

# Integrated Passenger and Freight Rail Forecast

## SCAG Modeling Task Force

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# Purpose and Objectives



## Purpose

- Fresh look at future passenger and freight rail operations, capacity needs and costs
- Identify strategic projects/infrastructure that mutually benefit public and private rail stakeholders in order to win funding opportunities

## Objectives

- Forecast future passenger and freight rail volumes and demand out to 2045/2050 including interim years
- Assess goods movement and intermodal facility capacities
- Identify necessary track capacity improvements with RTC software
- Develop cost estimates
- Develop funding strategies
- Identify strategic corridors to increase grant funding awards

# Project Tasks



- Task 1 – Project Management
- Task 2 – Stakeholder Engagement/TAC
- Task 3 – Existing and Future Conditions
- Task 4 – Rail Simulations (Freight Counts)
- Task 5 – Cost Estimate and Funding Strategy
- Task 6 – Shared Use Strategy
- Task 7 – Strategic Corridors
- Task 8 – Final Report and Recommendations

# Progress to Date



- Existing and Future Conditions
- Two TAC Meetings
- CTC/Metrolink Meetings
- 2019 Base Year Simulation
- 2028 Simulation
- 2035 Simulation beginning
- Three additional simulations
- Project completion February 2022

# Rail Simulations

- 1) 2019 Base Year
- 2) 2028 Metrolink Milestone 1B
- 3) 2035 Metrolink Milestone 2
- 4) 2035 Metrolink Milestone 2 + CA HSR
- 5) 2045 Metrolink Milestone 3 + CA HSR
- 6) TBD

# *Rail Traffic Controller*

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## *What is RTC?*

- Rail Traffic Controller™ is a state-of-the-art software tool for dispatching and scheduling trains
- It is based on the familiar Windows™ standard interface
- RTC™ has been designed for use in both real-time and offline-planning mode

## *RTC offers*

- A superior methodology for scheduling and routing trains
- A migration path to network operations software, real-time systems
- Consistency of operation throughout a railroad's network
- Flexible dispatcher districts depending on traffic levels



# *RTC's unique network-oriented design can provide system-level solutions*

Advantages to this approach are numerous

- ✓ Any track layout can be modeled
- ✓ Yard and terminal capacity become integrated with train schedules
- ✓ Dispatcher and yardmaster activities become better coordinated
- ✓ Better allocate locomotives via integrated TPC  
Reliance on HP per ton by district would become obsolete

## *What does RTC do?*

- Simulates trains running over a rail network
- Dispatches trains
- Optimizes dispatching and routing of trains to minimize either delay or cost
- Generates train schedules
- Generates train delay reports
- Displays results in high resolution graphics

# *Components of RTC*

- User interface for dispatching trains
- Draw program for creating and modifying networks
- Train Performance Calculator (TPC), which can account for many variables, including different locomotive types
- Advanced and realistic meet-pass logic

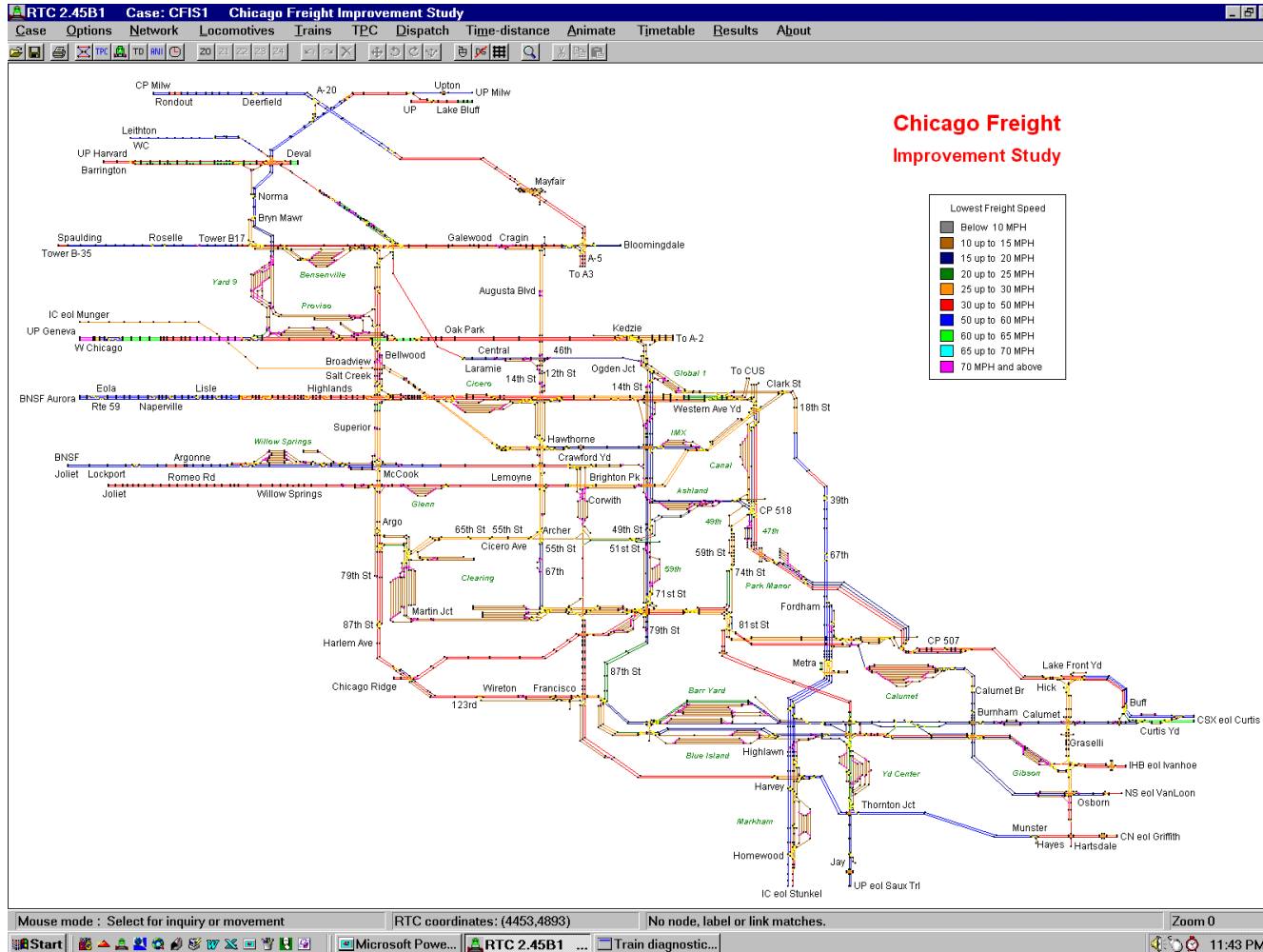
## *Offline applications of RTC*

- Analyze effects of capital projects, such as:
  - ✓ sidings, crossovers and bypass tracks
  - ✓ double tracking
  - ✓ new locomotives by type
- Optimize schedules based on either train delay or cost
- Determine best time to schedule trains
- Determine effects of adding and deleting train service

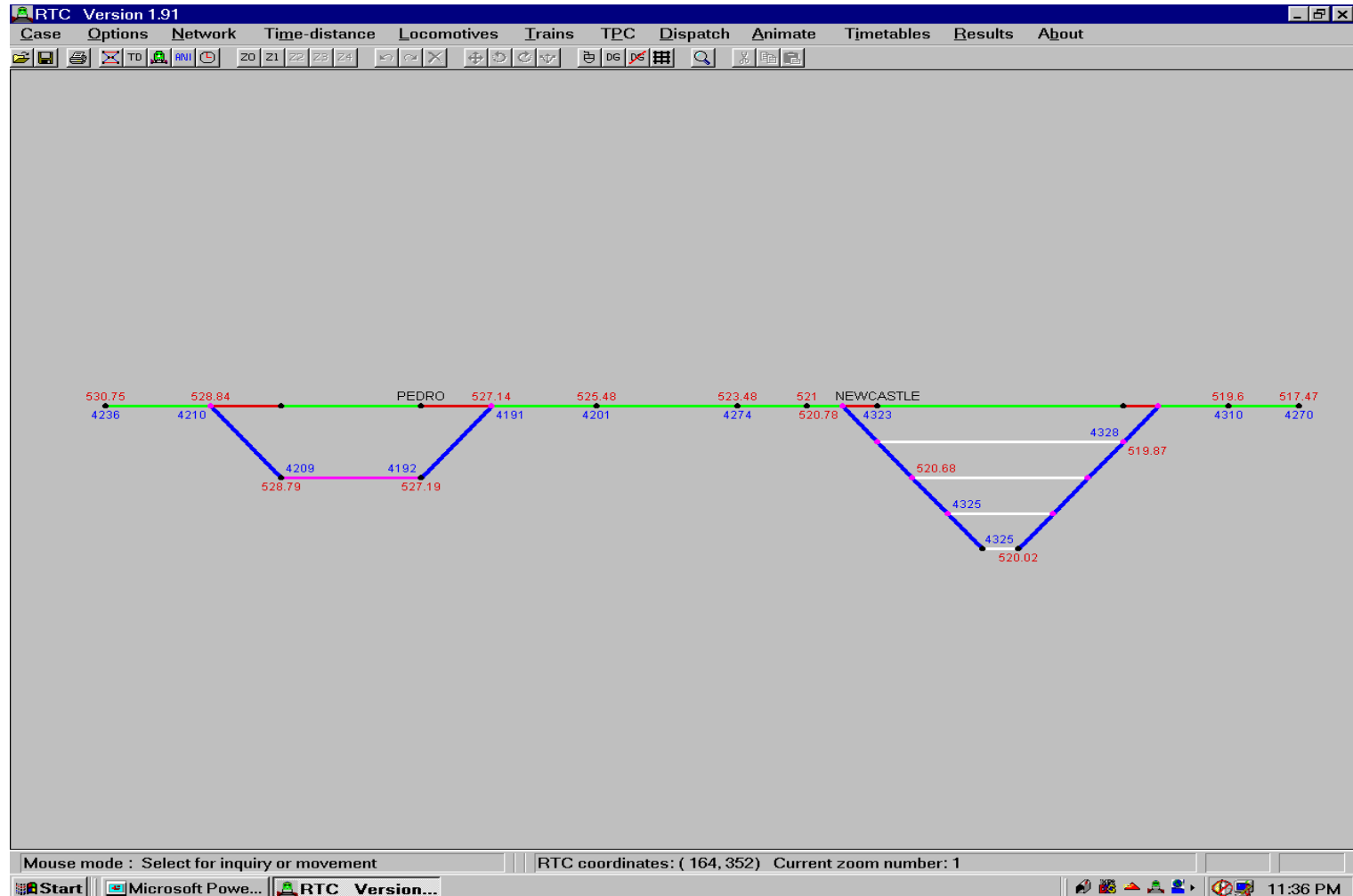
## *Users of RTC?*

- Dispatchers
- Service planners
- MOW planners
- Track engineers

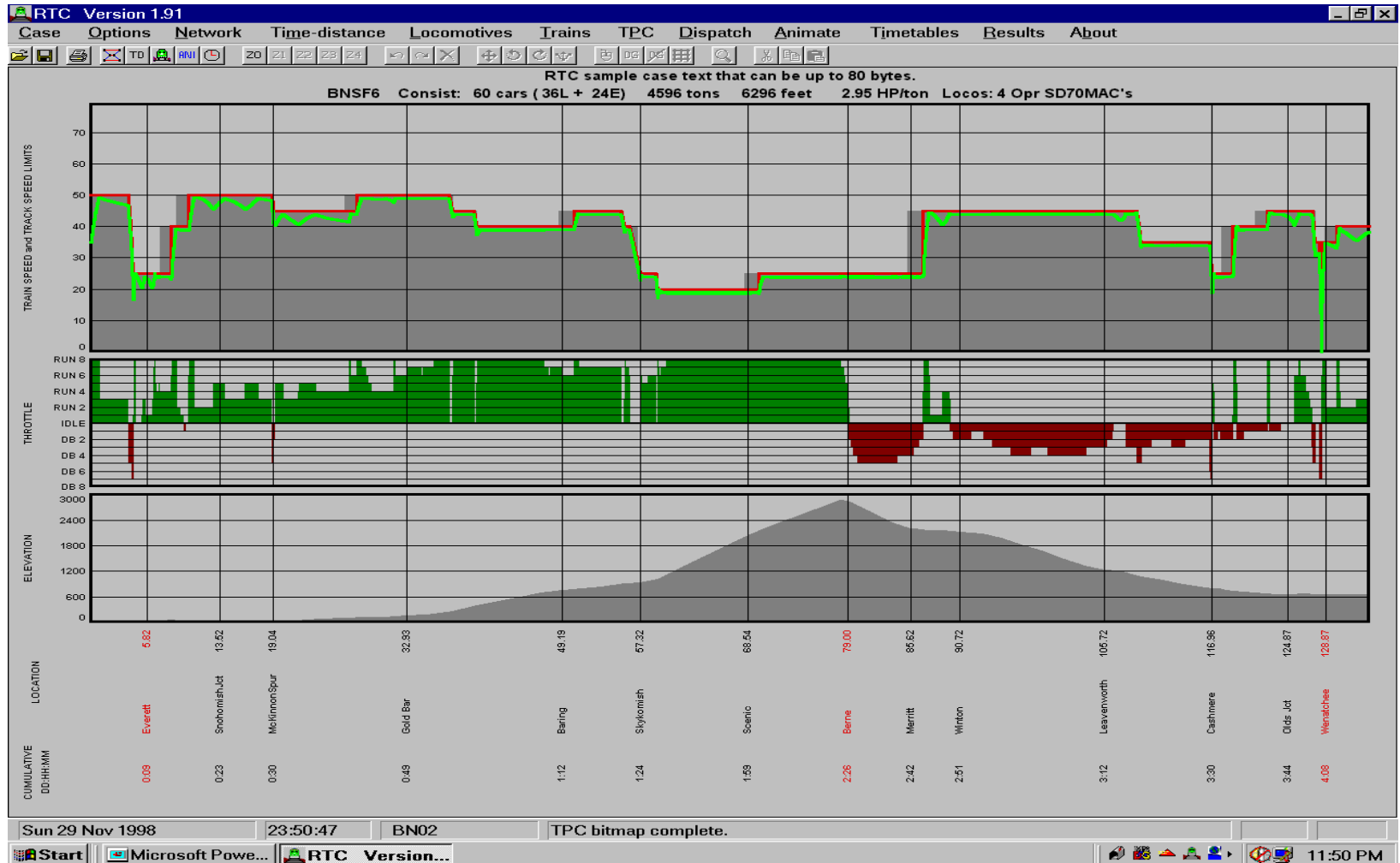
# Sample RTC network of Chicago



# Zooms show detail, such as the arrival and departure tracks at Newcastle



# Network accuracy is important because the TPC depends on it.





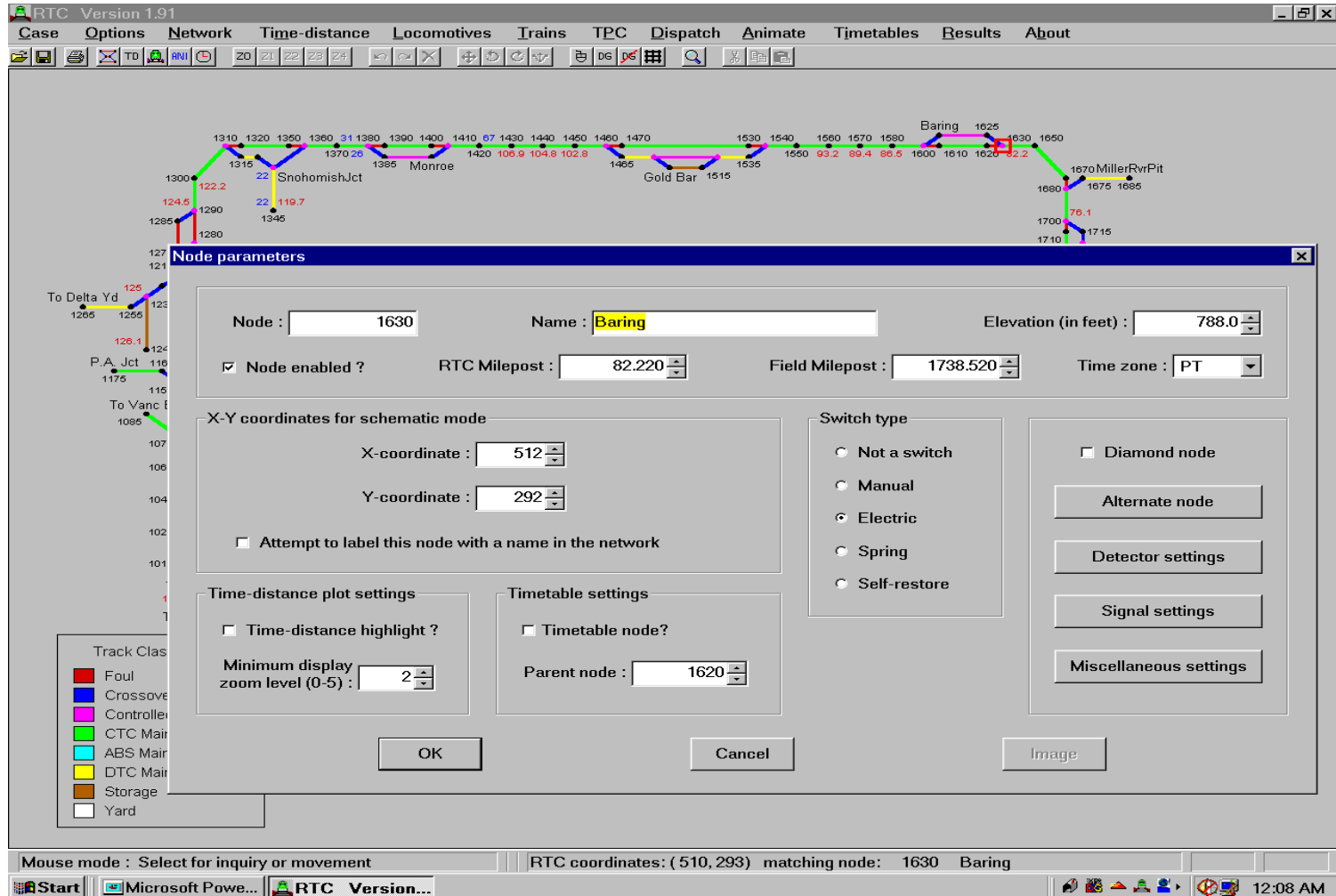
## *The data required to create an accurate network is generally available*

- Location of switches
- Location of signals
- Failed Equipment Detectors (FEDs)
- Speed change points
- Significant grade change locations
- Significant curve locations

## *Excessive network detail is unnecessary*

- For example, yard classification tracks do not significantly play a part in line capacity and therefore should not be included in networks
- The extent of yard tracks should reflect the ability of a yard to originate and terminate trains at any given time
- Obscure storage tracks should also be omitted

# User friendly interface permits quick updates to location (node) information



# Track (network link) information interface is detailed but easy to use

The screenshot displays the RTC Version 1.91 interface. The main window shows a network diagram with various track segments and nodes. A legend in the bottom-left corner identifies track classes: Foul (red), Crossover or Turn (blue), Controlled Siding (magenta), CTC Main (green), ABS Main (cyan), DTC Main (yellow), Storage (brown), and Yard (white). The status bar at the bottom indicates "Mouse mode : Select for inquiry or movement" and "RTC coordinates: ( 491, 296) 2 matching links: 1615 - 1625".

The "Link: 1615 Baring to 1625 Baring 1 of 2" configuration window is open, showing the following details:

- General link parameters:**
  - Link enabled ?
  - Name: Rust Subdivision
  - Class: Controlled Siding
  - Direction: East
- Track geometry:**
  - Link distance: 1.910
  - Equation distance: 1.910
  - Percent grade: 0.407
  - Equation % grade: 0.407
  - Degrees of curvature: 0.000
  - Equation curvature: 0.000
- Allowable next route node(s):**
  - Node 1: 1630
  - Node 2: (empty)
- Maximum track speed permitted by train group:**
  - Passenger: 20
  - Expedited: 20
  - Freight: 20
- Miscellaneous settings:** Insert new node

Buttons for OK, TSO, and Cancel are located at the bottom of the configuration window.

# *The data required to create accurate train performance is generally available*

- Accurate locomotive performance statistics
  - ✓ Tractive effort curves
  - ✓ Dynamic brake curves
  - ✓ Fuel consumption by throttle position
  - ✓ Tonnage, length, etc...
- Accurate train consist
  - ✓ Length
  - ✓ Tonnage
  - ✓ Car types and counts

# Comprehensive interfaces for updating locomotive specifications

The screenshot displays the RTC Version 1.91 interface for configuring locomotive characteristics. The main window is titled "Locomotive characteristics" and contains two main sections: "General settings" and "Rolling resistance coefficients and maximum adhesion".

**General settings:**

- Locomotive type: SD70MAC
- Umler name: SD70MAC
- Number of axes: 6
- Horsepower at generator: 4040
- Horsepower at rail: 3394
- Maximum speed (MPH): 70
- Length (feet): 74.0
- Width (feet): 11.7
- Height (feet): 15.5
- Minimum empty weight (lbs): 381237
- Maximum gross weight (lbs): 415000

**Rolling resistance coefficients and maximum adhesion:**

- Journal resistance constant: 1.30
- Journal axle resistance coefficient: 29.00
- Flange resistance coefficient: 0.030
- Lead unit air resistance coefficient: 0.00240
- Trailing unit air resistance coefficient: 0.00120
- Maximum starting adhesion ratio: 0.42

A secondary window titled "SD70MAC forces for throttle position: RUN 8" is open, showing a table of forces in pounds. The table has 10 columns (0-9) and 8 rows (0-70). The values represent the force at various speeds and throttle positions. The value 175000 is highlighted in the first row, column 0.

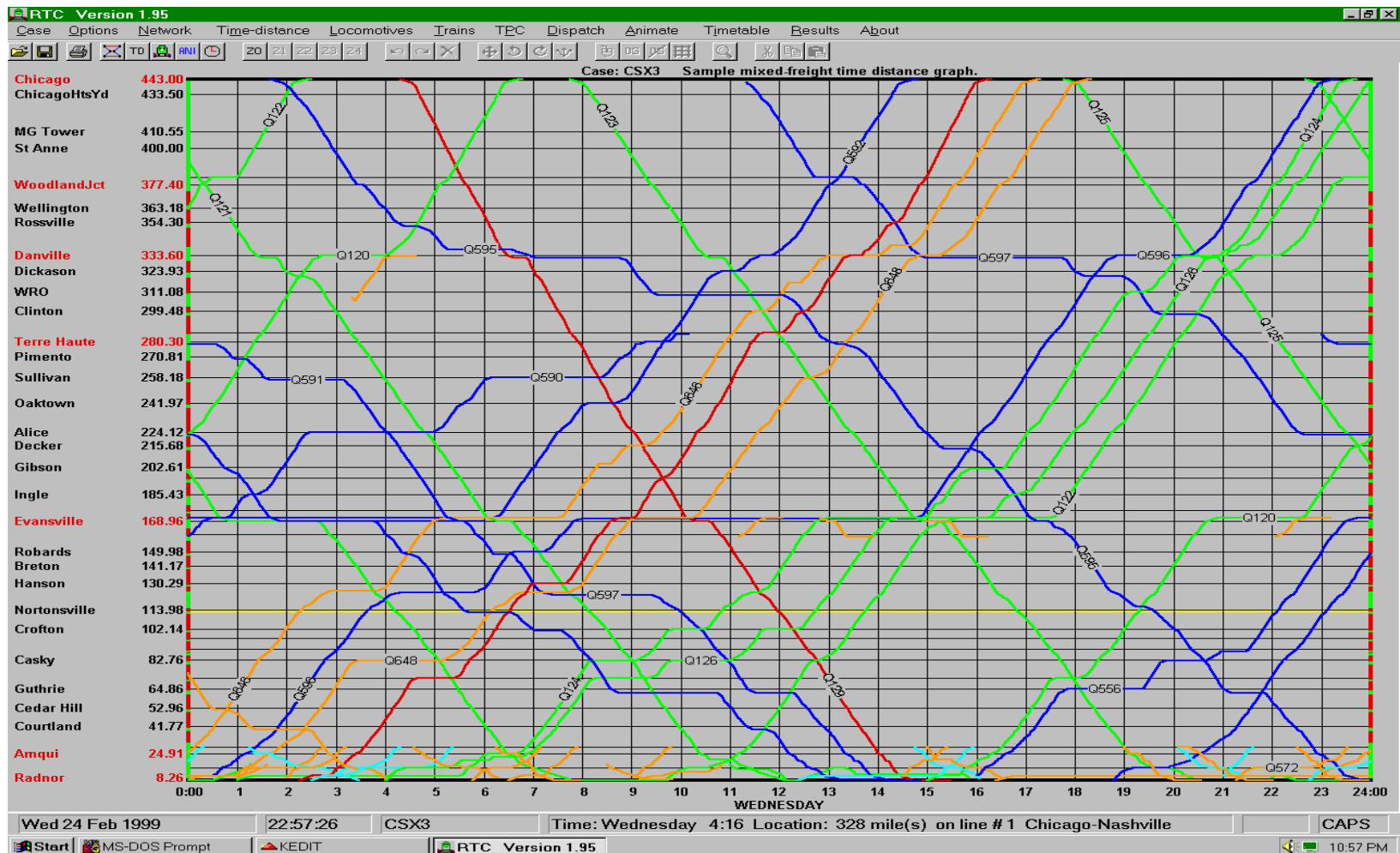
	0	1	2	3	4	5	6	7	8	9
0	175000	175500	175500	175500	175500	175500	175500	172157	154125	139000
10	126900	117000	107830	100072	93811	87843	82621	78012	73883	70176
20	66838					53899				
30	45100					38652				
40	33713					29871				
50	26775					24184				
60	22025					20157				
70	0									

Buttons for "RUN 1 forces" through "RUN 8 forces" are visible on the right side of the force table window. The main window also has "OK" and "Cancel" buttons at the bottom.

## *RTC output*

- Time-distance diagrams
- Train performance graphs
- Timetables in the form of train sheets
- Video animation of past, current and future train movements throughout network
- Detailed train routing and schedule reports

# RTC's time-distance plots contain automatic train labels for clarity





# Scrollable timetables are automatically produced

RTC Version 1.91

Case Options Network Time-distance Locomotives Trains TPC Dispatch Animate Timetables Results About

Case : CSX3 Timetable for Chicago-Nashville 80-byte string of additional text for the current line.

Read-down westbound direction displaying 8 of 41 trains Read-up eastbound direction displaying 8 of 47 trains

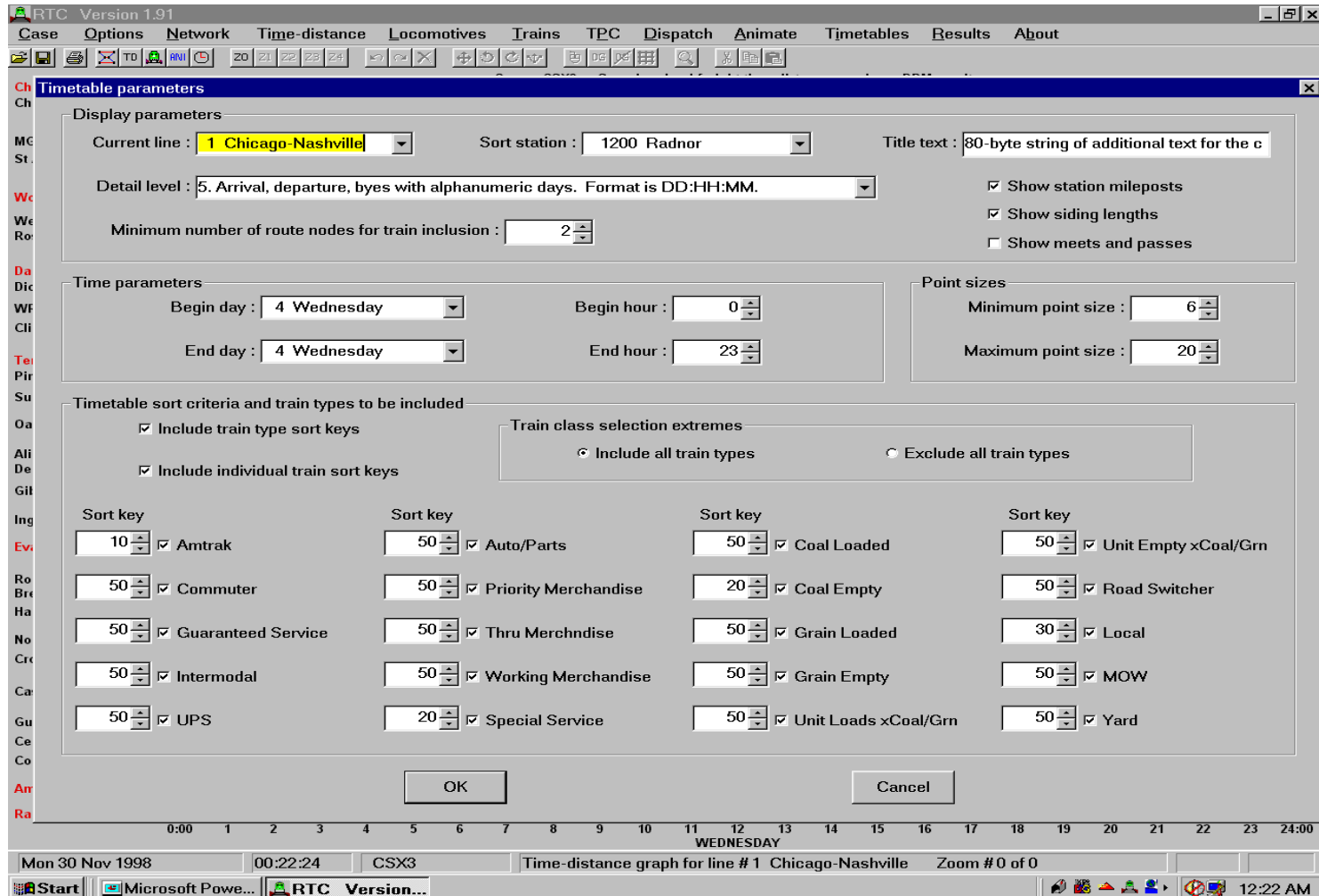
Q597	Q125	Q595	Q573	Q525	Q645	Q529	Q275	Location	Q122	Q120	Q648	Q592	Q155	Q214	Q646	Q535
	dep We:17:47	dep We:01:40			dep We:01:23			MP 16.0 Chicago	dep We:02:15	dep We:06:38	dep We:18:10	dep We:14:34				dep We:17:09
dep We:11:20	arr We:17:54	arr We:01:48			arr We:01:31			MP 19.5 Yard Center	arr We:02:10	arr We:06:33	arr We:18:05	arr We:14:29				arr We:17:04
by We:11:24	by We:17:58	by We:01:53			by We:01:36			MP 20.4 Thornton Jct	by We:02:01	by We:06:24	by We:17:56	by We:14:20				by We:16:55
by We:11:53	by We:18:22	by We:02:22			by We:02:04			MP 37.5 Beecher	by We:02:00	by We:06:23	by We:17:54	by We:14:18				by We:16:53
by We:12:08	by We:18:37	by We:02:37			by We:02:19			MP 49.5 MG Tower	by We:01:41	by We:06:04	by We:17:33	by We:13:57				by We:16:33
by We:12:21	by We:18:50	by We:02:50			by We:02:32			MP 60.0 St Anne								
arr We:12:44	by We:19:13	by We:03:13			by We:02:54			MP 77.7 Watsika	by We:01:14	by We:05:38	by We:17:03	by We:13:28				by We:16:05
dep We:13:29	arr We:19:13	arr We:03:13			by We:02:54			MP 82.6 WoodlandJct	dep We:00:52	arr We:05:17	by We:16:41	by We:13:06				by We:15:44
arr We:13:40	arr We:19:19	arr We:03:19			arr We:03:00			MP 96.8 Wellington 1277'	arr We:00:22	by We:05:05	by We:16:27	by We:12:53				by We:15:32
dep We:13:41	dep We:19:20	dep We:03:26			dep We:03:01			MP 105.7 Rosville 1247'	by We:00:09	by We:05:05	by We:16:09	by We:12:36				by We:15:14
by We:14:03	by We:19:38	by We:03:47			by We:03:22			MP 126.4 Danville	by Tu:23:53	by We:04:49	by We:16:09	by We:12:36				by We:15:14
by We:14:20	by We:19:55	arr We:04:17			by We:03:39			MP 148.9 WRO 9900'	by Tu:23:40	by We:04:36	by We:15:54	by We:12:22				by We:15:00
arr We:14:59	arr We:20:32	arr We:06:57			arr We:04:33			MP 160.5 Clinton 11510'	dep Tu:23:03	dep We:04:00	dep We:15:15	dep We:11:44				dep We:13:53
dep We:17:45	dep We:20:47	dep We:08:38			dep We:04:48			MP 173.9 Dewey 4995'	arr Tu:22:33	arr We:02:35	arr We:14:42	arr We:11:29				arr We:12:53
by We:19:19	by We:21:19	arr We:09:26			by We:05:20			MP 179.7 Terre Haute	by Tu:21:54	by We:01:54	by We:13:58	by We:10:14				by We:11:55
by We:19:33	by We:21:35	by We:12:22			by We:05:34			MP 189.2 Pimento 6389'	dep Tu:21:35	by We:01:39	by We:13:43	by We:09:59				dep We:11:37
by We:19:51	by We:21:52	by We:12:40			by We:05:52			MP 201.8 Sullivan 9388'	arr Tu:21:14	by We:01:22	by We:13:24	by We:09:41				arr We:11:24
by We:19:59	by We:22:01	arr We:13:10			by We:06:01			MP 218.0 Oaktown 9335'	by Tu:20:49	by We:01:22	by We:13:24	by We:09:41				by We:10:56
arr We:20:26	by We:22:16	by We:13:42			by We:06:18			MP 235.9 Alice 6969'	by Tu:20:38	by We:01:11	by We:13:12	by We:09:30				by We:10:45
dep We:20:36	by We:22:16	by We:13:42			by We:06:18			MP 244.3 Decker 9377'	by Tu:20:29	by We:01:02	by We:13:01	by We:09:19				by We:10:35
by We:21:03	by We:22:32	by We:13:59			by We:06:34			MP 257.4 Gibson	by Tu:20:13	by We:00:46	dep We:12:33	arr We:09:03				by We:10:19
by We:21:25	by We:22:55	by We:14:22			arr We:07:00				by Tu:19:52	by We:00:23	by We:11:50	dep We:08:33				by We:09:56
arr We:22:01	by We:23:24	by We:14:52			dep We:07:51				by Tu:19:25	by Tu:23:54	by We:11:21	arr We:07:56				by We:09:28
dep We:23:32	by We:23:24	by We:14:52			arr We:08:28				by Tu:19:15	dep Tu:23:34	by We:11:09	by We:07:17				dep We:09:10
arr We:23:59	by We:23:38	arr We:15:15			dep We:09:31				arr Tu:23:30	arr Tu:23:30	by We:11:09	by We:07:06				arr We:08:57
dep Th:00:25	by We:23:38	dep We:15:50			dep We:10:06											

RTC run : 30 November 1998 0:23 Timetable includes trains from Wednesday 0:00 until Wednesday 23:59 User : Eric Wilson of Berkeley Simulation Software

Mon 30 Nov 1998 00:23:50 CSX3 Timetable for current line: 1 Chicago-Nashville

Start Microsoft Powe... RTC Version... 12:23 AM

# Timetable interface allows customized schedules to be created



*RTC can bring significant cost savings and improved service. It can...*

- Minimize delays by optimizing schedules and routing
- Reduce number of crews expiring on hours-of-service
- Enable capital dollars to be spent most prudently
- Improve equipment utilization resulting from more predictable arrival and departure times

## *Rail Carrier RTC implementation*

- Build relevant networks
- Customize RTC to accommodate railroad databases
- Develop railroad-specific cost functions
- Install RTC with service designers and integrators
- Install hardware capable of running large systems

## *Looking ahead, RTC can ...*

- Provide a safe and feasible migration path from off-line analysis to on-line network operations
- Enable a consistent operating policy to be implemented throughout a network
- Assist in training of dispatchers
- Permit flexible dispatcher districts