Code Change Point Indicators

MTA Metro-North Railroad does not use automatic wayside signals between control points. These signals provide the engineer with a visual aspect of block conditions ahead of the train so they can operate into that block at the appropriate speed. Cab signaling provides the engineer with continuous block condition information without automatic wayside signals. The engineer reacts to more restrictive changes of his or her ADU signal indication by reducing train speed in order to forestall or "suppress" a penalty brake application initiated by the Train Control Apparatus.

During periods of low rail-wheel adhesion, wheel sliding during braking may prevent the engineer's ability to satisfy the braking or de-acceleration rate to avoid a Penalty Brake or Emergency Brake application. When wheel slide is detected during braking, the slide protection system provides a rapid series of brake release and applications until the system detects the axle is turning at the appropriate speed. Should the air demand (BP) exceed the air supply (MR), an Emergency Brake application occurs due to equalization. Additionally, an Emergency Brake application can occur if the Penalty Brake application does not reduce train speed to the de-acceleration rate. It is important to note in an **EXTREME EMERGENCY** situation such as preventing a Stop Signal violation or impact incident, the use of the red "**PANIC BUTTON**" on **dual mode M-Series** (**M2**, **M4** and **M6**) equipment will initiate an **EMERGENCY BRAKE APPLICATION** that **ELIMINATES WHEEL SLIDE PROTECTION** causing flat spots.

To minimize this condition, **Code Change Point Indicators** were placed at those code change points where the cab signal indication would change to a more restrictive aspect for diverging movements through an interlocking. Reducing speed before entering the block lessens the braking demand to forestall or suppress the Train Control Apparatus. During severe periods, Timetable Special Instruction SI 7-B reduces maximum authorized speeds in DTOBO specified locations.

Based on engineering design, cab signaled trackage has a cab signal MAS that is usually higher than civil track speeds. Additionally, there are several different systems that provide code to the Train Control Apparatus.

Signals are used to communicate speed information and track circuits are the means by which the condition of the block is conveyed. Aside from RTC controlling train movements, these track circuits also provide broken rail protection and track occupancy information from trains shunting circuits ahead.

"Overtaking a train" will cause the cab signal indication to progressively down grade as you get close to that train. To prevent this factor from affecting train operation during periods of reduced rail-wheel adhesion, engineers must be familiar with other trains' scheduling. On regular job assignments this can become routine and usually the engineer will adjust their train handling by "hanging back" or pre-braking at the code change location where this commonly occurs.

However, "extra" engineers covering these assignments do not have the benefit of experience. Using the employee timetable (or photocopy), identify those locations where there are two-three minutes between you and trains ahead, and highlight it on the timetable or write it down on a card for ready reference. This combined with your monitoring radio transmissions will greatly reduce the surprise of cab signal reductions at intermediate locations.

Finally, wheel slide can occur at very low speeds affecting train spotting at stations. Engineers must protect against the inadvertent opening of doors off a platform by activating the **DOOR OVERRIDE** feature until communication is established with the train crew. **DO NOT MAKE AN EMERGENCY BRAKE APPLICATION FOR STATION SPOTTING.**

Proactive Train Operation Requires:

1. BE FAMILIAR with the Employee Timetable and the scheduling of trains ahead.
2. OBSERVE track conditions regarding the discoloration (Black Track) of rail surface, **EXPECT** reduced rail-wheel adhesion in these areas and **ADAPT** your train operation to compensate for reduced rail-wheel adhesion.
3. COMMUNICATE with the RTC all low rail-wheel adhesion problems as they occur and **LISTEN** to radio transmissions from other trains.
4. COMPLY with **SI 7-B.**

Rev. 9/2012

2012 Operations Services Department

Low Rail-Wheel Adhesion

Train handling instructions under adverse operating conditions

MTA Metro-North Railroad

SAFETY PRIORITY ONE

Train Operation During Periods of Low Wheel/Rail Adhesion

On-time performance, equipment preservation and operating safety depend on a single factor: **proper control of train speed**. The three elements of controlling train speed are: acceleration, maintaining speed (cruise) and deceleration. Obviously all three are affected by the degree of adhesion between the train wheels and the ball of the rail (head). This level of adhesion between the wheel and rail contact surfaces is referred to as the "coefficient of friction." During "normal" dry conditions, the coefficient of friction is usually within the range of .3 to .5.

Moisture reduces this coefficient of friction initially, but the force of friction contact between the wheel tread surface of leading wheels of a train is usually sufficient to "clean" the rail, and restore a more normal coefficient of friction for each following set of wheels.

During the autumn, however, with the accumulation of leaves, the oils and other matter released as the train crushes this vegetation, builds up and bonds to the metal surfaces of both rail and wheel, and can reduce the coefficient of friction by up to 80 percent. This dramatic change in the physical operating environment adversely affects the performance characteristics of equipment. Normal or expected rates of acceleration and deceleration are inconsistent, and stopping distances, at almost every speed, will increase significantly.

Identification of trackage prone to induce slip/slide is crucial during this period. "**Black Track"** describes the gray or black color associated with leaf-laden rails. These changes require increased vigilance and constant attention. The locomotive engineer must adapt his or her normal braking and powering procedures to compensate for reduced wheel adhesion to minimize delay, maintain operating safety and prevent equipment damage.

Metro-North Railroad's efforts focus in three areas: (1) **CLEANING** the running rail; (2) **COMMUNICATING** information to the road crew as to areas of potential adverse rail conditions by DTOBO or RTC instruction and (3) providing **OPERATING RESTRICTIONS** by Timetable Special Instruction SI 7 B. Additionally, Code Change Point Indicators [MNR Rule 11-G(6)] installed along the right of way to identify approach circuits to interlockings or control points where the cab signal aspect may change to a more restrictive aspect.

Wheel Slip and Wheel Slide

Wheel slip (spin) refers to a condition where the train wheels lose rail adhesion when tractive power is being applied. Wheel slide refers to those conditions where adhesion is lost under braking conditions. While slip most clearly affects on-time performance, slide affects train performance, operating safety and damages equipment. This is why our efforts concentrate on reducing the chances of wheel slide.

MNR electric multiple units (EMU) are equipped with traction control and wheel slide protection systems. The slide protection system, upon sensing wheel slide or "locking" of the wheel under braking conditions, will automatically reduce the brake cylinder pressure, thus allowing the wheel to rotate again. This feature limits the wheel from sliding on the rail's surface to the point where it causes "flat spots." It is important to prevent wheel damage and potential rail damage from the flattened wheels battering the rail. Wheel slide also extends the stopping distance of the train and it reduces the engineer's ability to control train braking.

The situation is compounded due to the function of our train control apparatus and wayside cab signal design. This on-board system requires the engineer to reduce the speed of the train to comply with the signal speed within a defined time period. Defined deceleration rates must be achieved and maintained to suppress a penalty brake application.

The mandatory deceleration during low adhesion conditions often produces wheel slide. The slide protection system detects the slide and reacts to release the brakes to restore wheel rotation. The train control apparatus may respond to this reduced braking effort with an irrevocable emergency brake application that disables the slide protection.

MN-401 Equipment Operating Instruction (EOI) #125 found on the next page provides general information with regard to train operation during periods of reduced wheel-rail adhesion. MN-401 Appendix A provides specific information by equipment type describing various systems and providing instructions for forestalling and resetting penalty brake applications and other relevant unusual operating condition operation guidance.

125–Train Operation During Periods of Reduced Wheel-Rail Adhesion

REPORT INCIDENTS of slippery rail immediately to the **RAIL TRAFFIC CONTROLLER**. This information can be conveyed to other trains in the area. The following operating instructions apply:

1. **AVOID B-MAX BRAKING:** Minimal brake applications combined with "feathering," or the cycling of applications and partial releases, on M-Series trains may prevent serious wheel slide (lock) problems. This will extend the actual braking distance.
   M7 & M8 cars have an advanced wheel slide protection system (WSP). It is important to note that a "Wheel Slide/Slide" indication on the TOD conveys only that the system is active and may not directly relate to an actual spin or slide condition requiring engineer action.
2. **MOVE BRAKING POINTS:** Allow extra braking distance to compensate for slippery rail.
3. **SAND THROUGH STATIONS:** On units equipped with sanding apparatus, sand through stations as you make a station stop.
4. **PROTECT THE DOORS:** Engineers must use door over ride feature to prevent the opening of trainline doors if train is not properly spotted on a platform. **DO NOT MAKE AN EMERGENCY BRAKE APPLICATION FOR STATION SPOTTING**. Conductors must ascertain the train is properly spotted at the station before opening doors.
5. **DO NOT CUTOUT CONTROL SWITCH ON M-SERIES EQUIPMENT:** When this switch is cutout, only the friction service brake will be applied on that car causing a tremendous heat build up when slowing or stopping trains, and increases wheel wear and potential for ther mal cracking.
6. **INDEPENDENT BRAKE:** Applications of 10-15 psi or less may be used to control wheel spin when starting trains. On Genesis II locomotives, applications greater than 10 psi will cause the unit to detect "excessive power braking" and remove power.
7. **USE OF M-SERIES SNOW BRAKE FEATURE:** Use of this feature on M7 & M8 cars is prohibited. Engineers are discouraged from using the snow brake on other than M3 cars except in extreme cases of reduced wheel adhesion. **The RTC must be notified before activating this feature. Note:** On most dual mode M-Series (AC/DC) cars, the snow brake can only be released by deactivating and reactivating the master controller with "key-out" and "key-in" procedures.
8. **REDUCE SPEED:** Reducing speed will improve train han dling control and prevent equipment damage. The RTC must be notified when operating below MAS or speci fied train speeds.