Certified in Planning and Inventory Management

Capacity Requirements Planning (CRP)

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Capacity Requirements Planning (CRP)

1. Role of CRP in the MPC Framework

Capacity Requirements Planning links MRP and execution by determining whether planned and released orders can be completed with available work-center capacity. Understanding CRP's position within the Manufacturing Planning and Control (MPC) hierarchy is essential because it validates material plans with real-world resource limitations. CRP ensures schedules are achievable, exposes overloads/underloads, and helps planners adjust through routing changes, overtime, subcontracting, or rescheduling. Mastering its role helps ensure balanced, feasible plans that support smooth operations.

2. Inputs to CRP: Planned and Released Orders

CRP relies primarily on MRP outputs—planned order releases, firm planned orders, and released manufacturing orders—converted into time-phased capacity requirements. Understanding how order size, lead time, and timing affect workload is crucial. Planners must also ensure data accuracy for lot sizes, make-to-stock vs. make-to-order environments, and lead-time offsets. Accurate order data ensures CRP calculations correctly reflect real workloads, enabling practical decision-making.

3. Routing Data and Work-Center Assignments

Routing data specifies which work centers each operation uses, along with sequence, setup time, run time, and queue time. CRP uses routing information to convert product plans into work-center capacity loads. Misaligned or inaccurate routing leads to significant planning errors. Mastering

routing structures helps planners evaluate bottle necks, analyze capacity needs, and ensure accurate load distribution across operations.

4. Work-Center Capacity Definition and Measurement
Work-center capacity is defined in terms of labor hours, machine hours, or both. Capacity is affected by crew size, number of machines, efficiency, utilization, and available time. CRP requires accurate representation of theoretical, demonstrated, and planned capacity. Learning how to measure, adjust, and validate capacity ensures planners can compare load and capacity effectively and make meaningful decisions on constraints.

5. Load Profiles and Capacity Requirements Reports
Load profiles graphically or numerically compare required capacity versus available capacity over time. CRP generates these profiles to highlight overloads and underloads at each work center. Understanding how to interpret load profiles is vital for making decisions on rescheduling, lot splitting, or adjusting labor. These reports help align operational plans with realistic capacity, preventing delays and bottlenecks.

6. Backward and Forward Scheduling
Capacity requirements can be scheduled backward (from due date) or forward (from start date) depending on planning strategies. Backward scheduling minimizes inventory but may cause overloads. Forward scheduling prevents overloads but may lead to extended lead times. Mastering both methods allows planners to balance resource feasibility, service levels, and responsiveness.

7. Operation Lead-Time Elements

CRP relies on four major lead-time elements: queue, setup, run, and wait times. Understanding how each contributes to total capacity consumption is essential. Queue times often vary the most and reflect system congestion. Setup and run times directly consume capacity. Recognizing how lead-time variability impacts capacity requirements is key to improving schedules and increasing throughput.

8. Time Fences and Capacity Planning

Time fences—such as demand, planning, and execution fences—define the flexibility of the master schedule and hence CRP. Inside the demand fence, limited changes are allowed, requiring planners to manage capacity tightly. Beyond the planning fence, adjustments are easier. Understanding time fences enables planners to make realistic decisions about capacity adjustments and avoid destabilizing the system.

9. Infinite vs. Finite Capacity Planning

CRP traditionally assumes **infinite capacity**—capacity is calculated without constraint. While useful for analysis, infinite planning often reveals overloads that must be resolved manually. **Finite capacity planning**, on the other hand, schedules only within available capacity but is more complex. Understanding both approaches helps planners choose the appropriate method for their environment and manage bottlenecks effectively.

10. Capacity Adjustment Techniques

When overloads occur, planners can adjust capacity through overtime, adding shifts, cross-training labor, subcontracting,

rescheduling orders, splitting lots, or changing routings. Understanding when to use each adjustment method is essential for balancing cost, responsiveness, and delivery reliability. These techniques allow planners to maintain stable flow while dealing with variability.

11. Bottlenecks and Capacity-Constrained Resources (CCRs)
Identifying bottlenecks and CCRs is critical for effective CRP. Bottlenecks limit overall output, and CRP helps detect overloads at these key points. Understanding how bottlenecks differ from non-bottlenecks—and how capacity planning interacts with scheduling methods like Theory of Constraints (TOC)—ensures accurate flow planning and reduces delays.

12. Work-Center Efficiency and Utilization
Efficiency measures how well a work center converts input time into productive output. Utilization measures how much of the available time is actually used. Both impact capacity calculations. Overestimating efficiency can create unrealistic CRP outputs. Understanding how to calculate and apply these factors ensures accurate capacity modeling and realistic schedules.

13. Demonstrated and Rated Capacity
Rated capacity accounts for available time, utilization, and efficiency. Demonstrated capacity reflects actual historical output. CRP often uses demonstrated capacity for realism but rated capacity for planning. Understanding when to use each type helps planners create feasible and practical capacity plans and supports continuous improvement efforts.

14. Work-Center Queue Management
Queue time is often the largest component of lead time and reflects system congestion. CRP must account for expected queue times to calculate realistic capacity loads. Understanding queue behavior, causes of long queues, and methods to reduce them—like line balancing, WIP caps, or order prioritization—is essential for improving flow and schedule reliability.

15. Capacity Planning at Different Levels
Capacity planning occurs at multiple MPC levels: Resource Planning (S&OP level), Rough-Cut Capacity Planning (MPS level), and CRP (MRP level). CRP is the most detailed layer. Understanding how these layers interact ensures planners can validate capacity from strategic planning down to operational execution.

16. Pegging and Visibility of Capacity Loads
Pegging identifies which orders generate capacity requirements at a particular work center and time period. Pegging helps trace overload sources and determine which orders to adjust. Mastering pegging allows planners to analyze impacts quickly and make targeted schedule changes that preserve customer service while optimizing capacity.

17. Simulation and What-If Analysis in CRP
CRP is most useful when planners simulate alternative schedules, lot sizes, or routing changes. What-if analysis allows planners to test adjustments and evaluate impacts on capacity loads before committing to changes. Understanding simulation techniques helps improve decision-making, responsiveness, and schedule stability.

18. Integration with Shop Floor Control (SFC)
CRP depends on accurate shop floor data such as work order status, throughput, and actual hours consumed. Integration between CRP and SFC ensures real-time visibility of loads and capacity. Understanding this link improves capacity accuracy, prevents backlog surprises, and supports continuous improvement of planning parameters.

19. Load-Leveling and Capacity Smoothing
Load-leveling spreads work evenly across time periods to avoid peaks and valleys that destabilize operations. Techniques include moving orders, resizing lots, or balancing workloads across alternate work centers. Understanding load-leveling helps planners reduce queue time, increase flow, and improve resource utilization.

20. Exception Messages and Planner Action
MRP/CRP systems generate exception messages when capacity overloads or schedule conflicts occur. Understanding how to interpret and act on these messages is critical. Planners must evaluate priorities, customer service implications, capacity constraints, and cost impacts. This skill ensures timely, well-informed decisions that keep operations on track.

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