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A System Dynamics Model for Improving Railroad Performance

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Why this model? (Phase 1: 1998, Phase 2: 1999)

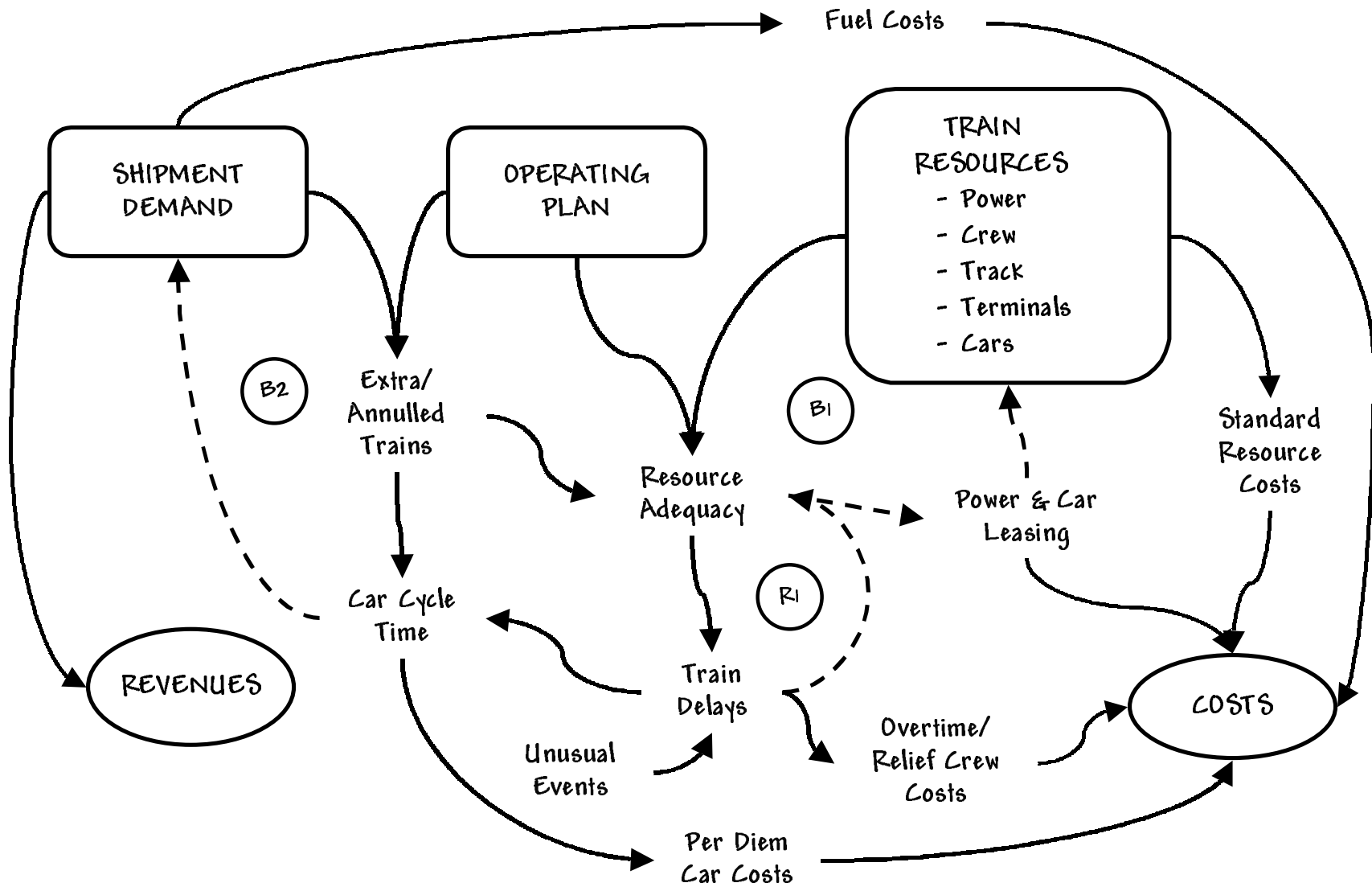
- Chronic problems with on-time service performance
 - Solve one problem, another pops up
 - Poor performance generates costs and ties up capacity
 - Shifting business (intermodal up, coal down) creates challenge
 - Competitive environment requires good service and financial performance -- only 5 major freight railroads left in U.S.
- Conrail acquisition and integration (June 1999)
 - Need to cut costs further to maintain cash flow
 - Anticipated new “single line” volume: Can CSXT handle it?
 - Concern about possible prolonged “gridlock” when two networks merge -- Union Pacific/Southern Pacific debacle 1997
 - Cars missing, RR crossings blocked, major terminals congested, factories closed....Customer lawsuits

Level of analysis: The view from the client organization (OR Dept.)

- Complements existing ops planning models
- 6-36 month time frame
- Network aggregates:
No specific geography
- Four business units
(Merchandise,
Coal/Unit, Auto,
Intermodal)
- Focus on cycle times
and variable costs

System Dynamics Model	
Strategic > 60 Days	
Operations Planning 7-60 Days	Locomotive Scheduling Tools Crew Scheduling Model Curfew Planning Tool Car Blocking Block-to-Train Assignment Model Terminal Simulation Model Train Scheduling Tool
Tactical < 7 Days	Dynamic Car Planning System Locomotive Distribution System Crew Assignment Tool Train Dispatching System

Performance comes from the interplay of resources, demand, and operating policies



The different business segments consume network resources differently (all resources shared except cars)

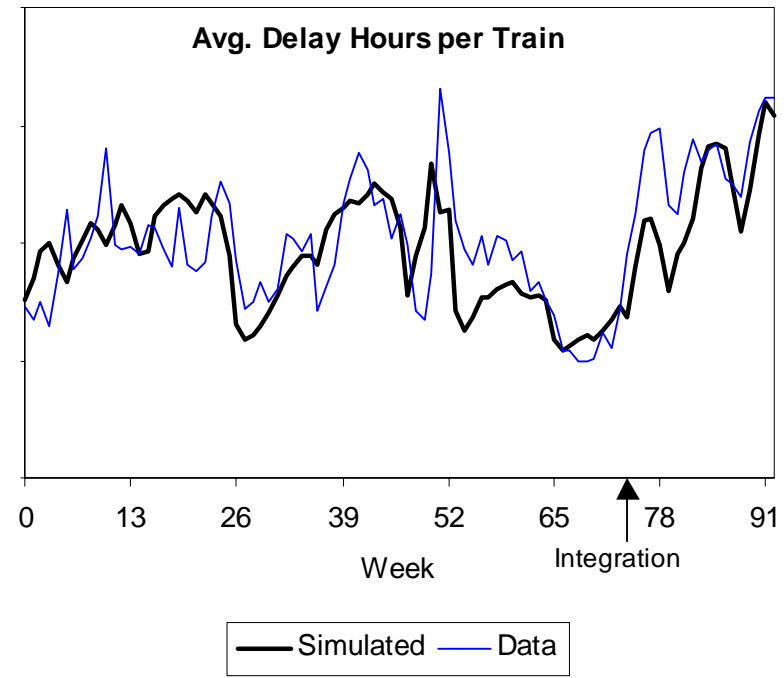
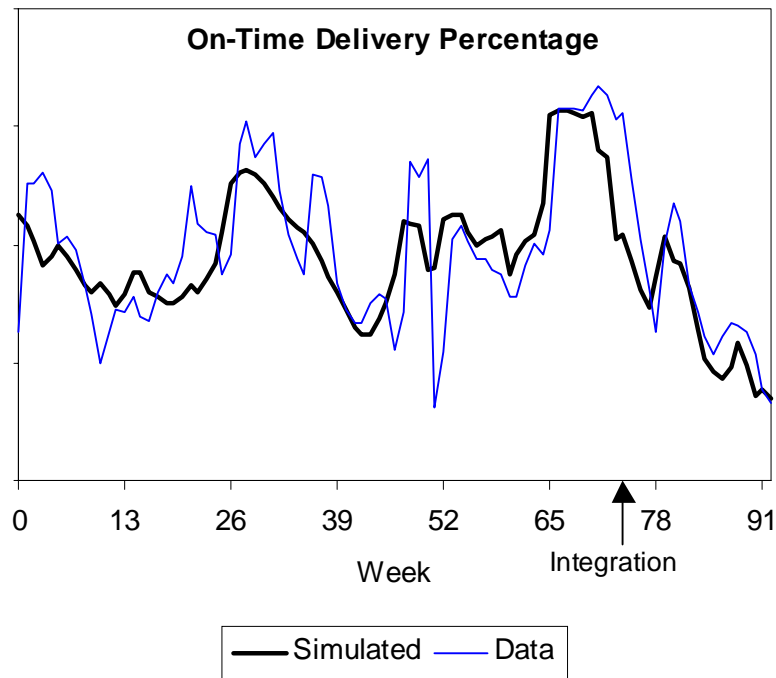
<u>RESOURCE AREA</u>	<u>RESOURCE CONSUMPTION PER CARLOAD</u>				<u>Key Issues</u>
	Merchandise	Coal/Unit	Auto	Intermodal	
Road Crews					Cars per train; Miles per crew shift
Road Locomotives					Velocity; Tonnage; Repositioning
Track					Train spacing; Curfews
Cars					Velocity; Number of connections; Customer holding days
Terminal Processing and Yard Crews					Connection capacity; Yard congestion
Local Crews and Locomotives					Fraction of shipments with local service

The model reproduces history (Jan. 1998 - Oct. 1999) for about 30 model variables, half of them broken out by business segment

Weeks 0-51: 1998...

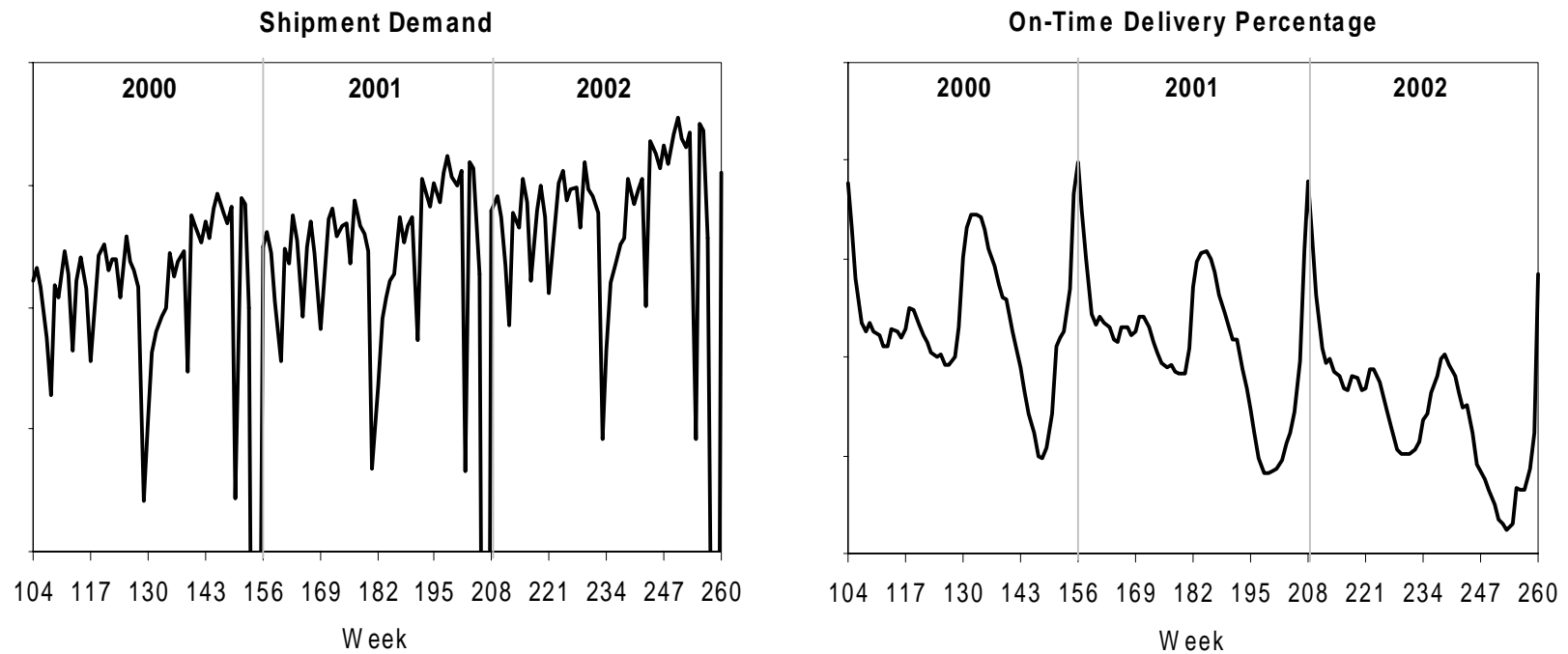
Weeks 52-72: 1999 pre-integration...

Weeks 73-92: 1999 post-integration



Base case projection: Expected volume gains cause service degradation in the absence of corrective action

Model Simulation Results for 2000-2002



What can the model tell us about managing the expected increase in demand over the next three years?

- Potential solutions are of three general types. A combination of these is necessary to achieve satisfactory performance.

