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HIGHWAY - RAIL GRADE CROSSING SOLUTIONS

Quiet Zone Preemption Analysis
City of Moorhead, Minnesota
City Council Work Session
March 19, 2012

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City Council Work Session

- Railroad Preemption
- Main Concerns/Complaints
- Challenges
- Recommended Solutions
  - Operational
    - Short Term
      - Less than 6 months
      - 6 months to 2 years
    - Long Term
      - Greater than 2 years
  - Safety
- Cost

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What is Railroad Preemption at a Grade Crossing?

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Railroad Preemption:

A special control mode in a traffic signal controller designed to start up and clear any vehicular traffic on the roadway approach crossing the railroad tracks

Then allows only traffic movements that do not conflict with the railroad for the duration of the train movement

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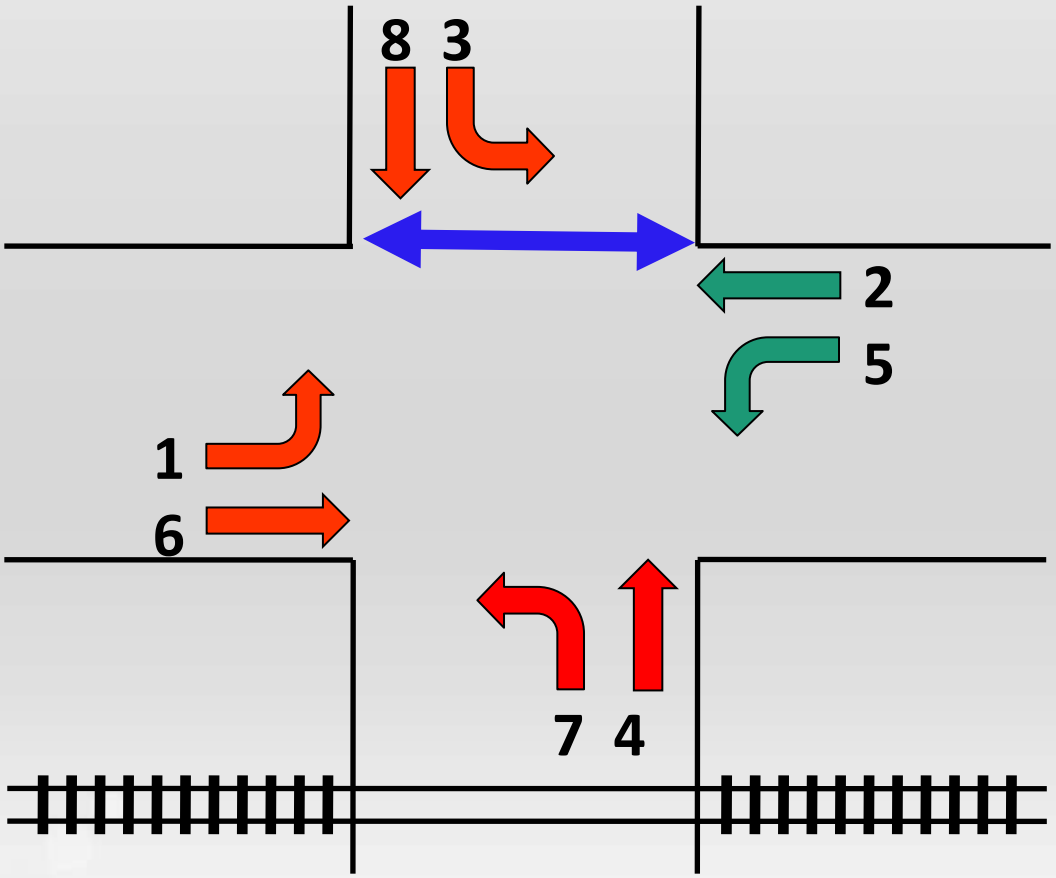
1. Terminate any allowable combination of phases and associated pedestrian movements.



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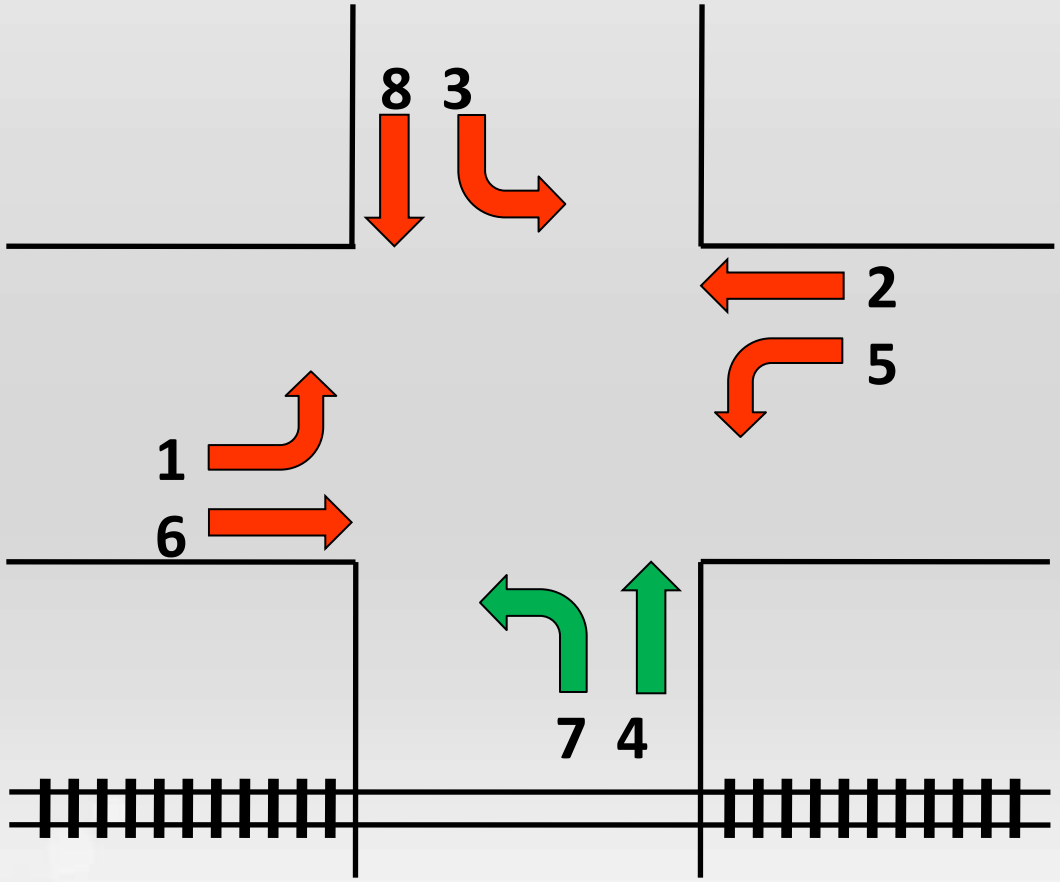
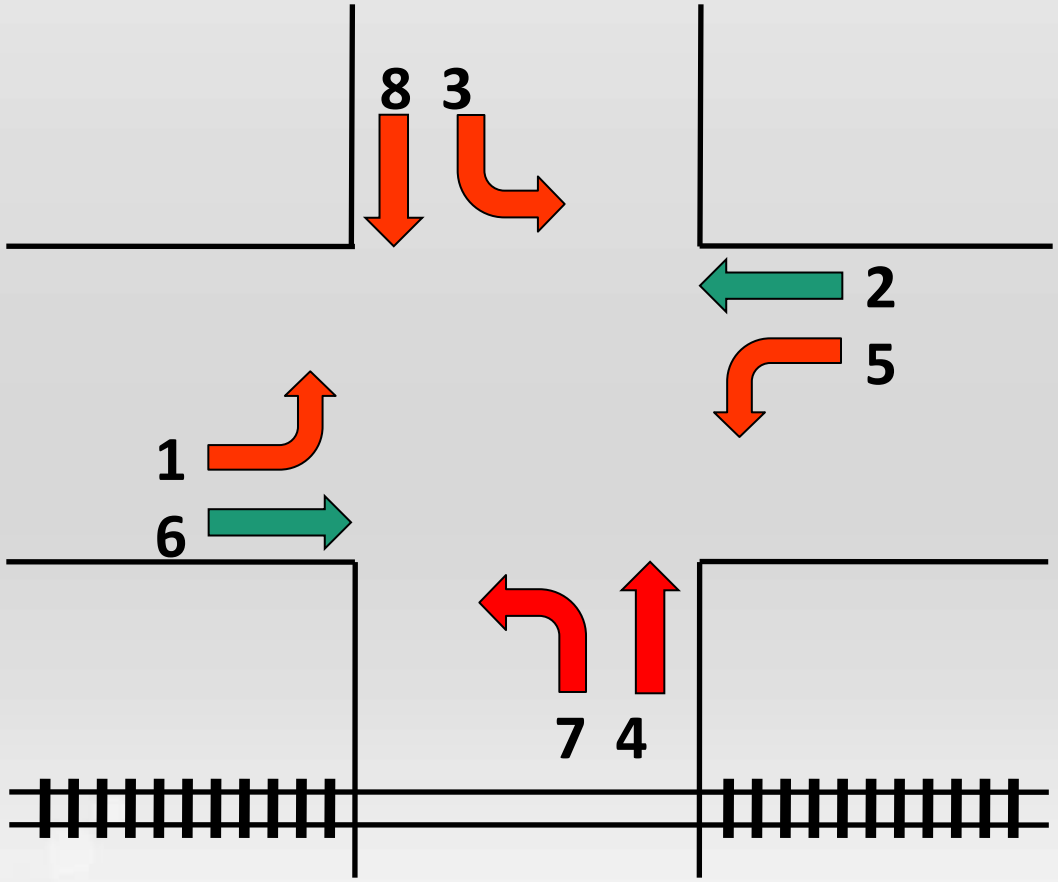
2. **Display Green for Track Clearance Movements and hold in Green until railroad gates are down.**



3. Allow only those phases or movements that do not conflict with crossing until preemption ends.



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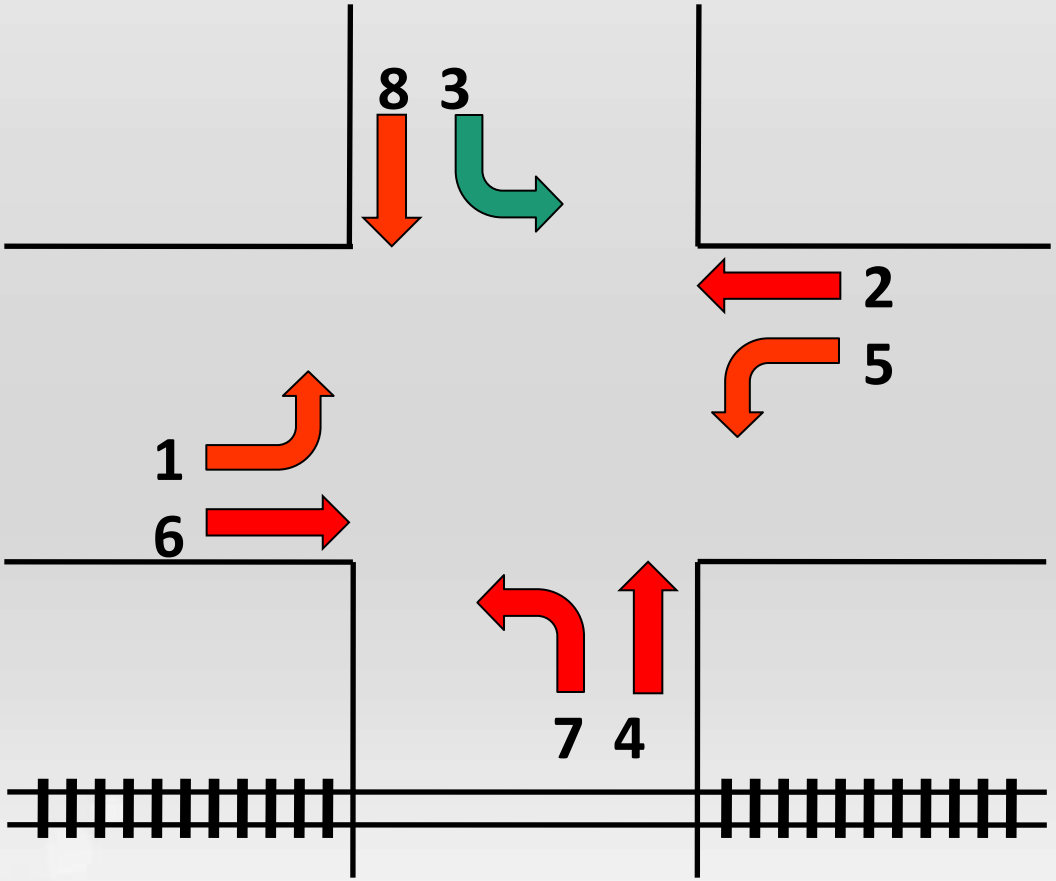

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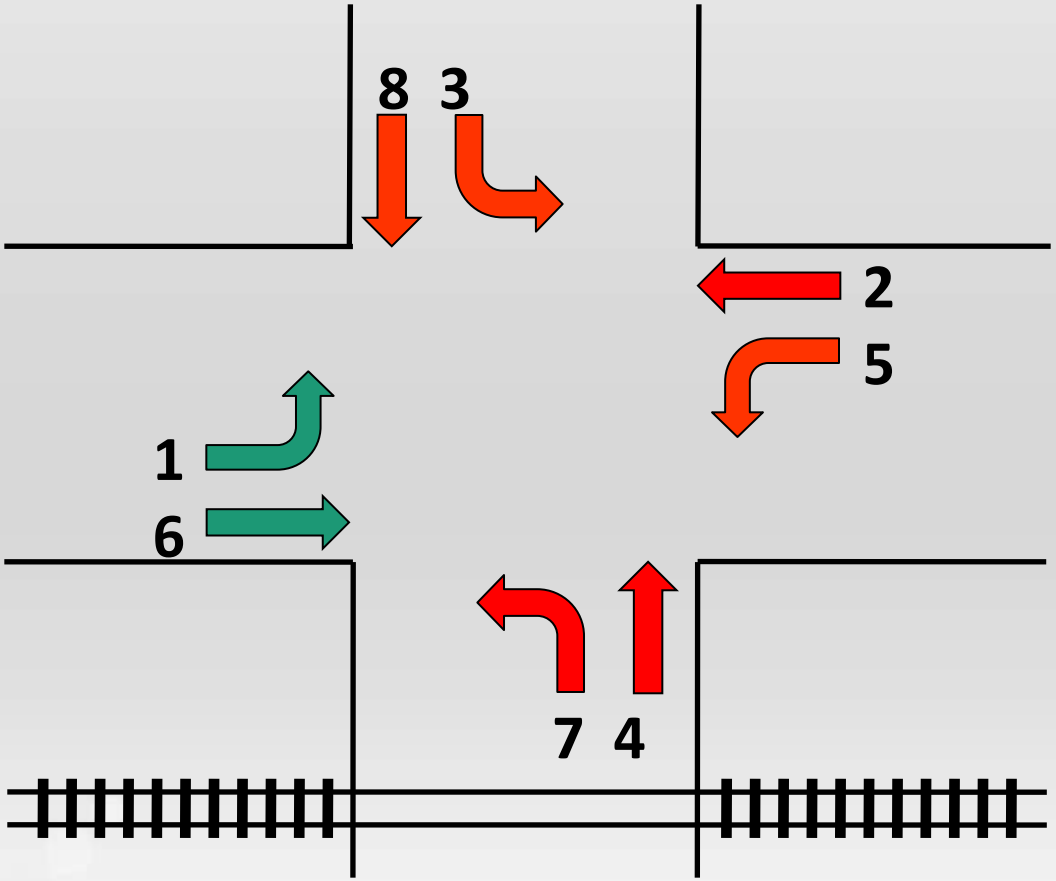

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What is Advanced Preemption?

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Advanced Preemption is an operating mode which allows the traffic signal to display green to clear the track before the railroad flashing lights begin to operate

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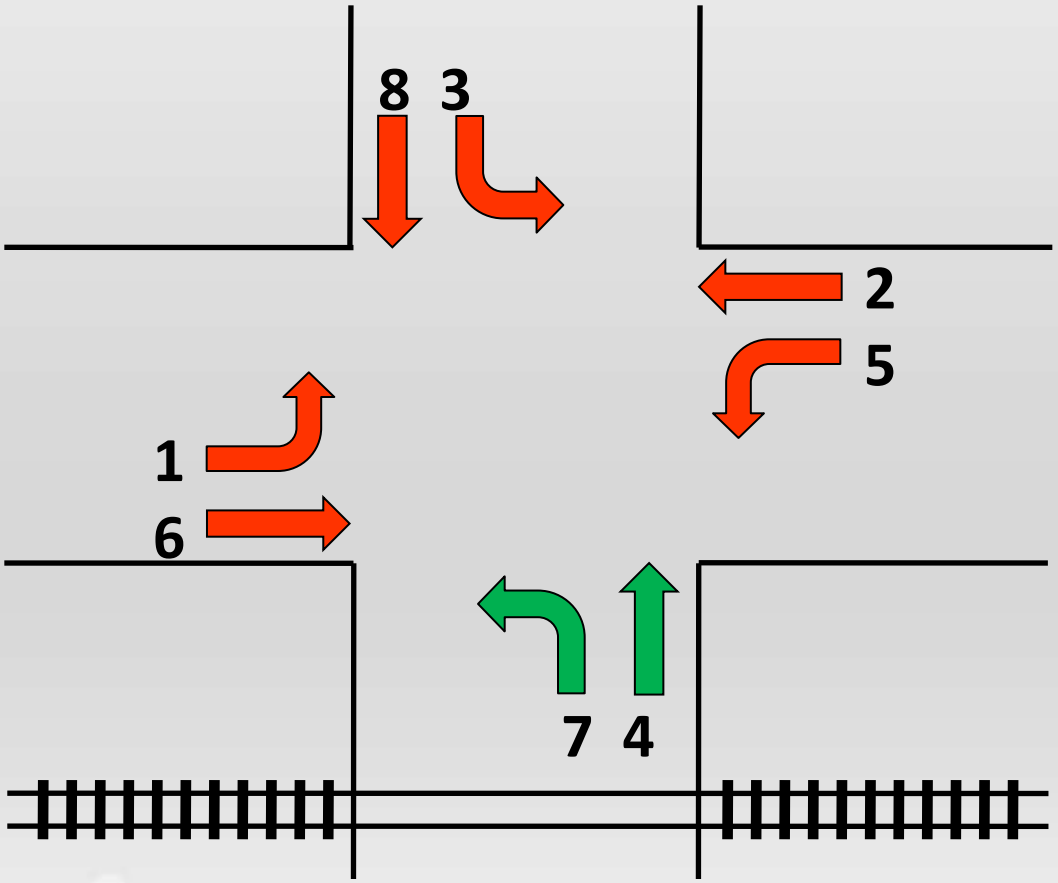
1. Track clearance green interval begins



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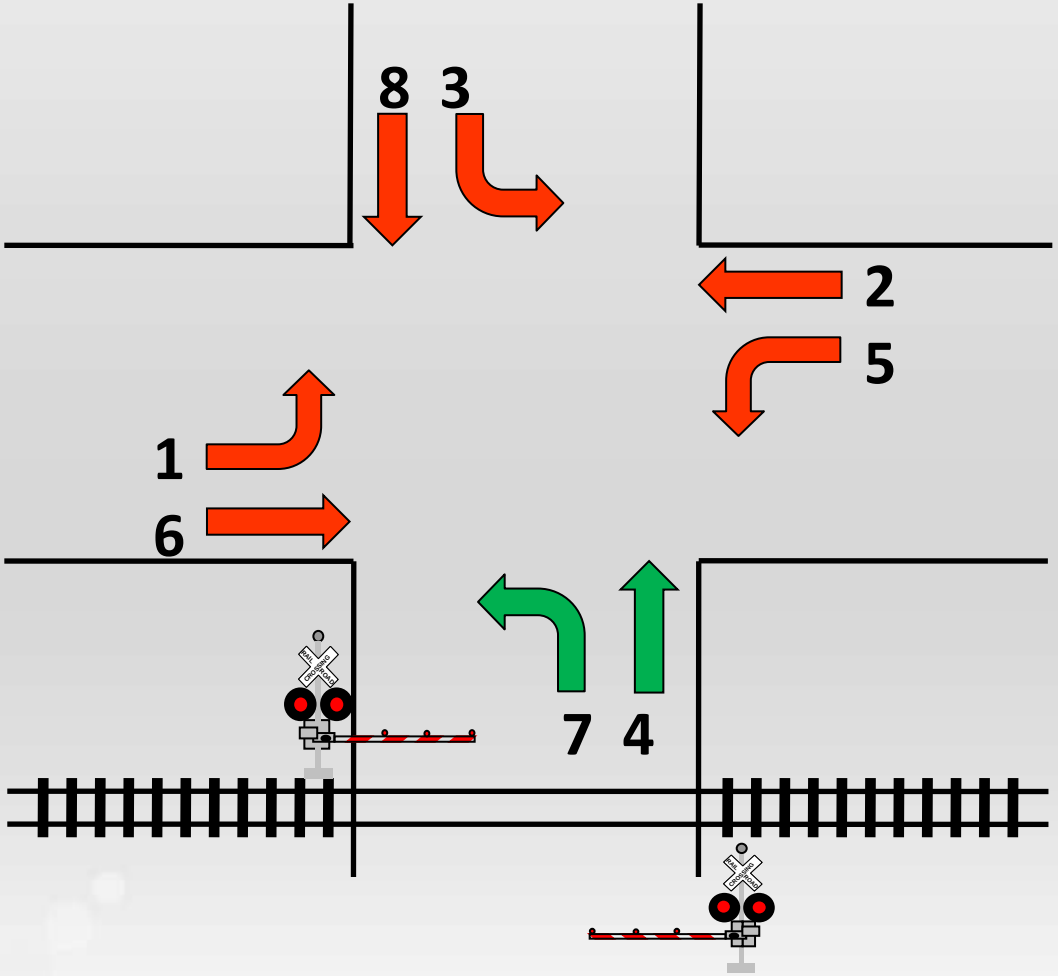
2. Railroad warning devices begin to operate



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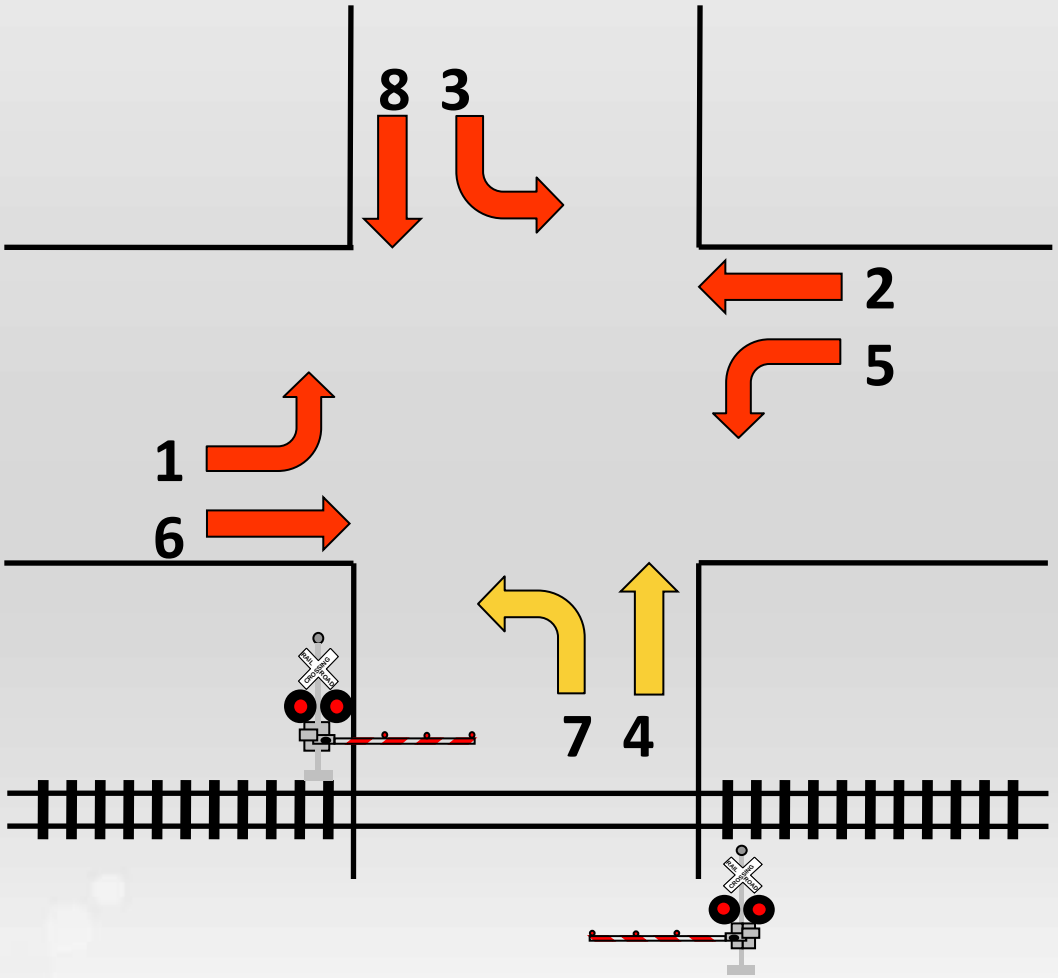
3. End track clearance green



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When preemption is implemented, adequate time must be provided in order to permit a Design Vehicle to clear the crossing prior to the arrival of the train

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So how much time does it take for preemption to operate?

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For 8th Street and Main Ave, 53 seconds is required.

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Minimum Green = 5 seconds

Pedestrian Change (Flashing Don't Walk) = 16 seconds

Yellow Change = 4 seconds

Red Clearance = 1 seconds

31 seconds of Advanced Preemption

Time required at this location

(Existing Design Provides 43 seconds)

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The required amount of time must be provided by the railroad train detection circuitry

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MUTCD requires that the railroad must provide a minimum 20 seconds of warning prior to the arrival of a through train

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Any time required beyond the minimum warning time prior to the arrival of a train becomes an addition to a basic warning system project

- **Examples of additional time are:**
  - **Entrance and Exit Gate Delay**
  - **Buffer Time**
  - **Clearance Time**

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That seems simple enough,

what's the issue here?

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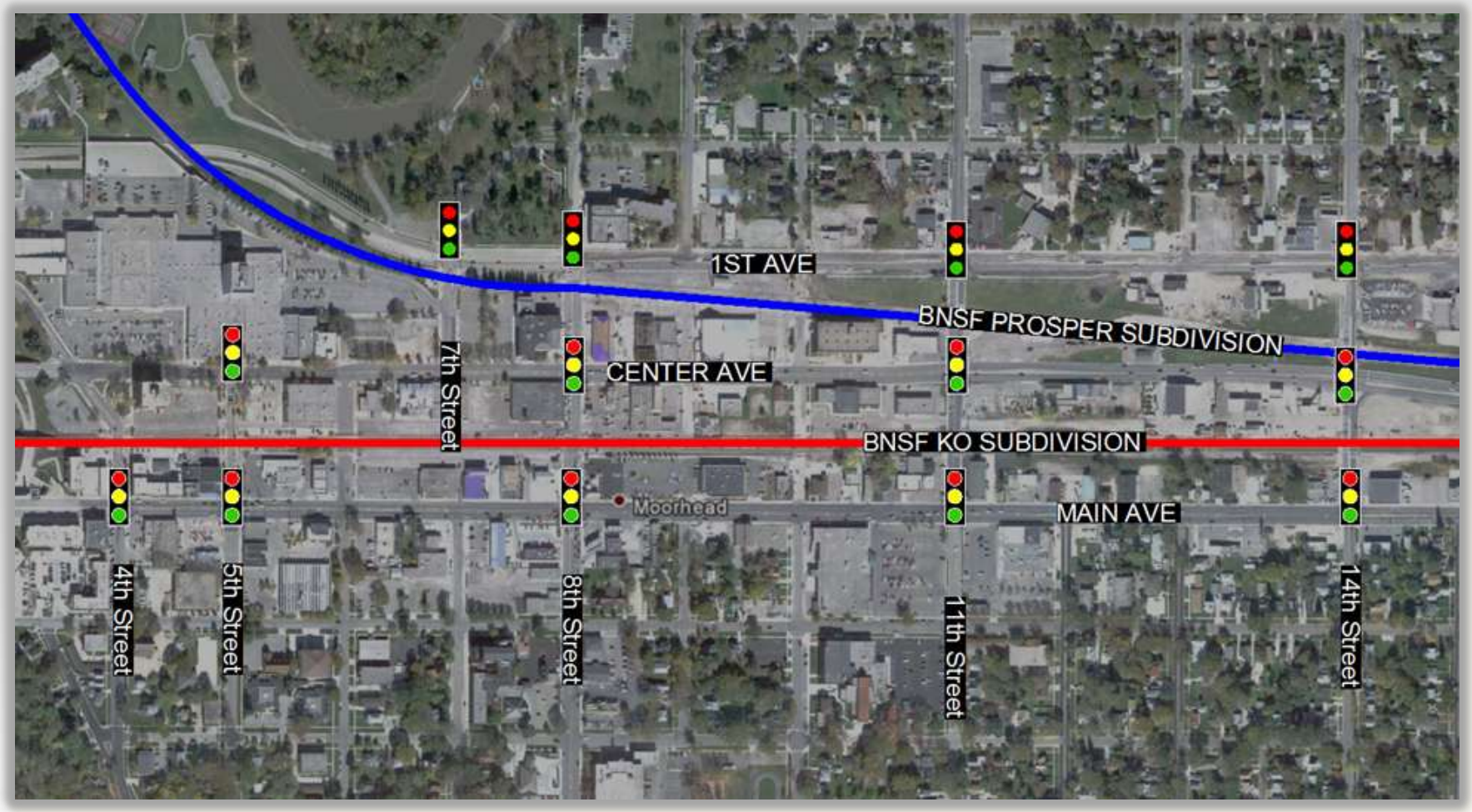
Study Area



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Main Concerns/Complaints with the Existing Preemption Operation

- Significant traffic congestion as a result of train operations
- Due to long traffic delays, drivers become impatient and cut through private parking lots
- Warning times at the railroad crossing appear to be excessive. Gates are down for long periods of time prior to and after train movements.
- Bus routes significantly delayed – up to 17 minutes on one route
- Traffic signals do not appear to be coordinated
- Traffic queues waiting for train to clear extend across intersections and block through lanes of traffic

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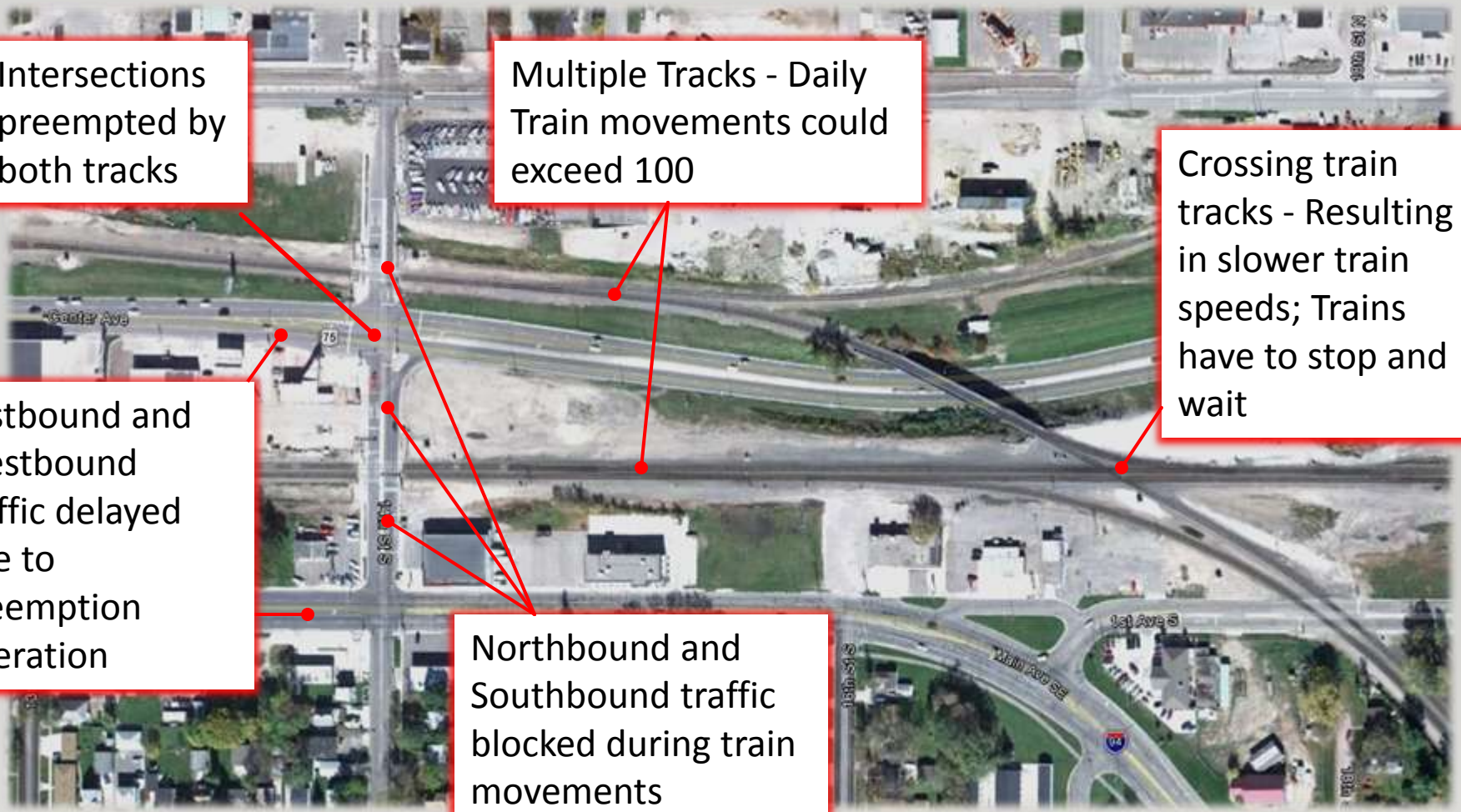
Challenges…..



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Is there anything that can be done?

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Recommended Solutions - Short Term (less than 6 months)

Improve efficiency of the intersection:

- Repair any inoperable pedestrian push buttons
- Install push buttons at intersections where they are not currently provided

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Recommended Solutions - Short Term (less than 6 months)

Improve efficiency of the intersection:

- Repair any inoperable Vehicle Detection
- Vehicle detection should be provided for all approaches at each intersection

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Recommended Solutions - Short Term (less than 6 months)

Improve efficiency of the intersection:

- Implement Gate Down Logic in the City's traffic signal controllers to reduce unnecessary track clearance green time

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Recommended Solutions - Short Term (less than 6 months)

Improve efficiency of the intersection during preemption

- Implement smart traffic controller software – Voyage Software
- Implement Interconnected Grade crossing Operations Recorder (IGOR)

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Recommended Solutions - Short Term (less than 6 months)

Voyage Capabilities During Preemption:

- Ability to calculate the time required to transition to the track clearance interval and use this time, if a minimum amount is available, to serve one or more phases prior to entering the track clearance green interval.
- Ability to terminate the walk phase
- Ability to coordinate downstream traffic signals during preemption
- Ability to exit preemption to the phase based on service demand
- Ability to implement flashing yellow arrow

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Recommended Solutions - Short Term (less than 6 months)

Interconnected Grade crossing Operations Recorder (IGOR):

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Operation:

- **IGOR** is a monitoring and recording system which records activities of both railroad and traffic signal systems during preemption events

- Records the operation and documents the proper functioning of both systems by logging their operation

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Reporting:

Authorized operators can view and download logs of events captured by **IGOR**. User software provides search criteria and filtering to enable a user to select specific data to view in order to monitor preemption system operation

Diagnostics:

IGOR provides a means to identify and resolve preemption system faults

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Recommended Solutions - Short Term (6 months to 2 years)

Improve Preemption Operation:

- Reduce the amount of total train approach needed
  - Eliminating the Vehicle Gate Interaction reduces the Advance Preemption Time (APT)
  - Eliminating the programmed traffic controller delay time reduces the APT

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Proposed One-Way Couplet

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Proposed One-Way Couplet
Why?

- Eliminates extensive advanced preemption time required at 11th & Center and 14th & Center due to dual preemption operation.
- Minimal cost to implement
- Minimal impact on businesses
- Improves intersection efficiency
- Allows “free right” operation northbound to eastbound at 14th & Center

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Recommended Solutions - Short Term (6 months to 2 years)

Improve Emergency Vehicle Preemption (EVP):

- Evaluate existing EVP to determine if improvements can be made to reduce false calls to the traffic signal

Improve Efficiency of the Intersection

- Implement Flashing Yellow Arrow for left turn lanes

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Recommended Solutions - Long Term (Greater than 2 years)

- Dedicated Turn Lanes

  Adding additional dedicated right and left turn lanes at the railroad preempted intersections could greatly improve the roadway capacity by allowing the through traffic to keep moving. When through traffic is able to move smoothly without being delayed by turning vehicles, traffic congestion could greatly be reduced.

- Grade Separation
- Implement Traffic Management Plan During Flooding Incidents

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Recommended Solutions – Safety and Operational

- Install back-up power supply to the traffic signal controllers
- Install “Do Not Stop on Track” Signs
- Install Limited Storage Space signs where the distance between the tracks and intersection is less than the design vehicle length (74 feet)
- Implement a track clearance green arrow indication for the track clearance green phase

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Recommended Solutions – Safety and Operational

- Eliminate the yellow trap during preemption
- Restrict turning movements toward the tracks when the storage distance is less than 75 feet
- Implement a Maximum Preemption Timer
- Implement a Traffic Signal Health circuit
- Implement a Preemption Operation and Maintenance Plan

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Cost Estimates

- Costs are grouped into categories based on construction work tasks:
  - Traffic signal improvements – city signals
  - Traffic signal improvements – state signals
  - Railroad changes
  - Additional changes/study

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Cost – City Traffic Signal Improvements

- Repair/install loop detectors
- Repair/install pedestrian pushbuttons
- Furnish/install left turn signals (track clearance arrow and FYA)
- Furnish/install MMU-1600EI monitors
- Furnish/install turn restriction signs (2 locations)
- Furnish/replace railroad interconnect cable
- Furnish/install railroad interconnect panels
- Furnish/install Voyage controller software
- Furnish/install radio/cable for interconnect

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Cost – State Traffic Signal Improvements

- Repair/install loop detectors (underway)
- Repair/install pedestrian pushbuttons (underway)
- Furnish/install FYA left turn signals (unknown)
- Furnish/install MMU-1600EI monitors
- Furnish/install Voyage controller software
- Furnish/install remote monitoring equipment

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Cost – Railroad Changes

- Reprogram advance preemption time in railroad equipment
- Circuit changes to include controlled signals for railroad movements to override preemption for stopping moves
- Engineering changes/documentation

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Cost – Additional Changes/Study

- Furnish/install clear storage distance signs
- Furnish/install DO NOT STOP ON TRACKS SIGNS
- Evaluate/repair/replace Sonic EVP system
- Furnish/install IGOR Preemption Monitoring System
- Prepare/install traffic signal system preemption/coordination timing plans

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Cost Estimates

- City traffic signals - $290,000 ($58,000 / 5 locations)
- State traffic signals – to be determined based on signal improvement project, but estimated to be $160,000 ($20,000 / 8 locations)
- State traffic signals beyond 14th – to be determined, but estimated to be $5,000 / location
- Railroad timing changes – $50,000 ($5,000 / crossing)
- Railroad circuit changes – additional study required

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Cost Estimates

- IGOR System - $132,000 (12 intersections & 10 crossings)
- IGOR Video - $9,000 per location plus $2,900 / camera
- Signal system timing plans - $100,000 (MN DOT?)
- Sonic EVP system improvements – additional study required
- Sign installations - $400 / location

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Questions?