

USE OF REMOTE CONTROL LOCOMOTIVES

Safety Advisory 2001-01

Recommendation: Operation of Remote Control Locomotives

The following design criteria and operating procedures are recommendations only. Compliance is voluntary. However, railroads are strongly encouraged to regard these suggested criterion as a minimum from which to tailor their own RCL operations. It should be noted that all of the design features recommended are available with the current generation of remote control technology. In certain circumstances, due to the design of their equipment, or differences in operating practices, a railroad may not be able to obtain complete consistency with these recommendations. In those situations railroads are encouraged to develop alternative designs or practices which offer at least equivalent or greater levels of safety. FRA emphasizes that although compliance with this Safety Advisory is voluntary, nothing in this Safety Advisory is meant to relieve a railroad from compliance with all existing railroad safety regulations. Therefore, when procedures required by regulation are cited in this Safety Advisory, compliance is mandatory.

(a) Safety Design and Operational Requirements

1. Each RCT should, at a minimum, have the following features:
 - a. directional control;
 - b. graduated throttle or speed control;
 - c. graduated locomotive independent brake application and release;
 - d. train brake application and release control;
 - e. audible warning device control (horn);
 - f. audible bell control, if equipped;
 - g. sand control (unless automatic);
 - h. headlight control;
 - i. emergency air brake application switch;
 - j. generator field switch or equivalent to eliminate tractive effort to the locomotive; and
 - k. audio or visual indication of wheel slip/slide.
2. Although an RCT can have the capability to control, at different times, different locomotives equipped with remote-control receivers, it should be designed to be capable of controlling only one RCR equipped locomotive at a time. (A locomotive may consist of one or more engines operated from a single control).
3. An RCT having the capability to control more than one RCL should have a means to lock in one RCR "assignment address" to prevent simultaneous control over more than one locomotive.
4. Each locomotive equipped with an RCR should respond only to the RCTs assigned to that receiver.
5. The RCT should be designed to require at least two separate actions by the RCO before RCL movement can begin (in order to prevent accidental movement).
6. When an RCT's signal to the RCL is interrupted for a set period, not to exceed five seconds, the remote-control system should cause:
 - a. full service application of the locomotive and train brakes; and

b. elimination of locomotive tractive effort.

7. If an RCT is equipped with an "on" and "off" switch, the switch, when moved from "on" to "off" position, should result in:

- a. application of the locomotive and train brakes; and
- b. elimination of locomotive tractive effort.

8. Each RCL should have a distinct and unambiguous audible or visual warning device that indicates to nearby personnel that the locomotive is under active remote control and subject to movement.

9. Each RCT should be equipped with an operator alertness device requiring manual resetting or its equivalent. It should incorporate a timing sequence not to exceed 60 seconds. Failure to reset the switch within the timing sequence should result in:

- a. application of the locomotive and train brakes; and
- b. elimination of locomotive tractive effort.

10. Each RCT should have a tilt feature that, when tilted to a predetermined angle, should result in:

- a. an emergency application of the locomotive and train brakes; and
- b. elimination of locomotive tractive effort.

Note: If RCL operations are being conducted in an isolated area, the railroad should establish timely emergency response procedures in the event the RCO is incapacitated. One method that would serve to meet this recommendation would be to equip the RCT with capability of transmitting an emergency signal. The signal should also be capable of identifying the RCO's location.

11. If the RCT is equipped with a "tilt bypass" system enabling the tilt protection feature to be temporarily disabled, the bypass feature should deactivate after 15 seconds, unless reactivated by the RCO.

12. The RCL should be equipped with a device that causes an application of the locomotive and train brakes and elimination of locomotive tractive effort whenever the RCL's main reservoir air pressure falls below 90 psi or when a locomotive protection alarm is activated while the locomotive is in remote operation. The device should need to be manually reset on board the RCL.

13. When the air valves and the electrical selector switch on the RCR are moved from manual to remote or from remote to manual modes, an emergency application of the locomotive and train brakes should be initiated to prevent unauthorized use of the system.

14. Railroads which acquire and utilize RCL equipment should comply with current human safety exposure standards for radio frequency radiation in their workplace. FRA further recommends that manufacturers should certify their equipment for compliance with current EMR exposure safety standards.

15. Consideration should be given to the design of the RCT to provide for a human-machine interface (HMI) that incorporates basic human factors principles for the design and operation of displays, controls, supporting software functions, and other components. FRA recommends that railroads work closely with RCOs when addressing RCT design and comfort issues. The overriding goal of the design should be to minimize the potential for design-induced error by ensuring that the RCT is suitable for operators, including female operators, and their tasks and environment. RCT systems that have been designed with human-centered design principles in mind-system products that keep human operators as the central, active component of the system-are more likely to result

in improved safety. This includes the ergonomic design of the RCT. See FRA's 1998 report entitled "*Human Factors Guidelines for Locomotive Cabs*" (FRA/ORD-98/03 or DOT-VNTSC-FRA-98-8). Special consideration should be given to the effect of the RCT on the musculoskeletal system of the RCOs as well as on RCT harness comfort to avoid distraction from safety-related duties. Additional consideration should also be given to the "breakaway" safety feature of the RCT harness. The harness should be designed to easily break free of the RCO in the event the harness becomes entangled on equipment.

(b) Training

Each person operating an RCL must be certified and qualified in accordance with 49 CFR Part 240 if conventional operation of a locomotive under the same circumstances would require certification under that regulation. Training must be provided to all RCOs subject to the requirements of 49 CFR Part 240. Additionally, training should be afforded those RCOs not subject to the requirements of Part 240 and those locomotive engineers who have little or no on-ground experience in switching operations if they are expected to conduct RCL operations. All affected railroad employees should be trained on RCL operating rules and procedures.

Under Part 240, railroad engineer certification programs must include procedures to keep certified engineers current on methods of safe train handling, operating rules, condition of equipment, and personal safety and to provide initial training for new engineers on those subjects. § 240.123. The programs must also include skill testing in the most demanding type of service the person will perform. § 240.127. Appendix B of Part 240 requires that railroad engineer certification programs address how the railroad responds to changes such as the "introduction of new technology" and "significant changes in operations." In FRA's view, it is likely that the introduction of remote controlled locomotives on railroads would typically necessitate a material change to each railroad's engineer certification program. Material modifications must be submitted to FRA for its review under 49 CFR 240.103(e).

(c) *Operating Practices*

1. The railroad should establish written standard operating procedures tailored to its RCL operations. At a minimum these procedures should include:

- a. Upon going off duty, each RCO should place the RCL in manual operation and properly secure it, unless control of the RCL is directly given to a relieving RCO.
- b. When operating an RCL, the RCO should not:
 - i. ride on a freight car under any circumstances;
 - ii. mount or dismount moving equipment;
 - iii. operate any other type of machinery; or
 - iv. stand or walk within the gage of the track or foul the track on which the movement is occurring while physically located in front of the movement.
- c. RCOs should ensure that the track is clear and properly alined ahead of the remotely controlled movement while it is underway. Therefore, RCL operations should be operated at restricted speed not to exceed 20

mph,i.e., at a speed that will enable stopping the movement within half the range of vision assuring that all movements are protected.

d. The RCO should operate only one RCL at a time.

e. Prior to performing any function as prescribed in 49 CFR 218.22(c)(5), the RCO should apply three point protection, i.e., fully apply the locomotive and train brakes, center the reverser, and place the generator field switch to the off position (eliminate locomotive tractive effort capability).

f. Passenger trains should not be operated by use of a remote-control device.

2. The railroad must include RCL operating rules and procedures in its program required under 49 CFR part 217.

3. The railroad should establish formal communication procedures to enable the appropriate railroad officials to receive and respond to information pertaining to RCL system failures or safety problems.

4. The FRA recommends that the railroad keep a record of the total number of labor hours and the total number of employees by location for both RCL and manual switching operations to ensure that accidents and incidents are accurately measured, and that valid comparisons between the two types of operations can then be made.

5. The FRA recommends that the railroad develop and implement a program specifically designed for RCOs that addresses the risks associated with switching operations and train movements on adjacent tracks. This program should incorporate the findings and recommendations of the Switching Operations Fatality Analysis Working Group.

(d) *Security*

1. The railroad should have instructions for the proper storing and handling of RCTs when not in use or in the operator's possession.

2. The operation control handles located in the RCL cab should be removed or pinned in place to prevent accidental or intentional movement while the RCL is being operated in remote.

3. The railroad should have strict procedures in place to ensure that only the intended RCTs are assigned to the appropriate RCL.

(e) *Inspections and Tests*

1. The RCL system must be included as part of the calendar day inspection required by 49 CFR 229.21, since this equipment becomes an appurtenance to the locomotive.

2. Each time an RCT is used for the first time on each shift, a test of the air brakes and the RCT's safety features (tilt switch and alerter device) should be conducted. The test would not be required if the RCT were being directly transferred from one RCO to another with no change in remote status.

3. The RCL system (both the RCT and RCR), should be designed to perform a self-diagnostic test of the electronic components of the system. The system should be designed to immediately "fail safe" (full service application of the locomotive and train brakes and the elimination of locomotive tractive effort) in the event a failure is detected.

4. The RCL system components that interface with the mechanical devices of the locomotive, e.g., air pressure monitoring devices, pressure switches, speed sensors, etc., should be inspected and calibrated as often as necessary, but not less than the locomotive's periodic (92-day) inspection. It is recommended that records of such inspections and calibrations be kept.

(f) *Notification of RCL Use and Protection of Workers*

1. Each RCL should have a tag placed on the control stand throttle indicating the locomotive is being used in a remote control mode. The tag should be removed when the locomotive is placed back in manual mode.

2. In areas where RCL operations are being conducted, warning signs should be posted indicating that there is no operator in the control compartment of the locomotive. These warning signs should be highly visible and posted at conspicuous locations so as to maximize their exposure to those most likely to encounter RCL operations.

3. Whenever worker protection is required according to 49 CFR part 218, the locomotive should be placed into manual mode and be properly secured. The appropriate blue signal protection should then be provided.

(g) *Accident-Incident Reporting Procedures*

1. All accident and/or incidents described in 49 CFR part 225 must be reported to FRA using the appropriate "remote control" reporting codes.

2. Railroads are also reminded that they are required to comply with the provisions of 49 CFR part 229.17-Accident reports.

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