JHARKHAND
Rai University
UGC RECOGNISED UNIVERSITY
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MINING ENGINEERING

B.TECH

LAB MANUAL

MINE DESIGN EXERCISE

MINE LAYOUT 1

...deep borehole.

MINE LAYOUT 1

Q. 2 : It is proposed to depillar 3m thick seam with caving by deploying SDLs. Give the layout, the number of equipments, the support plan and manpower required for producing 350 Tonnes per day from the panel.

Ans : Given

Seam thickness	: 3m
Method	: Bord & pillar
Depillaring	: Caving
Loading machine	: SDLs.
Production	: 350TPD.

Assumed :

Pillar size	: 25m x 25m
Gallery size	: 3m height x 4.2m width.

Layout : The main panel shall be divided in to subpanel of size such as to permit the extraction of sub panel within the incubation period, six heading panel shall be formed. Panel barrier shall be left one pillar size on dip and rise side both. Two intake and one return shall be kept open with preparatory stoppings and rest of the three galleries shall be closed by isolation stoppings.

Manner of extraction :

Diagonal line shall be maintained and slicing method shall be adopted.

1. Each pillar shall be split into two equal parts by driving a central level split gallery not exceeding 3.6m in width.
2. Each half of a pillar shall then be extracted by driving slice not exceeding 4.5m in width, so however that the area of roof exposure at any one working place shall not exceed 60 sq.m. at any time.
3. While driving slices a rib of coal not less than 1.8m in thickness shall be left against the adjacent goaf.
4. Not more than one slice shall be driven in a pillar at a time, and the extraction of half of a pillar shall not be commenced until extraction of the adjoining inbye of the pillar has been completed.

Number of equipment :

1.	SDL	: 4
2.	GEB	: 4
3.	Drill machine	: 6
4.	Drill panel	: 6
5.	LDCC	: 5
6.	MDCC	: 2
7.	Belt conveyor	: 1
8.	Face pump	: 1

Support plan :

Support of the depillaring panel shall be done as per approved support plan. Which shall be as follows :

1. The area lying within two pillars of the place under

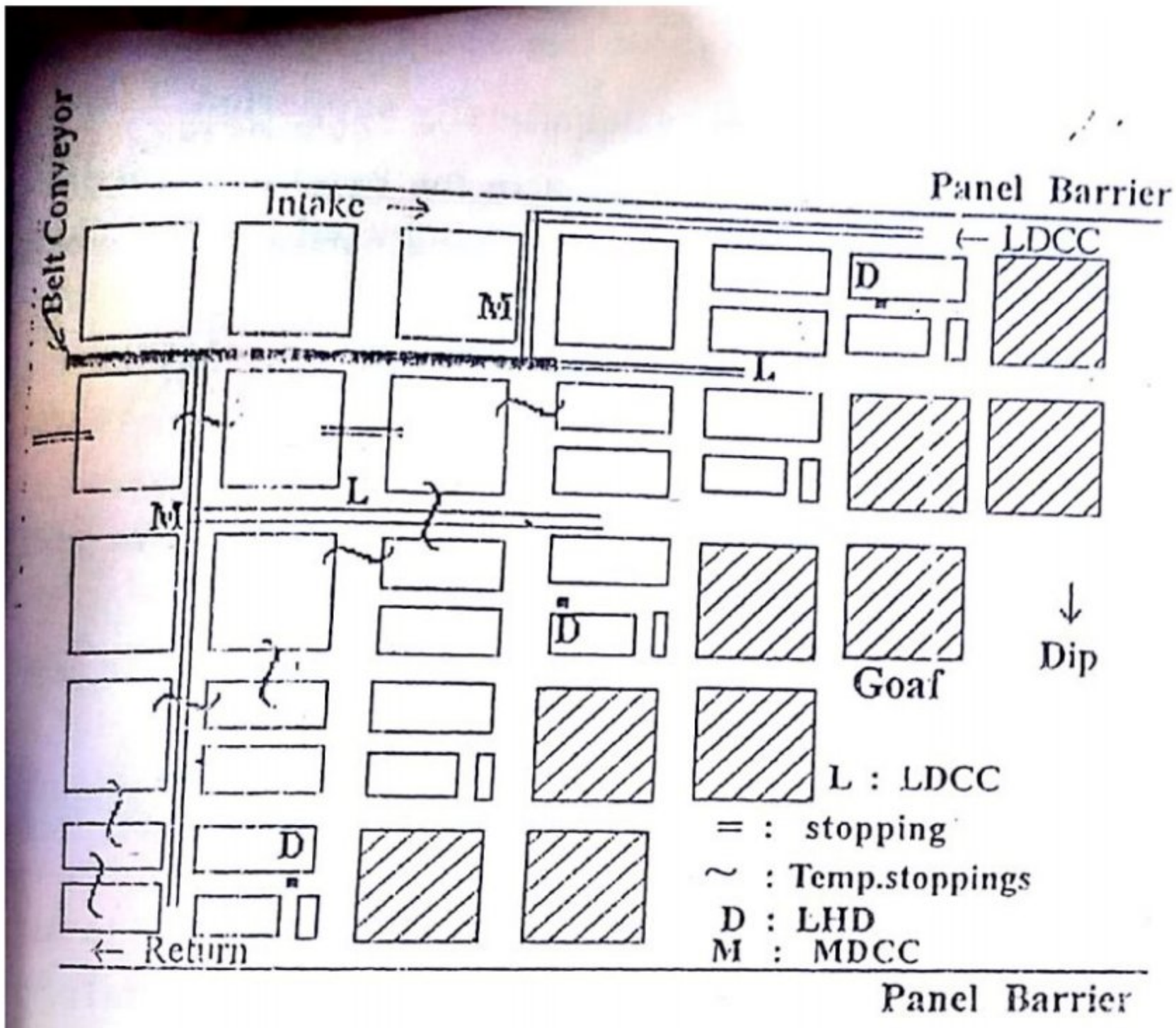


Fig. 69 : Panel Layout

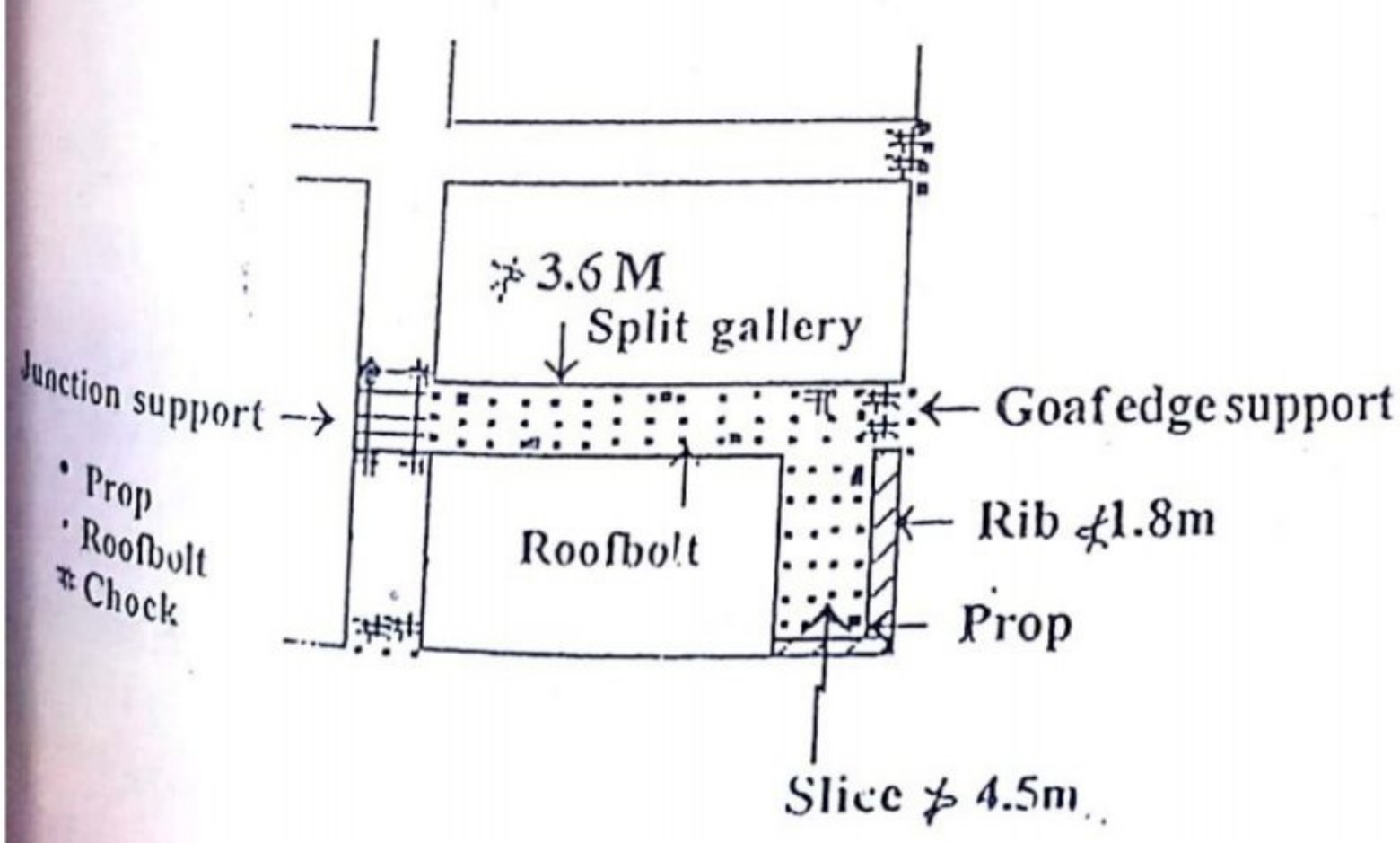


Fig. 70 : Manner of extraction of pillar and support

extraction shall be systematically supported.

2. Roof bolting shall be done in the depillaring district because SDLs machines are being used for loading of coal.

3. Distance between two bolts in same row shall be one metre and distance between two rows shall also be kept 1m.

4. 1.5m long roof bolt with bearing plate shall be used with quick setting cement capsules.

5. At least two indicator props shall be erected in each gallery, split and slice.

6. Junctions shall be supported by girder resting on the cogs.

7. Goaf edge shall be supported by the cogs skin to skin and props 15cm apart at the goaf edges.

Manpower required

S. No.	Designation	Per shift required
1.	Overman	1
2.	Mining sirdar	1
3.	Shot firer	2
4.	Exp. carrier	6
5.	Driller	6
6.	Dresser	2
7.	Support	8
8.	SDL operator + helper	12
9.	MDCC operator	2
10.	LDCC operator	6
11.	Cleaner	6
12.	Belt conveyor operator	1
13.	Mech. fitter + helper	6
14.	Electrician + helper	2
15.	Water spray	2
16.	Pump operator	1
	Total	64

General shift

S. No.	Designation	No of person required
1.	Asstt. manager	1
2.	Engineer	1
3.	Over man	1
4.	Mining sirdar	1
5.	Mech. foreman	1
6.	Electrical supervisor	1
7.	Electrician + helper	4
8.	Support gang(advance support)	8
9.	Mech. fitter	2
10.	Tyndal	8
11.	General maz. for misc. job	10
	Total :	38

Total manpower in shift - 64 x 3 = 192
Gen shift = 38
230

OMS : 350 ÷ 230 = **1.52**

MINE LAYOUT 2

Q.7 : Under what situations would you prefer longwall mining over bord and pillar method. What are its limitations. Sketch a typical retreat longwall power supported face specifying the manpower needed to work the face equipment required in a 3m thick seam with a gradient of 1 in 8. What is the expected advance per day.

Ans : In the following situations, we would prefer longwall mining over bord and pillar method.

1. The thickness of coal seam ranging from 0.7m to 3m and can also work up to 6m by longwall method.
2. The depth of coal seam from surface is more than 500m.
3. The floor of coal seam liable to creep.
4. The roof is very weak.
5. The coal seam is friable and weak.
6. The coal which is more liable to spontaneous heating.
7. Higher output is required.

Limitations :

1. Capital cost of modern equipments are very high.
2. Higher face moving cost.
3. Coal seam is very hard, so cutting machine can not work properly.
4. Presence of dirt bands are more. It will create more problem in longwall.
5. In caving method, if roof does not fall regularly. It is very difficult to work with longwall.
6. Geological disturbance should not be more.
7. Floor of the seam should be uniform .
8. Very high technically skilled manpower is required.

Longwall retreating method :

Parameter given :

Thickness of coal seam : 3.0m
Gradient of seam : 1 in 8

Sketch of typical retreat longwall panel :

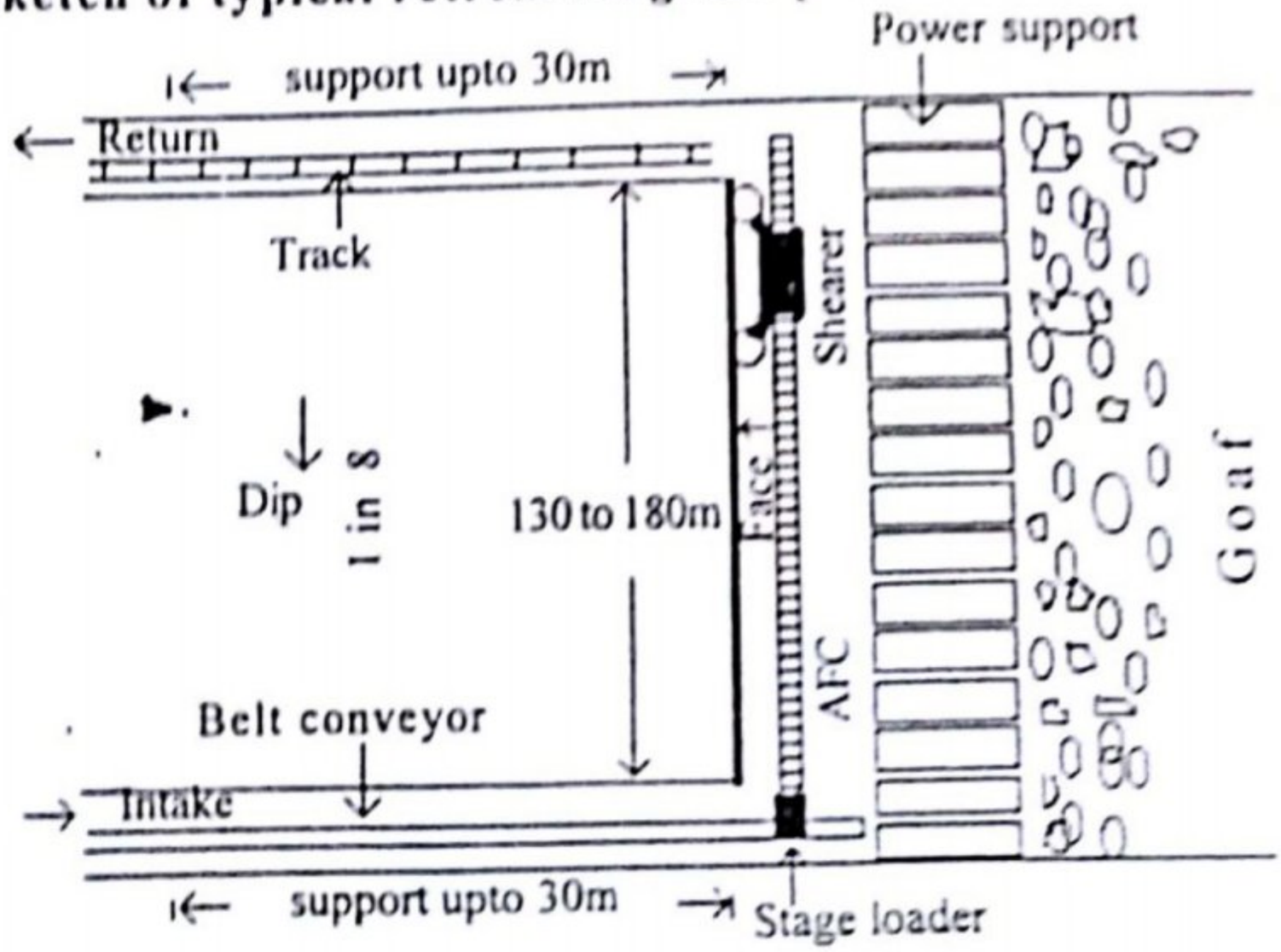


Fig. 54 : Longwall Retreating Panel Layout

Assumed :

Length of face = 140
Power support = 6 leg with canopy
Method = Retreating longwall with caving.

Manpower needed :

Manpower for production shift

S.No.	Designation	Nos required
1.	Under manager	1
2.	Engineer	1
3.	Overman	1
4.	Mining sirdar	1
5.	Shearer operator	2
6.	Cable men	2
7.	Stage loader operator	1
8.	Lump breaker operator	1
9.	AFC operator	1
10.	Belt conveyor operator	2
11.	Cleaner (coal shoveling)	6
12.	Power support shifting crew	6
13.	Maintenance crew	6
14.	Electrician + helper	2
15.	Electrical Supervisor	1
16.	Mech. Foreman	1
17.	Water supply for DERD	2
18	Misc. job	8
	Total =	45

Two shifts production shall be organised, so manpower for production shall be required.

45 x 2 = 90

Manpower for maintenance shift :

S.No.	Designation	Nos required
1.	Asstt. Manager	1
2.	Engineer	1
3.	Foreman	1
4.	Electrical supervisor	1
5.	Overman	1

6	Mining sirdar	1
7.	Power support maintenance crew	6
8.	DERD maintenance crew	4
9.	AFC stage loader crew	6
10.	Belt conveyor shifting crew	6
11.	Support for gate roadway	6
12.	Electrician	2
13.	Electrical helper	4
14.	Tyndle	10
	Total =	50

Total manpower required- production shift = 90
Maintenance shift = 50
140

Equipment required :

		nos.
1.	DERD	1
2.	AFC	1
3.	Stage loader	1
4.	Lump breaker	1
5.	Belt conveyor	1
6.	Power support	150
7.	Hydraulic props for gate roadways support	120

Expected per day advance :

Web length	:	0.75m
Cutting speed of DERD	:	1m/min
Cut per day	:	6
Per day advance	:	**4.5m** (production 2400tpd)

MINE LAYOUT 3

Q.1 Give the layout of a coal mine with annual production of 5.0 million tonnes having following parameters:

Seam thickness - 12m.. Average stripping ratio - 1:4, Dip of seam - 1 in 5

Top formation- loose material 12m thick.

The mine is to be worked by shovel dumper combination and the soils are to be stacked separately for subsequent reclamation. Determine the capacity of the major heavy earth moving machines. indicating daily as well as monthly coal production and overburden removal. Assume your own conditions.

Ans:

(1) Condition given :

Production	: 5 Mt/year
Seam thickness	: 12m.
Average stripping ratio	: 1:4 t/m^3
Dip of seam	: 1 in 5.
Top formation	: 12m thick loose material.
System of work	: Shovel dumper combination.

(2) Calculation of thickness of OB

Thickness of OB	: (Seam thickness x Sp.gravity of coal x Stripping Ratio)
	: 12 x 1.3 x 4 = 62.4m.
Top formation	: 12m thick loose material, assumed in which 2m soil on the top.

MINE LAYOUT 3

(3) Calculation of production

Assumed : 300 working days/year.
: 25 working days/month.
Production : 5 Mt.
Monthly : 50,00,000 ÷12= 4,16,666t
Daily . 16,666t (say 17,000t)

(4) Calculation of over burden removal

Stripping ratio : 1:4
So yearly removal of OB : 5 x 4 = 20 million m^3
Monthly : 1.6 million m^3
Daily : 66,666m^3 say 67,000m^3

(5) Height of benches

(A) OB

Total OB height : 62.4m
Top soil : 2m.
Bench I : 10m..
Bench II : 12.9m.
Bench III : 12.5m
Bench IV : 12.5m
Bench V : 12.5m

(B) Coal

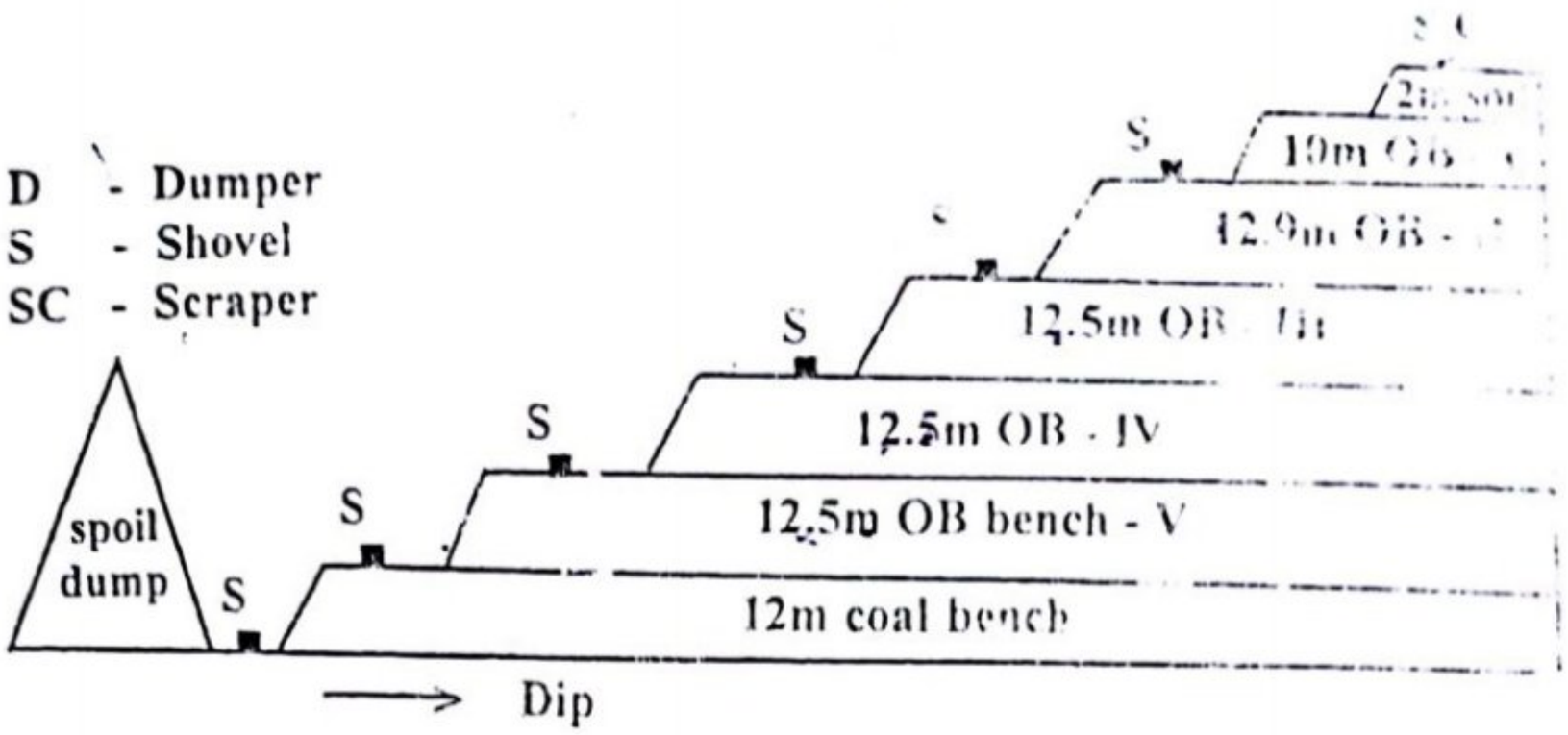
Only one bench of 12m height shall be made of ful thickness of coal seam.

(6) Method of work

Strike method
Length of bench : 600m
Width of bench : 100m
Two block of above mentioned size.

Top soil of two meters shall be collected by scrapers and stacked separetely for reclamation purpose.Top 12m is loose strata. which means there is no need to blast this bench. only shovel can remove the material.Total five bench shall be formed except for the 2m soil bench in OB.Only one bench of 12m shall be formed for coal because the seam is 12 m thick.OB and coal shall be removed by shovel and dumper combination.Holes will be drilled by 250 mm dia drill.Slurry explosive shall be used for the blasting.

D - Dumper
S - Shovel
SC - Scraper



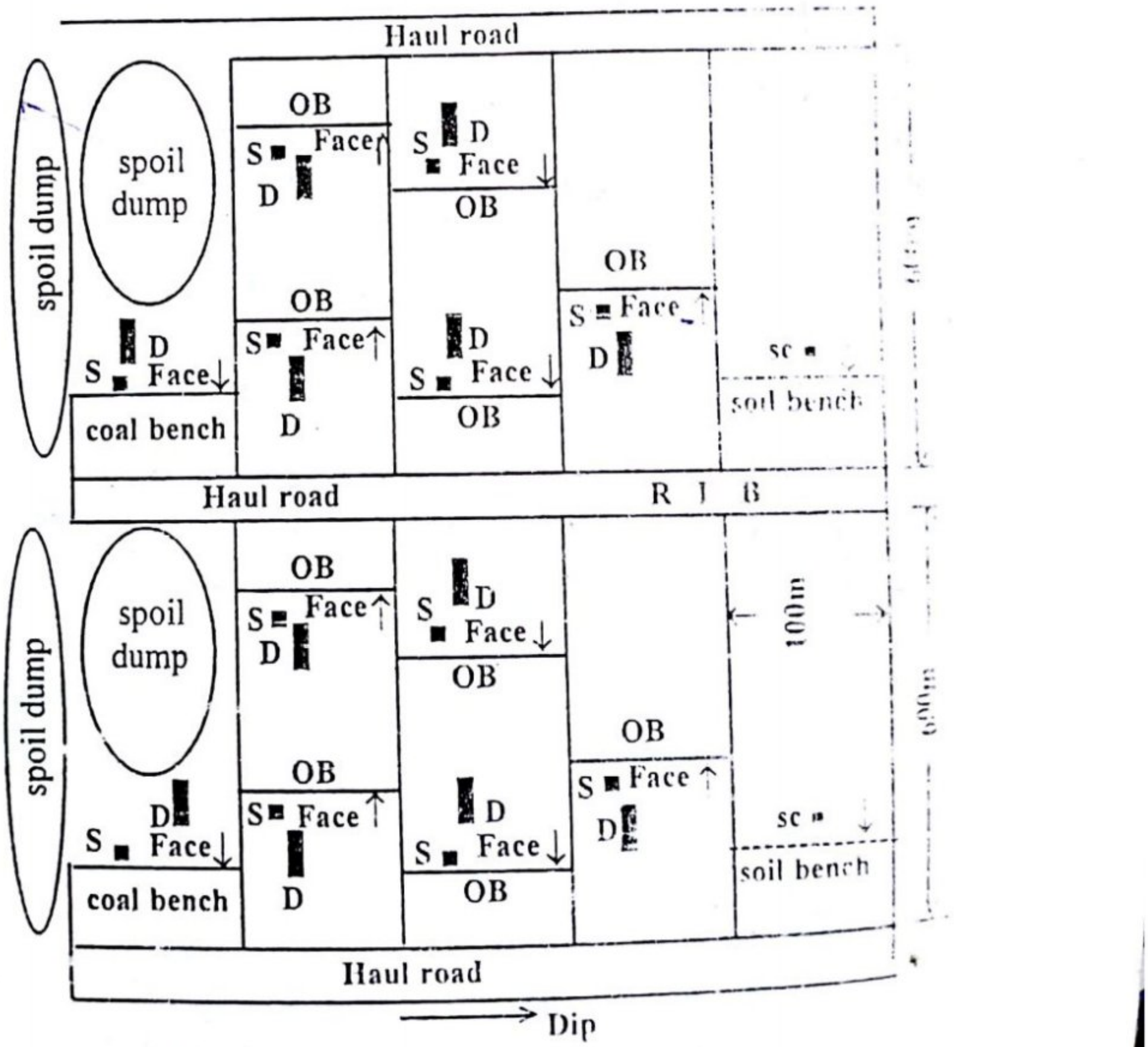


Fig. 1 : Layout - Opencast mine -Twin block

(7) List of Equipment

(A) For Over Burden

(a) Total 20 million m^3 OB is required to be removed in a year with 62.4m bench height, so 20 ÷ 62.4 = 0.32 million m^3 per metre bench height has to be removed per year.

(b) Soil 0.32 x 2m = 0.64Mm^3/year soil to be removed.
Scraper of 11m^3, capacity = 0.16 million m^3/year
No. of Scraper : 0.64 ÷ 0.16 = 4 (2 for each block)

(c) **OB Benches :**
OB to be removed = 19.16 million m^3/ year

(i) **Shovel** = 8m^3 - boom ht.15m
Annual Capacity of Shovel : 2 million m^3/year/shovel
So total nos. of shovels required = 10 nos.
per block = 5 and per bench = 1

(ii) **Dumper** = 85t (matching size for 8 m^3 shovel)
Capacity = 0.4 million m^3/year
So Dumpers required = 19.16/0.4 = 48 (say 50)
5 Dumpers per shovel
(but 5 Nos. will be kept for breakdown and maintenance) so 50 + 5 = 55 Dumpers required.

(iii) **Dozer** = 400 HP, one for each bench

For two blocks	: 8 nos.
For OB spoil bank	: 4 nos.
	12 nos.

(iv) **Drill machines** : 250 mm dia.
Capacity : 4000cum^3/day
Two for each bench : 16 nos. (for two blocks)
Drill machine is not required for loose material bench

(B) coal bench

(i) **Shovel**
Capacity : 6 m^3, 1.3Mt/ year
Required : 4 (two for each block)

(ii) **Dumper** : 50t
Capacity : 800t/day
So required number : 22 (17000t/day production
say 24. keeping consideration for breakdown & main
tenance. Then 12 for each block.(six for each shovel

(iv) **Dozer** : 2nos , 400HP
(iii) **Drill machine** : 250mm dia
Required : 4 Nos. (two for each block)

(C) Other equipments

(i) Water sprinkler (Tanker) Two Nos. for each block
Capacity : 14,000 Litres
Total required : 4 nos.
(ii) Motor grader : One for each block : 2 nos.
(iii) Road roller : One for each block
10 t capacity : 2 nos.
(iv) Jack hammer : three for each block : 6 Nos.
(for secondary blasting)
(v) Portable compressor : 2 for each block : 4 nos.
(vi) Mobile crane : 10t capacity : 2 nos.
(vii) Explosive van : 2 nos.

(8) Explosive required

(i) Slurry explosive shall be used for blasting.
(ii) Blasting is not needed in the top 12m bench
So explosive is required only for 50.4m of bench.
$(50.4m \times 0.32cum/m \times 10^6) \div 300$ day/year $= 53760 m^3$/day
$53760 m^3$ (say $53800 m^3$) OB daily to be blasted.
Explosive required : 0.4 kg/m^3
: 53,800 x 0.4 = 21,520 kg/day

(iii) Coal = 17,000 t/day
Explosive = 0.2 kg/t = 17,000 x 0.2 = 3400 kg per day.

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MINE LAYOUT 4

Q.3 (b) Give details of equipment and manpower required for an underground development district producing 250-300 tonnes daily giving a district OMS of over 2.0 tonnes. The seam is 3m thick, having a dip of 1 in 10, the roof and floor conditions are good and the seam is dry.

Ans : Parameters given :

Production	: 250-300 TPD
OMS	: 2.0 tonnes.
Seam thickness	: 3m.
Gradient	: 1 in 10
Roof & floor condition	: good
Seam	: dry

Assumed :

Production	: 300TPD
Pillar size	: 25m x 25m.
Gallery size	: 4.2m x 3m.
Panel	: 5 headings.

Equipment required

(a)	**SDL**	: 3 nos.(100 TPD)
	Make	: EIMCO -FLECON
	Electric motor	: 47Kw.
	Bucket capacity	: 1 cum.
	Voltage	: 550V
(b)	**Chain conveyor : LDCC**	: 5 nos
	Type	: Double drive
	Electric motor	: 2 x 20HP
	Pan width	: 30 cm.
	Pan length	: 2.0 m.
	Capacity	: 50 T/hr.
	Voltage	: 550v
(c)	**Chain conveyor : MDCC**	: 2 nos.
	Motor	: 2 x 30 HP
	Drive	: Double drive
	Pan width	: 50 cm
	Pan length	: 1.35m
	Capacity	: 100T/hr
	Voltage	: 550V

(d)	**Belt conveyor (gate belt)**	: 1no.
	Make	: Double drive.
	Motor power	: 2 x 37 kw
	Belt width	: 1000mm.
	Belt length	: 500m
	Voltage	: 550V
(e)	**Drill machine**	: 4
	Power	: Electrical operated
	Voltage	: 110v
	Make	: Rana
	HP	: 1.5 HP.
(f)	**Drill panel**	: 4
(g)	**Gate end box**	: 3
(h)	**Transformer**	: 2
	Type	: Step down 3.3kv/550v.
	Capacity	: 315 KVA.
(i)	**Face pump**	: 1
	Make	: Roto
	HP	: 20 HP
	Head	: 30m.

Panel laout

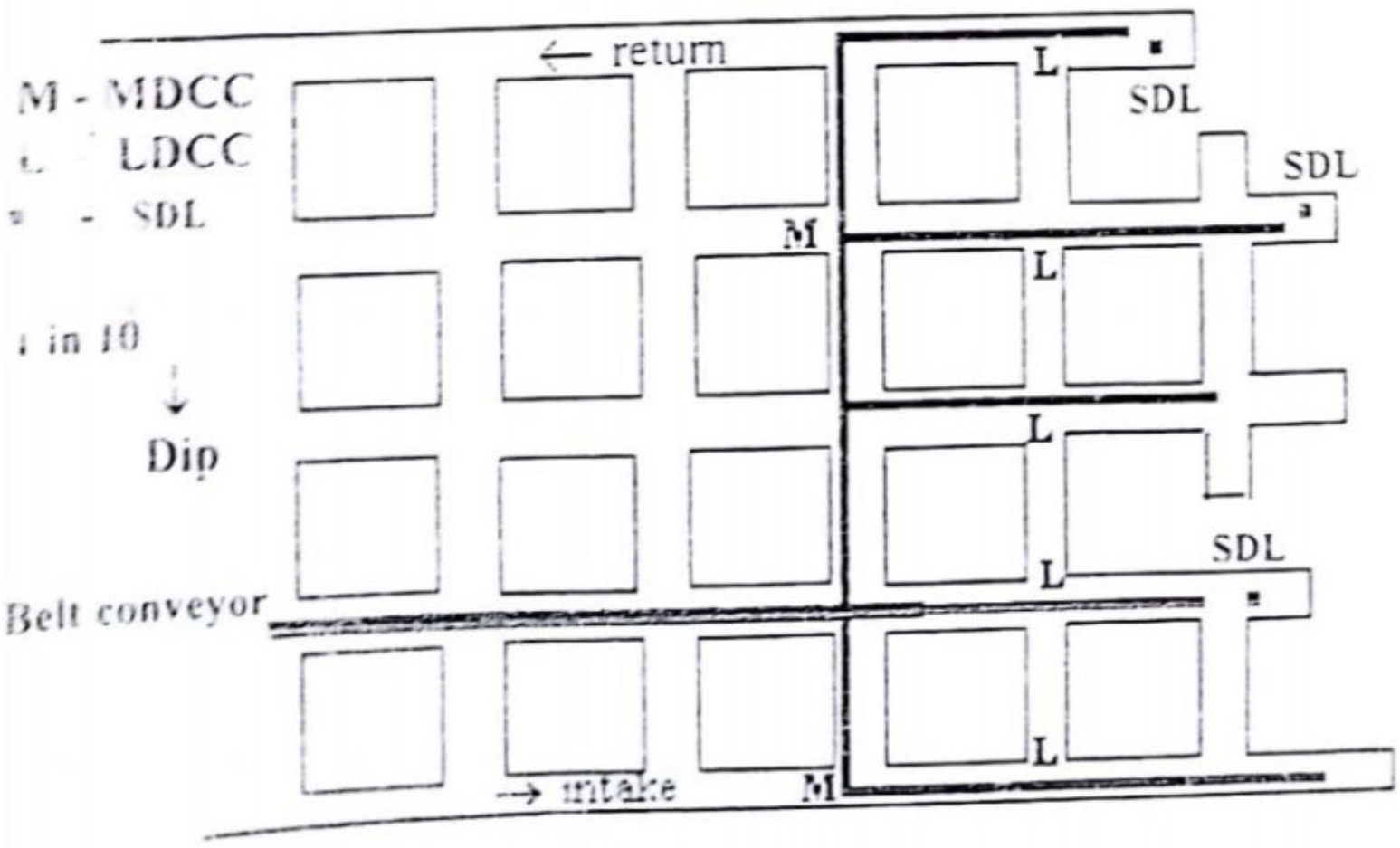

Fig. 3 : Panel Layout - Development with SDL

Manpower required

Following manpower shall be deployed in development district.

S.No.	Designation	Nos. required per shift
1.	Overman	1
2.	Mining sirdar	1
3.	Shotfirer	1
4.	Explosive carrier	3
5.	Driller	3
6.	Dresser	2
7.	Support	4
8.	SDL operator	3
9.	SDL helper	6
10.	SDL fitter+ helper	2
11.	Chain conveyor operator	7
12.	Belt conveyor	2
13.	Pump khalasi	1
14.	Chain/belt fitter+ helper	3
15.	Water spray	2
16.	Electrician + helper	2
	Total :	43

General shift

S.No.	Designation	Nos required per shift
1.	Under manager	1
2.	Engineer	1
3.	Foreman mech	1
4.	Electrical supervisor	1
5.	Electrician	1
6.	Mechanical fitter	2
7.	Electrical helper	2
8.	Mechanical gang	6
9.	Misc. job	6
	Total :	21

Total -shift - 43 x 3 = 129
G. shift = 21
Total 150
OMS = 300 ÷ 150 = 2.0