

**American Railway Engineering and Maintenance of Way Association
Letter Ballot 38 21-06**

1. Committee and Subcommittee:

AREMA C&S Committee 38

2. Letter Ballot Number: 38 21-06

3. Assignment:

MP's revised at Fall 2021 meeting.

4. Ballot Item:

Ballot 38 21-06: This ballot contains the MP approved at the Fall 2021 meeting:

04.1.10 - Recommended Design Criteria and Operating Guidelines for a Computer System to Control a Classification Yard and Handle Associated Data

5. Rationale:

Revised Manual Parts

Draft Not Yet Approved

4.1.10

Recommended Design Criteria and Operating Guidelines for a Computer System to Control a Classification Yard and Handle Associated Data

~~Revised 2018~~ Revised/affirmed 20232 (25 Pages)

A. Purpose

This Manual Part recommends design criteria and operating guidelines for a computer system (including installation) to control a classification yard and handle associated data.

B. Details of Work

Details of work should be specified as deemed necessary and explained, covering the following:

1. Electrical Protection.
 - a. Surge.
 - b. Memory.
 - c. Power.
 - d. I/O systems.
 - e. Data circuits.
2. Central Processing Unit (CPU).
 - a. Memory.
 - b. ~~Real~~ Real-time clock.
 - c. Digital input/output (I/O channels).
 - d. Interrupt responses.
 - e. Serial communication interface.
 - f. Parallel communication interface.
 - g. Redundancy switching system.
3. Memory.

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Part 4.1.10

202318

- a. Hard Disk.
 - b. CD, DVD.
 - ~~c. Magnetic tape.~~
 - cd. Other Mass Storage Devices.
4. Input/Output Devices.
- a. Printers.
 - b. Video display with keyboard.
 - c. Process control interface.
 - (1) Analog to digital channels.
 - (2) Digital to analog channels.
 - (3) Communication.
 - (4) Digital inputs.
 - (5) Digital outputs.
 - d. Test panel, interactive video display device.
 - e. Control consoles, interactive video display device.
5. Data Circuits and/or Local Area Networks.
- a. Central computer.
 - b. Back-up computer.
 - c. Distributed processors.
 - d. Work stations.
 - e. Management Information System (MIS) computer or connection.
 - f. Network security.

4.1.10

6. Car Identification System.
 - a. Video cameras.
 - b. Automatic equipment identification (AEI).
 - c. Optical character recognition.
7. Detector Systems.
 - a. Loose wheel and broken flange detector.
 - b. Cracked wheel detector.
 - c. High--wide load detector.
 - d. Dragging equipment detector.
 - e. Hot bearing detector.
 - f. Flat wheel detector.
 - g. Shifted load detector.
 - h. Overload detector.
 - i. Automatic wheel inspection system.
 - j. Weight detector.
 - k. Cut length detector.
 - l. Directional detector.
 - m. Wheel detector.
 - n. Occupancy detector.
 - o. Speed detector.
 - p. Weather detector
8. Weigh-in-Motion Scale.

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Part 4.1.10

202318

- a. Interface and control.
- 9. Automatic Hump Engine Control.
 - a. Cab signal.
 - b. Automatic speed control.
 - c. Speed measurement feedback.
 - d. Performance monitor.
 - e. Remote Control Locomotive (RCL)
- 10. Automatic Switching.
 - a. Switch control.
 - b. Switch indication (position and occupancy).
 - c. Corner protection.
 - d. Stall detection.
 - e. Blow-back detection.
 - f. Foul Protection
 - g. Monitor and alarms.
 - h. Performance monitor.
- 11. Automatic Retardation.
 - a. Exit speed calculations.
 - b. Car weighing system.
 - c. Car space system/Distance to Couple (DTC)———.
 - d. Retarder control.
 - e. Weather station.

4.1.10

- f. Performance monitor.
- g. Rolling resistance measurement system.
- i. h.—Calibration/exit speed tuning program (manual or automatic).

12. Car Stop Retardersa. Inert retardersb. Active retardersi. Control interfacesii. Alarm monitoring

- 132. Automatic Trim Control.
 - a. Automatic switching.
 - b. Automatic route tracking and protection.
 - c. Performance monitor.
- 143. Back-Up Systems.
 - a. Computers (hot/cold standby).
 - b. Peripherals.
 - c. Switch over system.
 - d. I/O systems.
 - e. Power sources (uninterruptible power source/generator).
 - f. Locomotive speed control.
 - g. Scale systems.
 - h. Data circuits.
 - i. Environmental system.
- 154. Test Panel or Test Interface Terminal.

AREMA® C&S Manual

Part 4.1.10

202318

- a. Track diagram.
- b. Lights/LEDs.
- c. Switches and/or push buttons.
- d. Meters (analog/digital).
- e. Test points.
- f. Interactive video display devices.

165. Software.

- a. Process control (PC).
- b. Information System.
- c. Diagnostics (I/O and processor).
- d. Training.
- e. Performance reports.

176. Weather Station.

- a. Temperature.
- b. Wind speed.
- c. Wind direction.
- d. Precipitation and/or Humidity.

187. Winter Switch Protection Devices.

198. Wayside Signals.

- a. Audible and visual signal to indicate beginning of humping.
- b. Trim signals.
- c. Escape route signals.

4.1.10

- d. Car cut display.

2019. Test Equipment.

- a. Meters.
- b. Power supplies.
- c. Oscilloscopes.
- d. Data scopes.
- e. Chart recorder.
- f. Patch panels.
- g. ~~Real~~Real-time lights.
- ~~h.~~i. Diagnostic terminals.
- ~~j.~~k. Simulating devices.
 - (1) Hardware.
 - (2) Software.

210. Training.

- a. Operation.
- b. Maintenance.
- c. Troubleshooting

C. Recommendations, Drawings, and Instructions

- 1. Drawings should include the following:
 - a. General yard plan. Drawing No. _____. Scale Drawings showing track arrangement, building locations, and other features pertinent to computer control operations arranged conforming to conform to AREMA Manual for Railway Engineering, Chapter 14- Freight Terminals, Part 3.

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Part 4.1.10

202318

- b. Configuration Management
- (1) Hardware
 - (a) Serial numbers
 - (b) Revision level
 - (c) Modification level
 - (2) Software
 - (a) Version of software
 - (b) Configuration
- c. Building plans, Drawing No. _____, dated _____, to include the following:
- (1) Computer, equipment, power and battery rooms, or bungalows.
 - (2) Location of I/O devices.
 - (3) Console locations.
 - (4) Cable ducts.
 - (5) Power distribution (UPS and commercial).
 - (6) Communication equipment.
 - (7) Emergency systems (power, fire protection, etc.).
 - (8) Heating and cooling systems, ducts.
 - (9) [Location of air lines](#)
 - (10) [Location of fiber-optic cables](#)
 - (11) [Location of direct-buried cables](#)
- d. Location and details of power-operated retarders and switches to be computer controlled, Drawing No. _____, dated _____.
- e. Location and details of wayside equipment housings.

4.1.10

- f. Location and details of wayside sensor, such as wheel detector, radars, cut length detectors, insulated joints, car space transformers, scales, AEI, etc.
 - g. Proposed track and velocity head profiles, Drawing No. _____, dated _____.
 - h. Yard Simulation Study.
 - (1) Yard Throughput in cars per day.
 - (2) Coupling Percentage/Distribution.
 - (3) Stall Rate.
 - (4) Hump Speed Range and Theoretical Maximum.
 - i. Typical clearance diagrams.
 - j. System block diagram of equipment with an explanation of concepts.
 - k. Basic flow charts showing concepts of software that will permit a distinction to be made between process control and management information services.
 - l. Track plan (double line) showing location of field equipment, cable runs, air lines, etc.
 - m. Detailed written circuit plans.
 - n. Cable diagrams showing size and type.
 - o. Layout plans of computer equipment, racks, control panels, housing, conduit, etc.
2. Other items or recommendations to be included:
- a. Automatic hump engine control requirements.
 - b. System logic concepts of hardware.
 - c. Estimated memory and auxiliary storage.
 - d. Estimate of process time required in computer system.

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Part 4.1.10

202318

- e. Explain methods used to control I/O devices and data files.
- f. Explain type of operating system, both advantages and disadvantages.
- g. Other provisions and drawings, including governmental regulations.
- h. AC power, environmental requirements, cabling, battery, etc.
- i. Recommended spare parts and test equipment.
- j. Complete sets of instruction manuals. Training manuals for operation, maintenance and troubleshooting.
- k. Delivery and implementation schedule for equipment and systems, including hardware and software.
- l. System Performance Specification.
- m. Payment schedule.

D. Items to be Installed

Necessary permits for federal, state, and municipal authorities should be obtained prior to construction and/or installation, if required.

- 1. Buildings, bungalows, cases, housing, etc.
- 2. Conduits, cable channels, and other wire raceways.
- 3. Cables.
 - a. Aerial.
 - b. Underground.
- 4. Retarders.
- 5. Radars.
- 6. Switches.
- 7. Wheel detectors.

4.1.10

8. Rails.
9. Insulated joints.
10. Winter switch protection devices.
11. Track circuits.
12. Presence detectors.
13. Car space/Distance to Couple (DTC) equipment.
14. Battery chargers.
15. Batteries.
16. Equipment racks.
17. Computer equipment.
18. I/O equipment.
19. Make necessary modifications to existing facilities.
20. Housing and distribution of equipment, materials and supplies.
21. Tools, fixtures for buildings and supplies required for maintenance of the system.
22. Communication system:
 - a. Modems.
 - b. Radios.
 - c. Consoles.
 - d. Intercoms.
 - e. PBX's.
 - f. LAN.

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Part 4.1.10

202318

- g. Wireless systems.

23. Air Systems

- a. Compressor plant
- b. Air drying
- c. Air lines

d. Valves

~~d.~~e. Air storage tanks

24. Environmental Systems

25. Power Distribution

E. Alternate Recommendations

The provisions in the Alternate Recommendation Section should be considered as a substitute for the original recommendations.

F. Tests

1. The following tests shall be made:
 - a. General.
 - (1) Determine that all circuits are in accordance with approved plans by individually checking the operating performance of each circuit and by opening circuit at all circuit selection points if possible.
 - (2) Determine that the electrical and mechanical characteristics of all apparatus or devices conform to the manufacturer's specifications.
 - b. Automatic process computer control.

4.1.10

- (1) Determine that switches line and lock properly for routes automatically selected by the computer.
 - (2) Determine that speed-monitoring devices are functioning properly and that car or cut speed is being automatically controlled within _____ m/h (k/h) of the calculated speed.
 - (3) Determine that all detectors are properly interfaced and adjusted.
 - (4) Determine that distance-to-go track circuits are properly interfaced and adjusted.
 - (5) Determine that cab signals and hump speed command are properly output and properly acted upon by hump set(s) being controlled.
 - (6) Determine that alarms are functioning properly.
- c. Car inventory data and message system.
- (1) Determine that errors are alarmed.
 - (2) Determine that inventories are updated on a ~~real-time~~ basis per the approved interface control document.
 - (3) Determine that all data fields and flags are properly sent and properly decoded.
- d. I/O Devices.
- (1) Determine that printers, display devices, storage devices and I/O devices are sending and/or receiving as required.
 - (2) Determine that control system will continue to function when specified I/O devices fail.
- e. Back-up systems.
- (1) Determine that back-up system will operate in the manner as designed.
 - (2) Determine that changeover will occur and not delay the yard operations.

AREMA® C&S Manual

Part 4.1.10

202318

2. The following performance standard shall be attained:
 - a. Coupling speed standard of _____ % of cars coupling at or below _____ m/h (k/h) with remaining couplings not to exceed _____ m/h (k/h).
 - b. Stall definition of cuts/cars. Stall rate not to exceed _____ % of cuts/cars processed.
 - c. Misroutes not to exceed _____ % of cuts processed.
 - d. Couple rate of ____ % cars coupled or cars that touch.
- ed. Hump rate, system is able to process _____ cars over hump and through switching area per hour.

G. Clearances

Clearances shall conform to clearance diagrams.

H. Electrical Protection

The following shall be furnished:

1. Surge protective devices (SPD's) with detailed plans for grounding as required. Parallel connected SPD's shall be connected to power conductors and grounding systems with leads no longer than 18 in (45.72cm) in length. Grounding grids shall have the lowest practical impedance. Grounding per railroad specifications.
2. Memory protection. Note: Usually part of input/output power protection.
3. Continuous, uninterrupted (no-break) power supply shall be provided and the load should be within typically 10% of rated capacity. The central processor units, peripherals, and apparatus operating the control system should continue to operate for ____min or until a complete "save operation" can be completed after a primary ac power failure. If the uninterrupted power supply (UPS) system fails, provision shall be included to transfer load (automatically or manually) to a primary ac power supply.
4. A standby power generator, if available, should be capable of being brought on-line to supply power to all connected computer systems within a specified period at any outside ambient temperature condition. The generator should

4.1.10

be on-line well before the UPS standby time has expired. An automatic transfer switch should transfer computer operation from UPS operation to standby generator operation without interruption to the computer system operation.

The transfer switch should be capable of monitoring the return of ac primary power, and should have an adjustable duration of time from primary power outage to the steady return of primary ac power. The adjustable ~~time-time-~~out period should be no less than 10 min (to minimize the probability that the primary ac power will again drop prematurely).

Transfer from generator power to primary ac power shall occur without the development of any undesired power transients.

I. Central Processor Unit (CPU)

CPU shall have sufficient ~~capability-capacity~~ to perform the process control and related functions specified. _____% spare memory should be provided for future enhancements and unimpeded system operation. _____ spare parts should also be provided. (*R-I)

Alternate Recommendations Section*J. Memory**

Memory should have sufficient capacity to meet requirements. _____% spare memory should be provided for future enhancements and unimpeded system operation. A means for backing up this memory system is required (e.g., disk drive, removable disks, off-site disaster recovery center, etc.).

K. Input/Output Devices

1. Printer should be capable of printing a minimum of _____ pages per minute.
2. Video display device should be capable of displaying a specified size and graphic resolution.
3. Serial interfaces, if provided, should operate at specified baud rates.
4. Buffers, relays, switches, etc., for interfacing process control subsystems to the computer should have _____ spare inputs and _____ spare outputs.

L. Data Circuits

AREMA® C&S Manual

Part 4.1.10

202318

1. Data interfacing between Processor Unit No. 1 and Processor Unit No. 2 (back-up) should be capable of transmission rate of _____.
2. Data circuits interfacing between processor unit and mass memory devices should be capable of a transmission rate of _____.
3. Data circuits interfacing between processor unit, analog I/O and digital I/O, and other peripheral devices should be capable of a transmission rate of _____.

~~*Alternate Recommendations Section~~

4. Data circuits interfacing between processor units and central computer systems, switch, and I/O peripherals should be capable of a transmission rate of _____.

M. Car Information System

System should interface for the following:

1. Verification and updating hump consist.

~~*Alternate Recommendations Section~~

2. Verification of incoming or outgoing consists where required.
3. Reporting of car inventory as cars are processed into classification tracks.
4. Reporting of car space/distance to couple (DTC).
5. Reporting of blocks, swings, etc.

N. Detector Systems

Systems should interface for the following equipment with specified features:

1. Loose-wheel and broken-flange, cracked wheel, high and wide-load, shifted load, dragging equipment detectors and other defect detectors; when detector is actuated, humping operations will be stopped and audible and/or visual alarms will be operated. (*R-N-1)

4.1.10

2. Hot bearing, flat wheel and hot-wheel detector information, on arriving trains, should be provided for inspection of equipment before humping.
3. High load, wide load, shifted load and overload detector actuation should be provided for the central information system.
4. Other detectors required to operate the yard, such as cut-length, radar, directional detectors, presence detectors, etc., should be provided and used for process control systems.
5. Means provided to archive operation of the above devices, attach to car record or other event log, and then generate a maintenance report upon request.

O. Weigh-in-Motion Scale

Interface should be provided for weigh-in-motion scale.
(*R-O)

~~*Alternate Recommendations Section~~

1. The computer should turn on the scale when a car to be weighed is occupying the scale and store the weight. Storage of weights for cars should be provided. The computer should be capable of providing tonnage of cars and trains.
2. Manual input of tare weight and car number, as required.
- ~~2. Manual input of tare weight and car number, as required.~~
- ~~3.~~ 3. The computer should print scale tickets automatically in format, specified, -as required~~specified.~~

*Alternate Recommendations Section

4. Back-up system for scale failures.
 - a. Weigh rails.
 - b. Weigh bill weights.

AREMA® C&S Manual

Part 4.1.10

202318

5. Means to archive the weight of all measuring systems for each car, then provide a maintenance report upon request by car number or specified time period.
6. Means to provide car weights to central information system.

P. Automatic Hump Engine Control

The following should be provided:

1. Cab signal equipment to be interfaced with the computer.
2. Automatic hump engine speed control interfaced with computer controlling hump speed in _____ m/h (k/h) increments. Actual humping speed should be monitored. (*R-P-2)
3. Radio requirements should include operating frequency and power.
4. Antenna requirements should include type, physical location(s), and loads.
5. A means to archive hump engine requests and measured speeds, then generate a maintenance report upon request for the specified time.

Q. Automatic Switching

The following shall be provided:

~~*Alternate Recommendations Section~~

1. Automatic switch control and locking to safely route a free-rolling car or cut to a selected track. A stored program with pre-selected track assignments, obtained from the stored hump list, should be used to initiate route selection. A blocked track request shall automatically prevent route selection into designated track or tracks.

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2. A swing request should reroute car or cut to the swing track.

*Alternate Recommendations Section

2. A swing request should reroute car or cut to the swing track.

4.1.10

3. Switch detector locking to be effective for cars of any structural configuration or size.
4. Misroutes, open switches, cornering conditions, detection failure, etc., shall be alarmed.
5. Means to archive switch operations, both correct and exception operations, then provide a maintenance report upon request for specified period of time.

R. Automatic Retardation

The following shall be provided:

1. Means for calculating exit speeds from retarders for adequate car or cut travel and proper coupling speed based on:
 - a. Car weight.
 - b. Car rolling resistance.
 - c. Distance to coupling.
 - d. Track characteristics.
 - e. Wind speed and direction.
 - f. Temperature.
 - g. Other weather.
 - h. Car type.
 - i. Load or empty status.

*Alternate Recommendations Section

- j. Side Bearing Type – normal or resilient side bearing (RSB).
2. Means to monitor car or cut speed at tangent point of each track. If speed deviates ____ m/h (k/h) from calculated speed, it is to be alarmed.

AREMA® C&S Manual

Part 4.1.10

202318

3. Means to gather distance-to-go track circuit data. Track space data shall be stored in the computer and continuously updated to assist in retarder control and track fullness detection.
4. Means to monitor speed of car or cut for releasing retarder control section when proper calculated exit speed is reached. If speed deviates _____ m/h (k/h) it shall be alarmed.
5. Means to safely handle two cuts in a retarder at the same time.
6. Means to gather rolling resistance, build a database, erase erratic data, recalculate new calibration constants and replace the existing constants.
 - a. Means for automatic calibration update to be tested for accuracy and large deviation to be rejected.
 - b. Rejected or accepted update should be reported.
7. Means to archive all data used to calculate exit speeds for each retarder, including exit speed, then generate maintenance reports of retarder performance over a requested period of time.

S. Automatic Trim Control

The following should be provided:

1. Means to control switches and automatically line and lock route for switching of cars during trim operations from hump end of yard.
2. Means to gather data for switch and bi-directional wheel detection to track cars, if specified.
3. Means to archive trim moves and provide a maintenance report for requested moves over a requested period of time.

T. Back-Up System

The following should be provided:

1. Processor unit or units duplicating items specified under Section I and referred to as back-up system.
2. Memory, digital I/O and ~~technicians'~~ technicians' printer/video display, as specified in Section K assigned to back-up system.

4.1.10

3. Automatic (or manual) switch over to transfer operations between normal and back-up computer systems when the system on-line fails. Information shall be transferred from the on-line to the off-line system to keep it continuously updated.

U. Test Interface Terminal

The following should be provided to permit monitoring the yard operation:

1. A color graphic video display which shows all operations of the yard, including but not limited to:
 - a. Track circuit occupancy (switches, clearance, retarders, approaches).
 - b. Switch position- automatic, manual, blocked, obstructed.
 - c. Signal indications.
 - d. Wheel counts.
 - e. Retarder operation.
 - Automatic.
 - Manual.
 - Position/pressure request.
 - Position/pressure actual.
 - Requested speed.
 - Actual speed.
 - Exit speed.
 - f. Distance to go, in feet.
 - g. Blocked tracks. (*R-U-1)
2. Interactive device to operate retarders, switches for simulating yard operation, and sectionalize the system for testing. (*R-U-2)

AREMA® C&S Manual

Part 4.1.10

202318

3. ~~3.~~ Test Interface Terminal, device, or software to simulate input and output messages to verify proper operation of all communication circuits.

*Alternate Recommendations Section

4. Test Interface Terminal, device, or software with capability to switch from on-line to off-line processor unit without affecting yard operation.
5. Test Interface Terminal, device, or software to display computer memory of all I/O bits.

V. Software

1. Process control software shall include the following:
 - a. Car tracking from the crest to the destination in the bowl. Tracking should be bi-directional for automatic train operations.
 - b. Automatic switching logic responsible for switch operation. Track assignments should be taken from Information System hump list logic. A simple input command should initiate route selection for switching moves during automatic trim operation. Swings should be initiated either automatically or manually. Checks shall be made for misroutes, improperly lined switch, and cornering conditions.
 - c. Automatic speed control logic shall be designed to provide data on a free-rolling cut of cars and applying it to exit speed equations from which retarder control is determined. Control factors shall include cut measurement, separation of cuts, track parameters, weight class, distance-to-couple, weather conditions, coupling velocity and yard calibrations.
 - d. Means to collect yard calibration data automatically under various ambient conditions and store in a file. The data shall be compared to variables used in controlling cars to all tracks. As ambient conditions change, the variables should be changed automatically after sampling _____ cars, averaging their performance and using the results for adjustment. As fixed constants of track parameters change, they shall be corrected by changing the database when sufficient data has been collected on a track or group of tracks shown to have changed parameters.

4.1.10*Alternate Recommendations Section

- e. Automatic weighing as specified.
 - f. Automatic hump engine speed control.
 - g. Track blocking protection.
 - h. Digital I/O control.
 - i. Mode of system operation.
 - j. Interrupt service routines.
 - k. Messages, reports, and alarms.
 - l. _____ language should be used.
 - m. _____ protocol should be used.
2. Information System software should include the following:
- a. Executive system.
 - b. Built storage I/O.
 - c. File handling subsystem.
 - d. Initialization.
 - e. Function page.
 - f. Utility routines.
 - g. Process commands, reports, messages, lists, statistics, inventory, and alarms.
 - h. _____ language should be used.
 - i. _____ protocol should be used.
3. Diagnostic programs shall be provided to test the following:

AREMA® C&S Manual

Part 4.1.10

202318

- a. Memory parity.
 - b. Processor unit or units.
 - c. RAM and cache memories.
 - d. Power failure sensing.
 - e. UPS & Generator status sensing
 - f. Timers.
 - g. I/O channels.
 - h. Digital I/O interface.
 - i. Peripheral devices.
4. Training should be provided as specified for:
- a. Computer maintenance.
 - b. Programming.
 - c. Operations.

W. Weather Station

A weather station should be provided and interfaced to the CPU. Data from the weather station should be part of the rolling resistance measurement.

1. Location of the weather station should not be in an area where the wind speed and direction ~~is~~are modified by buildings, equipment cases, and moving cars.
2. Location of the weather station needs to be accessible for maintenance.

X. Winter Switch Protection

Winter Switch protection should be installed when snow and ice may cause delays to yard operation. See Manual Part 12.6.1 (Recommended Guidelines for Selection of Winter Switch Protection Devices).

Y. Wayside Signals

4.1.10

Wayside signals should be installed to direct the movement of locomotives when alternate means have not been provided.

1. Hump signals may be used instead of cab signals. Location of the signals should be in areas where they are always visible from the locomotive. Repeater signals may be necessary to provide adequate visibility.
2. Audible and/or visual signals should be installed to indicate when humping operations are going to begin.
3. Trim signals and escape route signals should be in the bowl area at appropriate locations to govern movements of train crews working in the bowl.
4. Visual display at crest should indicate the number of cars to be cut. The indication may consist of a number of lights, car identification, hump list, etc.

Z. Test Equipment

The following should be provided to permit efficient maintenance and troubleshooting of the control system.

1. Built-in meters, diagnostic lamps, indicators, and video displays to show status of inputs and outputs of the control system.
2. Portable meters, oscilloscopes, data scopes, and any other test equipment necessary to maintain and troubleshoot the control system.
3. Hardware and software simulators to test subsystems of the control system.

AA. Training

Training should be provided in formal sessions and on-the-job sessions. Documentation should also be provided to train both maintenance and operational personnel.

1. Train maintenance forces as follows:
 - a. Class sessions.
 - b. On the job.
 - c. ~~Self~~ Self-taught documentation.

AREMA® C&S Manual

Part 4.1.10

202318

- d. Simulation.
- 2. Train operation personnel as follows:
 - a. Class sessions.
 - b. Demonstration/simulation consoles.
 - c. Documentation.
 - d. On the job.

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4.1.10

Alternate Recommendations Section

- R-I Distributed computer system should be furnished as specified. The capability of each processor should be provided as specified.
- R-N-1 When detector is actuated, operations will continue as specified and audible and/or visual alarms will be operated.
- R-O Coupled-In-Motion scale and associated logic to merge the car identification data and weight with the proper car record to be provided.
- R-P-2 Remote control of locomotive.
- R-U-1 Test panel arranged to display yard layout with lights, LED's, meters, and digital readouts to permit monitoring control systems and yard operations.
- R-U-2 Test panel with levers, push-buttons, and switches necessary to simulate operations and sectionalize the system for testing.

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