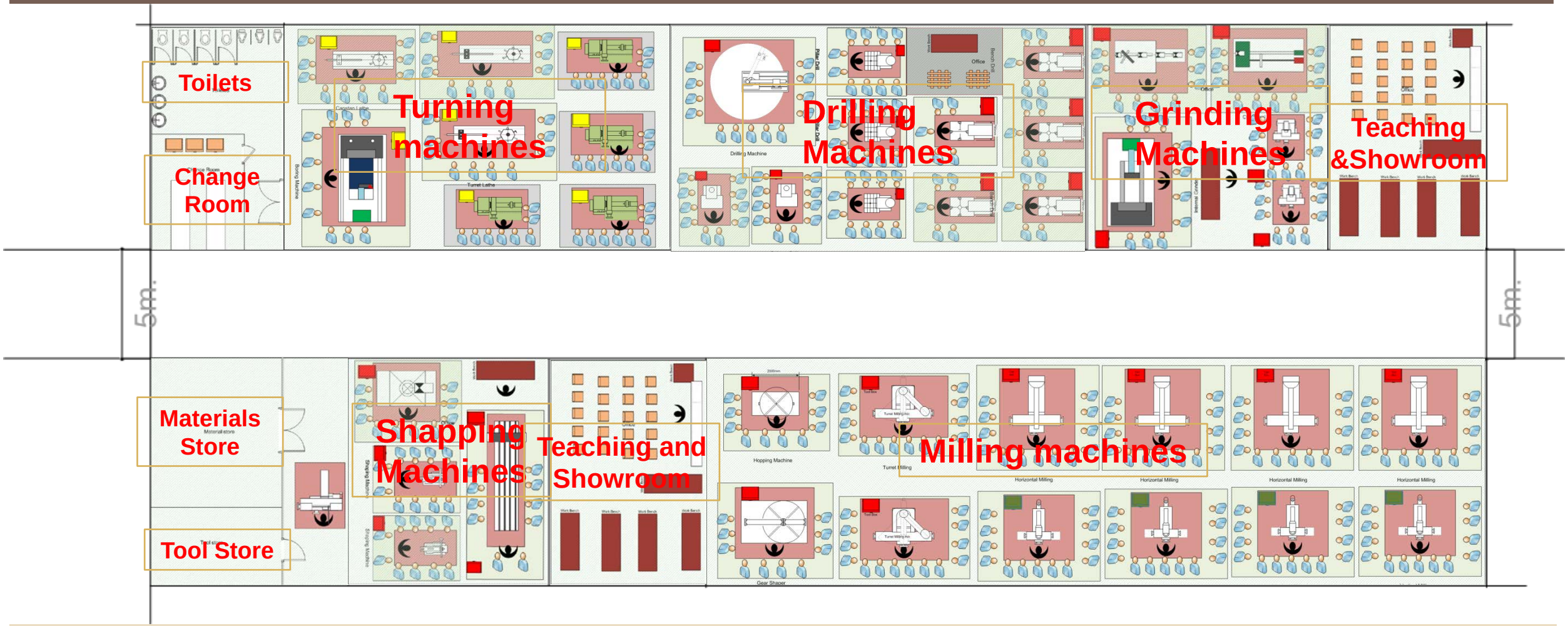
A	Absolutely necessary	4
E	Especially important	3
I	Important	2
O	Ordinary	1
U	Unimportant	0
X	Undesirable	-1
	REASONS	
1	Quantity of flow	
2	Cost of material handling	
3	Equipment used in material handling	
4	Need for close communication	
5	Need share some personnel	
6	Need to share some equipment	
7	Separation necessary due to:	
	Noise	
	Danger	
	Chemicals	
	Fumes	
	Explosion	

ACTIVITY RELATIONSHIP DIAGRAM

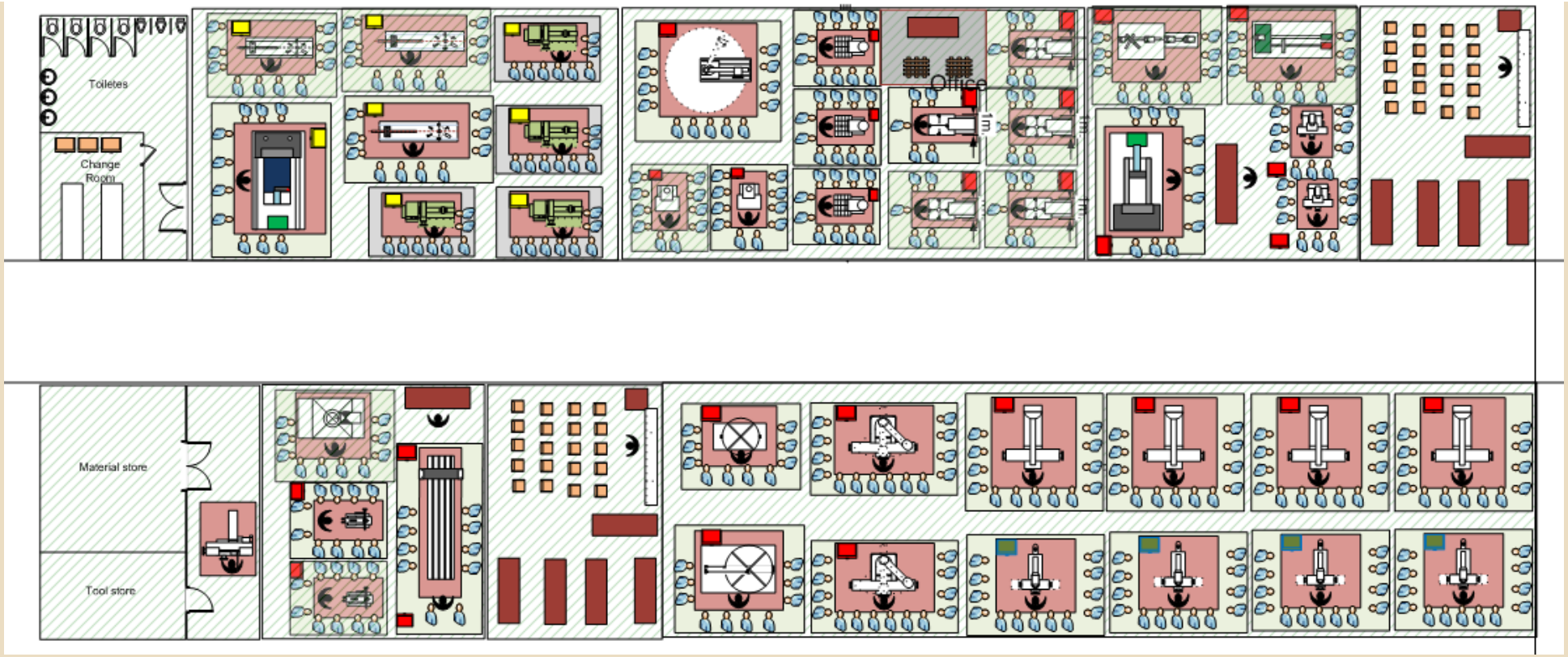
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
1	Raw Material Stores (Metallic materials)	Y	-1	2	3	2	2	2	2	2	1	1	2	2	-1	-1	-1	2	2	2	1	1	1	1	1	1
2	Raw Material Stores (Timber and wood logs)		Y	1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	4	4	4	-1	-1	-1	1	1	1	0	0	1
3	Tools store			Y	3	3	3	3	3	1	1	1	1	1	2	2	2	2	3	3	1	1	1	1	1	2
4	Convential Turning machinery				Y	3	3	3	3	0	0	0	1	0	0	0	0	1	2	2	0	1	1	2	2	2
5	Conventional Milling machinery					Y	3	3	3	-1	-1	-1	1	-1	-1	-1	-1	1	2	2	1	1	1	2	2	2
6	conventional Drilling machinery						Y	3	3	-1	-1	-1	1	1	0	0	0	1	2	2	1	1	1	2	2	2
7	Conventional Shapping machinery							Y	3	0	0	0	0	0	-1	-1	-1	1	2	2	1	1	1	2	2	2
8	Grinding machinery								Y	1	0	-1	1	1	-1	-1	-1	1	1	1	1	1	1	2	2	2
9	Forging machinery									Y	1	0	0	1	-1	-1	-1	1	0	0	1	1	1	2	2	1
10	Casting machinery										Y	4	-1	-1	-1	-1	-1	1	1	1	2	2	2	2	2	0
11	Sand lab											Y	-1	-1	-1	-1	-1	-1	-1	-1	-1	1	1	2	2	0
12	Sheet metal machinery												Y	3	-1	-1	-1	2	1	1	1	1	1	2	2	2
13	Mechanical presses													Y	-1	-1	-1	0	0	0	0	1	1	2	2	1
14	Wood cutting														Y	A	4	-1	-1	-1	1	1	1	2	2	1
15	Wood surface preparation machinery															Y	4	-1	-1	-1	1	1	1	2	2	1
16	Wood forming machinery																Y	-1	-1	-1	1	1	1	2	2	1
17	Welding machinery																	Y	1	1	1	1	1	2	2	2
18	Mon-convential machinery																		Y	3	1	1	1	2	2	1
19	CNC machinery																			Y	1	1	1	2	2	1
20	Technicians toilets and change room																				Y	1	1	0	0	1
21	Workers Toilets																					Y	1	0	0	1
22	Custodial services																						Y	0	1	1
23	First aid																							Y	2	1
24	Wokshop management																								Y	0
25	Filling and assembly area																									Y

28	Raw Material Stores (Metallic materials)
2	Raw Material Stores (Timber and wood logs)
43	Tools store
30	Convential Turning machinery
23	Conventional Milling machinery
28	conventional Drilling machinery
26	Conventional Shapping machinery
26	Grinding machinery
8	Forging machinery
11	Casting machinery
-2	Sand lab
16	Sheet metal machinery
8	Mechanical presses
6	Wood cutting
5	Wood surface preparation machinery
9	Wood forming machinery
18	Welding machinery
22	Mon-convential machinery
22	CNC machinery
18	Technicians toilets and change room
22	Workers Toilets
23	Custodial services
38	First aid
38	Wokshop management
30	Filling and assembly area

GENERAL WORKSHOP LAYOUT



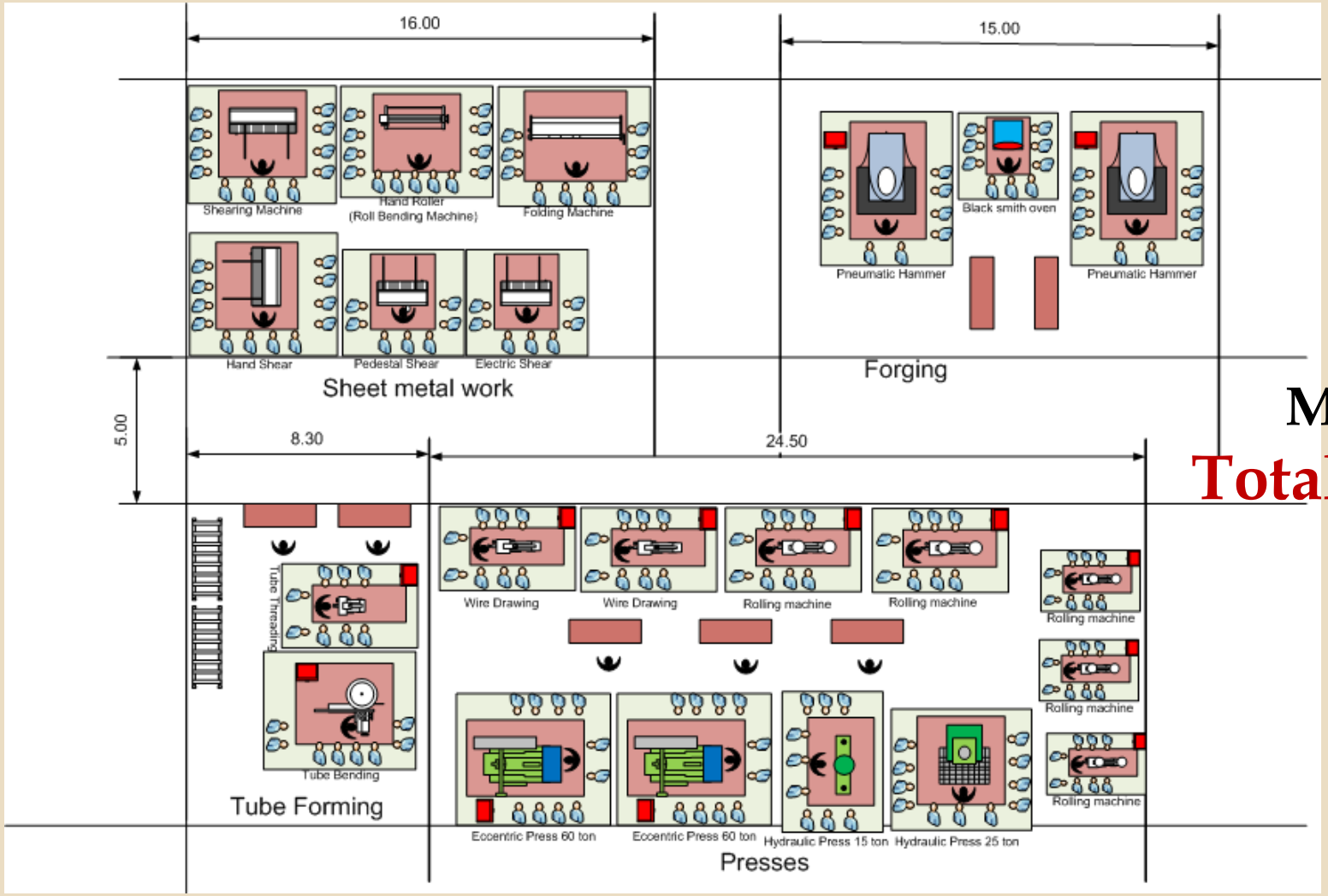
DEPARTMENTS' LAYOUT



Mechanical Workshop Layout

Total Workshop Area = 1400 m2

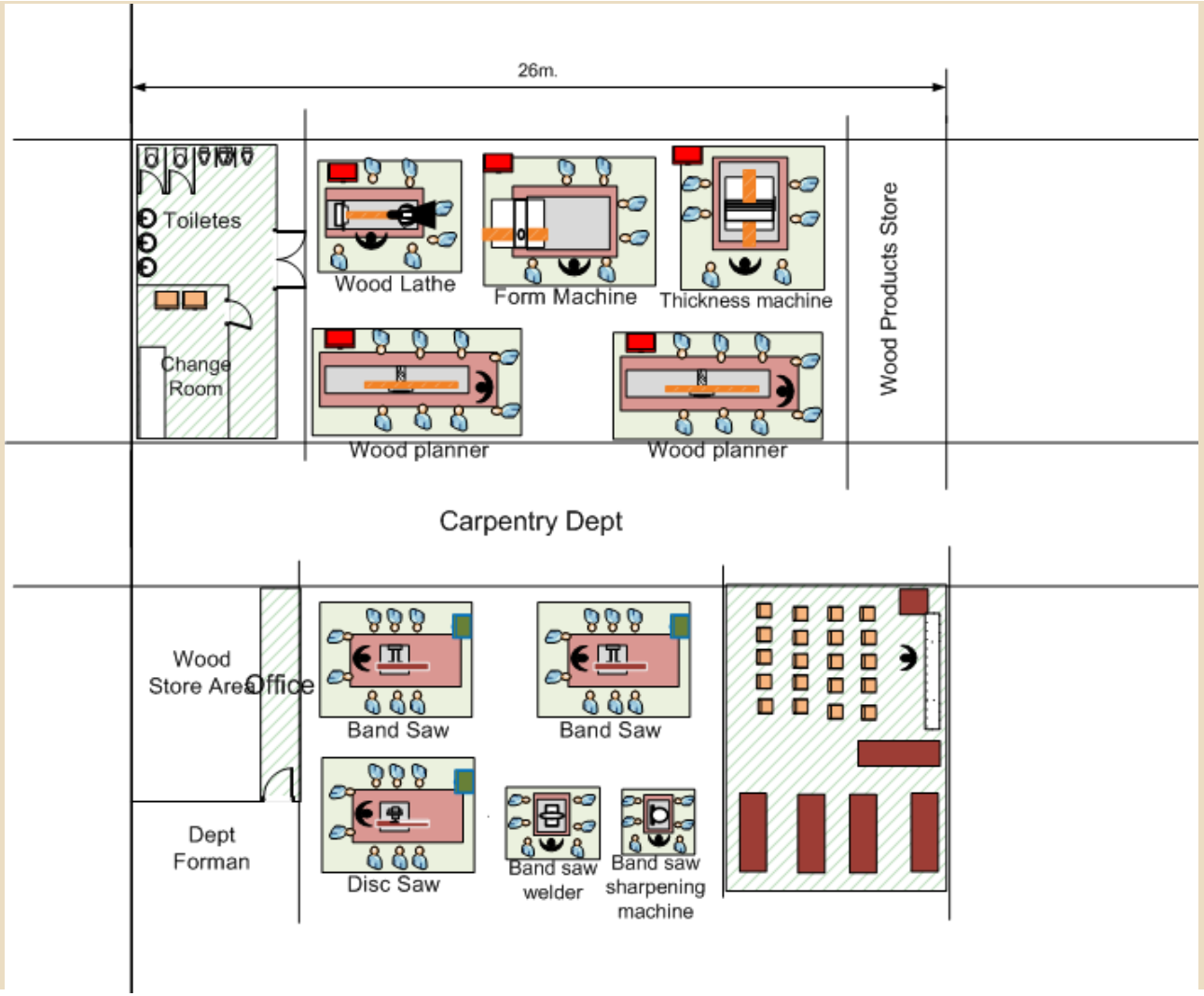
LAYOUT OF SHEET METAL AND FORGING DEPT.



Metal Forming Dept. Layout

Total Workshop Area = 600 m2

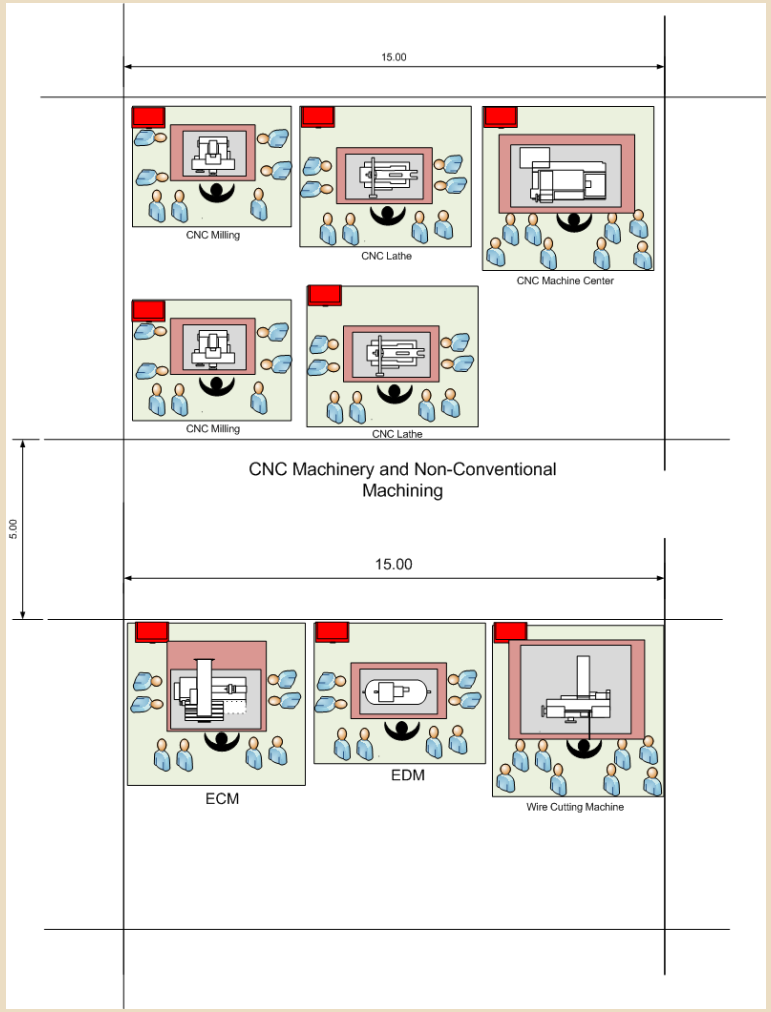
LAYOUT OF CARPENTRY DEPT.



Carpentry Dept. Layout

Total Workshop Area = 500 m2

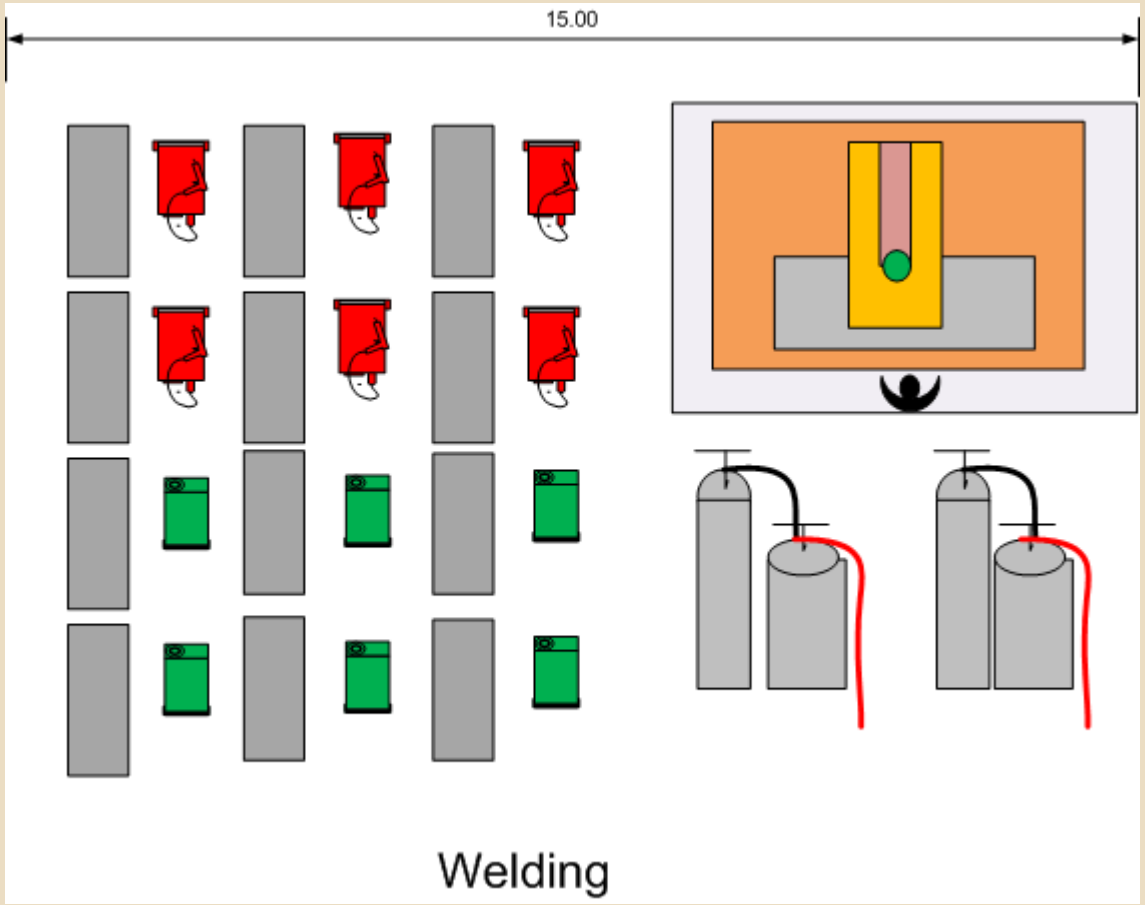
LAYOUT OF CNC & NON-CONVENTIONAL DEPT.



CNC & Non-Conventional Dept. Layout

Total Workshop Area = 300 m2

LAYOUT OF WELDING DEPT.



Welding Dept. Layout

Total Workshop Area ≈ 150m2

TOTAL WORKSHOP AREA

Mechanical workshop	≈ 1400 m2
Metal Forming workshop	≈ 600 m2
Carpentry workshop	≈ 500 m2
CNC & Non-conventional	≈ 300 m2
Welding workshop	≈ 150 m2
	2950 m2
Foundry (casting)	*≈ 700m2*
Polymer workshop (with lab)	*≈ 150 m2*
Total	*3800 m2*

FOUNDRY WORK REQUIREMENT & ENVIRONMENT

- Includes:
  - Cast house
  - Furnaces
  - Forging
  - Welding

- Work Requirement:
  - Open large storage area
  - Good ventilation
  - High roof
  - Benches for hands-on exercises
  - Safety gears (gloves, coat, eye glasses)
  - High electric energy
  - Should be isolated from other work areas

- Possible Hazards:
  - High heat emissions
  - Fumes
  - Sand and dust
  - Falling weights
  - Electric hazards
  - Flammable materials (solar, charcoal, gases)
  - Exposed hot surfaces

CARPENTRY WORK REQUIREMENT & ENVIRONMENT

- Includes:
  - Wood cutting
  - Wood forming
  - Wood cladding

- Work Requirement:
  - large storage area
  - Good ventilation
  - High roof (long logs)
  - Benches for exercises
  - Safety gears
  - Should be isolated from other work areas

- N.B. students are not allowed to use carpentry machinery

- Possible Hazards:
  - Flying wood dust
  - Very sharp moving tools
  - Falling weights
  - Electric hazards
  - Flammable materials
  - Moving parts

MECHANICAL WORKSHOP WORK REQUIREMENT & ENVIRONMENT

- Includes:
  - Mechanical workshop
  - CNC machinery
  - Non-Conventional machining

- Work Requirement:
  - Safety gears
  - Controlled work environment
    - Closed space
    - air-conditioning

- Possible Hazards:
  - Sharp moving parts
  - Possible flying chip
  - Electrical hazards

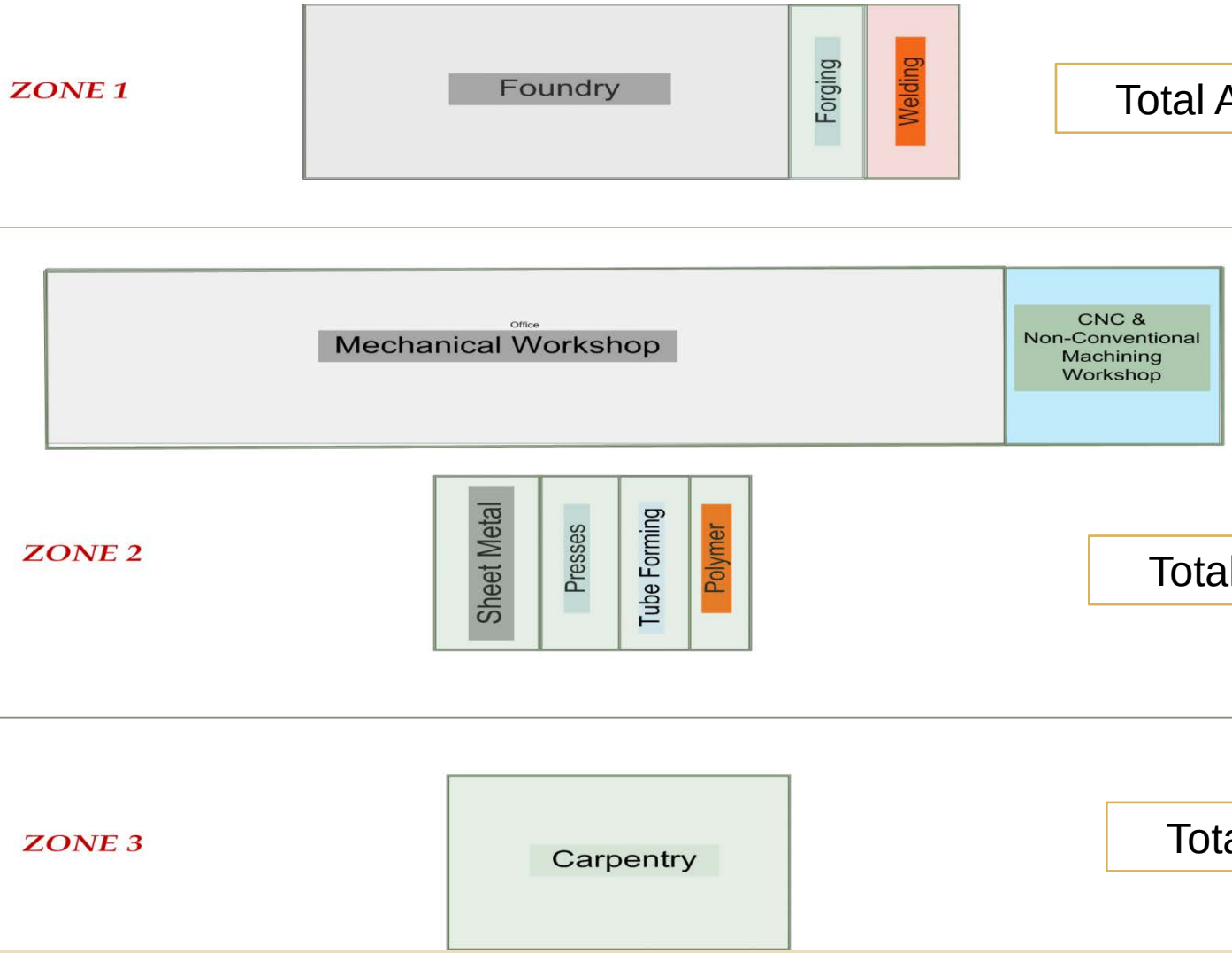
SHEET METAL AND FORMING WORKSHOP WORK REQUIREMENT & ENVIRONMENT

- Includes:
  - Sheet metal
  - Presses
  - Tube forming
  - Wire drawing
  - Polymer forming machinery

- Work Requirement:
  - Safety gears

- Possible Hazards:
  - Sharp edges
  - Fast moving parts
  - Electrical hazards

ZONING OF WORKSHOPS



SOME USEFUL DATA FOR DESIGN

- Truss span ≥ 18 m
- Truss bay spacing = 12 m
- Truss clean height at least 6.5 m
- Illumination: Windows or daylight design
- Ventilation: air change rate 5 liter/sec/person
- Outdoor air supply in case of air conditioning = 0.8 liter/sec/m2
- Temperature: 18 – 21Co
- Roof insulation coefficient "U"= 0 – 7 watt/m2/Co
- Min area per person = 7 m2

SOME USEFUL DATA FOR DESIGN

- Main vehicle door height= 5m
- Min height for high stacking over head hoist or mezzanine = 7.5m

What will be the next steps?

PROPOSED STEPS

1. Study of undergraduate study bylaws for specialization studying production engineering or workshop technology
2. Evaluate the technical conditions of the existing workshop machinery
3. Detailed layout
4. Human Resources:
5. Project Management

FUTURE ASSIGNMENTS

1. Study of undergraduate study bylaws for specialization studying production engineering or workshop technology

- Revising the undergraduate study bylaws and course contents for refinement
- Adopt workshop technology course content for preparatory year to fulfill special departmental requirements
- Redefine course contents and determine teaching and lab requirement
- Re-estimate number of students per course based on redefined bylaws with future forecast
- Approve and endorse modifications of courses contents and delivery techniques

FUTURE ASSIGNMENTS

2. Evaluate the technical conditions of the existing workshop machinery

- Physical examination of existing workshop machinery
- Determine machinery to be scraped
- Determine machinery and equipment to be added in scope of the amendments made to bylaws
- Determine required tools
- Set appropriate specifications of the new machinery, equipment and tools
- Estimate procurement and maintenance budget
- Set appropriate financial plan for procurement and maintenance

FUTURE ASSIGNMENTS

3. Detailed layout

- Re-calculate number of machinery required from each type after considering futher machinery uses
- Determine machine foot print exact dimensions for work station design considering appropriate teaching space
- Departmentalize machinery according type and nature of use
- Locate electric power supply outlets for each machine
- Estimate total electrical power load of each department and distribution panels

FUTURE ASSIGNMENTS

- Detailed layout
  - Determine required utilities (such as compressed air, gas, steam, water, etc)
  - Determine zones of possible fire hazards and determine required firefighting and extinguishing systems.
  - Determine different flow paths within the workshops (people flow, material flow, escape outlets, etc)
  - Determine appropriate handling equipment
  - Determine appropriate working temperature and humidity at each department based on emissions and the nature of each operation

FUTURE ASSIGNMENTS

- Detailed layout
  - Determine air flow rate at each department
  - Determine materials storage and related equipment
  - Determine workers' and technicians' services
  - Determine student required services
  - Determine general departments' requirement (flooring, lighting, change rooms, toilets, canteen, etc)
  - RELAYOUT

FUTURE ASSIGNMENTS

4. Human Resources:

- Propose organization structure for the management of the workshop
- Determine quality and number of needed technicians
- Prepare job description and manning tables

5. Project Management

Thank you