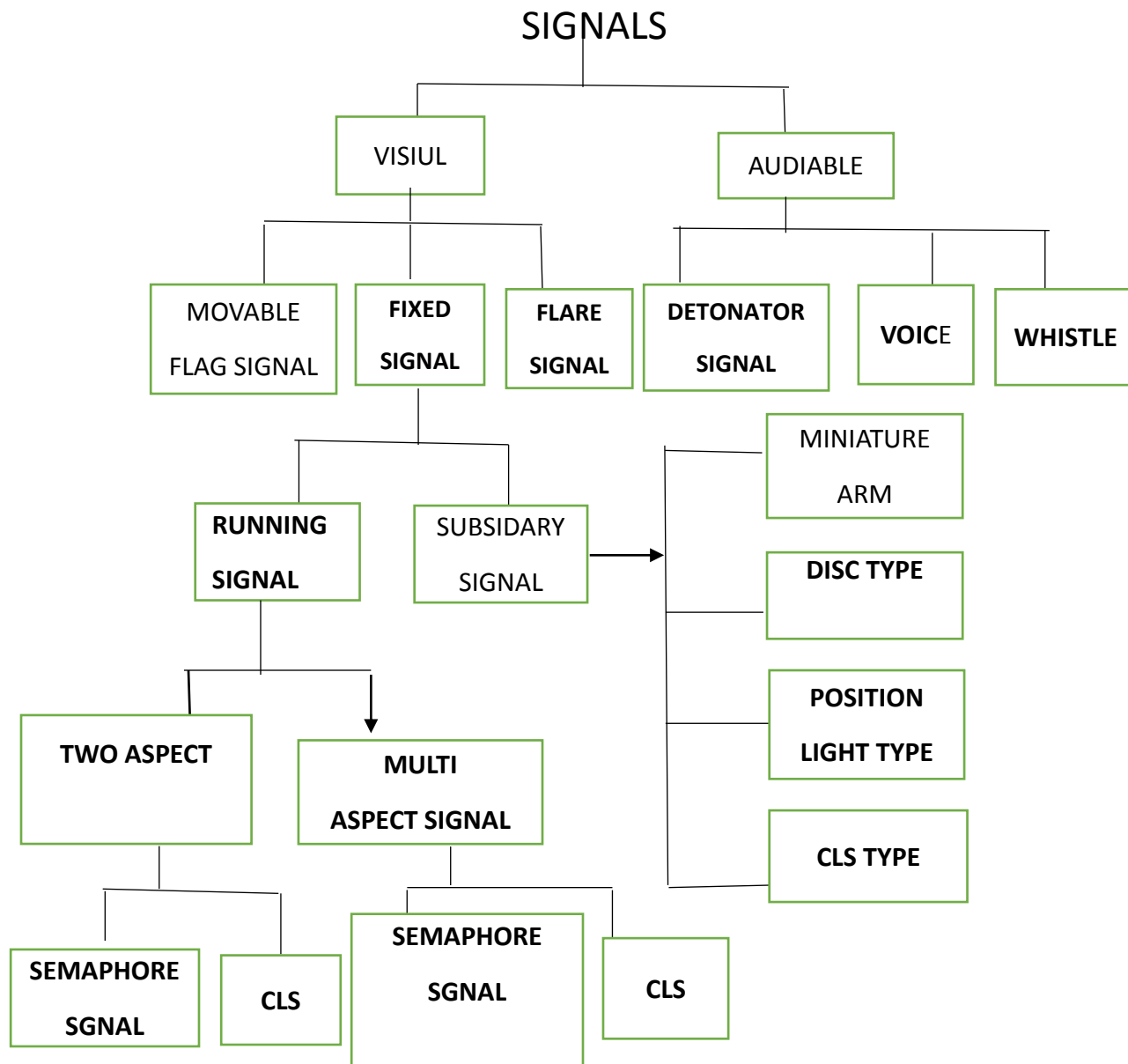


BASIC CONCEPT OF SIGNAL ENGINEERING(ST-15)

- **A "Signal" is a medium to convey a particular pre-determined meaning in nonverbal form. Every aspect of signal of signal is pre-determined meaning like ,Red aspect meaning is stop dead, yellow aspect meaning is caution and green aspect meaning is proceed.**
- **Aspect:-physical appearance of signal is seen by driver of train is called aspect.**
- **Indication:- meaning of aspect is called indication**

CLASSIFICATION OF SIGNAL IN I.R



AS PER GR 3.02-3.08 KIND OF SIGNAL USED IN I.R

- **FIXED SIGNAL**(A signal of fixed location control the movement of train)
- **HAND SIGNAL**(flag signal, Red and green)
- **DETONATING SIGNAL**(Detonator)
- **FLARE SIGNAL**(fusee, emits a red bright red flame)

Fixed signals

- Running signal(stop signal, permissive signal)
- Subsidiary signal(calling-on signal, position light shunt signal)

Stop signals

- STOP SIGNAL IN MAS:-HOME SIGNAL,STATER SIGNAL,ADVANCE STATER SIGNAL, GATE SIGNAL
- STOP SIGNAL IN TAS:-OUTER SIGNAL,FSS,STATER SIGNAL,AVANCED STATER SIGNAL,GATE SIGNAL

Permissive Signals

- **Permissive signal in MAS:-Distant signal, Inner Distant Signal**
- **Permissive signal in TAS:-Warner signal**

Two aspect signals(stop signal) semaphore signal



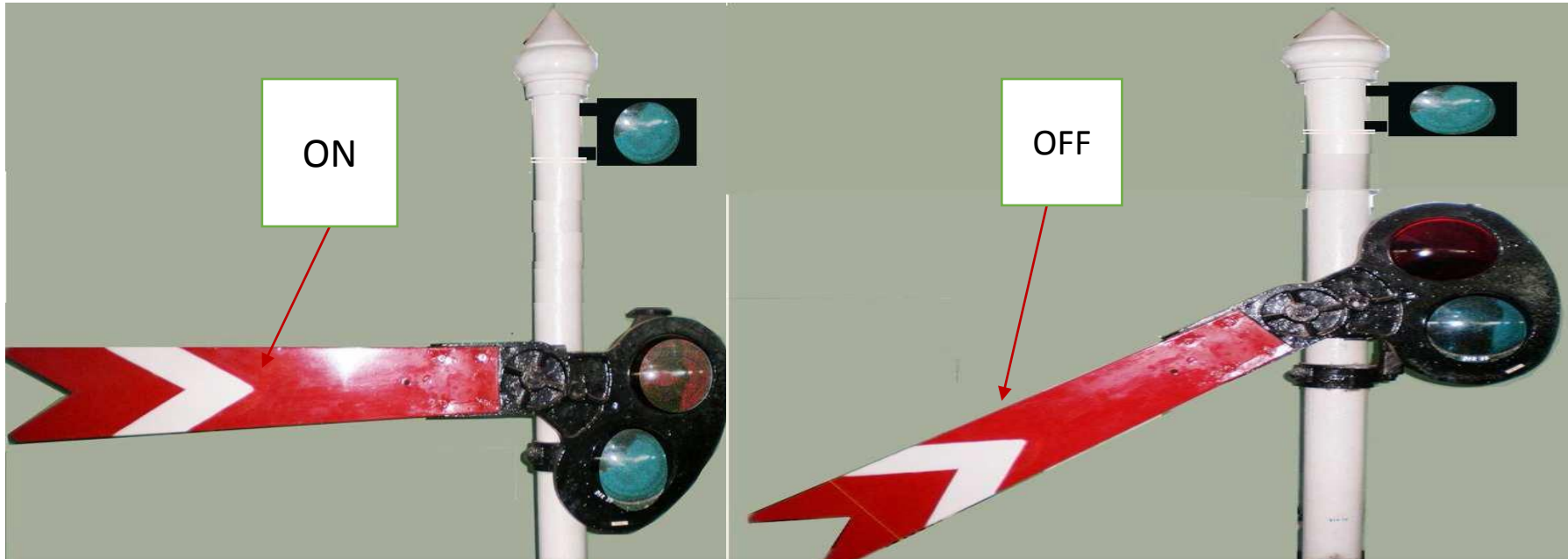
ON POSITION



OFF POSITION

ASPECT	STOP	PROCEED
INDICATION	STOP DEAD	PROCEED

TWO ASPECT SIGNALS(PERMISSIVE SIGNAL) SEMAPHORE

		
ASPECT	PROCEED WITH CAUTION	PROCEED
INDICATION	PROCEED WITH CAUTION AND BE PREPARED TO STOP AT NEXT STOP SIGNAL	PROCEED

Multi aspect(stop signal)semaphore signals

ASPECT AND INDICATION OF UPPER QUADRANT MULTIASPECT STOP SIGNAL

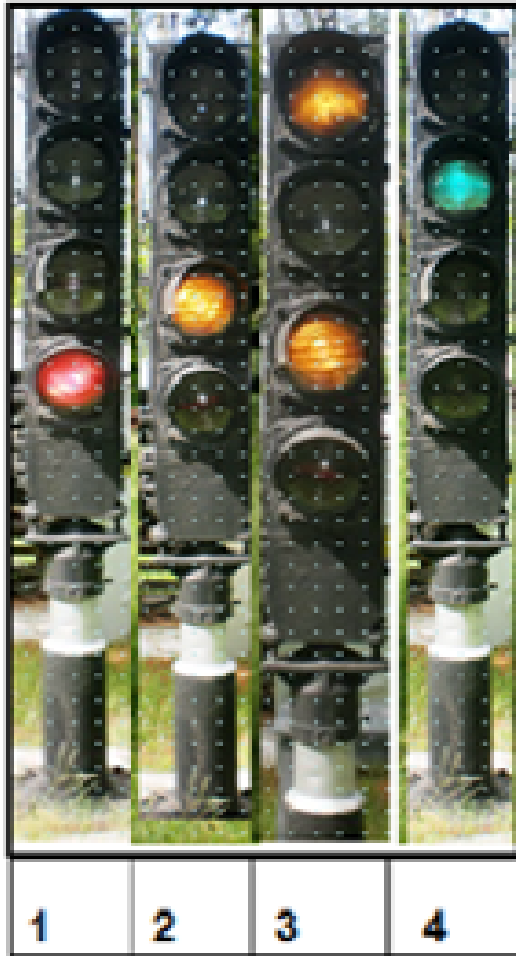


ASPECT	STOP	CAUTION	PROCEED
INDICATION	STOP DEAD	PROCEED & BE PREPARED TO STOP AT THE NEXT STOP SIGNAL	PROCEED

Multi aspect permissive signal(MAUQS)

ASPECT AND INDICATION M.A.U.Q. DISTANT SIGNAL			
			
aspect	Caution	Attention	proceed
Indication	Proceed & be prepared to stop at next stop signal	Proceed & be prepared to pass next stop signal at such a speed as prescribed by special instruction	proceed

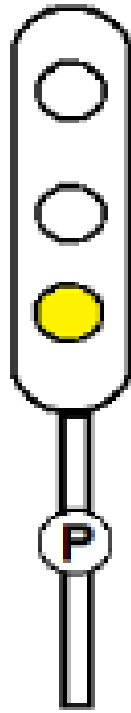
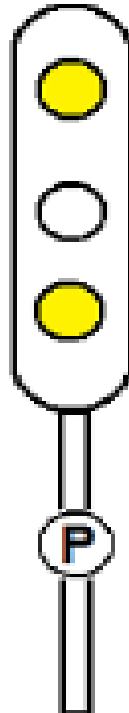
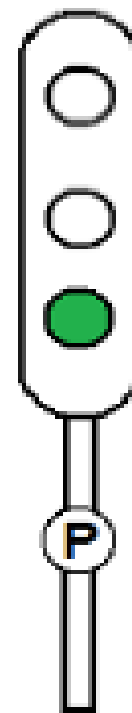
Multi aspect colour light (stop) signal



NO	ASPECT	INDICATION
1	STOP	STOP DEAD
2	CAUTION	PROCEED & BE PREPARED TO STOP AT NEXT STOP SIGNAL
3	ATTENTION	PROCEED & BE PREPARED TO PASS NEXT STOP SIGNAL AT RESTRICTED SPEED
4	PROCEED	PROCEED

ASPECT AND INDICATION FOR 4 ASPECT COLOUR LIGHT STOP SIGNAL

Permissive signal in MACL



Aspect	Caution	Attention	Proceed
Indication	Proceed & be prepared to stop at next stop signal	Proceed & be prepared to pass next stop signal at such a speed as prescribed by special instruction	Proceed

Designation of signals

- Signal for reception

1. permissive signal :-distant and inner distant signal

2. stop signal :- in two aspect- outer signal , FSS

In multi aspect:-Home , Routing Home

Signal for Departure

1. Starter signal

2. Advance starter signal

3. Intermediate starter



Aspect control chart of reception signal

Warner	Outer	Home	Indication
R	R	R	Stop at Outer Signal
R	G	G	Enter the station. Stop at Starter of concerned line if 'ON'
G	G	G	Run through via main line all signals ahead are 'OFF'

(b) Approaching signals used in MAUQ/MACL

Distant	Home	Indication
Y	R	Stop at Home Signal
YY	Y	Enter on Loop line. Stop at Starter if 'ON'
G	Y	Enter on main line. Stop at Starter
G	G	Run through via main line

(c) Using two Distant Signals in approach (MACL).

Distant	Inner Distant	Home	Indication
YY	Y	R	Stop at Home
YY	YY	Y	Enter on Loop Line. Stop at Starter if 'ON'
G	YY	Y	Enter on Main Line. Stop at Starter
G	G	G	Run through via main line

Aspect control chart of departure signal

(a) Departure signals in 2-aspect signalling

Starter	Advanced Starter	Indication
R	R	Stand in rear of starter
G	R	Shunt upto adv. Starter
G	G	Proceed line is clear

(b) Departure signals in M.A Signalling

Starter	Advanced Starter	Indication
R	R	Stand in rear of starter
Y	R	Shunt upto adv. Starter
Y/G	G	Proceed line is clear

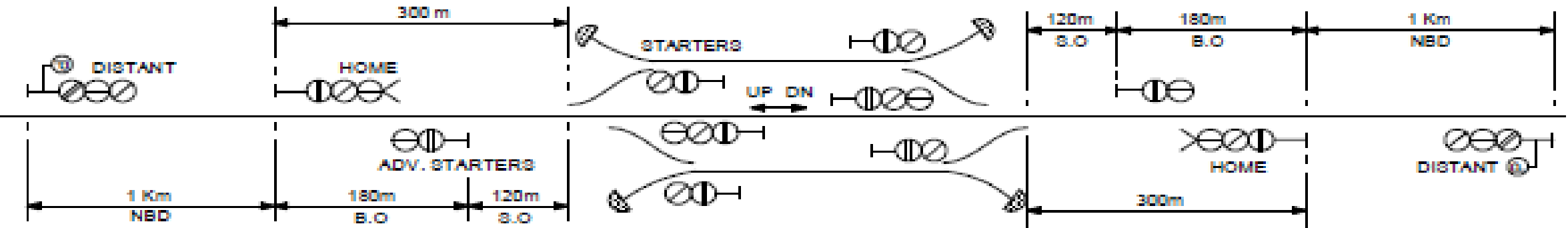
Location of signals in 2-aspect signalling

- WARNER SIGNAL:-1200 meter in rear of FSS or gate stop signal
- OUTER SIGNAL:-400 meter in rear of outer most point in D/L
580meter from FSS in S/L
- HOME SIGNAL:-Close to the first facing point
- ROUTING SIGNAL:-is placed in just rear of point which it protect
- STARTER SIGNAL:-Just in rear of facing point or fouling mark
- INTERMEDIATE STARTER:- Just in rear of facing point or fouling mark
- ADVANCE STARTER SIGNAL:-180 meter from outermost point on S/L

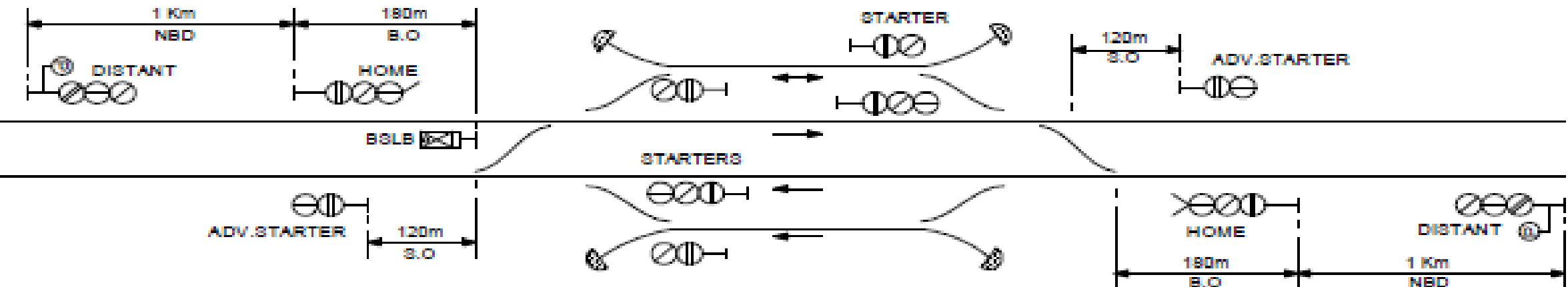
Location of signal in MACL

- **Distant signal:-1km in rear of FSS or gate home signal**
- **Home signal :-180 meter+120 meter from outer most facing point in S/L section**
- **Home signal on D/L:-180 meter in rear of facing point or BSLB**
- **Routing home :-just in rear of the point to which it protects**
- **Starter signal :-Just in rear of facing point or fouling mark**
- **Intermediate starter :- Just in rear of facing point or fouling mark**
- **Advance starter signal:-120 meter from outermost point in S/L and D/L section**

Location of signals in MACL



(a) SINGLE LINE



(b) DOUBLE LINE

Subsidiary signals (सहायक सिगनल)

All signals except main(Running) signal are called subsidiary signals.

- **Subsidiary signal**

Shunt signal

Calling on
signal

Shunting
permit
indicator



Shunt signal (GR 3.14)(शंट सिगनल)

- Shunt signals are used for shunting purpose in yard.
- Shunt signal can be independent and dependent
- More than one shunt signal may be placed on same post.
- When a shunt signal is placed below a stop signal
- , it shall shows no light in the “ON”



Independent and dependent shunt signal

ASPECT AND INDICATION FOR POSITION LIGHT TYPE
SHUNT SIGNAL



Aspect	Stop	Proceed slow
Indication	Stop dead	Proceed with caution for shunting

SHUNT SIGNALS

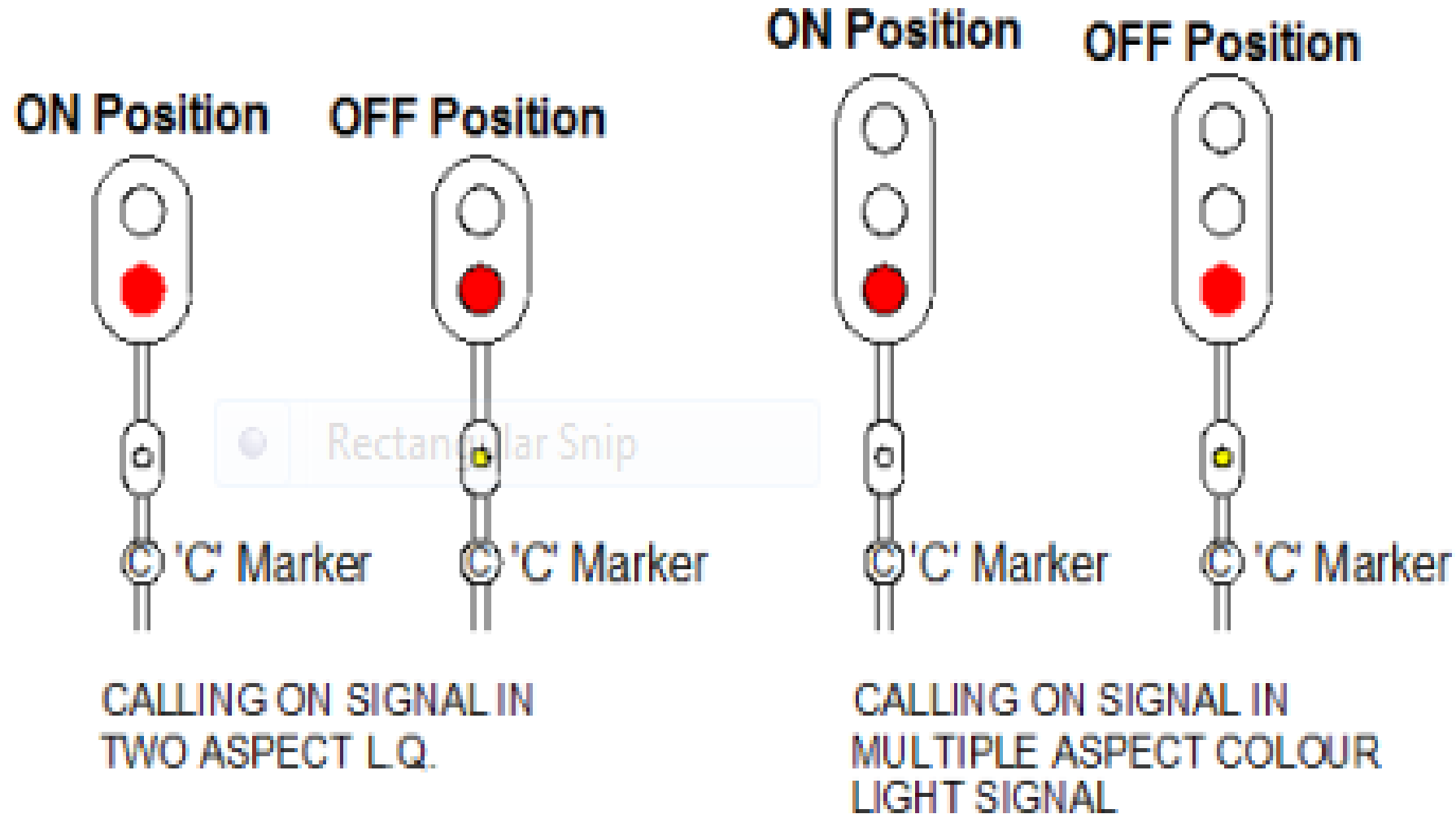


Shunt signal below stop signal Shunt signal on independent post

Calling ON signal

- **Calling on signals are used only for the specific purpose of indicating to the driver that he is required to draw ahead when OFF and be prepared to stop short of any obstruction even though the stop signal above it, is at ON.**
- **Calling on signals are taken OFF only after the train has come to a stop. Calling on signals of the colour light type are provided with a marker plate with letter 'C'.**
- **Under approved special instructions, a "calling on" signal may be provided below any other stop signal except the last stop signal**

Calling on signal in TAS and MACL



ROUTE INDICATOR

Types of Route Indicators to be provided shall be as under:

(a) Two aspect colour light signalling section - any route Indicator of approved design.

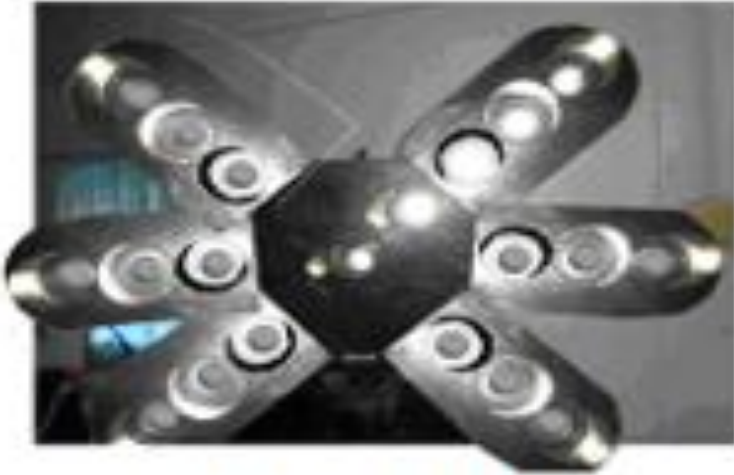
(b) Multiple aspect colour light signalling section –

For speed in excess of 15 Kmph - Direction (Junction) type route Indicator

For speeds not exceeding 15 Kmph - Any route Indicator of approved design

ROUTE INDICATOR

ROUTE INDICATORS



**JUNCTION
(DIRECTIONAL)
TYPE**



**MULTI-LAMP
TYPE**



**STENCIL
TYPE**

BOARDS

- **SHUNTING LIMIT BOARD:-**

The shunting limit board shall be placed at such a shunting distance from the outer most facing point as the local conditions may require, and shall not be less than 400m or 180m from the opposing first stop signal in 2-aspect or multiple aspect signalling respectively.

Shunting Limit Board demarks the station section and block section .



BOARDS(BSLB)

- **BLOCK SECTION LIMIT BOARD:** These boards are provided on Double line in multiple aspect signalling territory to distinguish the limit of the block section.
- It shall be provided at a station where there are no facing points or the outer most points at the approaching end are trailing.
- It shall be placed at distance not less than 180m from the Home
- Signal and protect the fouling



WARNING BOARDS

1.PASSENGER WARNING BOARD:-

Passenger warning boards shall be located at not less than 1 km in rear of first stop signal. In MACLS as distant signals are provided passenger warning board is dispensed with.



Passenger warning
board

WARNING BOARDS

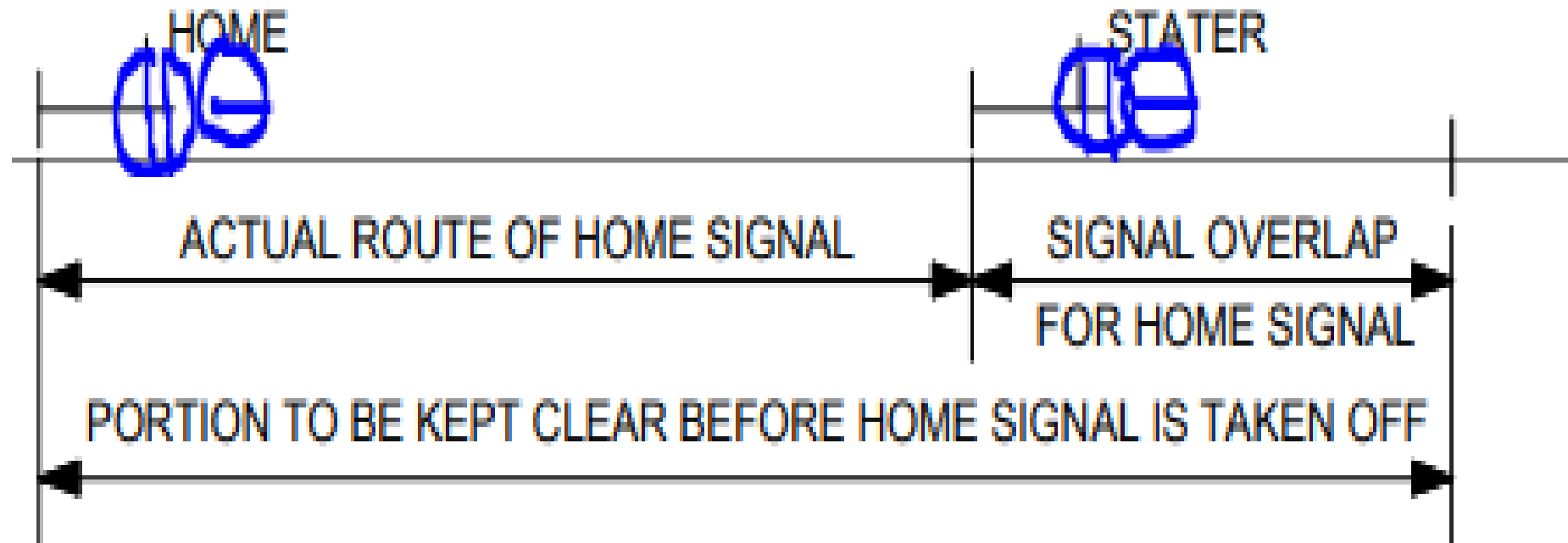
- **Goods warning board :-This Warning Board shall be located not less than 1.4 km in rear of the first stop signal.**
- **The distance may be increased suitably on falling gradients on approach to stations with the provision of second distant signal, this board is dispensed with .**



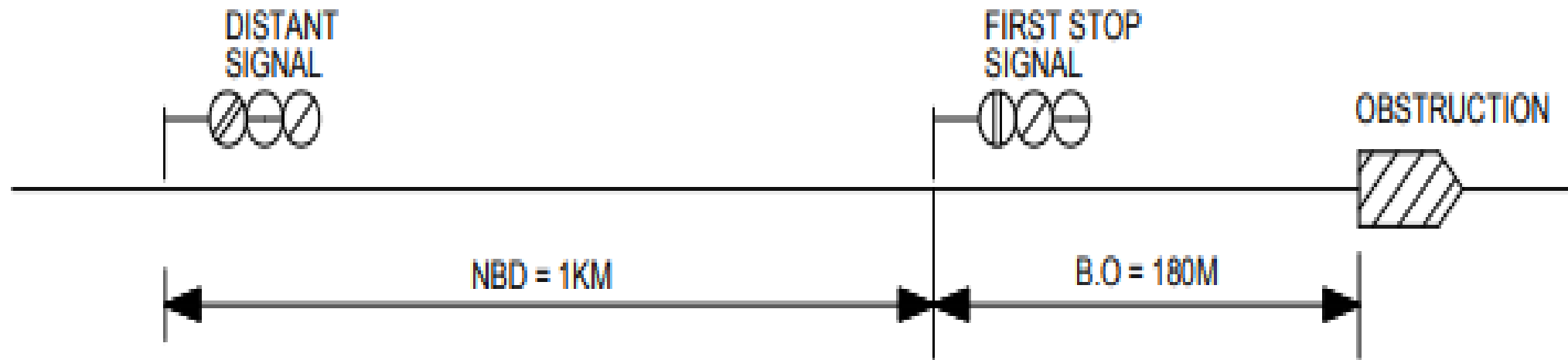
Goods warning
board

overlap

- The length of track in advance of a stop signal, which should be kept clear before the signal next in rear can be taken 'OFF' is known as the signal overlap.



Overlap(Block overlap)



(d) BLOCK OVERLAP IN M.A.S.

overlap

Type of signal Overlap	2 LQ signal	Multi- aspect signal UQ, MACLS & MLQ	Automatic signaling on double line	Automatic signaling on single line
Signal overlap	180 Mt.	120 Mt.	120 M	120 M
Block overlap	400 Mt.	180 Mt.	N.A	

As per Signal Engineering Manual (1988), the visibility of the signals is prescribed as under

- **MULTIPLE ASPECT SIGNALS**
- **Distant Signal 400 Meters**
- **Inner Distant Signal 200 Meters where this signal is provided**
All Stop Signals 200 Meters
- **If it is not possible to ensure 200 Meters continuous visibility of any stop signal while approaching it, a suitable speed restriction shall be imposed**

ISOLATION

- Isolation means an arrangement , secured by the setting of points or other approved means, to protect the line so isolated from the danger of obstruction from other connected line or lines.

Isolation between	Passenger line	Goods line	Siding
Passenger line	Not Required if speed < 50 Kmph. Required if speed $\geq$ 50 Kmph	Required irrespective of speed	
Goods lines	Required irrespective of speed	Not Required if speed < 50 Kmph Required if speed $\geq$ 50 Kmph	Desirable
Siding		Desirable	NA

Essential of interlocking

- (a) It shall not be possible to take off a running signal, unless all points including isolation are correctly set, all facing points are locked and all interlocked level crossings are closed and locked against public road for the line on which the train will travel, including the overlap,
- (b) After the signal has been taken off, it shall not be possible to move any points or lock on the route, including overlap and isolation, nor to release any interlocked gates until the signal is replaced to "ON" position,
- (c) It shall not be possible to take "OFF" at the same time, any two fixed signals which can lead to any conflicting movements and
- (d) Where feasible points shall be so interlocked as to avoid any conflicting movement.

SYSTEMS OF WORKING

- **SYSTEMS OF TRAIN WORKING** In Indian Railways, six systems of train working are adopted and they are :-

(a) Absolute Block System

(b) Automatic Block System

(c) Following Trains System

(d) Pilot Guard System

(e) Train Staff and Ticket System

(f) One Train Only System

Out of the above six systems of train working, the Absolute Block System and the Automatic System only shall be used, unless the adoption of other systems are especially permitted by the Railway Board.

Essential of absolute block system

- (a) Para 8.01 of General Rules stipulates the essential requirements of the system as under “Where trains are worked on the Absolute Block System”.**
- (i) no train shall be allowed to leave a block station unless Line clear has been received from the block station in advance.**
 - (ii) On double lines, such line clear shall not be given unless the line is clear not only up to the first stop signal at the block station at which such line clear is given but also for an adequate distance beyond it.**
 - (iii) On single lines, such Line Clear shall not be given unless the line is clear of trains running in the same direction not only up to the first stop signal at the block station at which such Line Clear is given but also for an adequate distance beyond it, and is clear of trains running in the direction towards the block station to which such Line Clear is given.**

Essential of absolute block system

- (b) The General Rule further states that the adequate distance referred above shall not be less than 400 meters in case of 2 aspect signalling and 180 meters in Multiple Aspect Upper Quadrant Semaphore Signalling or Color Light Signalling and modified lower quadrant signalling.**
- This is generally called the "Block Overlap" in signalling parlance. This distance can be reduced in case of necessity but this can be done, only under "approved special instructions" which means that sanction of Commissioner of Railway Safety is required to be obtained for reduction in the adequate distance.**

AUTOMATIC BLOCK SYSTEM

- **The essentials of automatic block system are –**
 - (i) The line shall be provided with Continuous Track Circuits or Axle Counters.**
 - (ii) The line between two stations may where required be divided into a series of section known as "Automatic Block Signalling Section".**
 - (iii) Entry into each automatic block signalling section is protected by a color light Multiple Aspect Stop Signal.**
 - (iv) Track Circuits or Axle Counters should controls the aspects of the Signal .**

CLASSIFICATION OF STATIONS - A, B & C

stations in absolute block system are classified as:-

- (a) CLASS `A' STATIONS:** Where line clear may not be given for a train, unless the line on which it is intended to receive the train is clear for at least 400 meters beyond the Home Signal, or up to the starter.
- (b) CLASS `B' STATIONS:** Where line clear may be given for a train before the line has been clear for the reception of the train within the station section.
- (c) CLASS `C' STATIONS OR BLOCK HUTS:** Where permission to approach may not be given for a train unless the whole of the last proceeding train has passed complete at least 400 meters beyond the Home Signal (IBS / IBH) and is continuing its journey. This will also include an Intermediate Block Post.
- (d) Class `D' Stations :-**These are passenger Halts & non- block stations

Multiple Aspect Signalling (minimum signaling equipment provided)

CLASS OF STATION	MINIMUM EQUIPMENT	ADDITIONAL EQUIPMENT
B	Distant, Home, Starters	Advanced Starter or SLB on single line where shunting in the face of an approaching train is required. Starters on double line. Block section limit board where there are no points or outermost point at the approach end is in trailing direction on double line.
C	Distant, Home	

STANDARDS OF INTERLOCKING

Standard of Interlocking	Previous standard (speeds up to Kmph)	Revised standard (speeds Up to Kmph)
Un-interlocked	15	-----
I	50	50
II	75	110
III	Unrestricted speed	140
IV	-----	160

LEVEL CROSSING GATE

- **When road traffic crosses the rail traffic at the same level they are known as level crossings .**
- **signalling arrangements at such crossings may be required if they are busy.**

CLASSIFICATION OF GATES ON BASIS OF TVU(as per SEM –II (Para no:14.1.1)

- **CLASSIFICATION OF GATES:-**
- **The classification of level crossings is made after conducting the level crossing census once in 3 years by a team consisting of supervisors of Engg and traffic department shall do the census of TVA for seven days generally and average per day is taken.**
- **(TVU train vehicle unit = No of trains x No of road vehicles .
Train motor vehicle, bullock card and tanga – 01 unit Cycle rikshaw
and auto rickshaw - $\frac{1}{2}$ unit) Classification of level crossing gate is
given below**
- **For road vehicles : - Special class, A Class , B Class , C Class**
- **For cattle crossings :- D Class.**

Classification of level crossing gate on TVU basis

Sl.no	CLASS	CRITERIA	INTERLOCKING/REMARKS
1	Special class	TVU greater than 50,000	R.O.B to be provided Gate to be interlocked till ROB is functioning)
2	'A' class	TVU between 30,000- 50,000 and number of road vehicle greater than 1000	Compulsory
3	'B' class	TVU between 20,000- 30,000 and number of road vehicle greater than 750	
	'B1' class	TVU between 25,000- 30,000	Compulsory
	'B2' class	TVU between 20,000- 25,000	
4	'C' class	All other LC Gate not cover in	If TVU is greater than 6000 OR

GATES(as per SEM , part II para no:-14.12)

- Closing arrangement for gates may be of swing /movable type or lifting barrier type of approved design.
- Gates can be divided into the following categories:-
 - I)Non-interlocked gates and Interlocked gates
 - II)Engineering Gates and Traffic gates

