

Maintenance of Passenger Coaches

- Safety, Hygiene and Passenger Amenities**

By

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My Background

- ❑ Passenger rail coach maintenance and operations
- ❑ Alumnus of
 - Massachusetts Institute of Technology, USA
 - Indian Railways Institute of Mech.& Elect. Engineering, Jamalpur
- ❑ Interests: Supply Chain Management, Quality Systems
- ❑ I spend time by Reading and Playing with my two Labradors
- ❑ Travel : USA, Spain, Thailand, Singapore, New Zealand, France, Germany, Switzerland, Nepal, India

Agenda

- ❑ Coach Maintenance Basics
- ❑ Safety Issues
- ❑ On-board Services
- ❑ Quality Systems
- ❑ Supply Chain Management
- ❑ Assimilation and Up-gradation of Technology



IR offers a wide range of Passenger Services



Luxury Trains



Rajdhani / Shatabdi



Mail-Express



Garib Rath

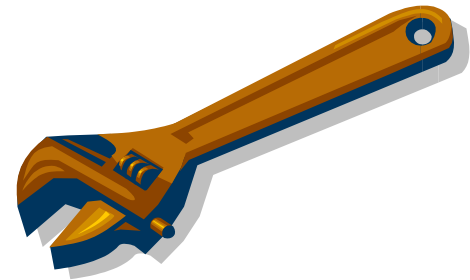


Suburban Trains



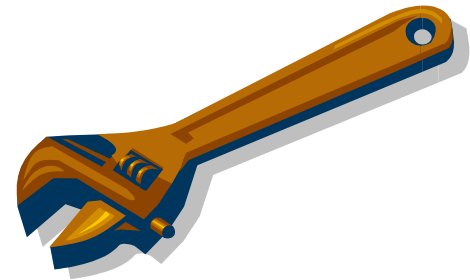
Hill Railways

Coach Maintenance Basics



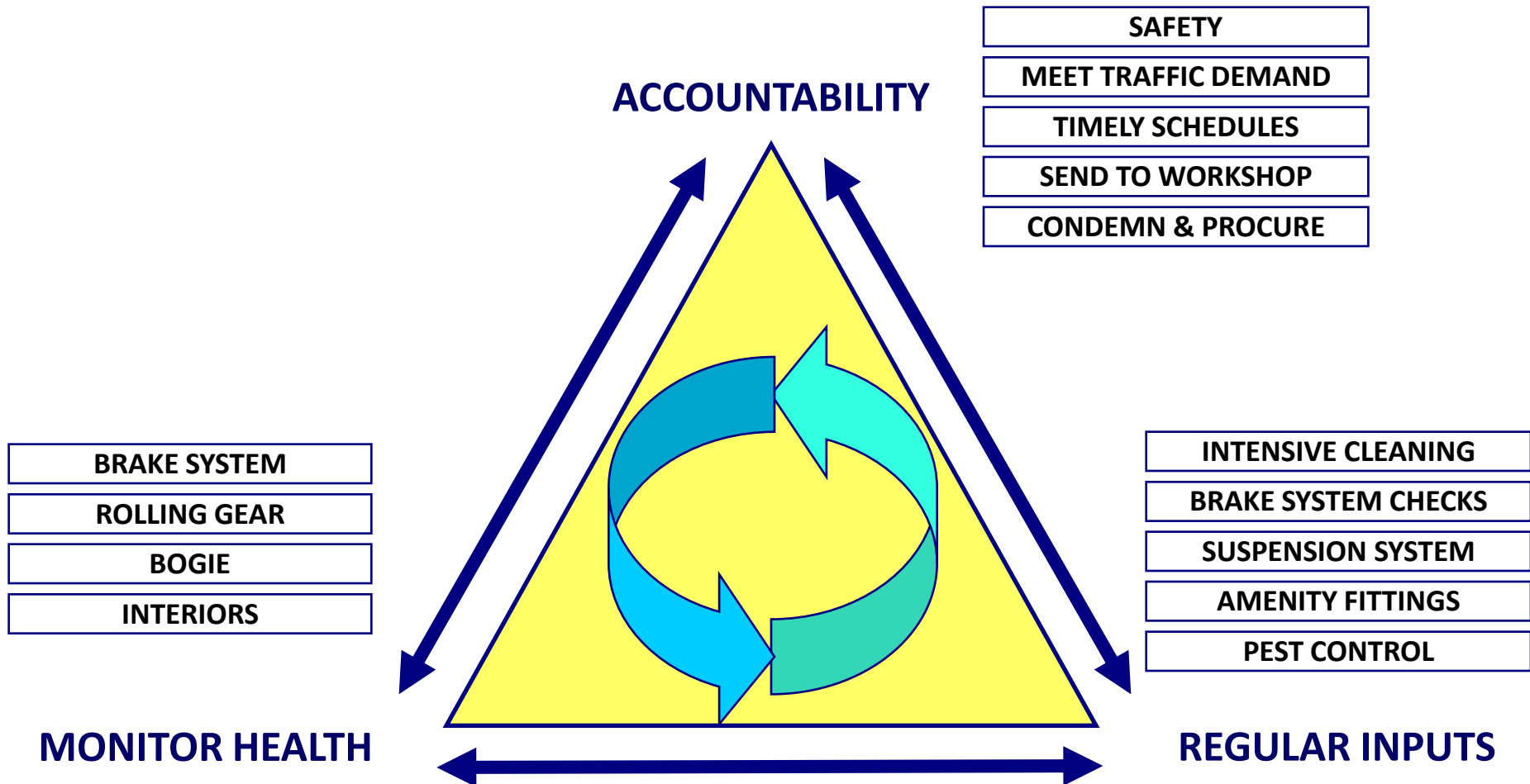
Coach Maintenance Basics

- ☐ The Principle of Ownership
- ☐ When to maintain?
- ☐ Other end attention
- ☐ Schedules
- ☐ Out of course Repair
- ☐ Facilities for maintenance
- ☐ What to monitor as a Maintenance Manager



Coach Maintenance Basics

□ The Principle of Ownership



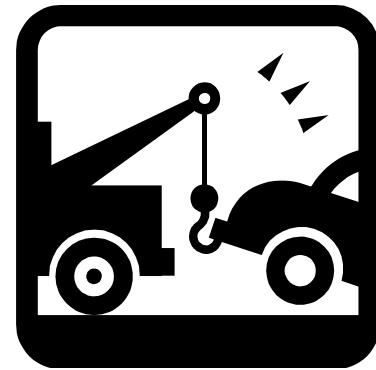
Coach Maintenance Basics

❑ When to Maintain?



FIXED INTERVAL BASIS

or



CONDITION BASIS

Fixed interval for primary maintenance – Distance Basis

Fixed interval for periodical maintenance schedules – Time Basis

Coach Maintenance Basics

☐ When to Maintain?

Aspect	Primary End	Other End at platform
Periodical Maintenance schedule	Yes	No
Under-gear Examination & Brake system maintenance	Yes	Not required if round trip distance < 3500 kms.
External Cleaning	Yes	Not required if round trip distance < 3500 kms.
Internal Cleaning & Passenger Amenities	Yes	Yes
Watering	Yes	Yes
Brake Power Check prior to start	Yes	Yes

Coach Maintenance Basics

❑ Other end attention



Shatabdi Express being provided 'other-end' attention on the platform before commencing its return journey

- Terminating Examination
- Positive security arrangements
- High Pressure Cleaning of Toilets
- Washable Aprons
- Waste Management
- Watering Hydrants
- Brake Power Check prior to start
- Material Storage & Movement

Coach Maintenance Basics

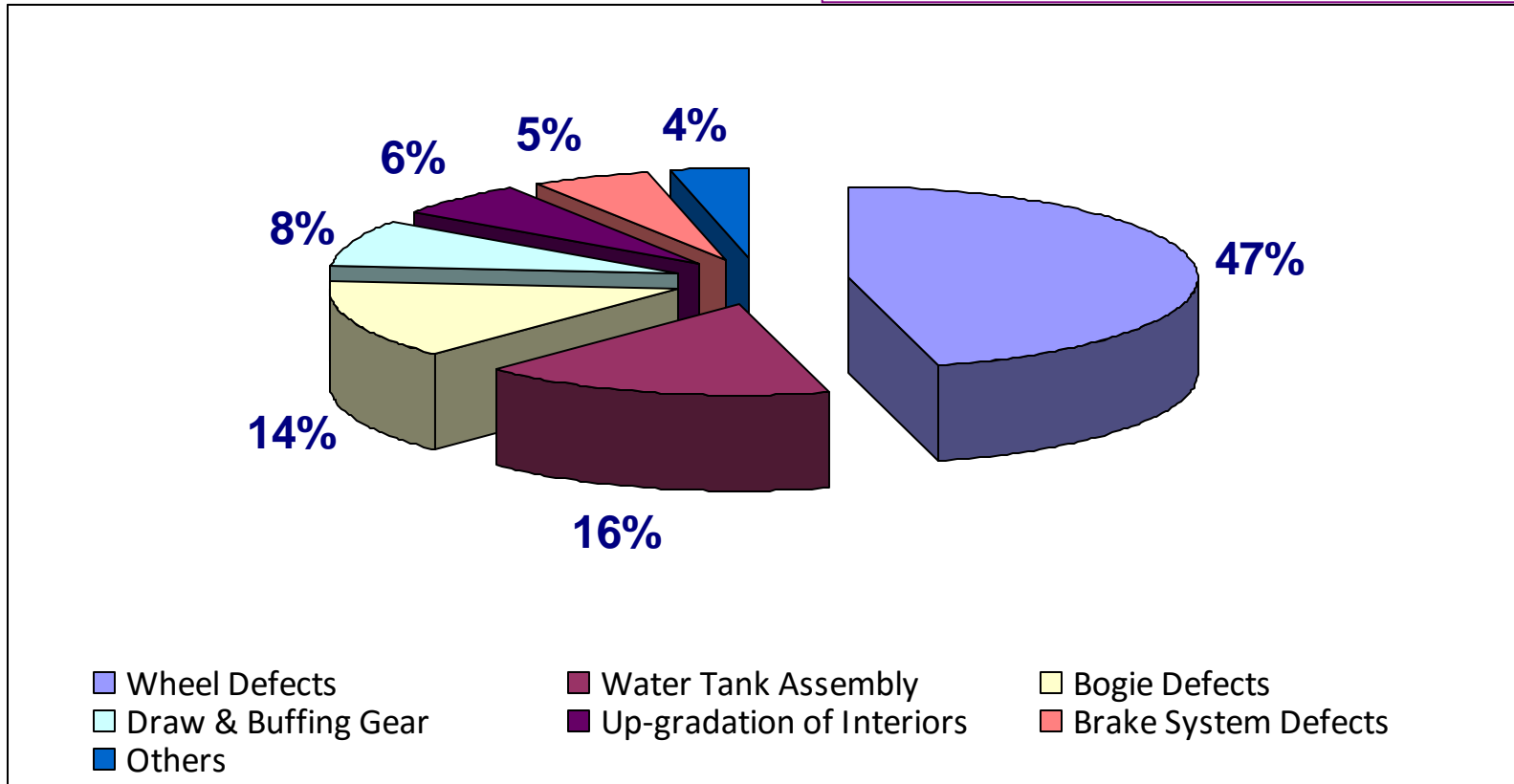
❑ Schedules for Passenger Carrying Coaches

Schedule	Periodicity	Where?
A	1 month	On-rake in primary maintenance depot
B	2 months	On-rake in primary maintenance depot
C or IOH	6 months	Intermediate Overhaul at associated IOH Shed
POH	12 months	Periodic Overhaul at nominated Workshop
MLR	12-15 years	Once in lifetime at CRWS, Bhopal and others

Coach Maintenance Basics

□ Out of Course Repair

2.2 per 100 coaches p.m.

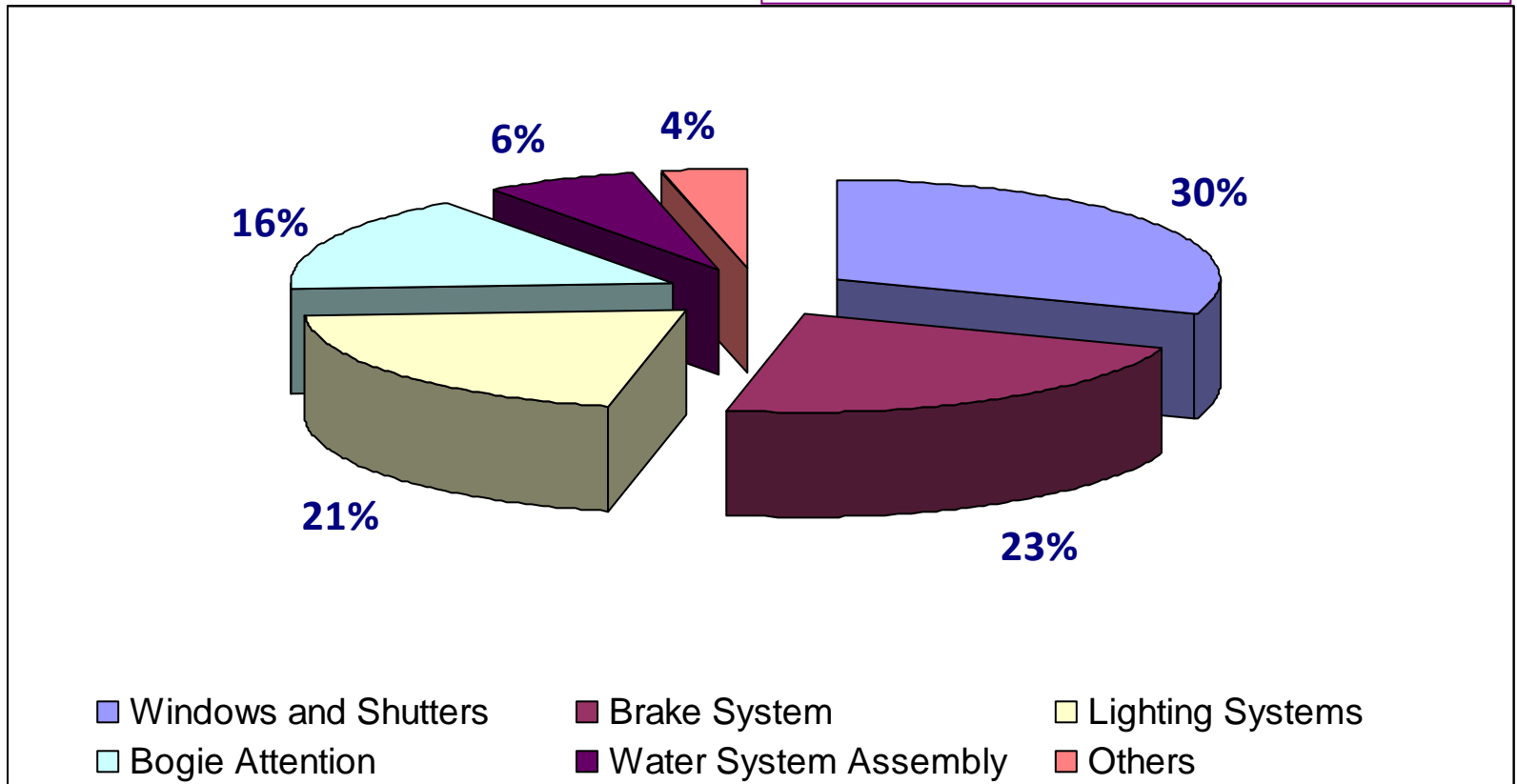


Non-Schedule Detachments

Coach Maintenance Basics

❑ Out of Course Repair

20.8 per 100 coaches p.m.



On-Rake Attention during Maintenance

Source: 2006-07 Data - Mumbai Division, Central Railway

Coach Maintenance Basics

❑ Facilities for Maintenance



Photos: Wadibunder, Mumbai

Train Maintenance Sidings

- 24 Coach length maintenance sidings
- Ergonomically designed pits
- 3m wide catwalks to move materials
- CFL Illumination for siding and pits
- High Pressure mechanized cleaning
- Watering & Drainage arrangements
- Adjacent Staff Rooms and Store
- Communication facilities
- Adjoining Shed for attending coaches

Coach Maintenance Basics

□ Facilities for Maintenance



Photo: Wadibunder, Mumbai

Intermediate Overhaul Shed

- Coach Lifting facilities to run out bogies
- Ergonomically designed pits
- 25 T EOT Cranes, Forklifts
- Welding Facilities
- Inspection & Testing of sub-assemblies
- Unit exchange of sub-assemblies
- Wheel Changing, Turning and Profiling

Coach Maintenance Basics

❑ What to monitor as a Maintenance Manager

Operations

- Punctuality
- Ineffective Percentage
- Other-end detachment
- Traffic Demand Pattern
- Availability of Spare coaches

Reliability

- Out of course repair
- En-route / Non schedule detachments
- Failures within X days of Manufacture / POH

Coach Maintenance Basics

❑ What to monitor as a Maintenance Manager

Amenities

- Customer Satisfaction Indices
- Zero-defect coaches

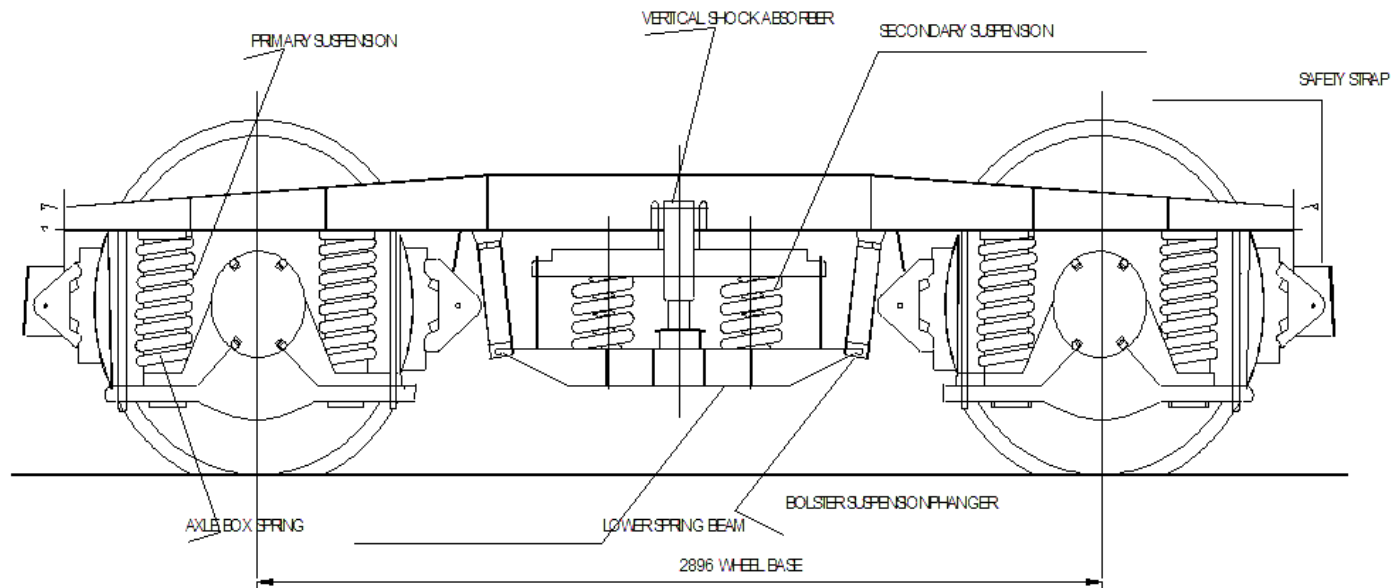
Stock

- Timely conduct of schedules/ Over-dues
- Time taken for maintenance and schedules

Resources

- Availability of manpower, Training needs
- Discipline, Absenteeism, Work-culture
- Availability of materials, Inventory turns
- Tools and equipment, Machine Downtime

Safety Issues



Safety Issues

- ❑ Originating, En-route & Terminating examination
- ❑ Brake System
- ❑ Wheel-sets
- ❑ Fire Hazards
- ❑ Accidents - Minimizing Injuries to passengers
- ❑ Occupational Health and Safety
- ❑ Inspections, Super-checks and Audits



Safety Issues

❑ Originating, En-route and Terminating examination



Visual examination to detect hanging / broken parts when train rolls in /out at stations



Axle Box temperature recording at en-route and terminating stations



Releasing of Brakes (Distributor Valve)



Safety Issues

- ❑ **Brake System**
- ❑ Check Application and release
- ❑ Continuity Check- loco attach/detach
- ❑ Brake power check
- ❑ Angle cock clamp to prevent miscreants
- ❑ Moisture affects reliability
- ❑ Unit Exchange of Distributor Valves, Brake Cylinders



Safety Issues

❑ Wheel-sets



Thermal Stresses

- Heat Checks, Thermal Cracks
- Shattered Rim, Shelled Tread

Wheel Profile due to wear in-service
Wheel Diameter measurement



Roller Bearing Failures

- Examine for Tell-tale signs, Temperature

Safety Issues

❑ Fire Hazards

- Maintenance of LPG based kitchen system during POH and Monthly schedules
- Ventilation Arrangement
- Joint inspections by Commercial and Mechanical departments with pantry contractor
- Adherence to Safety Regulations included in contract conditions of pantry-car services

Pantry Cars



On Coaches

- Safety Precautions listed for information of travellers
- Provision of Fire Extinguishers on trains



Safety Issues



❑ Fire Hazards

Up-grading coaches to UIC norms

Furnishing	Upgraded Specifications
Paneling for Side walls and partitions	Resin bonded Thermosetting Laminates
Cushioning Material for berths and seats	Densified Thermal bonded polyester blocks instead of PU foam
Upholstery Fabric	Vinyl coated Fire-retardant grade upholstery Fabric
Curtains	Fire Retardant fabric
Flooring Material	<ul style="list-style-type: none">• Compreg board for flooring• PVC flooring to latest specs
Roof Ceiling Material	NFTC Roof Ceiling / Non-asbestos Limpet Sheets

Safety Issues

❑ Accidents - Minimizing Injuries to Passengers

Coach Design

- Integral Design and Anti-telescopic design of shell
- Destruction tubes under Lavatories at ends
- Design studies by RITES, RDSO and IR to improve crashworthiness of coaches

Some Modifications done by Workshops



Ladder with PU foam



Sunk-in Soap Dish

Safety Issues

❑ Occupational Health and Safety



Helmets



Footwear



Welding Gear



Hand Gloves



Aprons



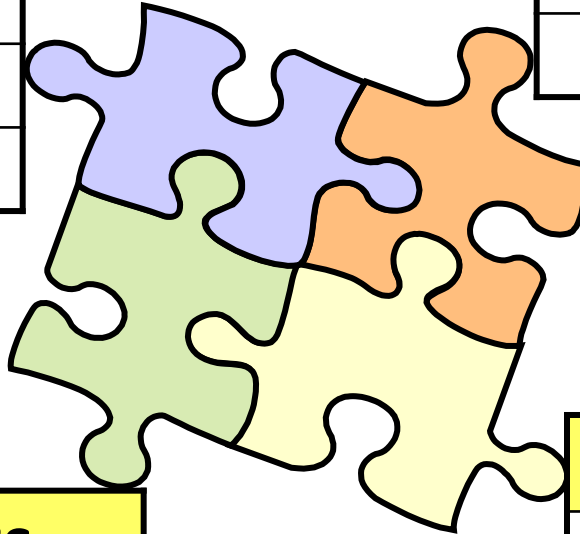
Masks

Safety Issues

☐ Inspections, Super-checks and Audits

Division
Rake Maintenance
Night Inspections
Operations
Quality of Work

Multi-disciplinary Teams
Safety and Amenities
Co-ordination Issues
Stores Verification



RDSO & RITES
Quality Audits
Technical Issues
Material Inspection

GM and HQ
Infrastructure
Strategic Inputs
Long-term Impact
Co-ordination Issues

On-Board Services



On-Board Services

- ❑ Hygiene – Toilet and coach cleanliness
- ❑ Amenities
- ❑ Pest Control
- ❑ Linen Management
- ❑ On-board deficiencies and diagnostics
- ❑ Importance of Customer Feedback



On-Board Services

□ Hygiene – Toilet and coach cleanliness

En-route Cleaning



**High pressure Jet Cleaning of
Toilets at Igatpuri**



**Travelling Safaiwallas (Cleaners)
on Pushpak Express**

- En-route Stations , every 250-350 kms
- From 06.00 to 22.00 hrs
- On-board cleaning crew on trains
- Outsourced to professional agencies

On-Board Services

❑ Hygiene – Toilet and coach cleanliness



Disinfecting Toilet fixtures at Itarsi



Cleaning Windows at Ratlam

En-route Cleaning

- 25 'Clean Train' Stations in India
- Outsourced to professional agencies
- From 06.00 to 22.00 hrs
- High quality cleaning in 20 min. halt

On-Board Services

☐ Hygiene – Toilet and coach cleanliness

**Intensive Cleaning
at Primary end**



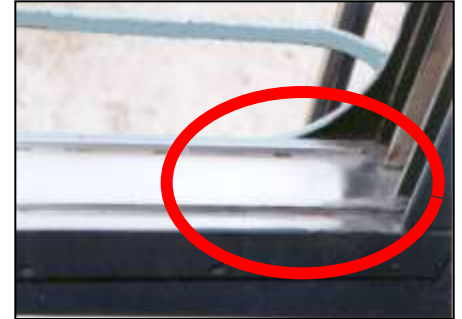
Before



After



Before



After



On-Board Services

❑ Amenities



- Mobile and Laptop charging
- GPS based Real-time info displays
- Retro-reflective Multi-lingual boards
- Quality cleaning for heavy toilet usage
- Odour Control System
- Dirt Trap Mats
- Linen in air-conditioned coaches
- Pantry Meals on-board
- Theme based decor

On-Board Services

☐ Pest Control



- ☐ Periodic Dis-infestation by spraying chemicals
- ☐ Special attention to Pantry cars & AC coaches



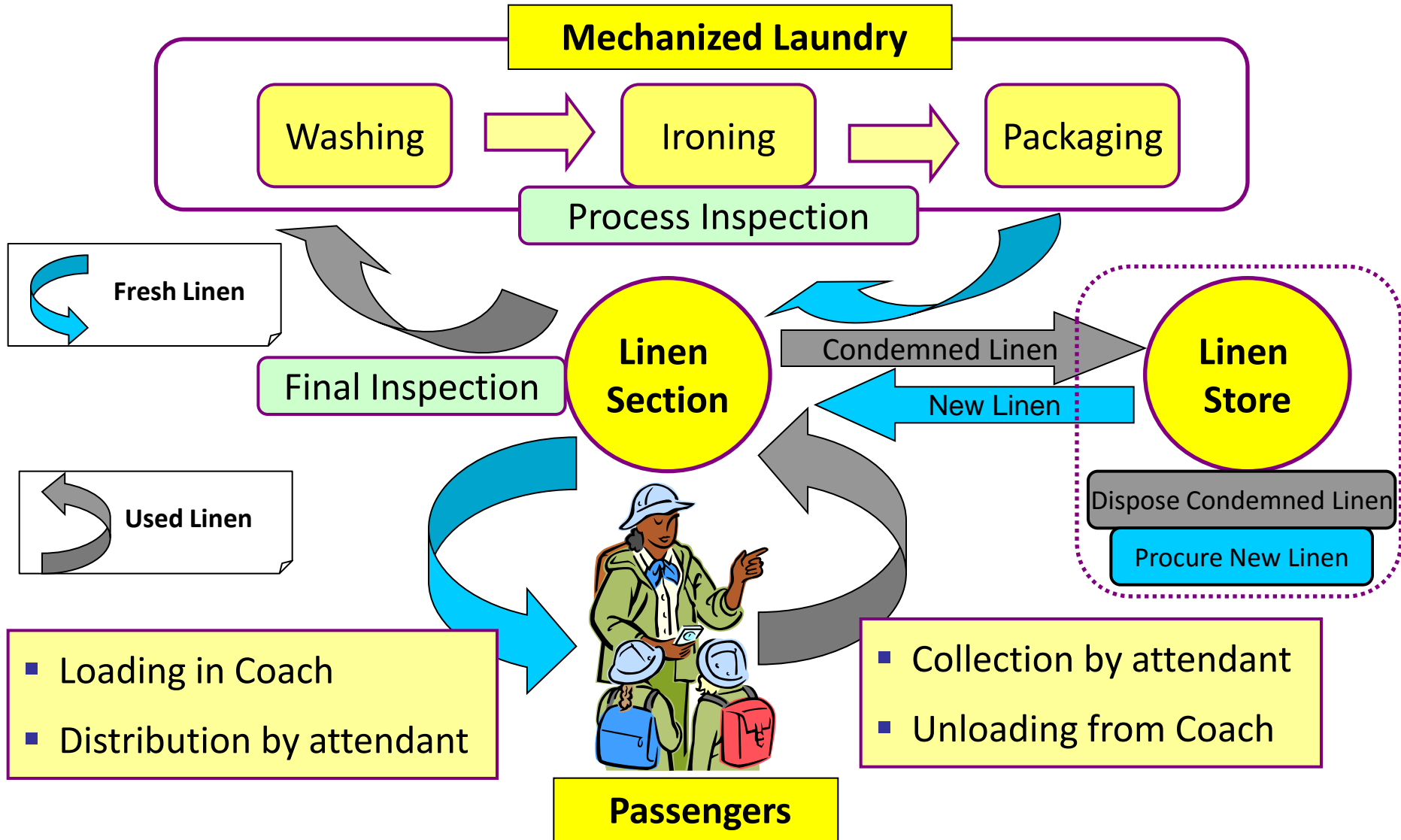
- ☐ Use of baits and rat-traps
- ☐ Treatment of live burrows at depots/stations



- ☐ Anti-mosquito fogging at primary depots
- ☐ Sprays at 'Clean Train' stations

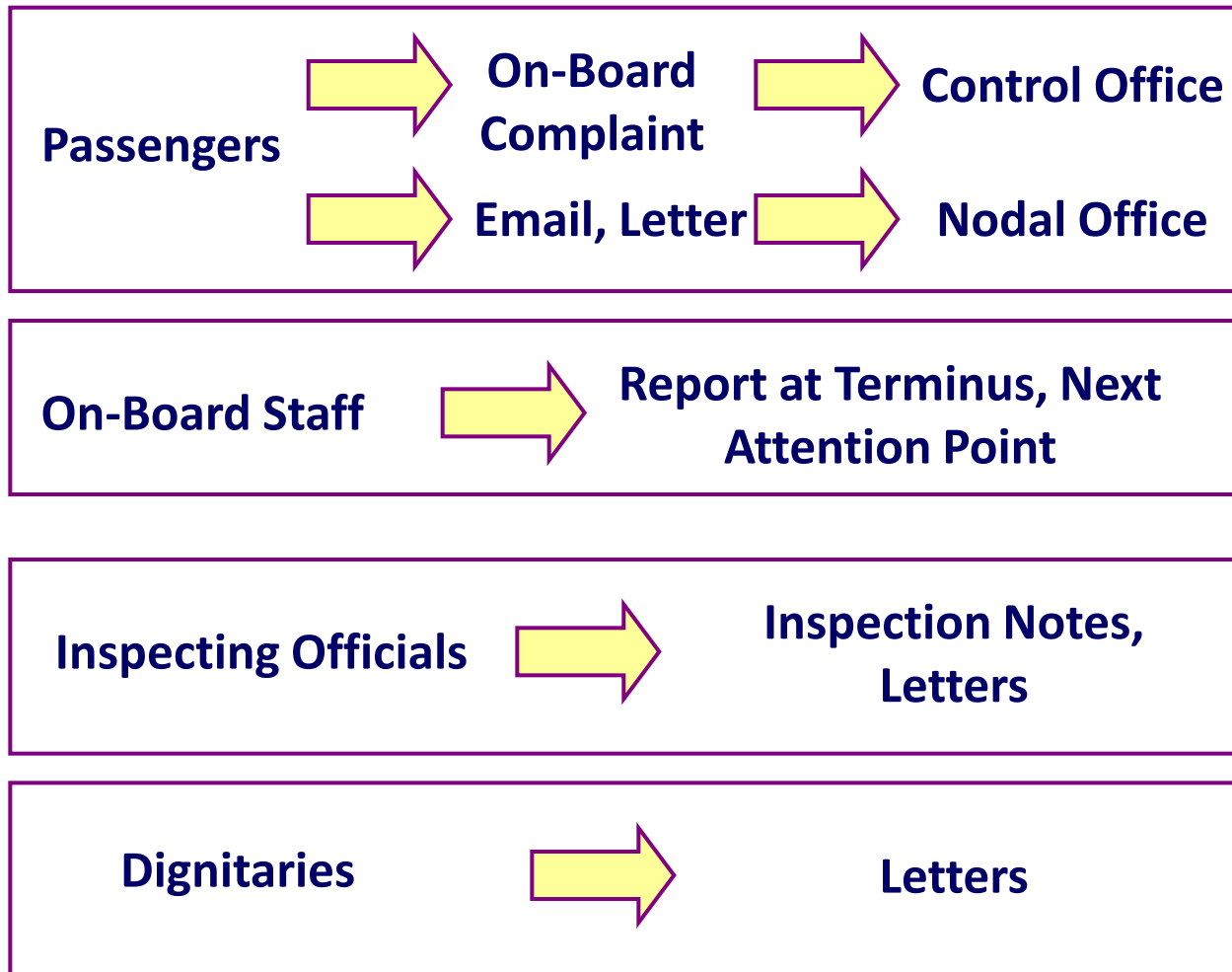
On-Board Services

■ Linen Management



On-Board Services

❑ On-Board deficiencies and diagnostics



Coach Maintenance Staff at the Primary end Or 'Other End' Or En-route Station Based on Nature of complaint

On-Board Services

□ Importance of Customer Feedback

साध्य रेल
Central Railway

एन/सी एन सी/एन
एन/सी/एन
मुंबई मंडल
Mumbai Division

प्रिय यात्री / Dear Passenger,

मुंबई मंडल द्वारा प्राथमिक अनुसंधान की गई यात्री पर आरम्भ हार्डिक स्वागत है। आप हमारे बहुमुखी यात्रक हैं और हमें आपकी सेवा करने का सौभाग्य प्राप्त हुआ है।

हमारे कोच अनुसंधान करने वाले समेकित आरम्भ बहुमुखी विचार तथा सुझाव की अपेक्षा करते हैं जिससे हमारी प्राथमिक अनुसंधान वाली यात्रियों का अनुसंधान स्तर उच्च हो सके। कृपया हमारे अनुसंधान के संबंध में अपने विचार प्रकट करें।

Mumbai Division welcomes you on board one of its Primary maintained train. We feel privileged to have you as our valued customer.

Our coach maintenance staff solicits your feedback / suggestions which will provide us an opportunity for further improvements in the standard of coaching maintenance of Primary maintained trains kindly grade the effectiveness of our maintenance.

आपका धन्यवाद,
Yours sincerely,

कुल मंडल रेल प्रबंधक, मुंबई
For Divisional Railway Manager CST Mumbai

यात्री संख्या: 1419 Dn कोच संख्या: 3-9 बर्थ/सीट संख्या: 58, 58, 62

Train No. 1419 Dn Coach No. 3-9 Borth/Seat No. 58, 58, 62

क्र. सं. / Sr. No.	विवरण / Description	उत्कृष्ट / Excellent	बहुत उत्कृष्ट / Very Good	अच्छा / Good	संतोषजनक / Satisfactory	असंतोषजनक / Unsatisfactory
1.	कोच की आंतरिक सफाई / Coach Interior Cleanliness					
2.	संयोजक की सफाई / Cleanliness of Toilet					
3.	विश्राम के क्षेत्र की सफाई / Cleanliness of wash basin area					
4.	बर्थ/सीट की स्थिति / Condition of seats and berth					
5.	आराम की स्थिति की स्थिति / Condition of Amenity Fittings					
6.	पानी की उपलब्धता / Availability of water					
7.	प्रकाश तथा रोशनी की स्थिति / Condition of Lights & Fans					
8.	कीटरोध और चूने / Cockroaches & Flats	अनुपस्थित / Not Present				
9.	सुधार के सुझाव / Suggestions for improvements	please do the necessity level higher				

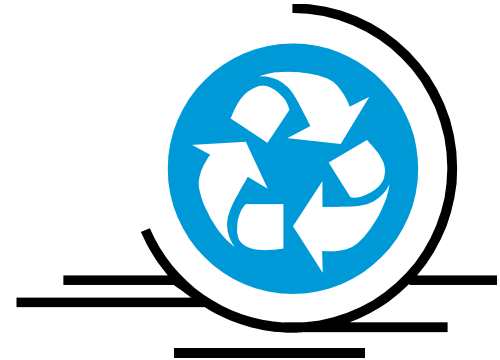
नाम / Name: Anil Pradhya रेल. प्र. संख्या / Train No.: 1419 Dn दिनांक / Date: 27/08/20

हस्ताक्षर / Signature: Anil Pradhya

- What is important to customer?
- What pinches the most?
- Corrective and Preventive Action
- Continual Improvement

- Class-wise Assessment
- Train-wise Assessment
- Direction-wise Assessment

Customer Feedback Form



Quality Systems



Quality Systems

- ❑ Quality in context of coach maintenance
- ❑ P-D-C-A
- ❑ ISO Quality Management Systems
- ❑ Customer Satisfaction Indices
- ❑ Moving up the Maturity ladder
- ❑ Kaizen – The incremental approach
- ❑ The Quality Trilogy



Quality Systems

☐ Quality in context of coach maintenance

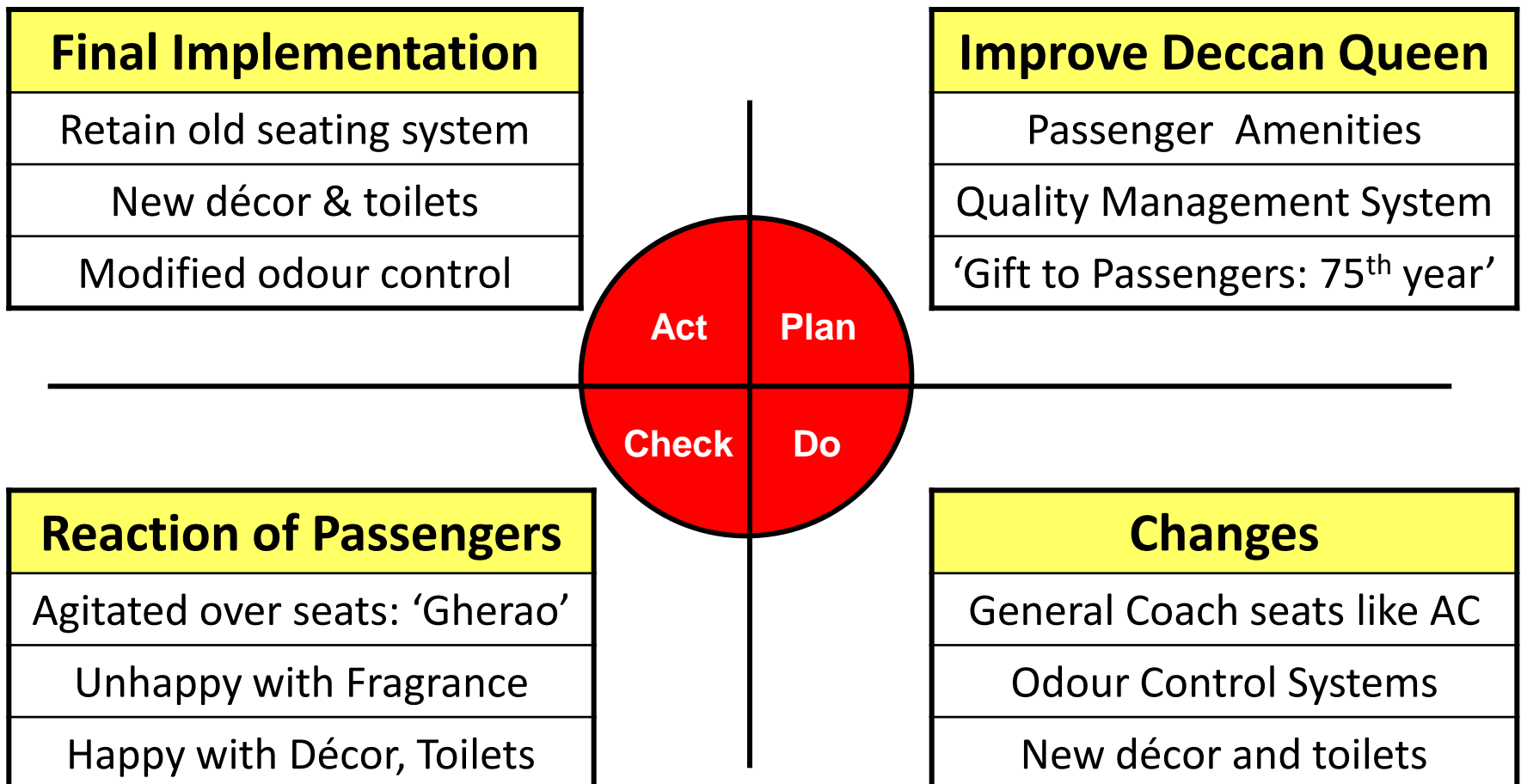


Quality Systems



□ P-D-C-A

Deccan Queen - 2005



Quality Systems

□ ISO 9001 Quality Management Systems

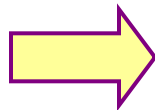
Salient Features

- Customer Focus
- Lay down Goals, Work methods
- Process Approach

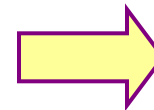
- Conformity Assessment
- Corrective and Preventive Action
- Continual Improvement

Steps to ISO 9001:2000

Establish QMS



Implementation



Assessment

- Quality Policy
- Quality Manual

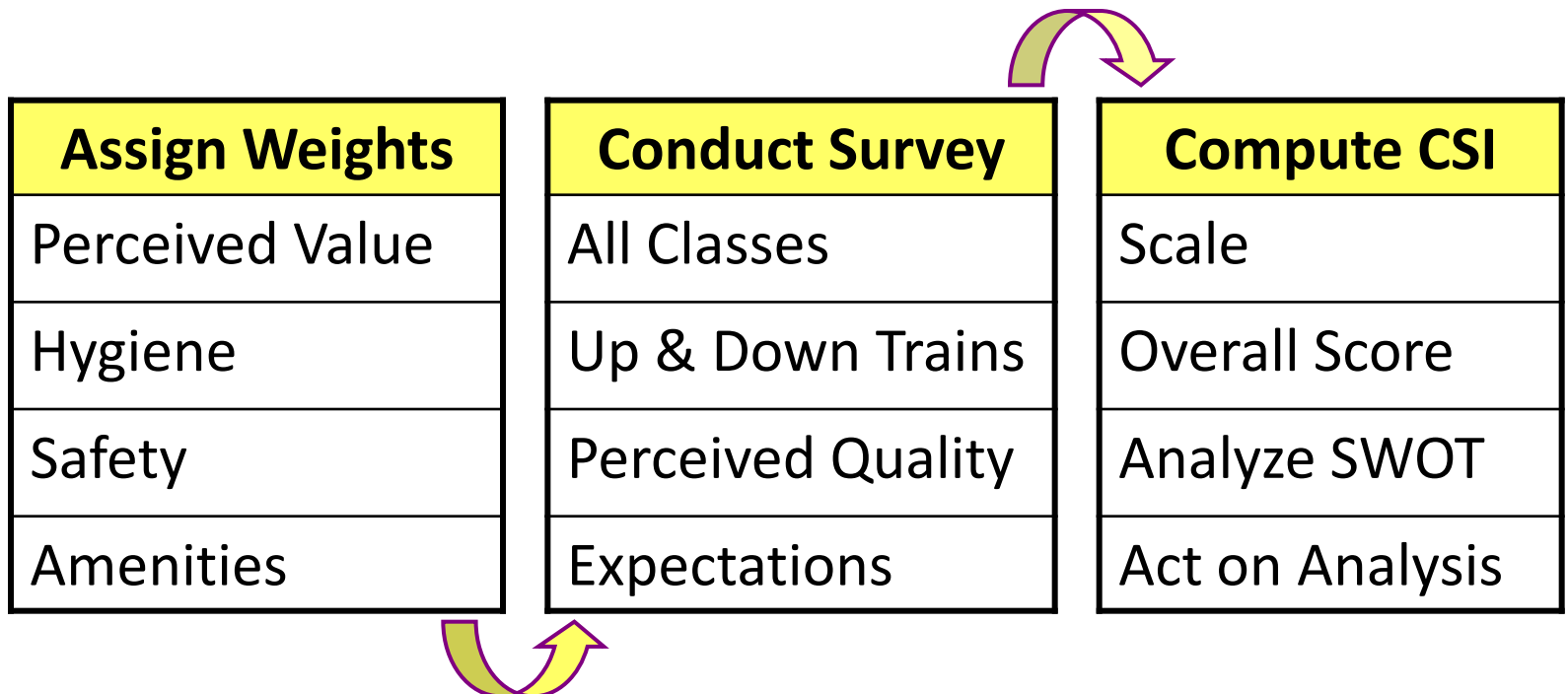
- Documentation
- Training

- Mgt. Review
- Audits

Quality Systems

❑ Customer Satisfaction Indices (CSI)

CSI links Customer Expectations, Perceived Quality and Perceived Value to Customer Satisfaction



Quality Systems

❑ Customer Satisfaction Indices (CSI)

Mumbai Division, Central Railway CSI scores (2007) -
AC coaches : **68.79** and Non-AC coaches : **67.80**

National ASCI Score for USA : 75.2 in Q3 of 2007

Industry	Score
Supermarkets	75
Gasoline Stations	71
Banks	77
Airlines	63

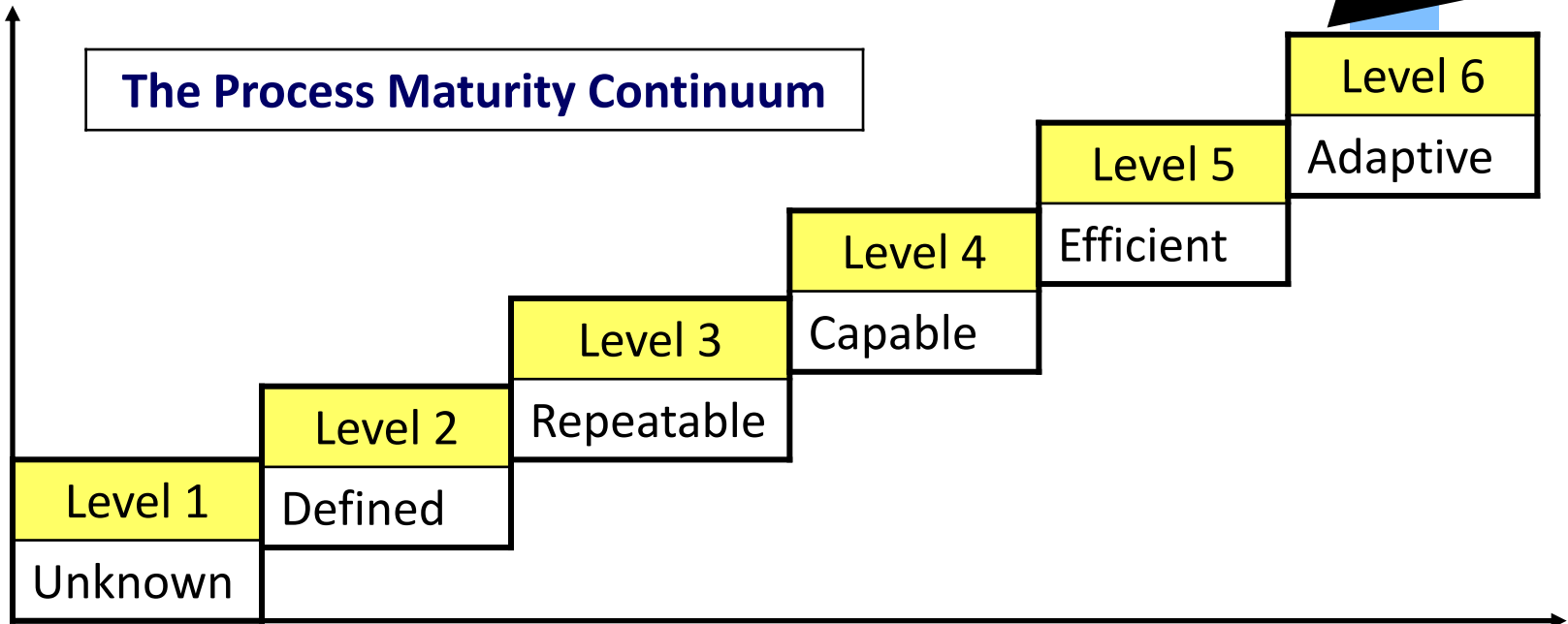
Industry	Score
Breweries	83
Newspapers	66
Apparel	82
Personal Computers	75

Source: www.theacsi.org

Scale: 0 -100, conducted by ASQ

Quality Systems

□ Moving up the Maturity Ladder



- Customer Requirements
- Work Methods & Response

- Performance & Accountability
- Results and Learning Cycles

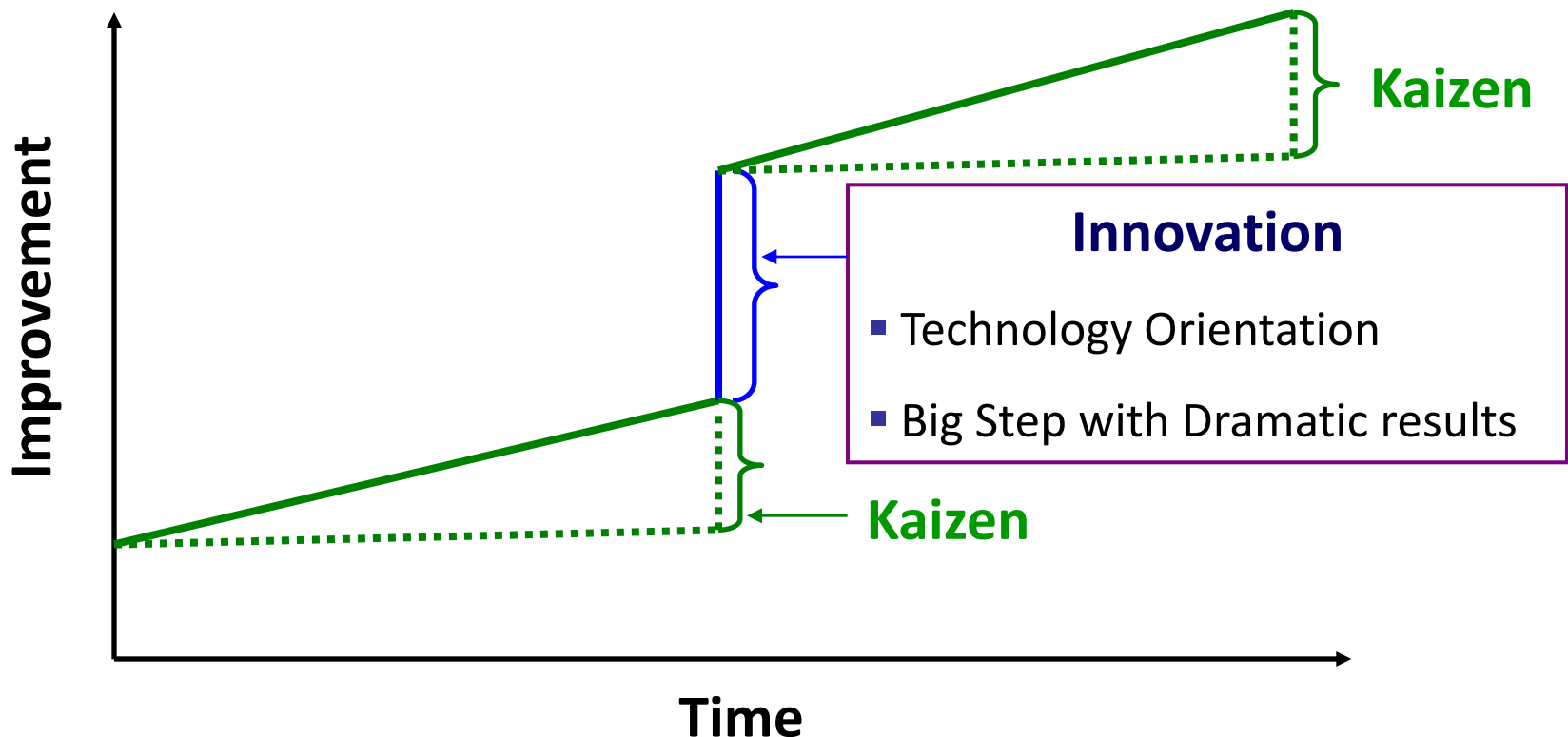
Source: ISO website

Quality Systems

□ Kaizen – The incremental approach

- Continuous Improvement
- Small changes add up to big Impact

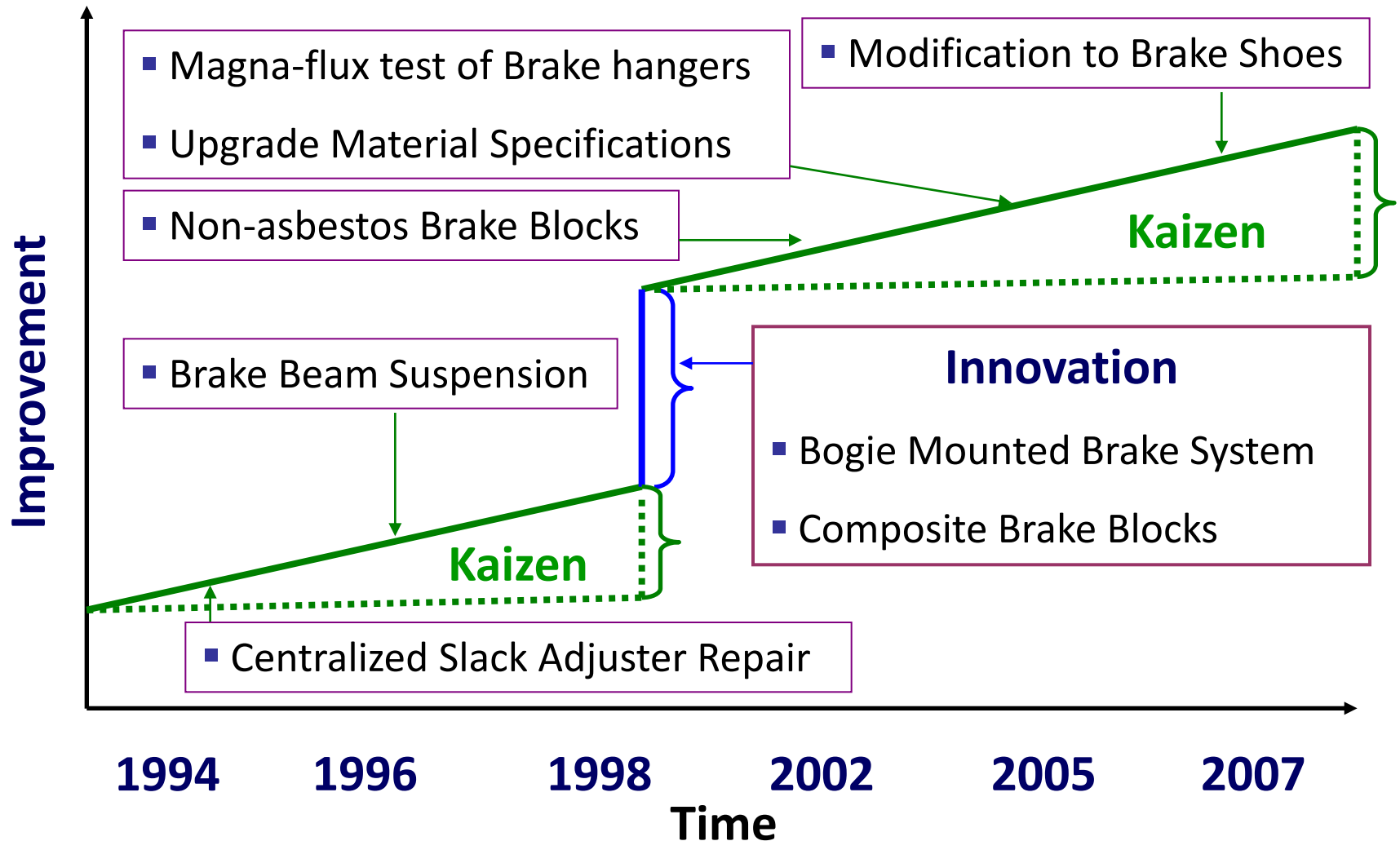
- Collective efforts of organization
- People & Process orientation



Source: Quality Assurance & Total Quality Management- Jain and Chitale (2005)

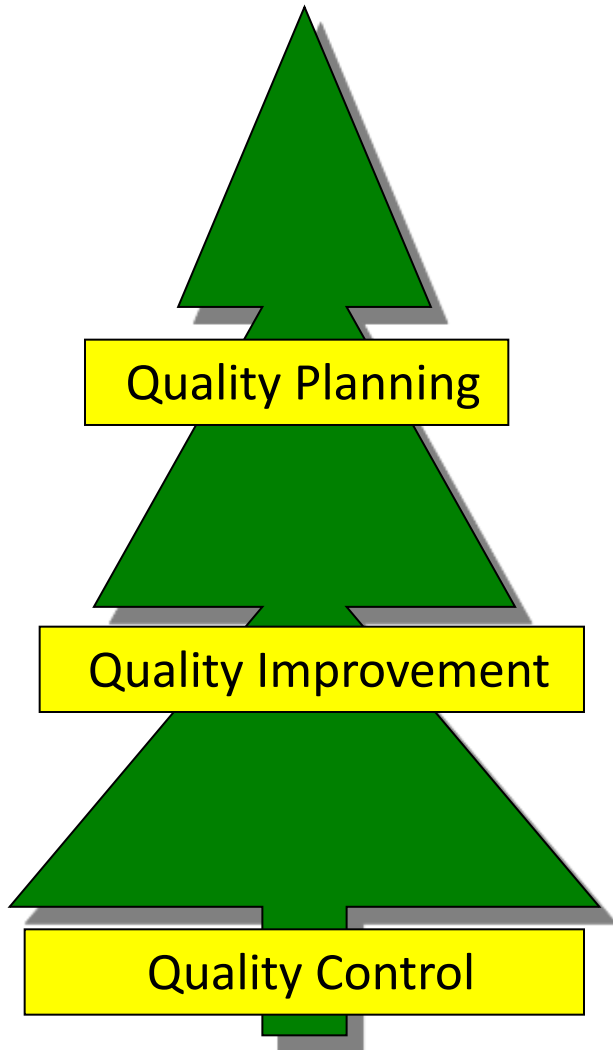
Quality Systems

□ Kaizen & Innovation - Improving the Brake Rigging of Coaches



Quality Systems

□ The Quality Trilogy



- Identify Customer
- Determine Customer needs
- Translate needs into our language
- Develop product to respond to these needs
- Optimize product features to match our needs and customer needs

- Develop a process to produce the product
- Optimize the process

- Prove process under operating conditions
- Transfer the process to Operations

Source: The Juran Institute

Supply Chain Management



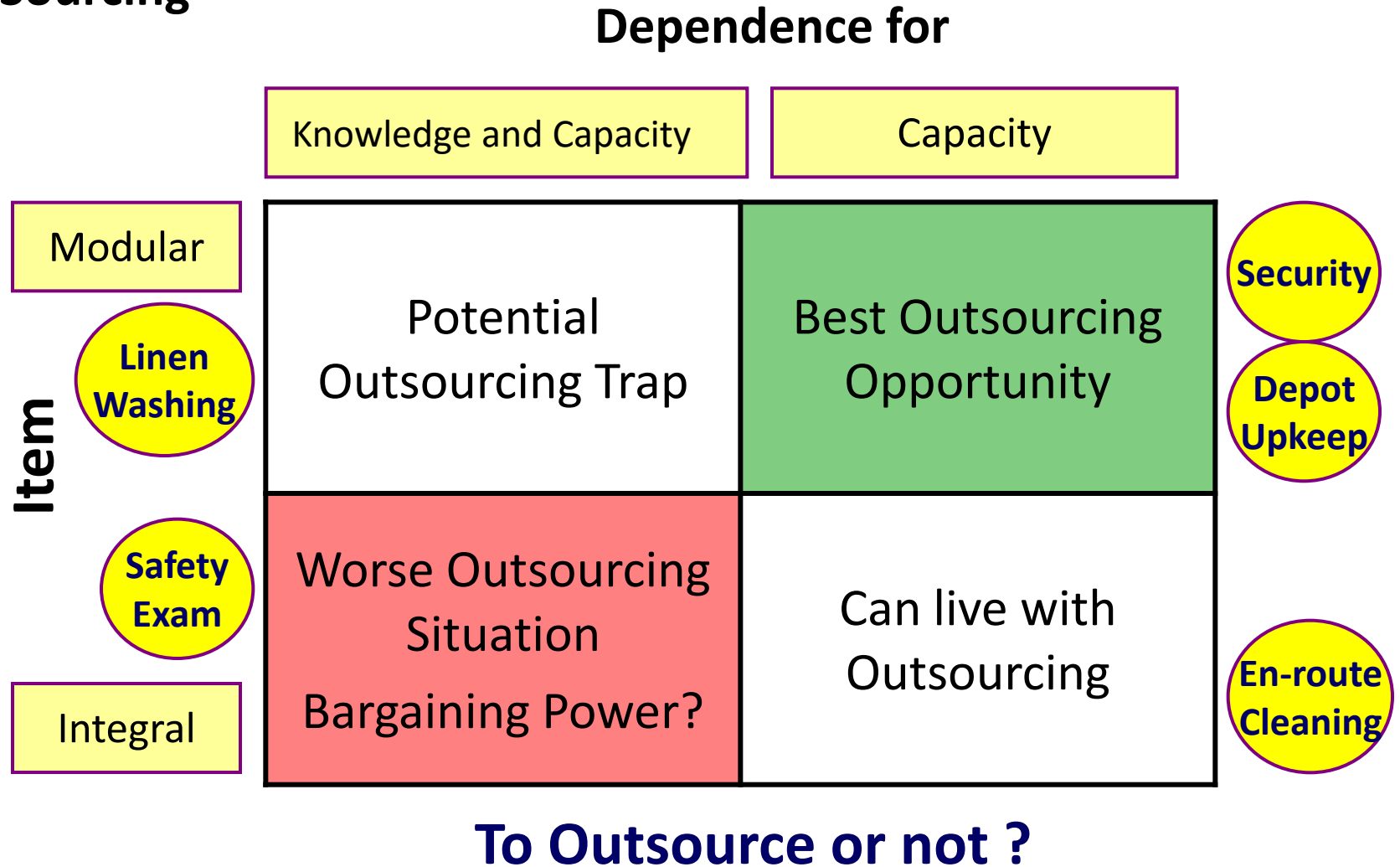
Supply Chain Management

- ❑ Sourcing
- ❑ Production Planning and Scheduling
- ❑ Inventory Management Systems
- ❑ Working with lower inventory levels
- ❑ Transportation
- ❑ Multi-Echelon Supply Chains



Supply Chain Management

□ Sourcing



Source: Adapted from Clockspeed – Charles H Fine (1998)

Supply Chain Management

□ Production Planning and Scheduling

System	Where Relevant	Primary Focus
Sequencing Rules	Low Volume	Flexibility to meet different orders, increase throughput
Optimized Production Technology	Batch; Low volume	Bottleneck Management
Material Resource Planning	Medium Volume	Effective coordination of material and labor
Just-in-Time	High Volume, Repetitive	Minimize Set-up times and inventory
Periodic Review / Cyclic Scheduling	Continuous process	High Capacity Utilization

Source: *Inventory & Production Planning and Scheduling*-Silver, Pyke, Peterson -3rd edition.

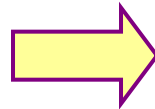
Supply Chain Management

□ Inventory Management Systems

Key Questions

- How often inventory status should be determined ?
- When to place Replenishment order ?
- How large should the replenishment order be ?

Aspect
Planning Horizon
ABC Analysis
Service Levels
Inventory Turnover



What Coaching Depots do
Annual Review (AAC)
Also Monitor Safety Items
Stock-outs, Local purchase
Monitor Slow-moving items

Supply Chain Management

□ Working with lower inventory levels



- Forecast demand as per Bill of Materials
- Reduce Lead Times
- Reduce Variability in supplies
- 'Must Change' Items - Deterministic Situation
- Anticipate Technology Changes – Order Size
- E-procurement speeds up ordering system
- Supplier Relationship Management
- Improved Quality of materials reduces rejections

Supply Chain Management

❑ Transportation



Wheels by Rail

or



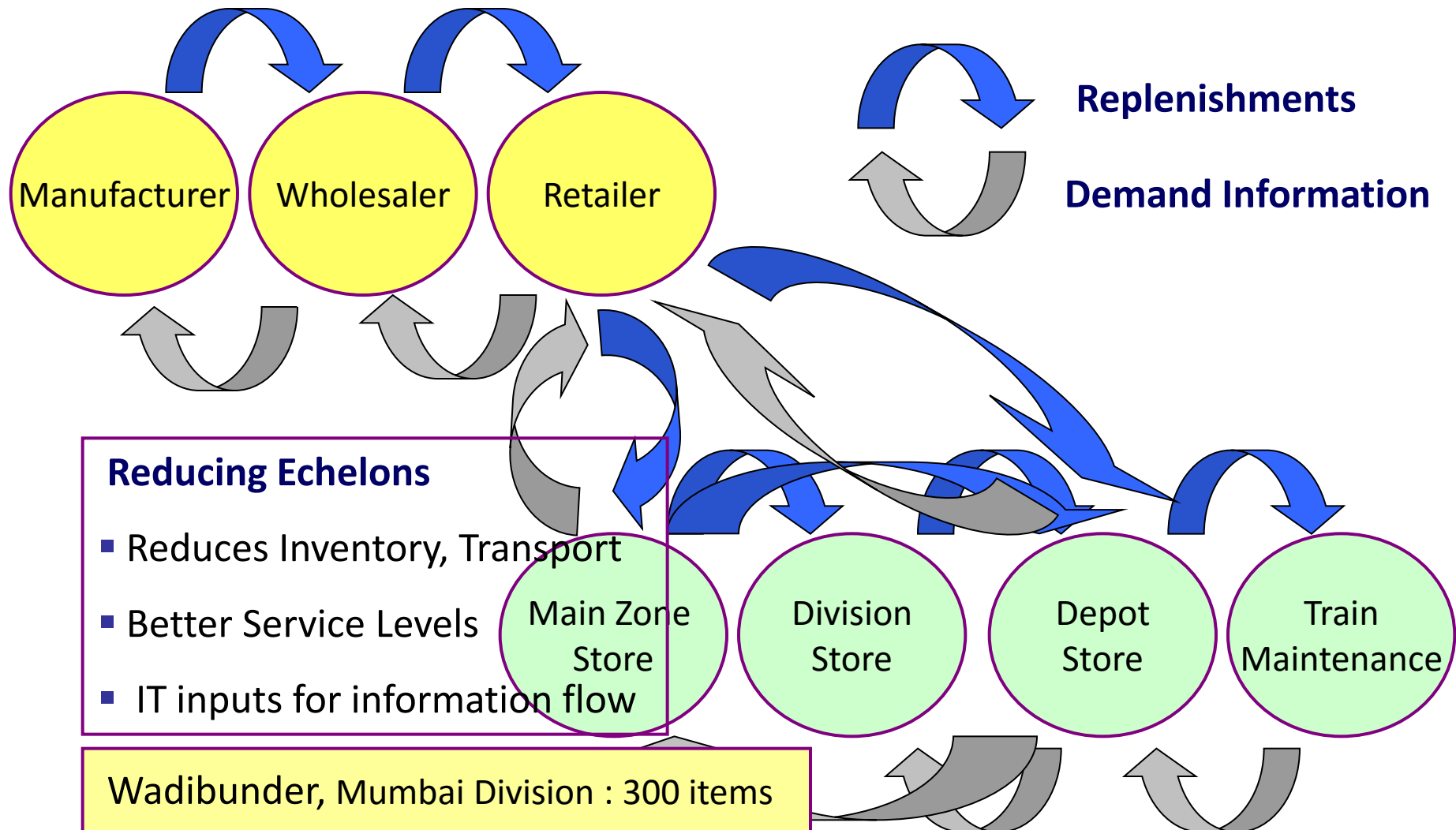
Wheels by Road

Key Considerations to decide how to Transport

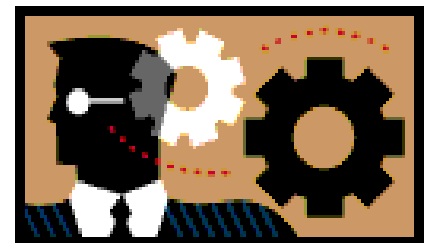
- | | |
|---|---|
| <ul style="list-style-type: none">■ Landed Cost■ Lead Time■ Access■ FOB/ex Works | <ul style="list-style-type: none">■ Consolidation■ Loading/Unloading Facilities■ Weigh Out or Cube Out ?■ In-house or Out-source |
|---|---|

Supply Chain Management

❑ Multi-Echelon Supply Chains

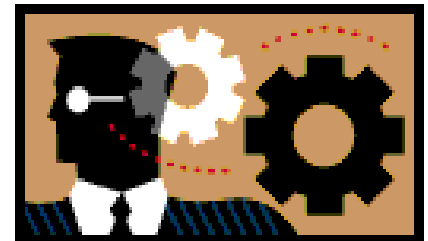


Assimilation and Up-gradation of Technology



Assimilation and Up-gradation of Technology

- ❑ New Features, Better Materials
- ❑ Adopting Changes
- ❑ Training
- ❑ External Sources of Knowledge
- ❑ Information Technology as an enabler



Assimilation and Up-gradation of Technology

❑ New Features, Better Materials

Some Examples

Eliminate Corrosion

Stainless Steel Lavatory Inlays, Fittings

Prevent Thefts

Composite Brake Blocks, FRP Window Shutters

Reduce Weight

FRP Boards, Bins, Use of Composites & Plastics

Longer Life

Hytrel® Washers in Primary Suspension

Fire Retardancy

Upholstery, Curtains, Cushioning

Superior Characteristics

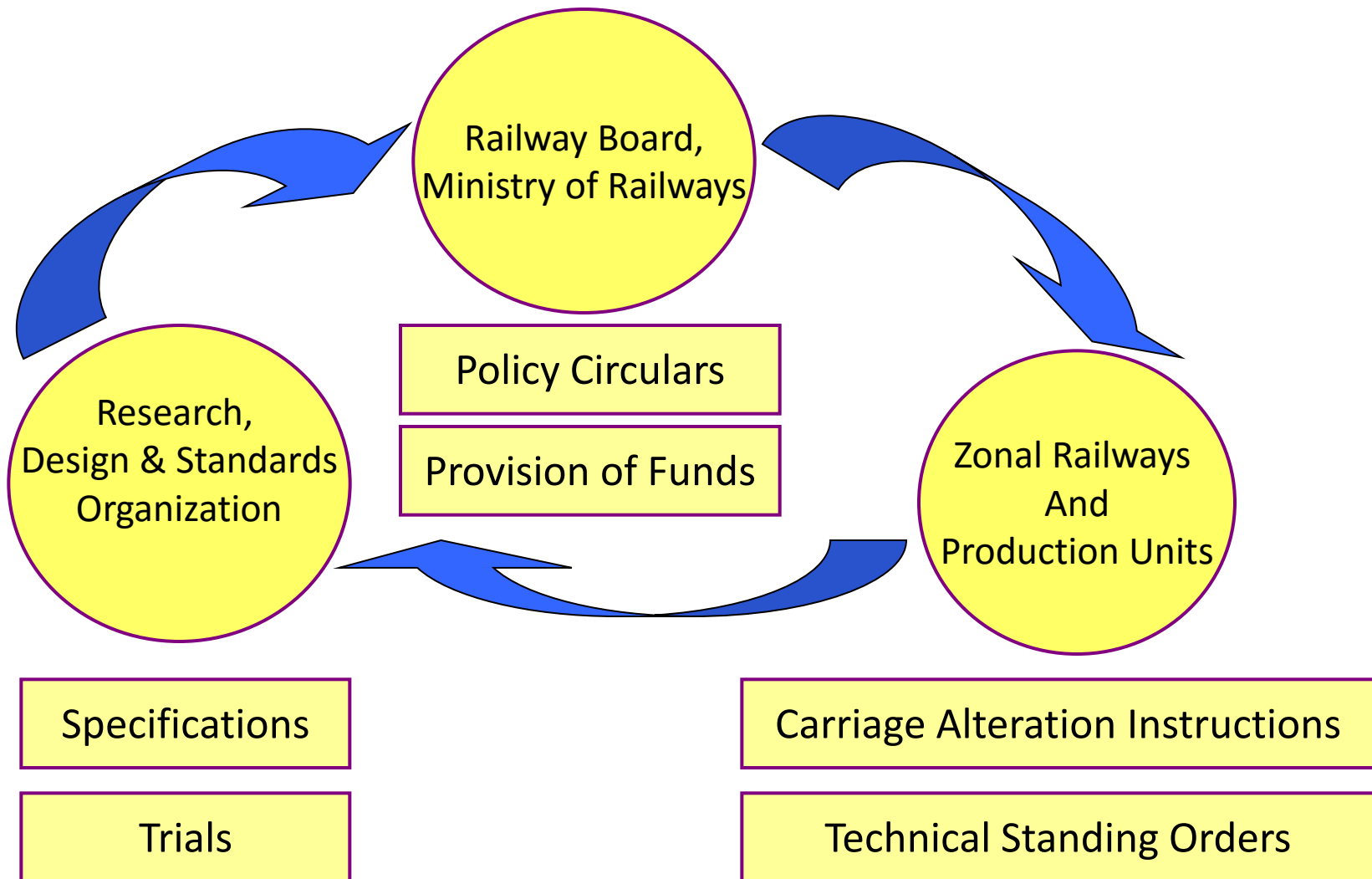
Micro-processor Based Odour Control

Reduce Failures

Stainless Steel Water tanks, Kitec™ Plumbing

Assimilation and Up-gradation of Technology

□ Adopting Changes



Assimilation and Up-gradation of Technology

□ Training

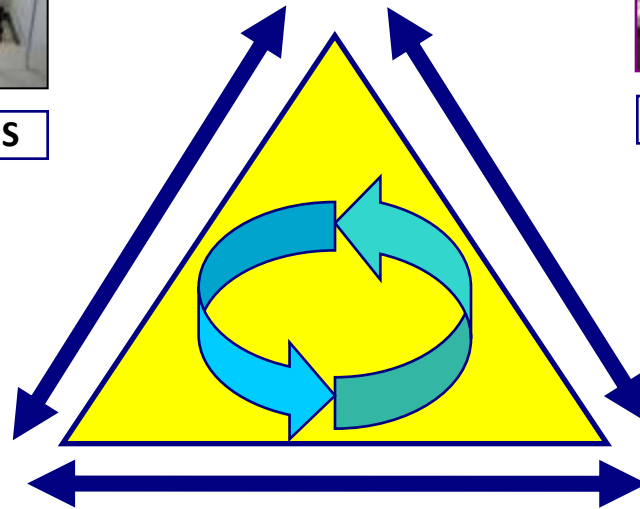


EQUIPPED CLASSROOMS



PRACTICAL TRAINING

TRAINING FACILITIES



TRAINING THE TRAINER

LATEST DEVELOPMENTS

REAL WORLD PROBLEMS

BURNING ISSUES

TEACHING SKILLS

TRAINING PROGRAMME

COURSE DESIGN

EFFICACY OF PROGRAMME

MOTIVATION

ATTENDANCE

Photos : Basic Training Centre,
Wadibunder, Mumbai

Assimilation and Up-gradation of Technology

❏ External Sources of Knowledge

- Interaction with Academia – Professor Chairs
- Post-graduate programmes at institutes like IITs
- Interaction with industry
- Use of external Consulting Services
- Conferences, Trade Fairs / Expo
- What's going on abroad?



Assimilation and Up-gradation of Technology

❑ Information Technology as an enabler

- Management Information Systems
- Scheduling
- Coach History
- Material Management
- Enterprise Resource Planning Systems
- e-learning



Thank You

email: saurabhprasad@hotmail.com

