MAINTENANCE SYSTEM OF PASSENGER COACHES (INFRASTRUCTURE DESIGN)

INFRASTRUCTURE DESIGN

- TO DEVELOP A TEMPLATE FOR COACHING WORKSHOPS FOR CARRYING OUT POH

PURPOSE

- THIS TEMPLATE IS AIMED TO CRISTALIZE MAINTENANCE SYSTEM FOR PASSENGER COACHES

TERMS & REFERANCES

- TEMPLATE SHOULD BE CONSTRUED TO MEAN LAYOUT,INFRASTRUCTURE, SYSTEM, M&P etc.
- REFER JICA REPORT-ITS IMPLEMENTATION & IMPACT
- REFER IGP REPORT-ITS IMPLEMENTATION & IMPACT
- REFER MODULAR CONCEPT OF CRWS/BPL

TEMPLATE DEMYSTIFIED

- PROCESS FLOW
- LAYOUT
- INFRASTRUCTURE
  - SHEDS
  - M & P
  - MATERIAL HANDLING
- MATERIAL STACKING
- FLOORING,ROOFING,ILLUMINATION

NEED FOR TEMPLATE

- READY RECKONER TO PLAN MODERNISATION
- NEWER CONCEPT LIKE CoC
- PU PAINT TECHNOLOGY
- DESIGN CHANGES,TECHNOLOGICAL DEVELOPMENT,SUPERIOR MATERIALS
- CHANGE IN PRODUCT MIX

VISION

- GENERAL
  - TO STANDARDIZE SYSTEMS & INFRASTRUCTURE
- SPECIFIC
  - TO REDUCE CYCLE TIME FORM 18 TO 7 DAYS
  - TO ACTS AS READY RECKONER

WHY?

- VOLUMES HAVE BEEN SPOKEN ABOUT TEMPLATE. EVERY ANGLE HAS BEEN MAGNIFIED.STORY ABOUT EACH & EVERYTHING TOLD & RETOLD.ONCE AGAIN, SINCERE ATTEMPT HAS BEEN MADE TO EVOLVE TEMPLATE BY UTILISING VARIOUS PRINCIPLES & CONCEPT.

WHY?

- BASICALLY IT IS AN ATTEMPT TO CRYSTALIZE VARIOUS THOUGHTS/IDEAS AT MACRO LEVEL FOR AN IDEAL LAYOUT,WITH A VIEW TO REPLICATE SOME OF THEM IN BROWN FIELD PROJECT.
- MACRO TO MICRO APPROACH HAS BEEN PREFERRED IN THIS PRESENTATION

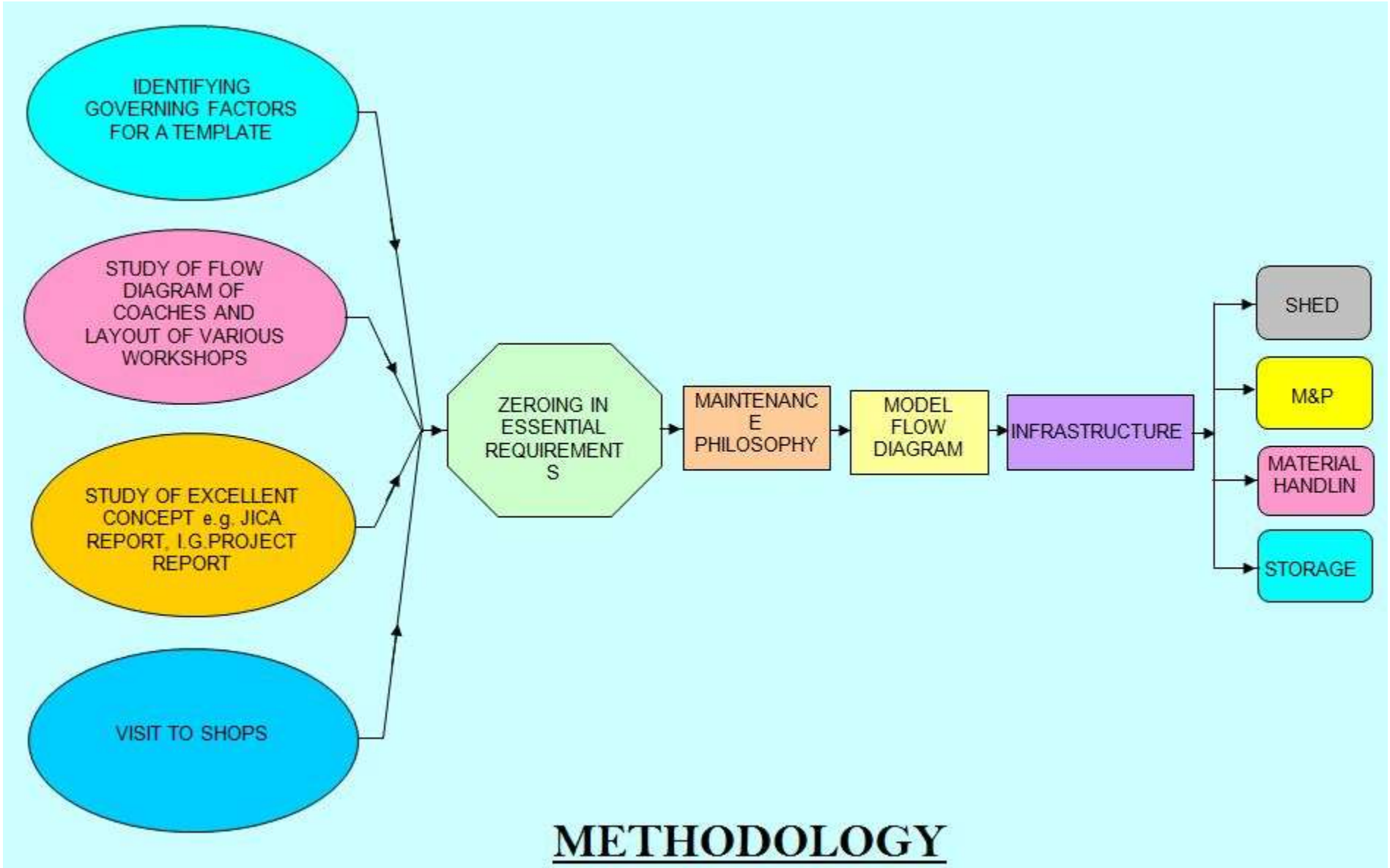
WHY?

- IMPROVED
  - PRODUCTIVITY
    - REDUCED HOLDING
    - REDUCED CYCLE TIME
  - QUALITY
    - EFFICIENT WORK FLOW
    - DEDICATED WORK STATION/GANG

METHODOLOGY

- IDENTIFY GOVERNING FACTORS
- STUDY
  - EXISTING PROCESS FLOW
  - JICA REPORT
  - IGP REPORT
  - MODULAR CONCEPT OF CRWS/BPL
- EAXMINE LAYOUTS OF VARIOUS WORK SHOPS
- VISIT VARIOUS WORKSHOPS
- EVALUATE VARIOUS OPTIONS
- EVOLVE TEMPLATE

MODUS OPERANDI



HOW?

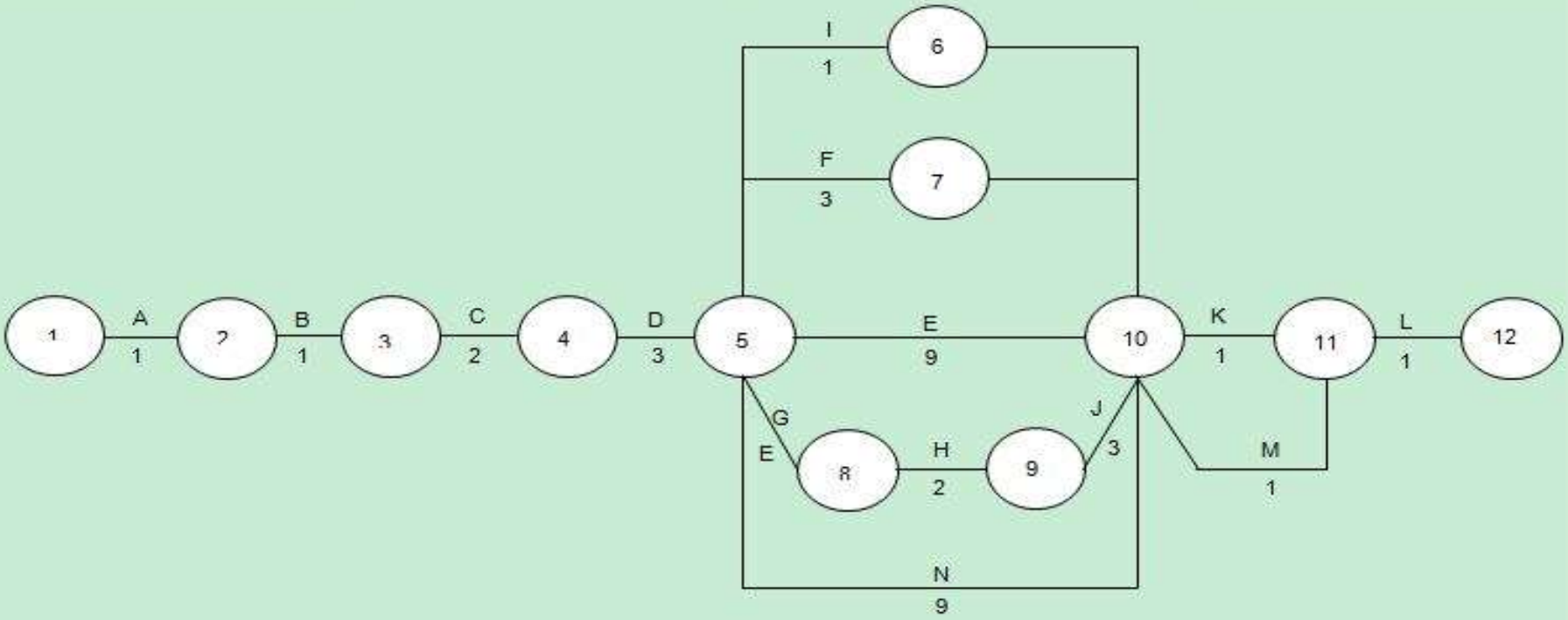
- IMPROVED WORK FLOW
  - BELT SYSTEM FOR EVERY THING
- SHORTEST MOVEMENT BETWEEN WORK STATIONS
- NEWER CONCEPT
- NEWER TECHNOLOGY
- UNIT EXCHANGE

GOVERNING FACTORS

- MAINTENANCE PHILOSOPHY & CONCEPT
- TYPE OF COACHES
- DAILY OUT TURN
- CYCLE TIME
- VARIOUS OPTIONS

EXISTING NETWORK FOR POH

NETWORK FOR POH OF COACHES (NORMAL REPAIRS)



	ACTIVITY DESCRIPTION	DURATION (Days)
A.	VERIFICATION OF DEFICIENCIES	1
B.	PRE-INSPECTION & LIFTING	1
C.	STRIPPING	2
D.	BODY REPAIR, MODIFICATIONS AND ALTERATIONS	3
E.	PAINTING	9
F.	FITTING OF WATER TANK, PLUMBING & LEAKAGE TESTING	3
G.	REPAIRS TO INTERIOR PANELS	3
H.	FITMENT OF SHUTTERS	2
I.	FITMENT OFDOORS	1
J.	FITMENT OF BERTHS & SEATS	3
K.	VACUUM/AIR BRAKE TESTING & FINAL WORKS	1
L.	FINAL INSPECTION & DESPATCH	1
M.	FITMENT OF AXLE PULLEY, TENSION ROD & TESTING OF COACH WIRING	1
N.	TESTING OF BRANCH WIRING & FITMENT OF ELECTRICAL EQUIPMENT	9

[Total Duration= 18 days]

DEFICIENCIES IN EXISTING PROCESS FLOW

- NO PARALLEL ACTIVITY CAN BE UNDERTAKEN WHILE PU PAINTING IS GOING ON.
- NO PROVISION FOR COACH CLEANING IN THE BEGINNING.
- DESIGNED FOR NORMAL REPAIR COACHES ONLY. AC/HCR COACHES,HAVING HIGHER CYCLE TIME HAVE BEEN LEFT OUT.

JICA

- OBJECTIVE
  - TO ENHANCE REPAIR CAPACITY
  - TO SHORTEN REPAIR CYCLE TIME
- IMPLEMENTED IN 2002-03

JICA

- FEATURES
- SEGGREGATION OF HCR/AC COACHES
- CENTRALIZATION OF BODY REPAIR ACTIVITIES
- ADEQUATE REPAIR SPACE AROUND COACHES

JICA

- BENEFITS
- USE OF CoC CONCEPT,HELPED TO AVOID BOTTELNECK BY INTRODUCING FLEXIBILITY IN THE PROCESS FLOW FOR ACHIEVING SMOOTH UNIFLOW OF COACHES.
- THIS ALSO HELPED TO ENHANCE REPAIR CYCLE TIME OF BOGIES FROM 1DAY TO 3 DAYS TO IMPROVE QUALITY.

IGP

- FOR LOWER PAREL W/S
- BETWEEN 1996-2000
- OBJECTIVE
  - EFFICIENT WORK FLOW
  - IMPROVED WORK METHODS
  - WEAR STUDY ON BOGIE COMPONENTS
  - COST CENTER APPROACH

IGP

- ACHIEVED:
- ESTABLISH EFFICIENT WORK FLOW & IMPROVED METHODS IN BOGIE REPAIR SHOP
  - BOGIE SUB STORE
    - MUST CHANGE ITEMS (24)
    - EXCHANGE ITEMS (27)
    - REPAIRABLE ITEMS (15)
- IMPROVEMENT IN BOGIE

CRWS/BPL

- BELT SYSTEM
- MODULAR CONCEPT FOR HEAD STOCK REPAIR & FITMENT
- CLEANING THROUGH OUTSOURCING
- PALLETIZATION
- SCREEN PRINTING
- BOGIE EXCHANE AT FINAL STAGE

DISCUSSION ON VARIOUS OPTIONS

• BOGIE EXCHANGE	INITIAL/FINAL
• BOGIE CLEARANCES	EOT/JACK
• COACH MOVEMENT/L	RRV/LOCO/PUSHER
• CLEANING	**BOSCH TANK/SHOT BLASTING**
• COACH MOVEMENT/T	TRAVERSER/EOT
• HCR COACHES	TRESTLE/DUMMY BOGIES/REPAIRED BOGIES

ZEROING-IN ESSENTIAL REQUIREMENTS

- CoC
- TRAVERSER BETWEEN PAINT BOOTH & DRYING OVEN
- BOGIE TRANSFER ARRANGEMENT BETWEEN CRS & BRS
- TWO PARALLEL ROAD
- JACKS IN OGS
- TRACK IN SMS & WAS

ZEROING-IN ESSENTIAL REQUIREMENTS

- SEPARATE HCRS
- TRIMMING SHOP NEARER TO CRS
- SUPPORT SHOPS NEARER TO MAIN WORK CENTERS

MAINTENANCE PHILOSOPHY & CONCEPT

- UNI FLOW
- OPTIMIZED REPAIR CYCLE TIME USING
  - CoC
  - TRAVERSER BETWEEN BOOTH & OVEN FOR PU PAINT TECHNOLOGY
- SUPPORT SHOPS NEARER TO MAIN WORK CENTERS
- PALLETIZATION

5 STAGES OF POH

1. CLEANING OF ENTIRE COACH
2. INSPECTION & STRIPPING
3. COMPLETE REPAIR OF BODY & BOGIE
4. PAINTING
5. ELECTRICAL EQUIPMENT FITMENT, BHA/BC,ELEC/AIR BRAKE TESTING, NTXR/DCWI INSPECTION

5 WORK STATIONS

1. COACH CLEANING WORK STATION-CCWS
2. INSPECTION & STRIPPING WORK STATION-I&SWS
3. BODY/BOGIE REPAIR WORK STATION-B/BRWS
4. PAINTING WORK STATION-PWS
5. FINAL INSPECTION & TESTING WORK STATION-FI&TWS

MAINTENANCE PHILOSOPHY & CONCEPT

STAGE	LOC	ACTIVITIES
1st	CCWS	COMPLETE CLEANING OF COACH
2nd	I&SWS	STRIPPING OF TRIMMING, TL ITEMS, BATTERIES TESTING OF WATER TANKS
3rd	B/BRWS	COMPLETE REPAIR OF BODY-BERTHS,PVC, LP SHEETS,ROOF,TOILET, DOOR WAYS, SC/COUP, BUFFERS, VESTIBULE.BOGIE REPAIR IN BRS
4th	PWS	PAINTING OF COACH BODY
5th	FI&TWS	FITMENT OF TL ITEMS, BATTERIES, BHA & BC AIR BRAKE TESTING, NTXR/DCWI INSPECTION

CYCLE TIME AT EACH WORK STATION-EXISTING

- CCWS NIL DOES NOT EXIST
- I&SWS 4
- B/BRWS 12
- PWS 9 PARALLEL/B/BRWS
- FI&TWS 2
- TOTAL 18 DAYS

KEY ELEMENTS

- MAXIMUM TIME CONSUMING ACTIVITIES ARE:
  - BODY REPAIR/BOGIE REPAIR-12 DAYS
  - PAINTING-9 DAYS (A-SCH),6 DAYS(C-SCH)

COMPARISION OF KEY ELEMENTS OF POH

W/S	BR	PAINT	TOTAL
GKP	11	3	17
MTN	5	4	14
KGP	6	6	16
MAN	6	6	16
PL	7	6	18
PER	3	4	9

THRUST ON KEY ELEMENTS

- KEY ELEMENTS (BODY REPAIR & PAINTING)CONSTITUTE ALMOST 75% OF TOTAL CYCLE TIME.HENCE THEY REQUIRE FOCUS.

THRUST ON KEY ELEMENTS- PAINTING

- PAINTING 9 DAYS A-SCH
- PAINTING 6 DAYS C-SCH

HOW TO REDUCE CYCLE TIME OF PAINTING?

- ANSWER
  - PU PAINT TECHNOLOGY WHICH NECESSITATES INSTALLATION OF PAINT BOOTH & DRYING OVEN
  - A TRAVERSER BETWEEN PAINT BOOTH & DRYING OVEN WOULD ENHANCE PRODUCTIVITY MANIFOLD.
  - LET US SEE STEPS INVOLED FOR C-SCH

C-SCH PU PAINTING

- C-SCHEDULE PAINTING

C-SCH PU PAINTING WITH SEQUENCE OF OP & TIMING

- C-SCH PAINT TIMING

C'-Schedule coach painting-Sequence of operation with timings

No.	Activity	Timing	Berths available	COACHES									
				1	2	3	4	5	6	7	8	9	10
1	Wet Rub down	4 hrs	3	7.30-11.30	7.30-11.30	7.30-11.30	7.30-11.30	7.30-11.30	12.00-16-00	13-00-8.30	13.50-9.20	7.40-11.40	8.30-12.30
2	Paint booth	40 min	1	12.00-12.40	12.50-13.30	13.40-14.20	8.20-9.00	9.10-9.50	10.00-10.40	12.50-13.30	14.30-15.10	15.20-16.00	9.10-9.50
3	Oven	40 min	1	12.50-13.30	13.40-14.20	14.30-15.10	9.10-9.50	10.00-10.40	10.50-11.30	13.40-14.20	15.20-16.00	10.00-10.40	10.50-11.30
4	Masking	30 min	1	13.40-14.10	14.30-15.00	15.20-15.50	10.00-10.30	10.50-11.20	12.50-13.20	14.30-15.00	7.30-8.00	10.50-11.20	12.00-12.30
5	Paint Booth	40 min	1	14.30-15.10	15.20-16.00	7.30-8.10	10.50-11.30	12.00-12.40	13.40-14.20	7.30-8.10	8.20-9.00	12.00-12.40	12.50-13.30
6	Oven	40 min	1	15.20-16.00	7.30-8.10	8.20-9.00	12.00-12.40	12.50-13.30	14.30-15.10	8.20-9.00	9.10-9.50	12.50-13.30	13.40-14.20
7	Lettering	2 hrs	2	7.30-9.30	8.20-10.20	9.40-11.40	12.50-14.50	13.40-15.40	15.20-8.50	9.10-11.10	10.00-12.00	13.40-15.40	14.30-16.30
				OUT TURN-1st day-5coaches					OUT TURN 2nd day- 5 coaches				

THRUST ON KEY ELEMENTS - BODY REPAIR

- BODY REPAIR ACTIVITIES

1. UNIT EXCHANE OF SCREW COUPLING -FEW HRS
2. UNIT EXCHANE OF BUFFERS -FEW HRS
3. UNIT EXCHANGE OF DV,AIR RESERVOIR -FEW HRS
4. UNIT EXCHANGE OF TOILET/ FITTINGS -FEW HRS
5. REPLACEMENT OF UIC VESTIBULE -FEW HRS
6. REPLACEMENT OF WATER TANK -FEW HRS

THRUST ON KEY ELEMENTS - BODY REPAIR

- BODY REPAIR ACTIVITIES

7.	REPLACEMENT OF DOOR,WINDOW SHUTTER	1DAY
8.	USE OF STANDARD PATCHES OF LP SHEET	1DAY
9.	REPLACEMENT OF BERTHS	2DAY
10.	REPLACEMENT OF ENTIRE PVC IN AISLE PORTION	1DAY
11.	REPLACEMENT OF ENTIRE PVC IN TOILET	1DAY
12.	REPLACEMENT OF Al CHEQUIRED PLATE IN DOOR WAYS	1DAY

THRUST ON KEY ELEMENTS - BODY REPAIR

- BODY REPAIR ACTIVITIES

13. UNDER FRAME SCRAPING & PAINTING -2DAYS
14. MINOR CORROSSION REPAIR -3DAYS
15. INTERIOR PAINTING

– -MIN NO OF DAYS IN BODY REPAIR SHOP

-DAY 1 1,2,3,4,5,6,7,8,9(S),13 (S),14 (S)

-DAY 2 9(F)10,11,12,13 (F)

-DAY 3 14 (F),15

THRUST ON KEY ELEMENTS - BOGIE REPAIR

- BOGIE REPAIR ACTIVITIES ARE TO BE DONE PARALLELY ALONG WITH BODY REPAIR AT ADJOINING WORK STATION & ARE TO BE COMPLETED IN 3 DAYS

ALTERNATOR MOUNTING

- ALTERNATOR MOUNTING STAND

Earlier, alternators for AC coaches were being mounted on bogie using pit. Since pit normally remains full of scrap, dark & water logged, the system was not liked by workers. With above elevated arrangement, mounting activity has become highly productive. This arrangement may be replicated either in green field or brown field project.

DEFINING PRINCIPLSE/CONCEPT FOR

- BOTH
  - GREEN FIELD PROJECT
  - BROWN FIELD PROJECT
- THESE ARE:
  - UNI FLOW-BELT SYSTEM
  - COC
  - TRAVERSER BETWEEN PAINT BOOTH/OVEN

DEFINING PRINCIPLSE/CONCEPT FOR

- UNIT EXCHANGE
- PROVIDE RATHER THAN PRODUCE
- REPLACE RATHER THAN IN-SITU REPAIR
- OUTSOURCING NON CORE ACTIVITY
- MAINTENANCE BY OEM
- LEAST MOVEMENT OF MEN/MATERIAL

DEFINING PRINCIPLSE/CONCEPT FOR

- OUTSOURCING OF CLEANING ACTIVITIES/SEPARATE DIRTY/CLEAN AREA
- SEPARATE HCRS
- STANDARDIZATION
- MODULAR WORKING
- PALLETIZATION
- UNIT EXCHANGE
- PLASMA CUTTING/CO2 WELDING

DEFINING PRINCIPLES/CONCEPT

- DEDICATED WORK CENTERS WITH ERGONOMICAL FEATURS INCLUDING PROVISION OF BALANCER, POWERED TOOLS,SERVICES LIKE GAS MANIFOLD,OXYGEN,AIR,ELEC. POINT ETC.
- SUPERVISERS'CABIN NEAR COLUMN & ON THE STILT.GROUND PORTION TO BE USED FOR STORAGE.

COACH OVER COACH CONCEPT

- MAKES WORKSHOP COMPACT
  - LEAST MOVEMENT OF COACH/MEN/MAT
- ENSURES SPECIFIED ACTIVITIES AT DEFINED WORK CENTER BY DEDICATED GANG
- INDUCTS FLEXIBILITY IN SYSTEM
- ENSURES EFFICIENT WORK FLOW

COACH OVER COACH

COACH PROCESS FLOW

- Coach Flow

PROPOSED CYCLE TIME

W/STN	EX	PRO
• CCWS	NIL	0.5
• I&SWS	4	1.5
• BR&BRWS	12	3
• PWS	9	1
• BHA/FI&TWS	2	2
• TOTAL	**18**	**8**

COACH HOLDING FOR 5 COACH OUTTURN DAILY

WORK STN	CT	OT	HOL
CCWS	0.5	5	2.5
I&SWS	1.5	5	7.5
B&BRWS	3	3	9
HCRWS	15	1	15
PAINTING-C	1	4	4
PAINTING-A	7	1	7
AC	25	1	25
TOTAL			70

SUM & SUBSTANCE

- THIS TEMPLATE IS FOR
- POH CYCLE TIME OF 8 DAYS
- REDUCED HOLDING IN WORKSHOP

A CASE STUDY COMPARISION OF KEY ELEMENTS OF POH

W/S	BR	PAINT	TOTAL
GKP	11	3	17
MTN	5	4	14
KGP	6	6	16
MAN	6	6	16
PL	7	6	18
PER	3	4	9

WHY PER HAS LOWEST CYCLE TIME?

- CREDIT GOES TO COC CONCEPT,COUPLED WITH STRICT TIMINGS FOR BODY REPAIR i.e.3 DAYS
- REDUCTION IN PAINTING TIME HAS FURTHER HELPED.
- SEGGRIGATION OF HCR COACHES(20%) ENSURES SPECIFIED CT FOR MAJORITY(80%) OF COACHES.

AN INTERESTING STORY ABOUT COC OF PER

- COC SHED WAS ORIGINALLY ENVISAGED BY JICA FOR HCR & AC COACHES WHOSE REPAIR TIME VARIED TO A GREAT EXTENT.SO COC SHED COULD PROVIDE FLEXIBILITY.
- THIS MEANS COC WAS PLANNED FOR 20% HCR COACHES.
- BUT ACTUALLY IT IS BEING USED FOR 80%OF COACHES,THEREBY ENSURING SPECIFIED CT.HCR COACHES HAVE BEEN SEGGREGATED TO ANOTHER WORK STATION
- THEREFORE CREDIT FOR REDUCED CT GOES TO LOCAL MANAGEMENT & NOT TO JICA.
- BUT THEN IT HAS CERTAIN DEFICIENCIES i.e. IT DOES NOT HAVE SUPPORT REPAIR SHOPS NEARBY,SC.BUFFERS,DV ETC GO TO FAR OFF PLACES FOR REPAIR ATTENTION.
- AN EFFORT HAS BEEN MADE TO REMOVE THESE SHORTCOMINGS IN THE PROPOSED TEMPLATE

ADVANTAGES

- LOW HOLDING
- REDUCED CYCLE TIME
- VERY HIGH PRODUCTIVITY
- QUALITY REPAIR AT SPECIFIED WORK STATION
- SHORTEST COACH/MAT MOVEMENT
- EFFICIENT WORK FLOW

MATERIAL STACKING

- INTELLIGENT WAREHOUSING WITH
  - AUTOMATIC STORAGE
  - RETRIEVAL SYSTEM
- DRIVE-IN PALLET SYSTEM
- SELECTIVE PALLET SYSTEM
- MATERIAL HANDLING & TRANSPORTATION EQUIPMENTS

MATERIAL HANDLING EQUIPMENT

- HYDRAULIC MOBILE CRANE & FORK LIFT




NEED FOR COMPACTOR

- A SUITABLE CAPACITY PRESS WOULD HELP TO COPACT SCRAP FOR EASY HANDLING & SCRAP MANAGEMENT.

FLOORING

- CEMENT CONCRETE FLOORING M 25

FLOORING

- HARDONITE FLOORING
  - 150mm THICK (112 mm CC BASE + 38 mm HARDONITE)
  - 38 mm HARDONITE (FOR 100 SQ FT AREA)
    - 0.44 cum ANGULAR CRUSH GRANITE CHIPS
    - 0.22 cum CEMENT
    - 79 KG HARDONATE COMPOUND
      - MIXED WITH REQUIRED QTY OF WATER
      - TOPPING TO BE KEPT DAMP FOR 15 DAYS

FLOORING

- EPOXY FLOORING
  - SUITABLE FOR PAS, RBS, ABS etc
- CRIB FLOORING
  - SUITABLE FOR BATTERY SECTION

CLEANING OF FLOOR

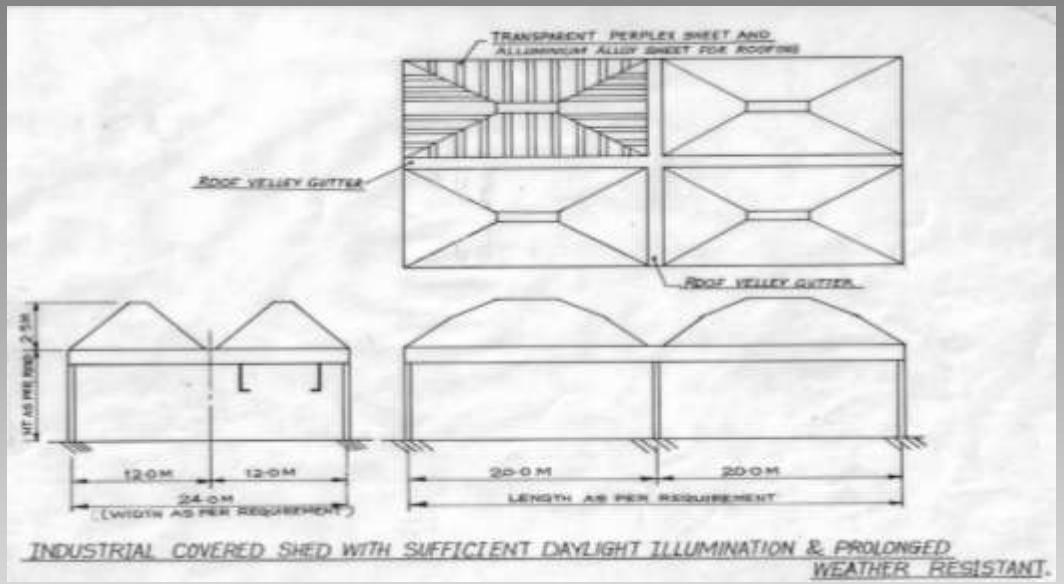
- SINCE ENTIRE REPAIR AREA IS PAVED WITH CONCRETE, FLOOR SWEEPER WITH MAGNETIC PICKER NOW CAN BE DEPLOYED FOR DAILY USE & SCRUBBER FOR PERIODICAL USE.

ILLUMINATION LEVEL

SHOP	MIN LUX
• CCWS	150
• I&SWS	300
• B/BRWS	300
• PWS	100
• FI&TWS	150
• ACS	300
• HCRS	150
• SMS	150
• BAS	100
• TLS	300
• BRS,BCS	300
• RBS,WAS	300

ROOFING

- ALUMINIUM ROOFING AS PROVIDED IN RCF



- ALUMINIUM ZINC ALLOY ROOFING AS PROVIDED IN COC SHED OF PER

VENTILATION

This Express air ventilation system would be very useful in old shops to improve ventilation & illumination. The wind velocity spins the vanes which causes a region of low pressure which in turn draws hot air out. The slightest breeze will cause the turbine to spin. Suction is maintained even at low wind velocities. The convective thermal currents are given further boost by venturi dome to further enhance the rotation of the system. This system will be able to exhaust trapped hot air, chemically polluted air, steam, gas, and powder & dust particles. This is a simple, light weight construction, easy to install, noise free & weather proof system. This system comprising of 60 ventilators has been installed at corrosion shop of Lower Parel workshop of WR at a cost of Rs 3.6 lakhs by M/S Express Engineering Construction Ltd GIDC Baroda. Contact person Mr S.V.Kori (09819744355).

VENTILATION

- FUNCTIONS WITH NORMAL AIR VELOCITY
- SPINNING VANES CREATES LOW PRESSURE WHICH DRAWS OUT HOT AIR

THANK YOU