



# CS-05 Planning Foundations

Howard Leach



# The necessary stuff



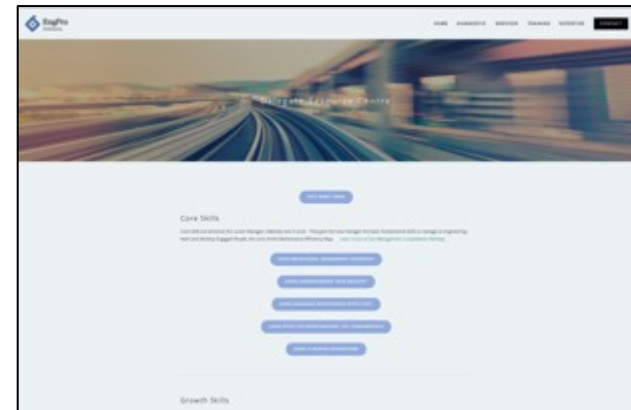
In workshop exercise



Factsheet (or further reading) online



Toolkit – checklist etc online



[www.engpro.co.uk/training-resources](http://www.engpro.co.uk/training-resources)

# Workshop objectives



- The Plan-led concept, control of maintenance and planning horizons
- Load v capacity management
- Input planning, list of work generation
- Scheduling the work
- Daily meeting schedule
- Defect management
- Productivity and production control
- Planning accountabilities



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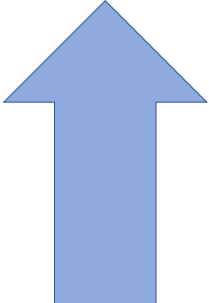


# Concept of maintenance efficiency



Choices: smaller fleet, more service, service protection, lower costs.... Choices!

Improving fleet planning and maintenance performance



Good Planning  
Efficient delivery

# Maintenance & Production



*Henry T Ford – Inventor (the production line)*



*Plan-led (MPRM) aims to 'productionise' maintenance?*



# Business of Maintenance (Theory)



Cost and opportunities are high enough to prompt significant research by major educational institutions:



**MIT**  
**INSEAD**  
**Harvard**  
**Carnegie Mellon**  
**Ashridge**  
**Warwick University**



*Much of this theory is extensions to manufacturing practice*

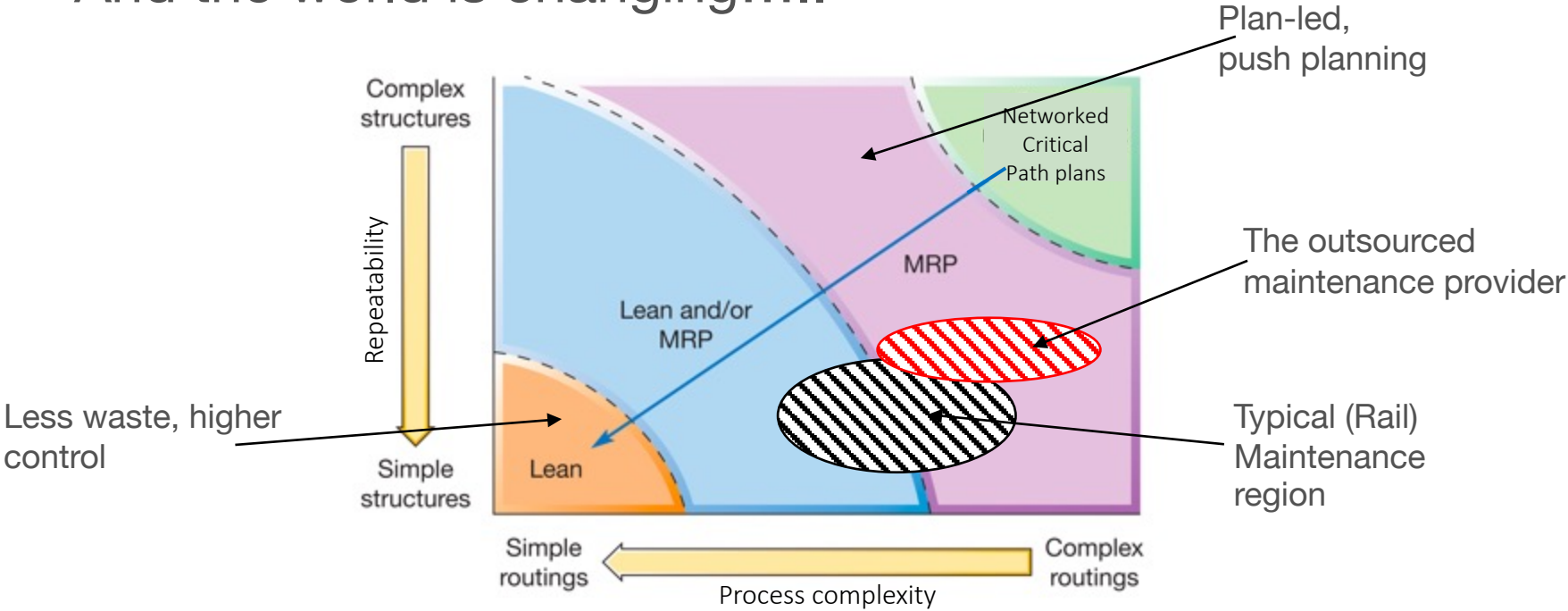
*There is a considerable body of research which has been adopted by maintenance providers.*

*Cost control and efficiency are mantras in every organisation, wherever they operate.*

# (Rail) maintenance is hard!



- And the world is changing.....

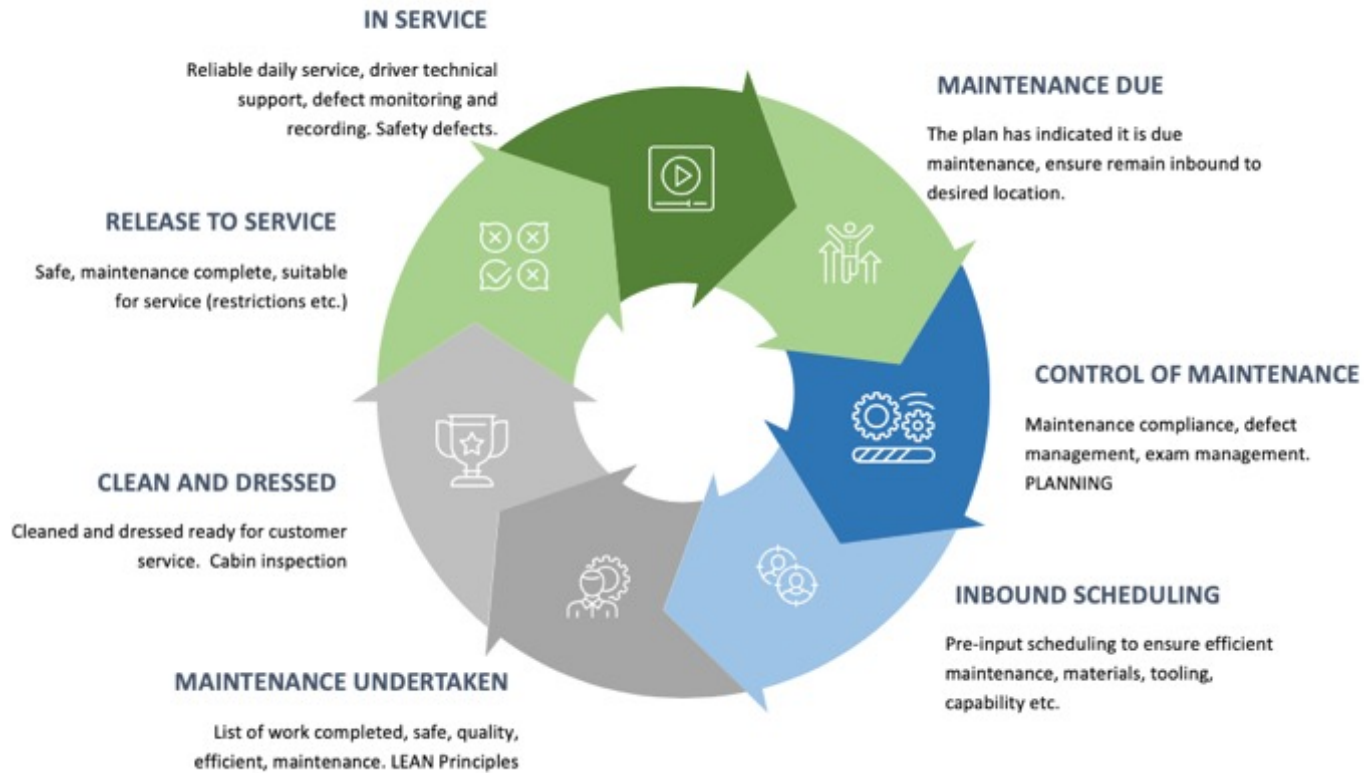


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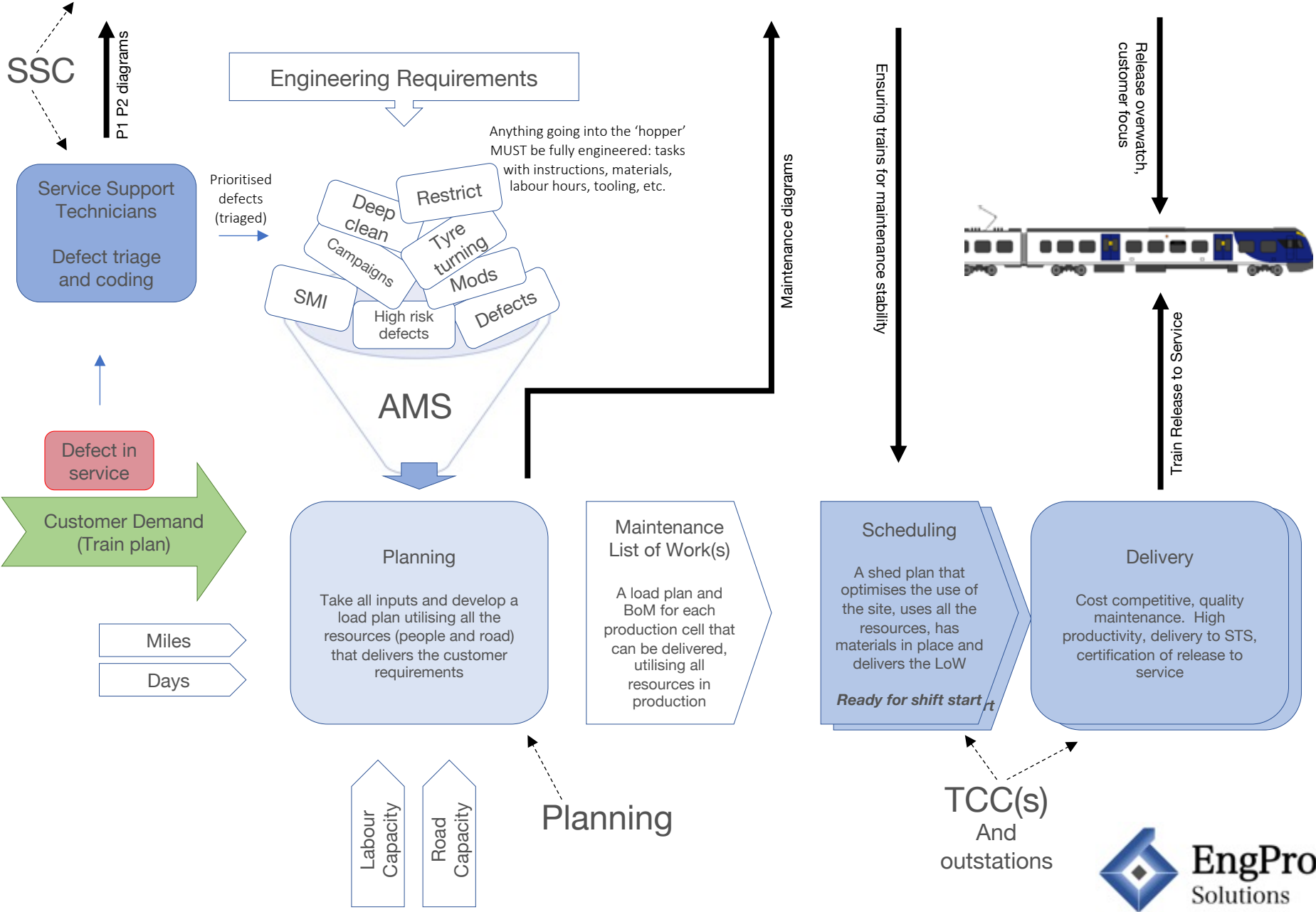




# The maintenance cycle



**Control Room (Service Support Cell)**  
 Providing **Service Support** for in service customer trains. Providing fleet control of inbound maintenance trains. Providing release 'overwatch'



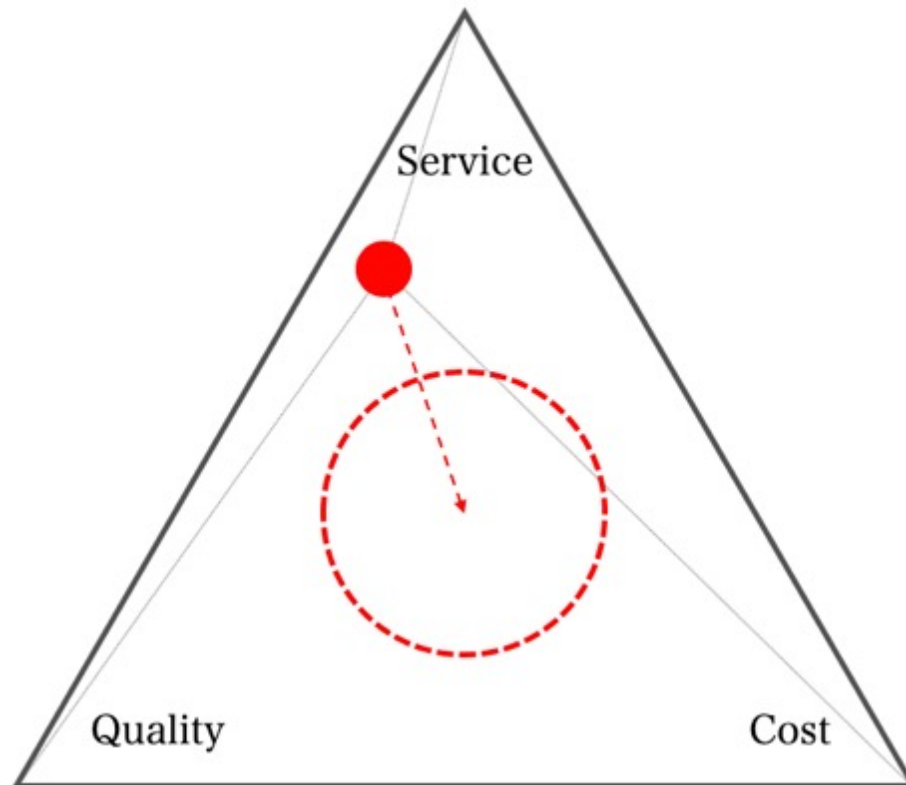
# Process/workflow Design Objectives



*The whole point of process design is to make sure that the performance of the process is appropriate for whatever it is trying to achieve.*



We need processes that stimulates ...



“Service at the right: cost, value and, quality!”

# Maintenance process selection

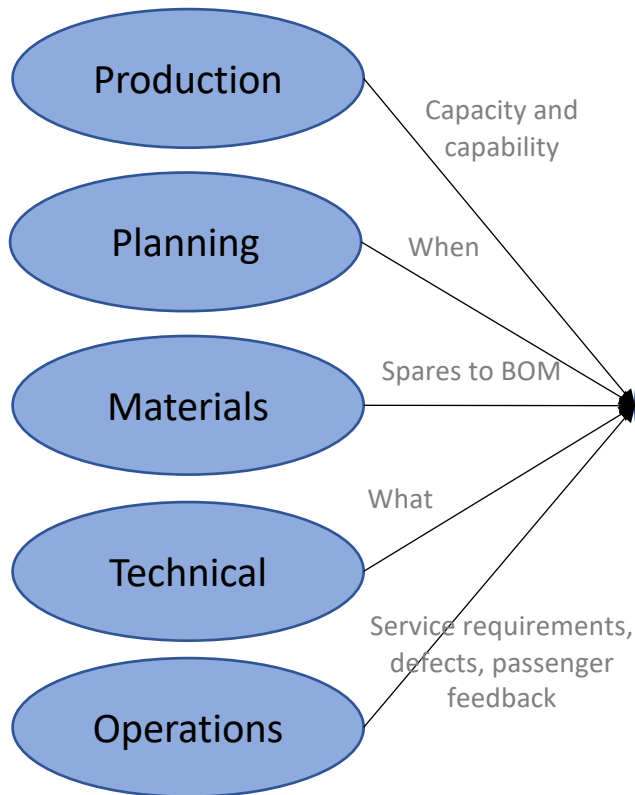


Performance objective	Typical process design objectives
Quality	<ul style="list-style-type: none"><li>• Provide appropriate resources that can achieve the specifications</li><li>• Error-free processing</li></ul>
Speed	<ul style="list-style-type: none"><li>• Minimum throughput time</li><li>• Output rate appropriate for demand</li></ul>
Service Dependability	<ul style="list-style-type: none"><li>• Provide dependable process resources, such as training, competence, and materials</li><li>• Reliable process output timing and volume</li></ul>
Flexibility	<ul style="list-style-type: none"><li>• Have resources with a wide range of capabilities</li><li>• Change easily between volume and critical path (exams to defects)</li><li>• Ability to redeploy the volume workforce</li></ul>
Cost	<ul style="list-style-type: none"><li>• Right capacity workforce to meet demand – strategic planning</li><li>• Eliminate process waste:<ul style="list-style-type: none"><li>○ Excess capacity</li><li>○ Excess capability</li><li>○ In-process delays</li><li>○ In-process errors</li><li>○ Inappropriate process inputs</li></ul></li></ul>
Sustainability	<ul style="list-style-type: none"><li>• Minimize energy usage</li><li>• Reduce local impact on community</li></ul>

# What is Plan Led?



## Everybody inputs

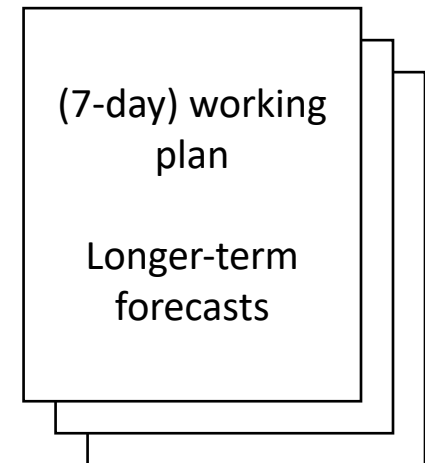


## Planning optimise

'The Plan'  
(OUR Plan)

## We all commit

All activity ***subordinates***  
to the plan





# Three important 'controls'



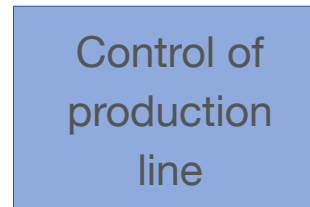
Control of rolling stock	Responsible for presenting the right traction to maintenance site on time
Control of maintenance	Responsible for the compliance of maintenance and developing a plan that permits service performance
Control of production line	Responsible for setting the production line (TCC) for optimum working, materials, tooling, resources.

	Control of rolling stock (for maintenance)	Control of maintenance (in date compliance)	Control of production (cost effective quality output)
	CPC fleet planners	CPC production planners	Depot PM
	CPC planners	CPC planners	Depot PM
	Maintenance controllers	Depot Planners	Depot PM
	MC Team Leaders	CPC Production Planners	Depot PM
	CPC	CPC	Depot PM
	ASR	CPC	Depot PM



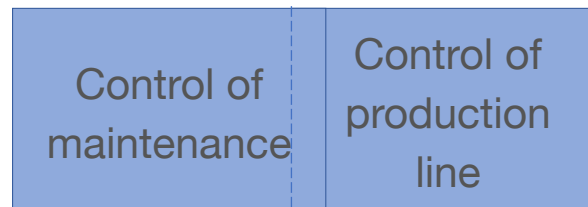
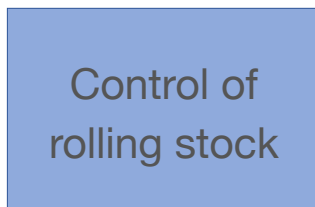
In groups – define your three 'control accountabilities'

# Planning independence



Aligning it with ROC can:

- Shorten planning horizons
- Exam contingency erodes to protect service stability
- Maintenance stability reduces



Aligning it with TMC can:

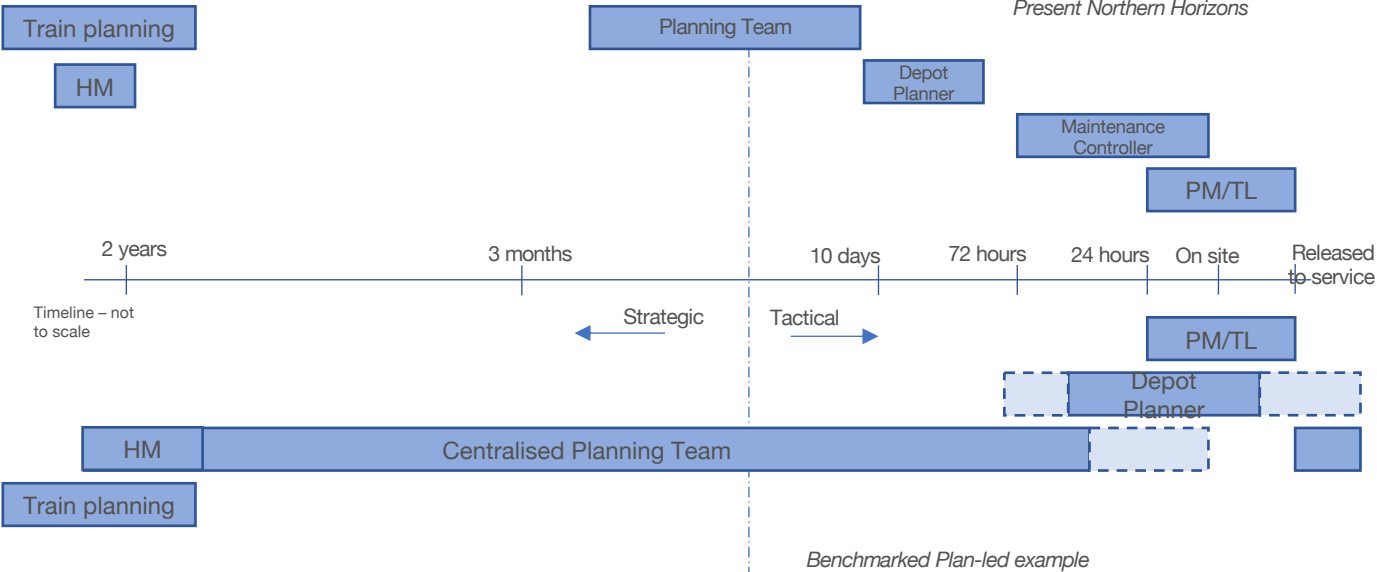
- Shorten planning horizons
- Reduce customer focus
- Introduce lots of localised process
- Damage overall fleet control

# Alternative terms



- Fleet planning = Rolling Stock Control (for maintenance only)
- Production planning = control of maintenance

# Planning horizons



# Workshop objectives



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# Capacity

- Two types of capacity to be considered:



Labour Hours



Facility constraints

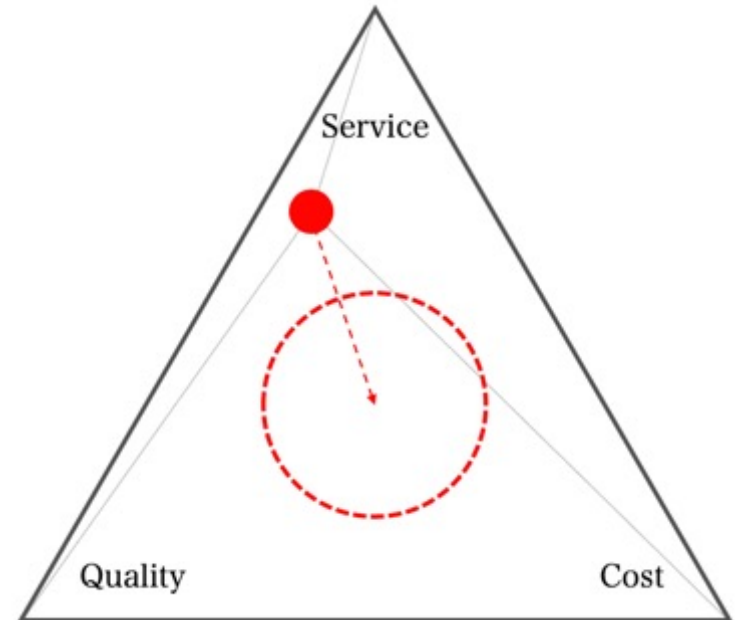


# Discussion....

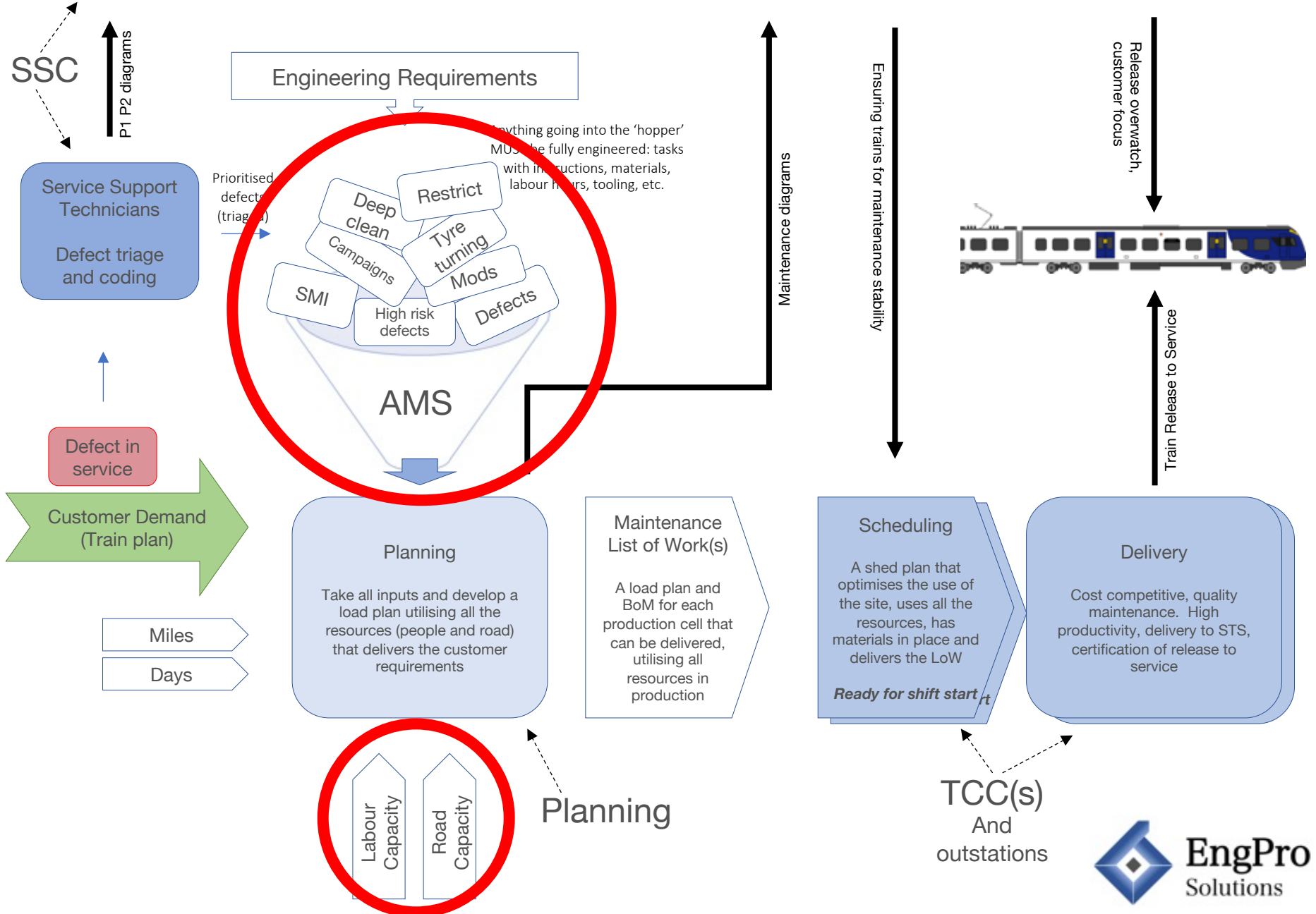


2 mins

- What happens if we don't match load and capacity?



**Control Room (Service Support Cell)**  
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# Labour Capacity Exercise

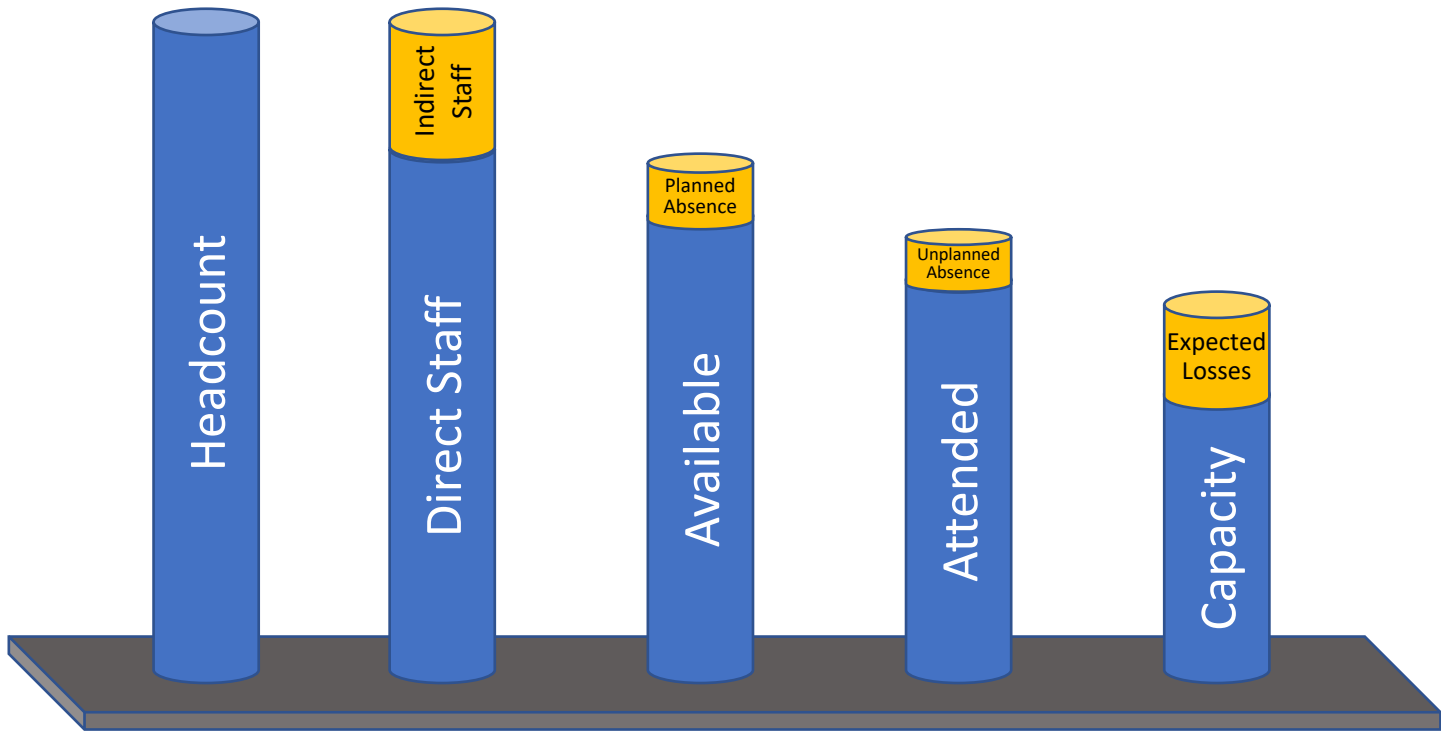


15 mins

In pairs, work together to estimate the average weekly task-hours the company has to offer for sale to its customers.

Remember to consider where losses and inefficiencies occur!

# Labour capacity

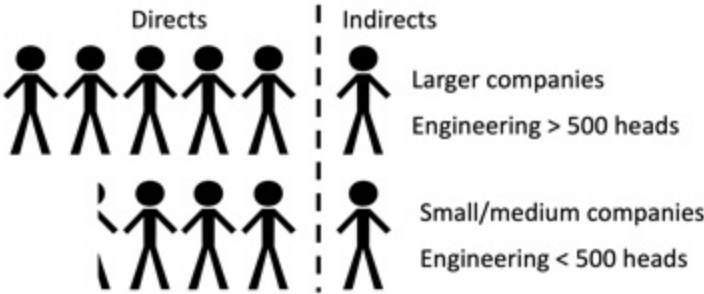


# Gathering capacity data



- Use more granularity than you think you need (for reporting later)
- (Direct) Headcount – less
  - Leave
  - Sickness
  - Training
  - Other
- Factor productivity into ‘available’
- Consider systems first then Excel

# Benchmark ratios



Directs:Indirects

	Best in class	Average	Lowest measured
Aviation Running maintenance (A and B Checks)	71%	68%	51%
Aviation Base maintenance (C and D checks)	85%	73%	62%
Rail Running Maintenance (A and B exams)	62%	42%	19%
Rail Heavy maintenance (C exams, overhaul)	71%	46%	12%

Productivity



# Activity



20 mins

- As a group, discuss how capacity data is best collected, Considering:
  - The number of inputs required
  - The geographic diversity
  - The sites to be included
  - Accuracy required
- Capture ideas for future work

Load!



# Types of load

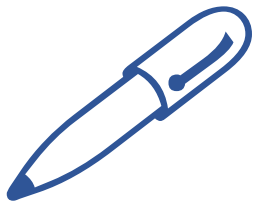


- Routine work
- Non-routine work
  
- In Groups
- List your present problems with identifying accurate load from each of these work types



2-3 mins

# Exercise – task time (1)



7 mins

## Exercise 1: In pairs

1. What factors affect how long a task takes to complete?
2. Which of these factors you've listed are legitimately chargeable to the customer.

# A typical task.....



Task Element	Customer Chargeable (direct)	Organisation's Overhead
Travelling time to and from job		✓
Getting parts from the stores		✓
Getting tools from tool station		✓
Setting up tools on job	✓	
Calling Engineering to resolve a discrepancy		✓
Printing off drawings		✓
Performing the direct task	✓	
Fatigue break necessary because of difficult or awkward access		✓
Performance shortfall due to task performed by staff in training		✓
Oversight/supervision of staff in training performing task		✓
Inspection of installation	✓	
Function check	✓	
Clean up post job complete (vehicle)	✓	
Clear tools away		✓
Return tooling to tool station		✓

# Task-hour Estimation



A consistent approach to task-hour estimation is important..... establish a set of 'golden rules'.

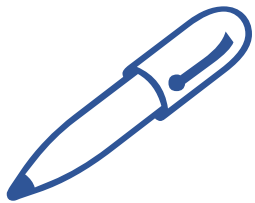
What might your 'golden rules' be?

# Types of task time



- **Fixed provision** – time that is standard for all tasks and probably not directly chargeable, such as getting tools
- **Travelling time** – time taken to go from where the work is allocated to the work location
- **Allowance** – known losses that all tasks will induce, such as going to stores, staff competence levels etc.
- **Chargeable labour** – either fixed or variable charge to customer

# Exercise – task time (2)



15 mins

## Exercise 1: In pairs

1. Complete exercise 2 considering a real task in your work area



# Task time allocation exercise



Task: inspecting and replacing brake pads	Fixed Provision	Travelling time	Chargeable Labour	Allowance (expected losses)
Travelling time to and from job		:10		
Getting parts from the stores				:10
Getting tools from tool station	:02			
Setting up tools on job			:01	
Calling Engineering to resolve a discrepancy				:05
Printing off drawings	:03			
Performing the direct task			1:05	
Fatigue break necessary because of difficult or awkward access	:15			
Performance shortfall due to task performed by staff in training				:12
Oversight/supervision of staff in training performing task	:10			
Inspection of installation			:05	
Function check			:20	
Clean up post job complete (vehicle)			:05	
Clear tools away	:03			
Return tooling to tool station	:02			
	<b>0:35</b>	<b>0:10</b>	<b>1:36</b>	<b>0:27</b>

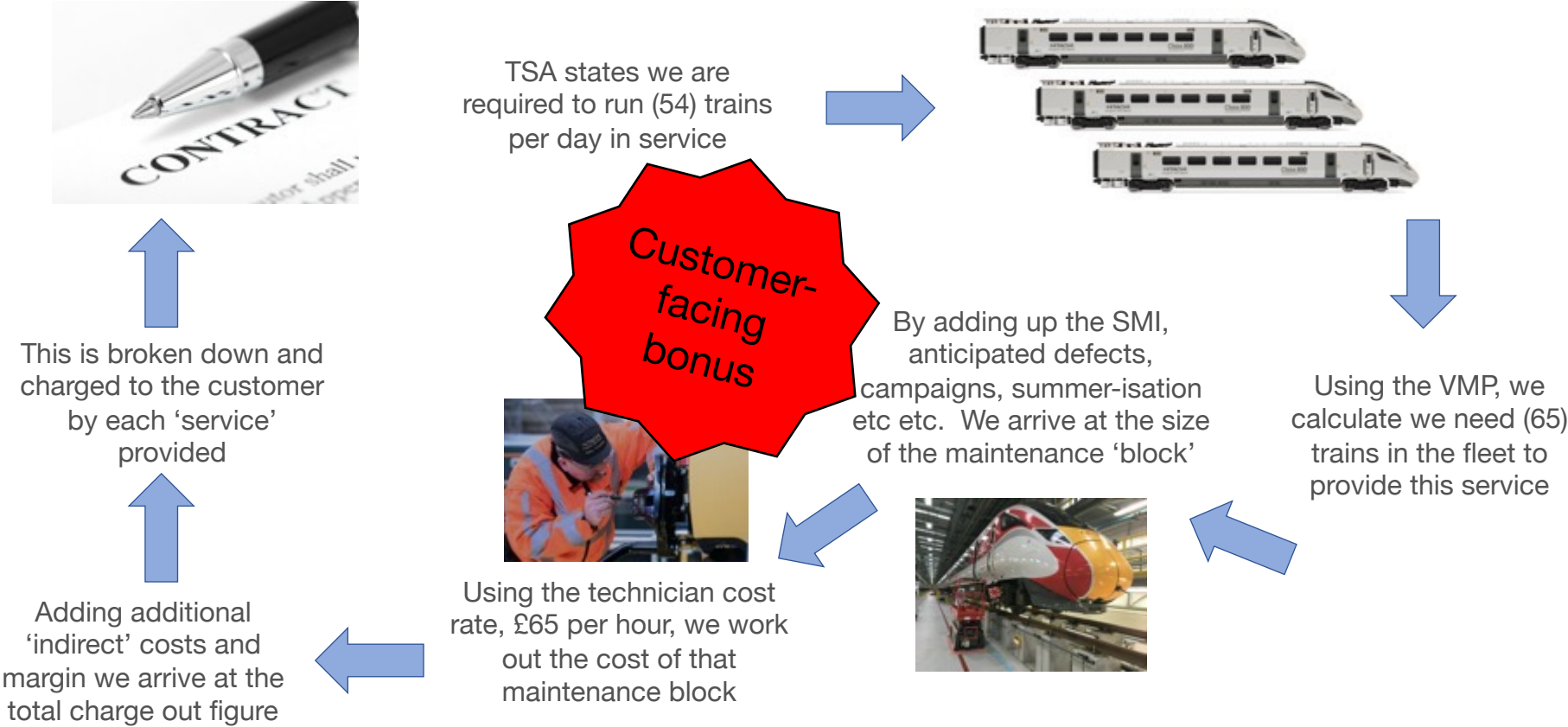
# Planning and productivity



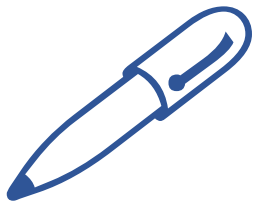
- In our example:
  - 1:36 directly chargeable
  - 2:48 time planned to task
- Even working at top rate the technician will only be

$$\frac{1:36}{2:48} \times 100\% = \mathbf{57\%}$$

# Fixed price maintenance contracts



# Task-hour Validation

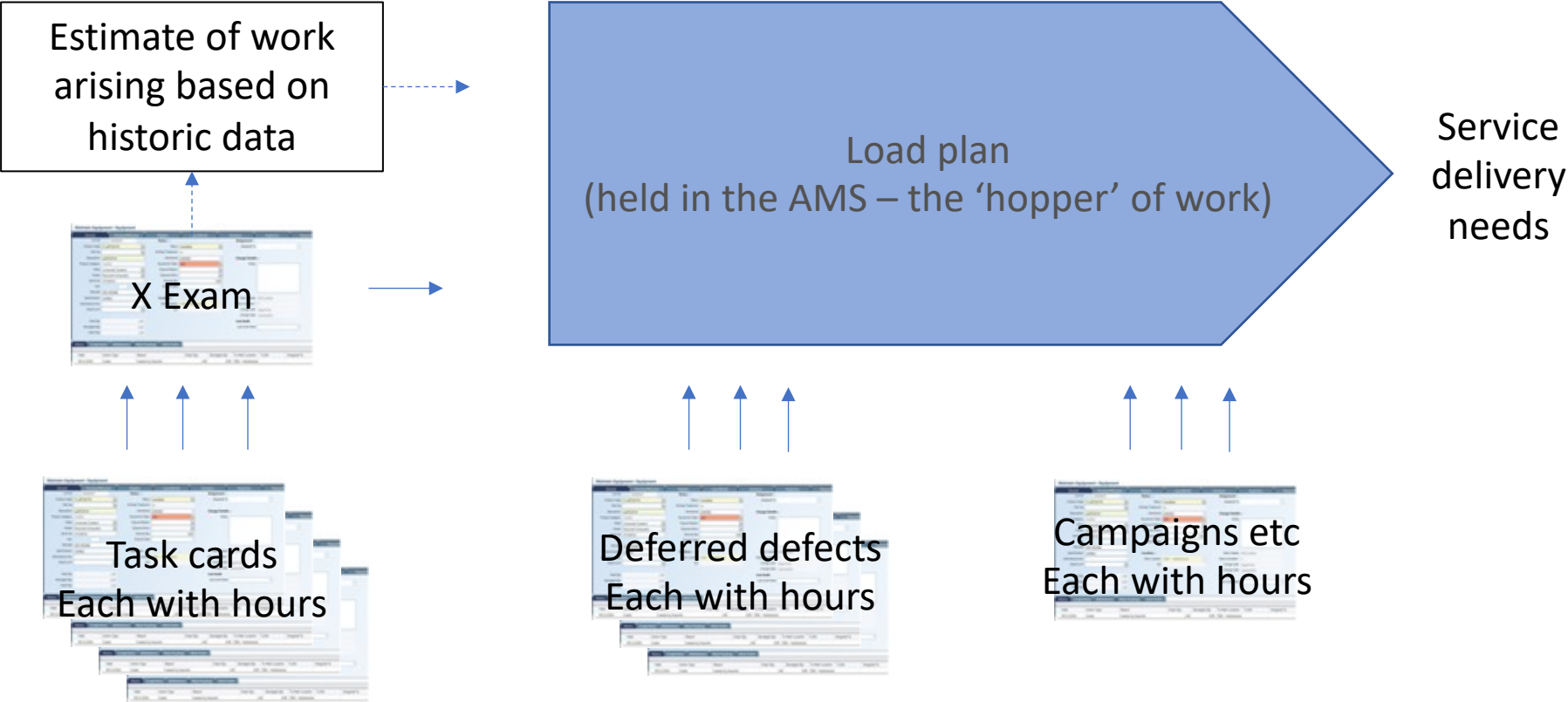


5 mins

Exercise: In pairs

How do we know that the task-hours allocated to a task are accurate?

# Generating the load plan



# Activity



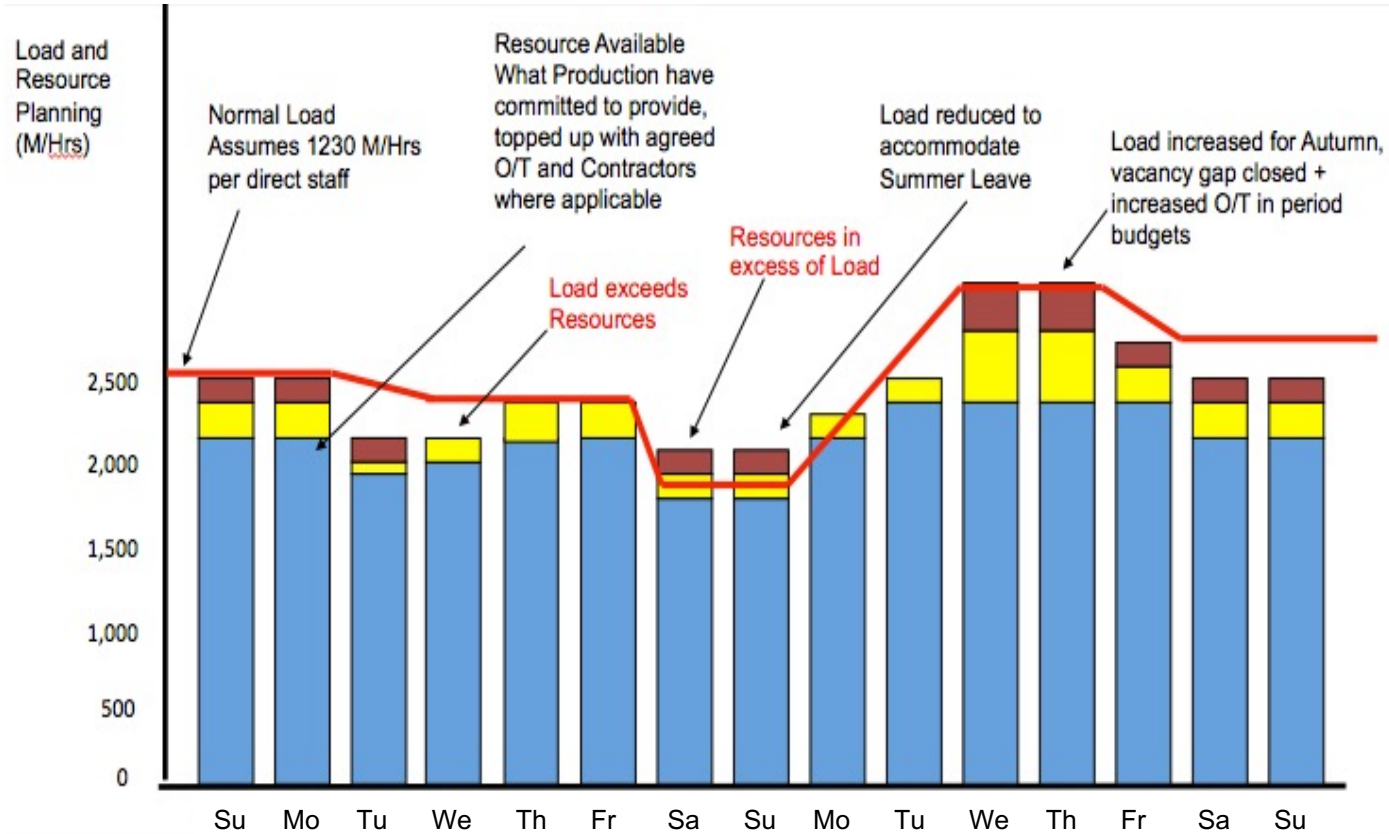
15 mins

- What activities need planning – and therefore make up the load plan?
  - Exams
  - Defects
  - PHC
  - Restrictions
  - Concessions
  - AVIS
  - Tire Turning

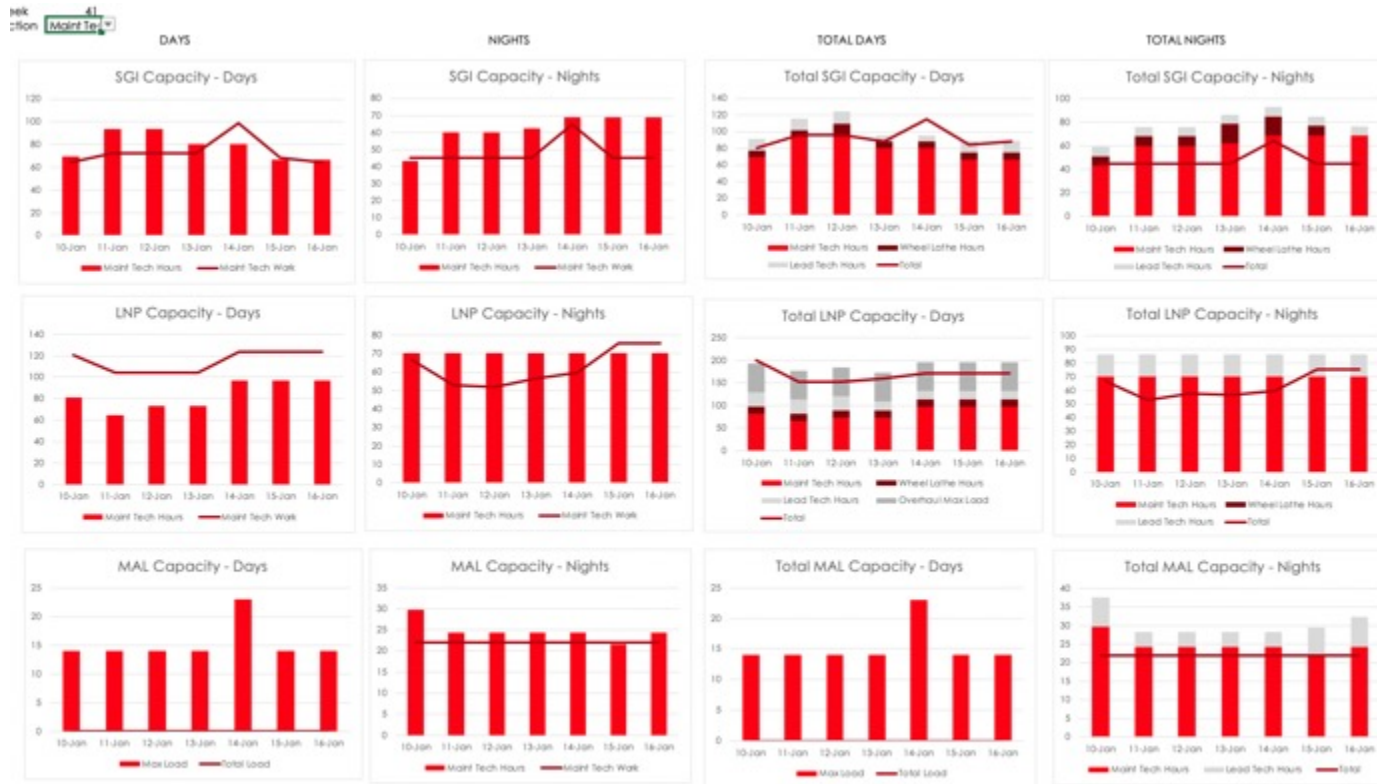


- Capture ideas for future work

# Load & Capacity management



# Real example





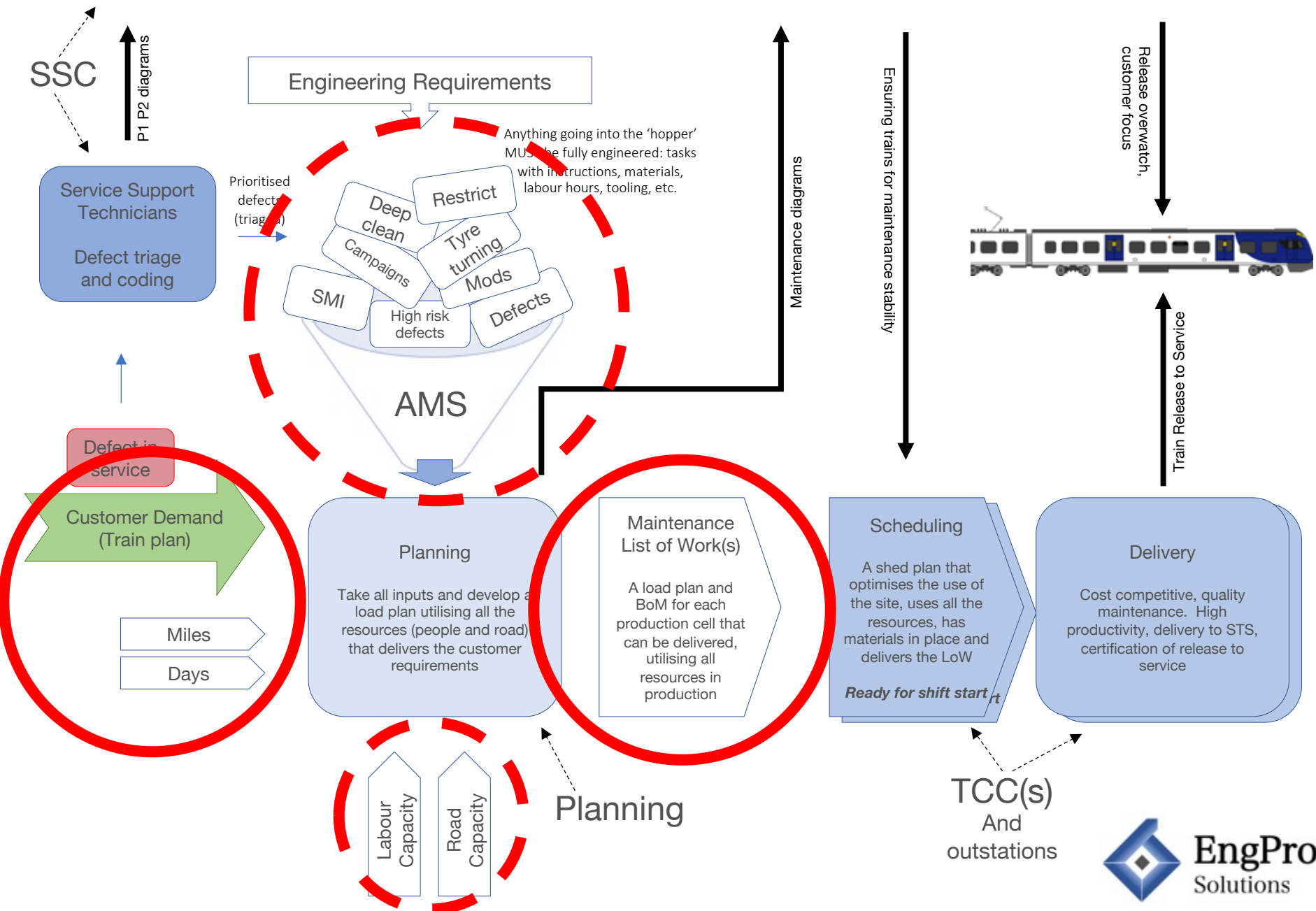
# Workshop objectives



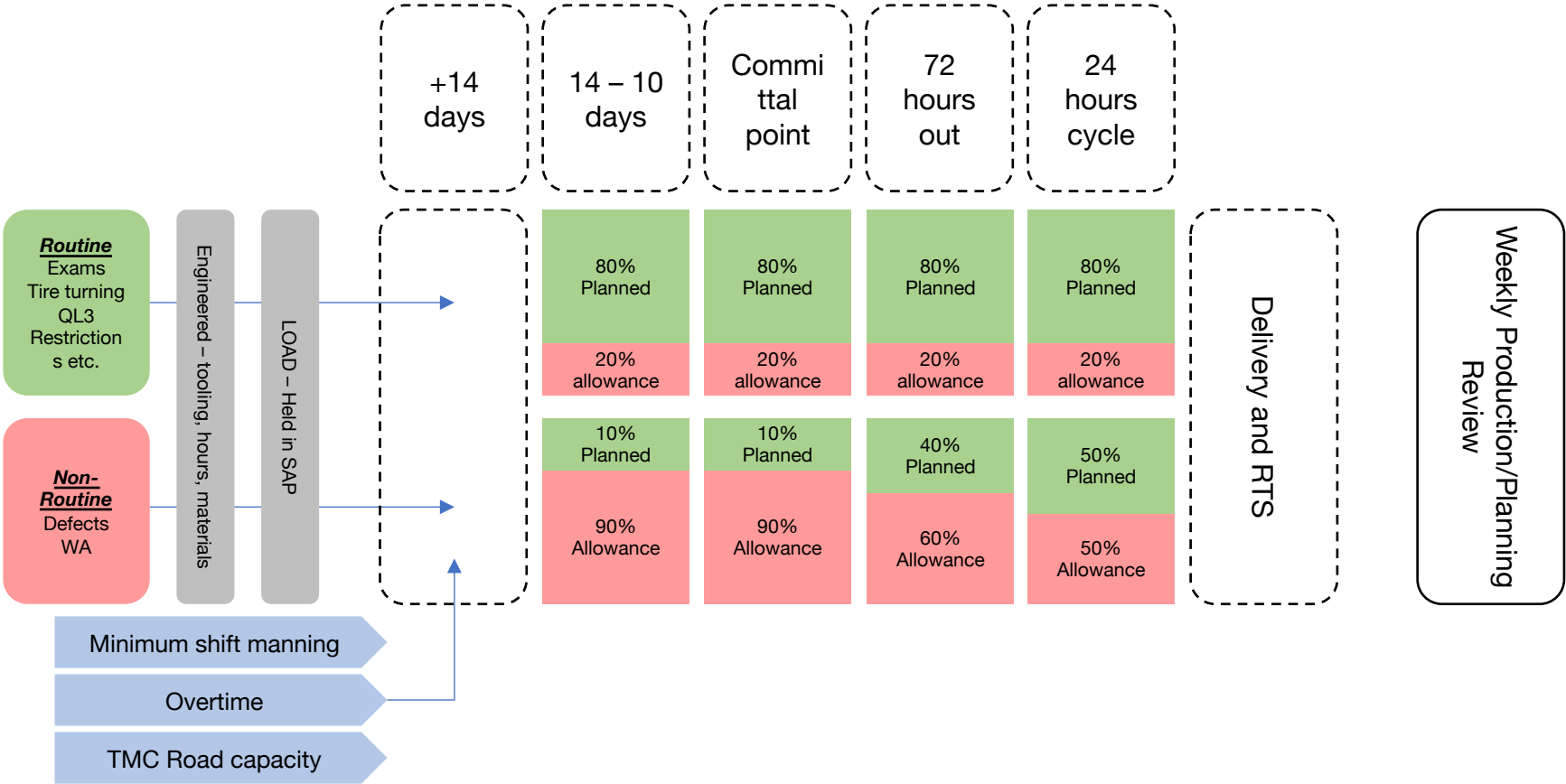
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# Planning horizon



# Input planning principles



- Manage the SMI line always – slipping this line presents significant challenges
- Make allowance for defects and work arising
- At (about) 72 hour point load key critical defects, restrictions, concessions etc.
- Consider capacity available, and manage constraints
- Leave contingency

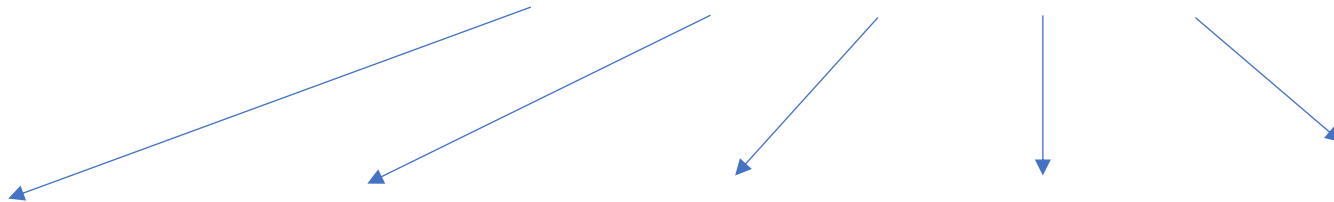


# Work packaging concept



Defect or other enters the work bank

Depending upon prioritisation  
Using anticipated or average capacity  
Considering the exam plan  
Start to build provisional work packs



Long-term



Next 30 days



Next 3 to 10 days



Next 48 hours



Next 24 hours

# Scheduling ALL maintenance

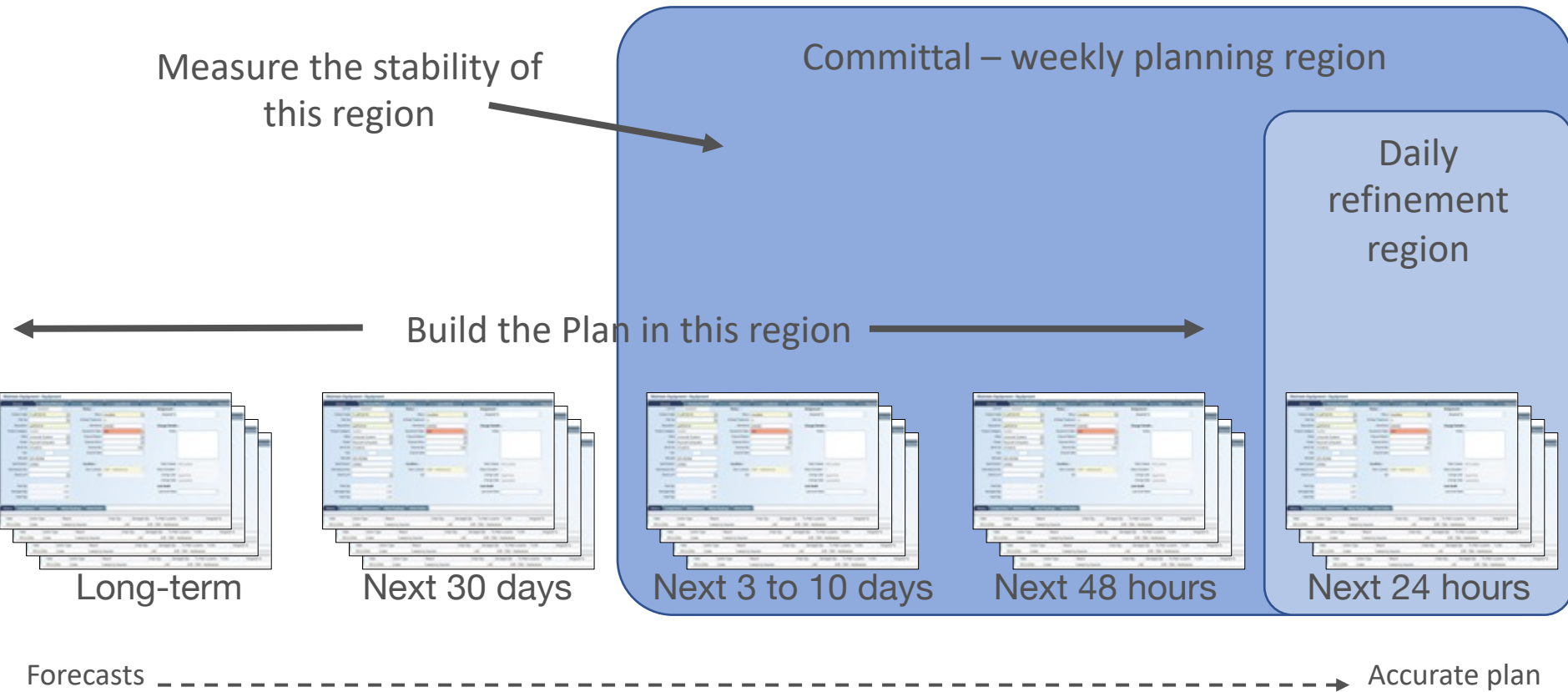


15 mins

- Consider the SMI exercise, and using the information you have available determine the most effective maintenance input



# Work packaging concept



# The management of materials



5 mins

- Exercise – in groups

- Discuss Planning's role in managing materials?
- What challenges does materials management present, and how can you overcome these?



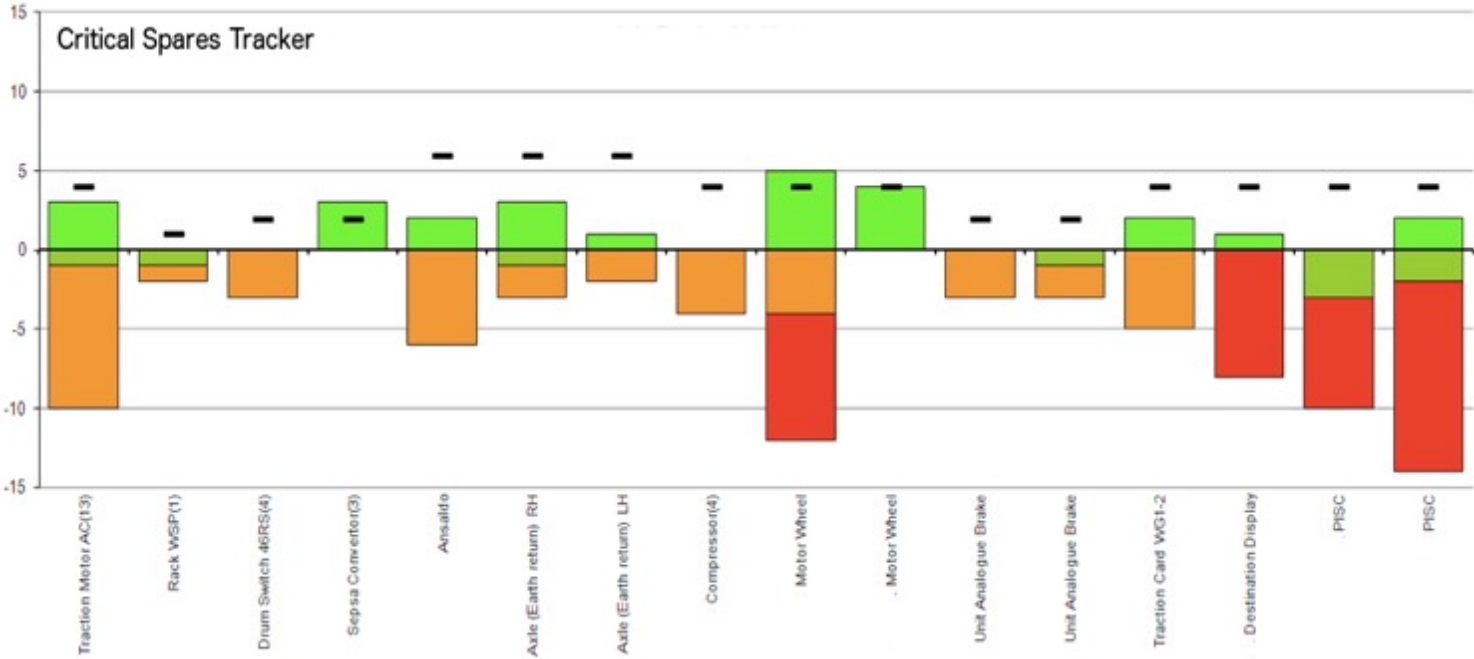
A train stopped awaiting materials – is a **planning failure!**



# Rotable and high risk spares



(Example) Critical spares tracker



# List of work (LoW)



- Final issue of the plan
- A viable list of the work that needs doing, considering: materials, capacity, constraints, skills, customer needs.
- HANDSHAKE between planning and production
- Issued at a point in time, measured completeness
- Everything subordinates to the plan
- With an associated Bill of Materials (BoM)

# List of work example (Excel)



London North Pole Planning																
Day:				Wednesday Nights												
Staffing levels				Daily Exams Calculator				Shed Space Calculator								
Available hours				Units	Departure	10 min	1 hour	Hours	Amount of units requiring pit space			Amount of units requiring gantry access				
Planning hours (-20% MT, -50% LT)				5 cars	8.00	8.00	8.00	12.00	5.00			0.00				
Daily exam hours				9 cars	8.00	2.00	8.00	12.00	Amount of units requiring bogie drop			0.00				
Amount of work planned				Total	18.00	2.00	14.00	24.00	Amount of units requiring laths			0.00				
Variance				-4.10	4.90	0.00			Production to complete							
Unit ID	Subunit	Notification priority	Description	Is open?	Staffing Account?	Single drop?	Lath?	Worked to plan?	Estimated Setup Time (Hours)	Estimated Lead Time (Hours)	Setup Units (Units)	Comments	Completed	Reason why work not completed	Additional comments	Actual hours taken
Exam Setup from Exam																
8000	80000		80000 Units 1 Car 20 200 200 Day Exam						0							
8000	80000		80000 Units 1 Car 200 200 Day Exam						0							
8000	80000		80000 Units 1 Car 200 200 Day Exam						0							
8000	80000		80000 Units 1 Car 200 200 Day Exam						0							
Additional work planned for shed exams																
8001	80000	3	1000 800 800 800 800 800	Yes					0							
8001	80000	3	1000 800 800 800 800 800	Yes					0			W/O Priority				
8001	80000	3	1000 800 800 800 800 800	Yes					0							
8000	80000		1000 800 800 800 800 800	Yes					0							
Workable work																
Additional planned work to plan																
8000	80000	3	1000 800 800 800 800 800	Yes					0.00							
8000	80000	3	1000 800 800 800 800 800	Yes					1.0			Downhaul - Investigation				
8000	80000	3	1000 800 800 800 800 800	Yes					1.0							
8000	80000	3	1000 800 800 800 800 800	Yes					1.0			1000 800 800 800 800 800				
8000	80000	3	1000 800 800 800 800 800	Yes					1.0							
8000	80000	3	1000 800 800 800 800 800	Yes					1.0							
Other																
8000	80000	3	1000 800 800 800 800 800	Yes					1.0							
8000	80000	3	1000 800 800 800 800 800	Yes					1.0							
8000	80000	3	1000 800 800 800 800 800	Yes					1.0							
8000	80000	3	1000 800 800 800 800 800	Yes					1.0							