FEDERAL RAILROAD ADMINISTRATION

Sharma & Associates, Inc.
Engineering Consultants

BRAKING DISTANCE SIMULATION

Emergency & Normal Applications

HQ-2011-15

April 26, 2011

Objective of the Simulation Study

Braking Distance Estimates for a Heavy and Long Loaded Coal Train under Emergency Application and Normal Train Handling

FEDERAL RAILROAD ADMINISTRATION

BRAKING DISTANCE SIMULATION
(Train Energy and Dynamics Simulator – TEDS)

Sharma & Associates, Inc.
Engineering Consultants

Train Configuration

- 3 Locomotive (Distributed Power)
- 18,529 Training Tons
- 6,901 Ft. Train Length
- Head End : Two (2) 4,400 HP Locomotives (SD70ACE and ES44AC)
- Remote: One (1) 4,300 HP Locomotive (SD70ACE)
- One Hundred Thirty (130) 110-Ton Cars, Loaded GRL 286,000 Lbs
- Locomotive Braking Ratio: 29%
- Car Braking Ratio: 9% - Emergency Cylinder Pressure: 78 psi
- Car Braking Ratio: 8.5% - Emergency Cylinder Pressure: 76 psi
- Brake Pipe Pressure: 90 psi

FEDERAL RAILROAD ADMINISTRATION

BRAKING DISTANCE SIMULATION
(Train Energy and Dynamics Simulator – TEDS)

Sharma & Associates, Inc.
Engineering Consultants

Simulation Scenario – Emergency Application

- **Track Chart Generated Data**
- **Train Placed at 448.658 MP (1364 Ft. prior to MP448.4)**
- **Throttle in Notch 4**
- **Train Speed Initialized to 20 MPH (per the Event Recorder Data)**
- **Emergency Initiated at Both Head end and Rear Locomotive**
- **Locomotives Bailed-off**

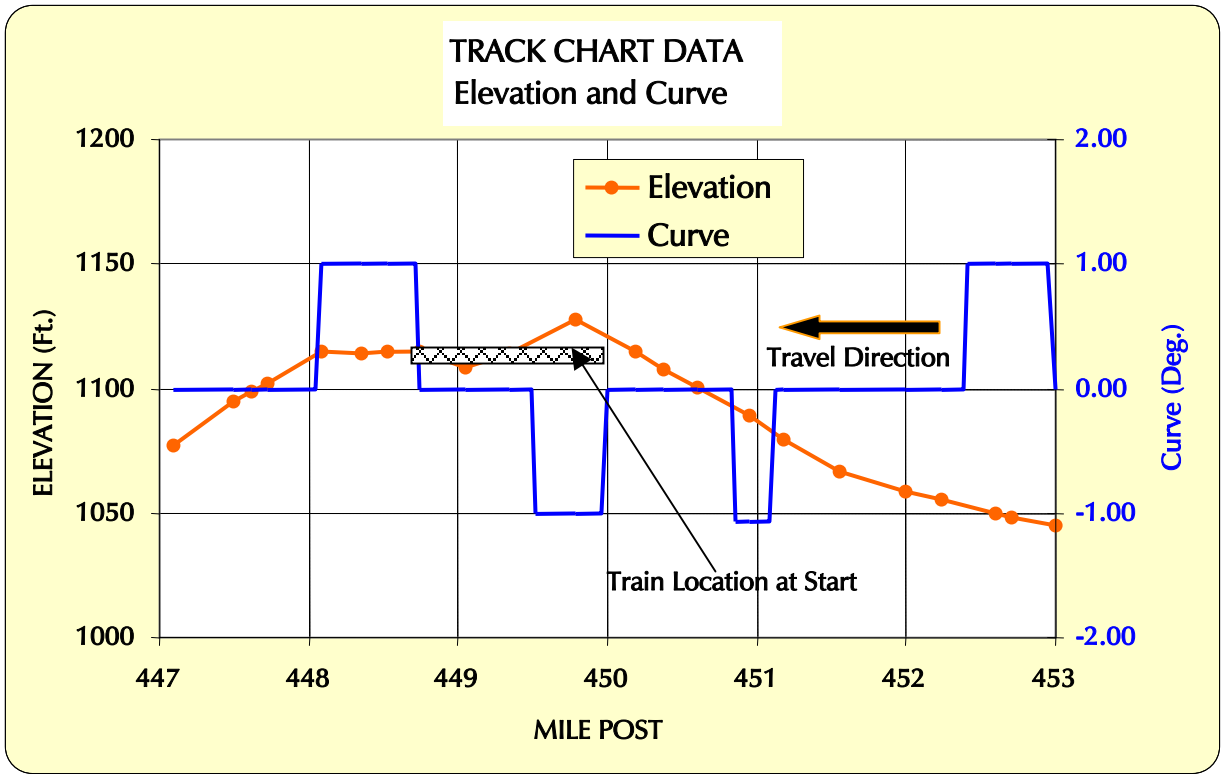
Point of Collision is at MP 448.4

FEDERAL RAILROAD ADMINISTRATION

BRAKING DISTANCE SIMULATION
(Train Energy and Dynamics Simulator – TEDS)

Sharma & Associates, Inc.
Engineering Consultants

Simulated Track Chart Data



DRAFT- For Discussion Only

FEDERAL RAILROAD ADMINISTRATION

BRAKING DISTANCE SIMULATION
(Train Energy and Dynamics Simulator – TEDS)

Sharma & Associates, Inc.
Engineering Consultants

Stopping Distance – Emergency Application

At Braking Ratio of 9% : 542 Ft.

At Braking Ratio of 8.5%: 615 Ft.

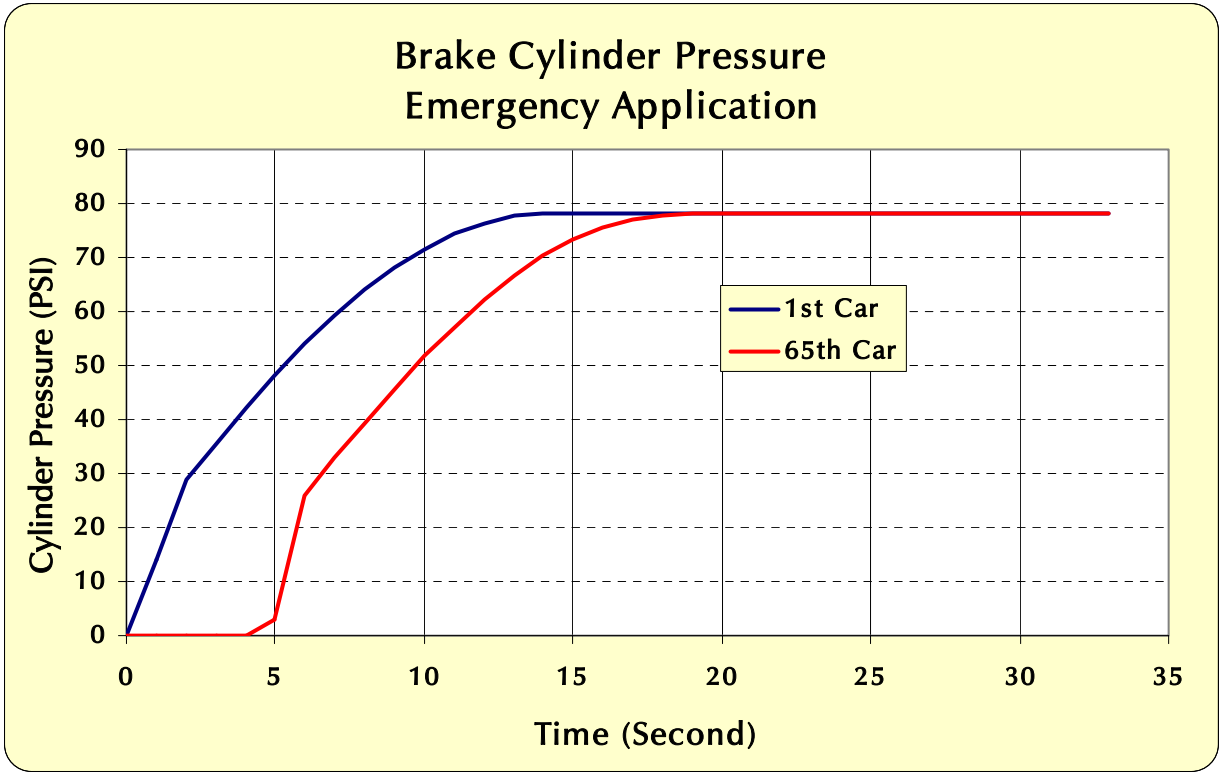
Both Simulations Result in a Stop Well Short of the Point of Collision

FEDERAL RAILROAD ADMINISTRATION

BRAKING DISTANCE SIMULATION
(Train Energy and Dynamics Simulator – TEDS)

Sharma & Associates, Inc.
Engineering Consultants

Braking Ratio 9%



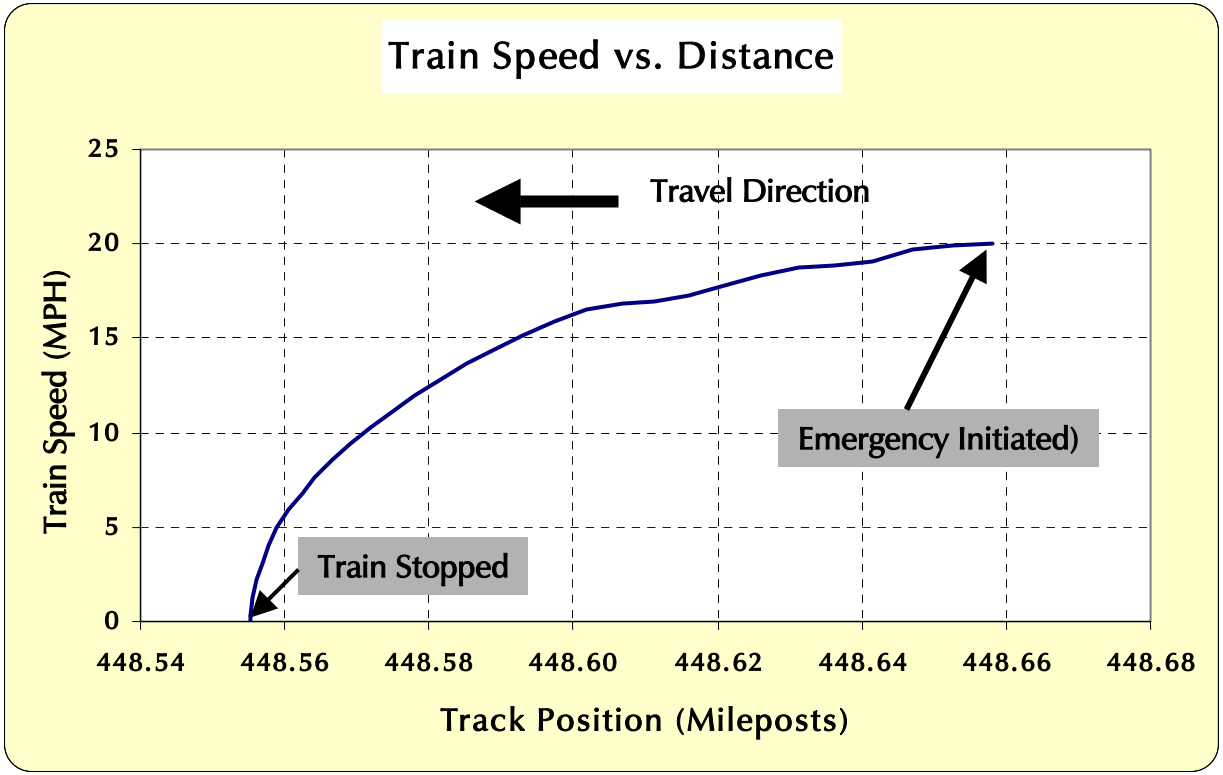
DRAFT- For Discussion Only

FEDERAL RAILROAD ADMINISTRATION

BRAKING DISTANCE SIMULATION
(Train Energy and Dynamics Simulator – TEDS)

Sharma & Associates, Inc.
Engineering Consultants

Braking Ratio 9%



Collision Point is at MP 448.4

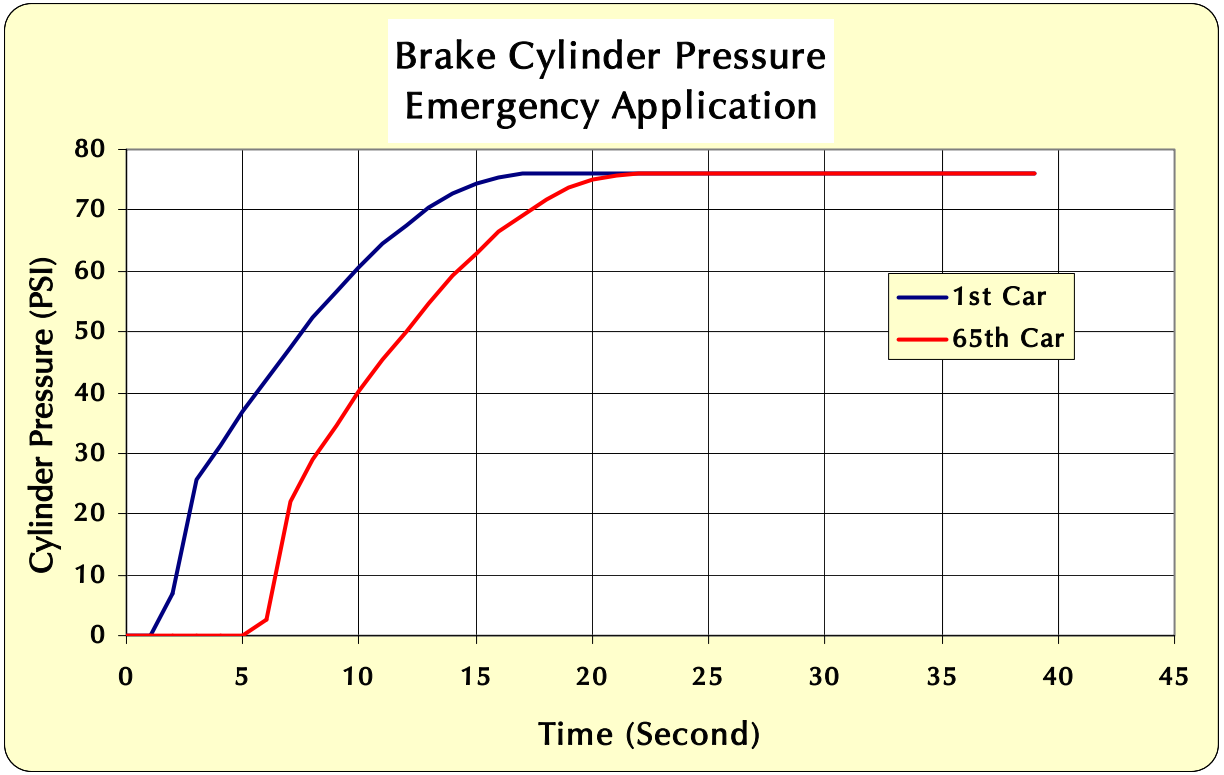
DRAFT- For Discussion Only

FEDERAL RAILROAD ADMINISTRATION

BRAKING DISTANCE SIMULATION
(Train Energy and Dynamics Simulator – TEDS)

Sharma & Associates, Inc.
Engineering Consultants

Braking Ratio 8.5%



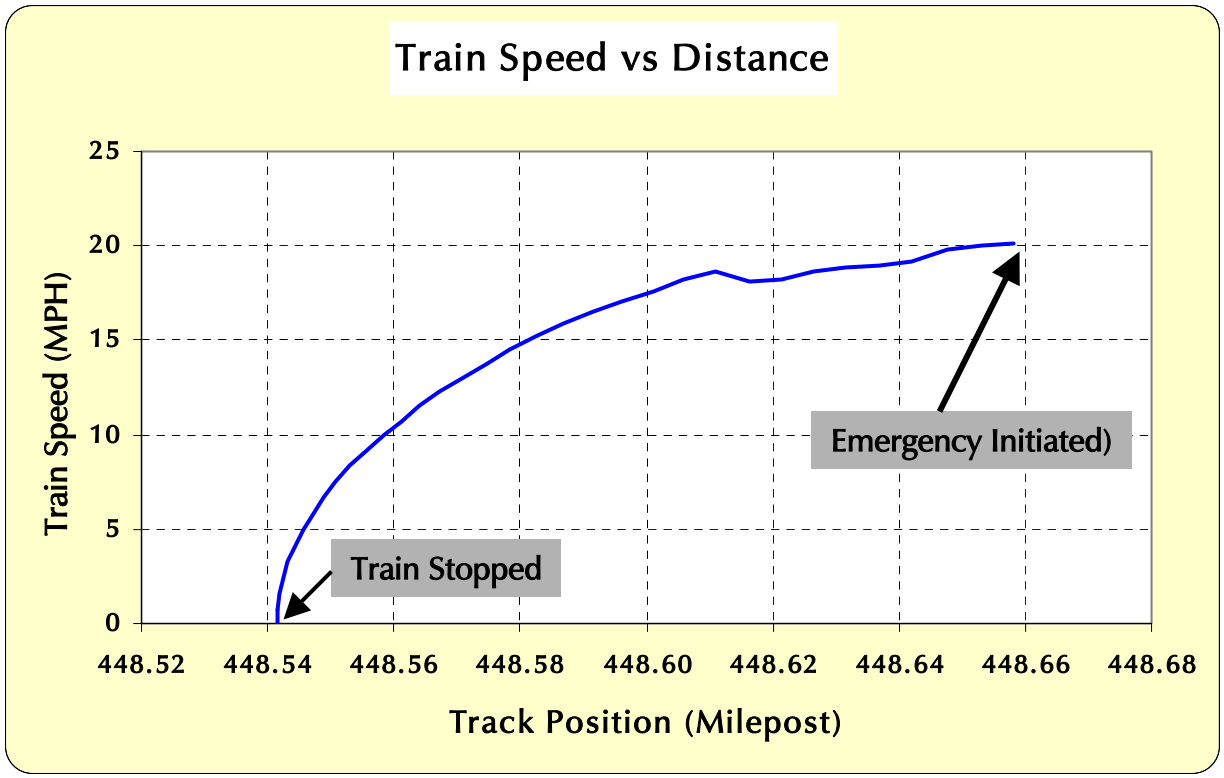
DRAFT- For Discussion Only

FEDERAL RAILROAD ADMINISTRATION

BRAKING DISTANCE SIMULATION
(Train Energy and Dynamics Simulator – TEDS)

Sharma & Associates, Inc.
Engineering Consultants

Braking Ratio 8.5%



DRAFT- For Discussion Only

FEDERAL RAILROAD ADMINISTRATION

BRAKING DISTANCE SIMULATION
(Train Energy and Dynamics Simulator – TEDS)

Sharma & Associates, Inc.
Engineering Consultants

Simulations using Normal Train Handling Show that the Train would have stopped well short of the Signal Location.

FEDERAL RAILROAD ADMINISTRATION

BRAKING DISTANCE SIMULATION
(Train Energy and Dynamics Simulator – TEDS)

Sharma & Associates, Inc.
Engineering Consultants

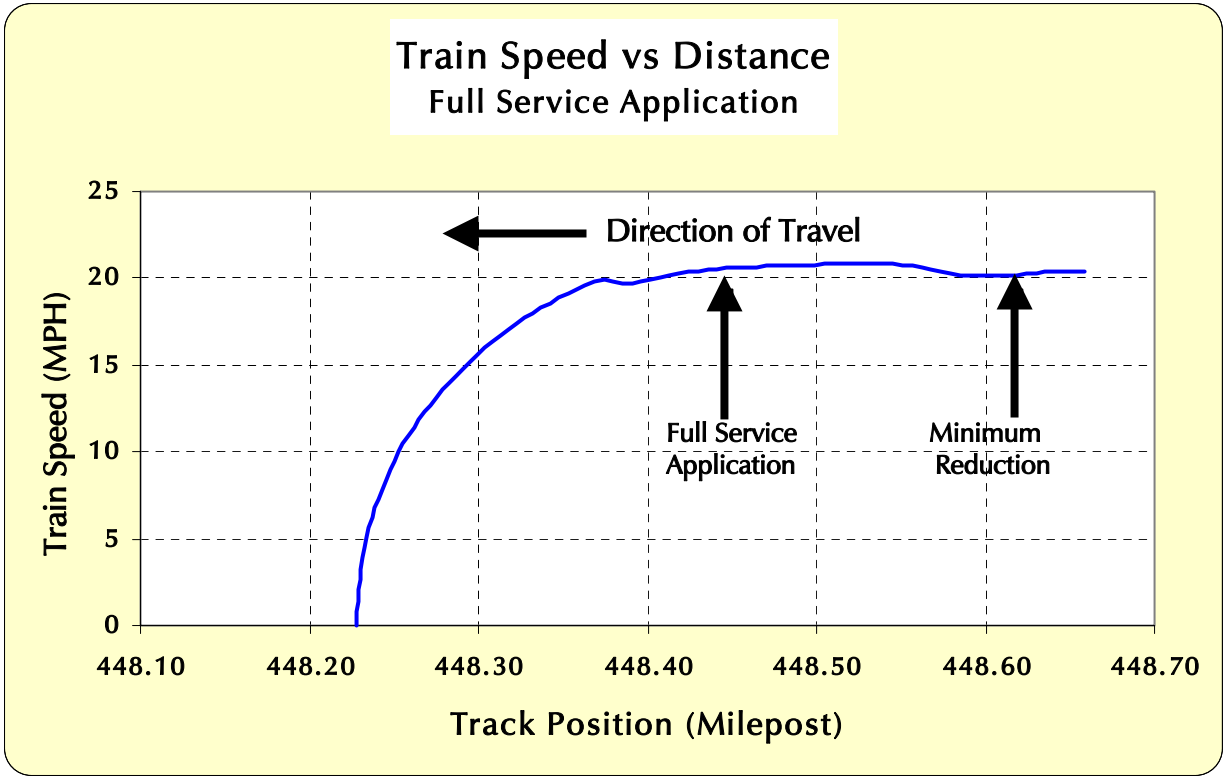
Simulation Scenario – Normal Train Handling

- Train Initialized at 20 MPH at MP 448.66 MP
- (Braking Ratio: 8.5%)
- Throttle in Notch 4
- Throttle Notched Down to N2 in 3 Seconds Interval
- Minimum Service Initiated
- Locomotive Bailed-off
- Full Service Application after 30 Seconds
- Throttle to Idle below 10 MPH
- Continue until Stopped

FEDERAL RAILROAD ADMINISTRATION

BRAKING DISTANCE SIMULATION
(Train Energy and Dynamics Simulator – TEDS)

Sharma & Associates, Inc.
Engineering Consultants

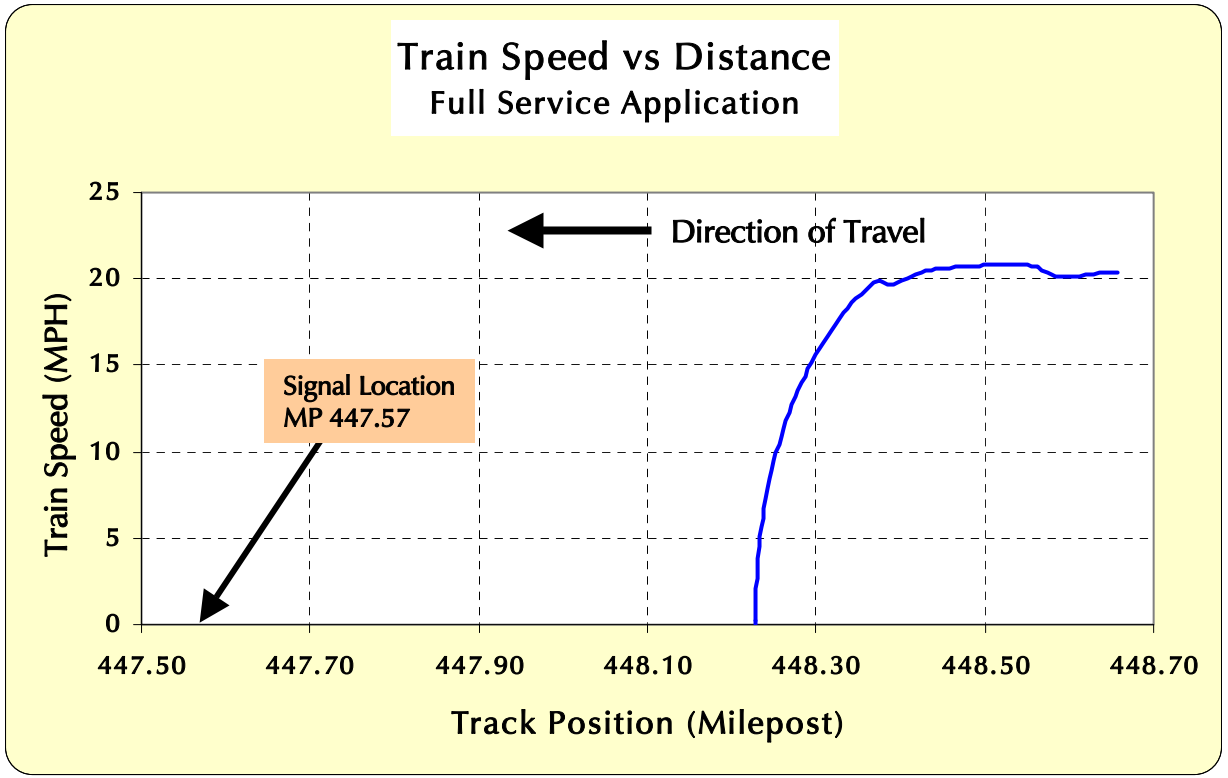


DRAFT- For Discussion Only

FEDERAL RAILROAD ADMINISTRATION

BRAKING DISTANCE SIMULATION
(Train Energy and Dynamics Simulator – TEDS)

Sharma & Associates, Inc.
Engineering Consultants



DRAFT- For Discussion Only