1. Committee and Subcommittee: 6
2. Letter Ballot Number: 06-20-02
3. Assignment: Charles McGloughlin & Jim Michel
5. Rationale:

*Part 11 was last updated in 1991 and the part needed significant updates to new technologies and current practices for centers designed for the control of rail traffic.*
Part 11

Design Criteria for Dispatching CTC Centers

FOREWORD

A centralized dispatching facility (CDC) houses train control and traffic management equipment and the personnel to operate and maintain it. In its broadest sense, CTC is the focal point of the operating railroad, whether it be an entire railway network or a significant regional portion of such a network. It monitors, directs, and controls all train operations, while keeping in constant communication with every activity in the controlled territory. A CDC should be a secure, hardened facility with controlled access whether as a standalone building or a dedicated space within a railroad office building. The vital components of the signal system are located in the field and the CDC provides the facilities for the human interface with the installed technology. As such, it is possible to relocate a CTC quickly, combine workstation assignments during periods of low traffic, or temporarily shift operations to a back-up facility in an emergency. Part 11 deals with the building and facilities to support the dispatching function and not with the train control hardware or technology installed to perform the function. We will be mainly concerned with the building that houses this “Nerve Center.” It is recommended that building designs incorporate flexible spaces that can be easily updated while maintaining operations as technology evolves, typically on 5-10 year cycle.

Establishing basic design parameters begins with ascertaining the proposed method of operation of the particular facility and the geographical extent of the controlled territory which will define the number of dispatcher positions. A detailed design program should be prepared with input from the Operations, Signal and Communications and Signals Departments, and Informational Technology departments. Since the communication network required is very extensive, it is often decided to include other functions at this location. These other functions that support train operations may be co-located in the CDC, including crew management, locomotive assignment, dispatching and car distribution, railroad police, and multi-department emergency response. These departments provide design criteria in the development of the design program.

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6.11.1
### SECTION 11.1 - SITE CONSIDERATIONS (1991-2020)

The facility location will be determined by the particular circumstances of the territory to be served, and the signal and communication systems to be used, and the proximity to the executive offices that are responsible for the railroad operations. In many cases, a CDC will be co-located in a railroad office building or adjacent to other railroad facilities that may require separate entrances and standalone power and communications. Dedicated, secure employee parking is recommended due to the 24/7 nature of the operation.

Site selection should consider extreme weather events that regularly occur and incorporate structure hardening as appropriate for the conditions. Site conditions should consider the protection of employees and their personal property who must operate the CDC during adverse weather conditions. Evaluation of flood risk should include access to the CDC site by employees during extreme weather events for flooding potential so the CDC is not isolated and inaccessible to employees. A sophisticated data link may permit the facility to be far removed. A simpler arrangement using cable connections may require that the facility be within a prescribed distance. In selecting a site, provide for adequate stand-off distance from public roadways to enable a secure, hardened perimeter to be established as the CDC building is a critical facility for the railroad.

Other concerns relative to location should include: local zoning requirements, availability of an ultra-reliable power supply, soil stability, drainage, roadway accessibility, perimeter security, utilities availability, and proximity to alternate accommodations for employees during emergency events. Reliable commercial power with redundant sources and multiple high-speed data links are essential when siting a CDC. Protective areas, adequate parking space, drainage, sanitary sewer and water systems, and other design considerations should be accounted for in the selection of the CDC site.

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SECTION 11.2 EQUIPMENT

11.2.1 DISPATCHER WORKSTATIONSCONTROL CONSOLES (1994-2020)

A dispatcher workstation will be typically composed of a L-shaped or U-shaped desk with arrayed LCD screens that display the controlled territory, a communications control console or screen for radio and telephone communication with train crews, and a general purpose computer for accessing company business systems with a dedicated printer. This equipment may be located in office modular furniture or enclosed rooms, the latter typically with glass walls to permit visual interaction with the adjacent dispatchers and the dispatching supervision. Overhead lighting should be low glare and adjustable supplemented with work surface task lighting. Since these workstations are often 24/7 positions, a small under counter refrigerator and/or personal property storage cabinet may be desirable.

A unique design consideration for these facilities and these displays is the supervisory control and data acquisition (SCADA) system that will be the content displayed on these screens. SCADA systems are usually proprietary and custom-built for the railroad transit agency and sufficient design lead-time and coordination with the SCADA vendor should be allowed to prevent delays in start-up and commissioning.

Control consoles may be hardwired pushbutton, stylus select device CRT, or keypad CRT or any combination of those types.

11.2.1.1 Hardwired Pushbutton

This rather conventional system is best described as one large console (or several smaller consoles) which present a schematic of the territory to be controlled, with pushbuttons located at strategic points on the schematic which define the entrance and exit locations used for route control. In addition there exists a separate matrix of unit lever type switches (either toggle or lever type) which can force switch position in the NX mode, and provide unit lever capability.

11.2.1.2 Stylus Select Device CRT

This term applies to a color monitor with an SSD overlay on the face of the monitor which responds to either pressure or the...
intersection of infrared light beams which produce a signal to activate a device. Each CRT presents a schematic or a portion of the territory to be controlled. Sensitized areas called "Poke points" are located at strategic places on the schematic. These "Poke points" are poked with a stylus in order to effect NX control. Since only a portion of the controlled territory can be displayed on a CRT, a "Search and scroll" function is necessary to first "Call up" the location to be controlled. An alternative to the "Search and scroll" technique is to have a bank of CRT's in sufficient number to cover the entire controlled territory.
11.2.1.3 Keypad/CRT

This term applies to a color monitor which is linked to a function type keypad device which is used to enter entrance/exit type commands for route control. The CRT presents a schematic of a portion of the territory to be controlled, and as commands are entered on the keypad the CRT dynamically indicates field conditions. A “Search and scroll” function is also necessary with this system.

11.2.2 OVERVIEW DISPLAYS (1991-2020)

Overview wall displays of a CDC territory may be beneficial in high density passenger terminals to allow sharing of information amongst many dispatchers and the support staff in the center. Some freight dispatching centers use the wall displays to offer real-time weather and news, operational metrics, and other information that may affect train movements. Typically, such displays are either arrayed LCD screens or rear-view projected images. The specification of such equipment should be made by the Operations and C&S Departments in conjunction with the designers and suppliers of the train control equipment. Wall displays will require a behind the screen utility space with adequate ventilation and/or cooling. Include the following types multiple CRT’s, mnemonic wallboards and projected overviews.

A unique design consideration for these rooms and these displays is the Supervisory Control and Data Acquisition (SCADA) systems that will be the content displayed on these screens. SCADA systems are mostly proprietary and custom.

**Fig 11.2** Free-standing workstation

**Fig 11.3** Overview Wall Display for a passenger system dispatch center
11.2.1 Multiple CRT's

These provide only a limited overview in that they cannot be read from a distance. They are usually clustered around each dispatcher, with each screen showing a particular territory.

11.2.2 Hardwired Mnemonic Wallboards

These are either a mosaic or phenolic type schematic display of the controlled territory which employs lighted track segments, and defines switch and signal indications by use of colored light bulbs.

11.2.3 Projected Overview

This system uses a series of projection units to project the schematic of the controlled territory on a series of large screens. Dynamic indications of switch, signal and train status are conveyed through the use of colors, changes of color and also shapes and images of field apparatus. Projection can be from front or rear.

11.2.3 AUXILIARY FUNCTIONS (1991-2020)

Auxiliary functions which may be performed at a CDC that are listed in the following.

- ab. MoW trouble call assignments
- ac. Passenger information systems.
- ad. Telecommunications control.
- ae. Motive power control and assignments.
- af. Monitoring wayside detection systems (hot box monitoring).
- ag. Television train consist monitoring if the facility is in a yard location.
- ah. Facility security.
- ai. Monitoring security and facility access systems of remote sites.
SECTION 11.3 FUNCTIONAL REQUIREMENTS

11.3.1 TYPICAL SPATIAL RELATIONSHIPS SUPERVISORY OFFICES (2020) (1991)

Refer to Table 11-1 for typical spatial relationships. The values in this table are useful for moderate sized centers of up to 15 workstations. Not all functions shown in the table are applicable to every facility. For larger facilities, a specific design program should be developed with other departments utilizing the space. Some railroads organize their large system dispatch centers into geographic clusters so all functions related to a specific portion of the railroad are co-located enabling dispatchers and work staff to interact.

Figure 11.4 Large Railroad Centralized Operation Center

Refer to Figure 11-5 for a dispatching center for a moderate size regional passenger railroad.

Refer to Figure 11-6 for a dispatching center for a moderate sized regional freight railroad.
TABLE 11-1 TYPICAL CONTROL CENTER SPATIAL REQUIREMENTS

<table>
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<tr>
<th>Room or Space</th>
<th>Function or Activity</th>
<th>Area</th>
<th>Adjacencies</th>
</tr>
</thead>
<tbody>
<tr>
<td>General Superintendent – Train Operations (GCTO)</td>
<td>Responsible for operation of trains on mainlines</td>
<td>150 sf</td>
<td>Near GCTO</td>
</tr>
<tr>
<td>Executive Assistant</td>
<td>Supports GS-TO and staff</td>
<td>10 x 10</td>
<td>Near GCTO</td>
</tr>
<tr>
<td>Executive Conference Room</td>
<td>Transportation Dept. meetings</td>
<td>300 sf</td>
<td>Near GCTO</td>
</tr>
<tr>
<td>Manager of Rules</td>
<td>Responsible for rulebook and operating instructions</td>
<td>120 sf</td>
<td>Near GCTO</td>
</tr>
<tr>
<td>Asst. Manager of Rules</td>
<td>Responsible for rulebook and operating instructions</td>
<td>120 sf</td>
<td>Manager of Rules</td>
</tr>
<tr>
<td>Supervising Road Foremen</td>
<td>Responsible for oversight and management of train engineers</td>
<td>120 sf</td>
<td>Manager of Rules</td>
</tr>
<tr>
<td>Transportation General Offices (TGO)</td>
<td>Support staff in 10x10 cubicles- number will be determined by size of railroad</td>
<td>100 sf</td>
<td>TGO</td>
</tr>
<tr>
<td>Hearing/Interview Room</td>
<td>Private meeting space for employee meetings</td>
<td>200 sf</td>
<td>TGO</td>
</tr>
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The following spaces are part of the Central Dispatch Center operations control center and are in a highly secure area.

Dispatcher Workstations
- Number of modules or private offices with glass wall on side facing the Chief Train Dispatcher area - low glare lighting; acoustic treatment
- 200 sf total for each
- Within vision range of Chief Train Dispatcher desk

Chief Train Dispatcher Desk
- Supervises the dispatchers
- 10x10 desk station in open room
- Asst Chief Desk and Dispatcher workstations

Asst Chief Train Dispatcher Desk
- Supports Chief Dispatcher in peak hours
- 10x10 desk station in open room
- Chief’s desk and Dispatcher workstations

Chief Train Dispatcher or Supervisor office
- Private meeting room
- 120 sf private office
- Proximity to the Dispatch area

Emergency Command Center
- Conference room set up for activation in the event of service disruption
- 500 sf Conference room
- Glass wall to Chief Dispatcher desk space or viewing window

Train Control Computer Equipment Room
- Room for Train Control Equipments
- 400-2000 sf depending upon equipment selected
- Dispatcher Workstations

Technical Support office
- Separate room with workstations to develop or validate software changes
- 100 sf per person
- Train Control Computer Room

Training Simulator Room
- Provides off-line dispatcher workstation for individuals to qualify for positions and allow testing of software wrinkles
- 150 sf per workstation
- Train Control Computer Room and the Software Development office

Administrative Area
- Storage, records preparation and retention, crew calling, timekeeping, etc.
- 120 sf
- Use of office modular furniture depending upon the number of positions required near the Asst. Chief Dispatcher

Lunch / Kitchen area
- Kitchenette for dispatcher breaks with sink, microwave and refrigerator
- 300 sf
- Dispatchers may prepare foods for consumption at their workstations

Toilets
- Male and Female toilets - accessible to mobility impaired
- Number per code and occupancy load
- Lunchroom

Qualified Mechanical Person Workstation (QMP)
- Supports the Chief Dispatcher for car and track trouble reports
- 10x10 desk area in open room
- Near the Chief Dispatcher Desk

Maintenance of Way Trouble Desk
- Coordinates dispatch of signal and track maintainers when failures are reported to the dispatcher. Also coordinates scheduled track outages with dispatchers
- 150 sf office with two workstations
- Near Dispatcher workstations

Railroad Police / Emergency Responder Liaison Office
- Liaison to support dispatchers during service disruptions and periods of peak train activity
- 100 sf
- Near the Chief Dispatcher Desk and the Emergency Command Center

Radio/Comms Equipt. Room
- 80 sf
- Train Control IT Room

11.3.2 DISPATCHING OPERATIONS LOCATION (2020)
The location within the building of the dispatchers’ space should be hardened without windows, environmentally conditioned with individual temperature control for each dispatcher workstation if contained in a single room, be well insulated thermally and acoustically. A common configuration places the dispatchers on a floor with electronic equipment and power conditioning equipment located directly below on another floor.

Adjacent to the dispatchers’ area, a dedicated conference room with operable glass partitions or large viewing window opening onto the dispatch floor should be provided for use during emergencies and service disruptions. This room should have wall screens to display selected dispatcher controlled areas, monitors for viewing commercial and cable TV coverage of events and weather conditions, phone and company radio access, specific phone or radio communications to police and emergency responders, and for passenger services a means to effectively interact with social media and passenger information systems in stations. Supervisory offices will include private offices for the chief and assistant chief dispatchers frequently overlooking the dispatchers and the display.

### 11.3.2 TRAIN CONTROL RELAY RACKS AND COMPUTER EQUIPMENT ROOM (19912020)

Relay racks and computer equipment should be housed in computer room environmentally controlled space. Close control of temperature and humidity combined with a relatively dust free atmosphere ensures optimum operation and life for electronic gear. Fire suppression system suitable for the installed equipment should be evaluated by a fire protection professional. The computer room can be located directly below the dispatch center, ceiling hung cable trays provide maximum flexibility for making upgrades and renovations. If on the same level as the dispatch center, cable can be run in cable trays either above the ceiling or surface-mounted on the wall for ease of access and future modifications. Consideration to the fire code requirements for floor penetrations and through other fire rated construction should be evaluated for adequate flame and smoke stoppage and fire suppression.

### 11.3.3 TECHNICAL SUPPORT SERVICE SPACES (19912020)

Technical support service spaces should include a technician's workshop for both Communications and Signal employees as well as for Information Technology personnel to perform minor repairs, testing of components, and management of controlled inventory of spare parts, room for minor repairs and equipment monitoring.

If the railroad develops its own software or reprograms the installed train control equipment on site, a secure office space with at least one fully equipped dispatcher workstation should be provided. This extra/dispenser workstation can also be used for training and qualifying employees for new assignments without disrupting the real-time operations. Wall display systems require sufficient space behind the display to permit service and adjustment of the equipment.

### 11.4 DISPATCHER LOCATION (1991)

The location within the building of the dispatcher space ideally is in the central core since this space should be without windows and be well insulated thermally and acoustically. The electronic equipment and associated power conditioning units are best located remote from the dispatchers for isolation of the noise and heat generated by this gear.

### 11.5 EMPLOYEE LOCKER FACILITIES (19912020)

If dispatcher workstations are not in enclosed rooms, lockers for the storage of employee personal property and outer garments should be provided. Locker facilities for each individual should be provided in a space adjacent to the CDC, easily accessible to the dispatching theater.

### 11.6 LUNCH/KITCHEN AREA ROOM (19912020)

Lunch area with microwave ovens, refrigerator, kitchen sink, coffee maker, storage cabinets and vending machines should be considered since dispatchers usually work in a 24/7 environment cannot leave their workstations for extended periods of time. For large facilities, the lunch area may also serve as a training or group meeting room and should be equipped with a large video screen for displaying training materials or general video information.
11.3.7 SMOKING AREA (1991) TOILET FACILITIES (2020)

Toilet facilities should be provided in close proximity to the dispatcher workstations to minimize the time away from the desk. Toilets should be accessible for mobility impaired as required by governing building code and may be either unisex or gender specific. Depending upon the total staffing of the CDC, additional toilet facilities may be warranted adjacent to the lunch area or outside the CDC secure perimeter.

11.3.8 (RESERVED FOR FUTURE USE)

Smoking lounge may be required if the theater area is made a non-smoking area as recommended.

SECTION 11.4 SUPPORT SYSTEMS

11.4.1 LIGHTING (1991 2020)

In general, lighting should be of light intensity of a typical office setting for general workspace area. Indirect lighting sources should be favored over direct lighting for ambient illumination to minimize reflection and glare with hidden light sources to minimize reflections. Dimmer control of general lighting is essential to allow for fine adjustability. Task lighting must be tightly controlled beams with dimmer control of intensity. The use of indirect lighting with long life low maintenance sources is most practical in the dispatcher’s room. Lighting in the other spaces has no special requirement although use of long-life low maintenance sources is very practical to minimize security risk of frequent required service. Natural light, if present, should be mediated by shades, drapes or blinds that will allow for reduction of glare. If natural light is desired, light tubes or similar solutions that do not provide direct sunlight are encouraged provided shade options are maintained.
11.4.2 COMMUNICATIONS AND NOISE ATTENUATION (1991-2020)

Communications by the dispatchers with trains create certain acoustical problems which require a compromise. Radio contact with trains can create a noisy atmosphere which can be mitigated with the use of headsets. Headsets are a solution to the problem but that affects the viability of alarm sounds used in conjunction with the overview display. Sound attenuating ceiling and wall finishes, such as acoustical tile, are effective to minimize reverberation. Wall finishes can also be used in low traffic areas to further reduce noise. Ceiling finishes are the most effective at sound attenuation. Wall and floor coverings should be evaluated for smoke and toxicity properties.

11.4.3 HVAC SYSTEMS (1991-2020)

HVAC systems in the computer and technician spaces should be the computer room type with a downflow air distribution using the access floor space as a supply air plenum. Conditions in this space should be designed to 72°FDB and 50% relative humidity. Systems in the dispatcher area should be designed to normal office standards with zone control to permit some individual temperature control. Draft conditions in these areas must be carefully controlled since these individuals must remain at fixed positions for extended time periods. Fresh air supply should be brought in through the HVAC equipment and filtered to limit dust. Adequate exhaust and some air purification through activated carbon filters should be given consideration in the design. Redundant HVAC equipment is essential for both reliable operation and for routine maintenance of equipment during system operation since downtime is not available. This requirement may be accomplished with overlapping zones in lieu of duplicate standby equipment. All dedicated computer and server rooms should be separately designed and fitted for appropriate conditioning as these rooms can get higher heat loads due to the equipment, and sustained exposure to elevated heat can reduce the lifespan of that equipment.

11.4.4 FIRE PROTECTION (1991-2020)

Fire protection and suppression is an absolute requirement. The type and its activation protocols should be evaluated to suit the equipment and risk. The detection system is of paramount importance. Halon fire suppression is the current best practice system for electronic equipment areas. Individual ABC extinguishers should be provided near each console and in service spaces. Water sprinkler systems should be avoided if the code permits, since the equipment being protected will usually be destroyed by the water damage. Ionization type detectors should be installed using a cross zone plan to trigger halon discharge. An annunciator panel with mimic board should be installed to indicate actual location of any sensor in alarm. Abort switches to prevent an unnecessary halon discharge should be provided in a central location. Spaces in the CDC not hosting electronic equipment may be protected by conventional water sprinklers as recommended by the railroad’s risk department or by local code provided adequate drainage is provided to divert the water away from electronic equipment spaces.

11.4.5 WIRING SPACES (1991-2020)

Wiring spaces and cable routes to workstations and displays from the computer room should be through a raised access floor system, up fed from wire trays below, or down fed from ceiling wire trays. Signal and communication cable should enter the building through a splicing chamber. If the entrance is remote from the computer room, an access floor route is preferred for cable runs. Lacking an access floor system cable horizontal runs should be in oversized cable tray run overhead. Power wiring should be shielded, cable or in metal conduit. In routing cabling, it may be preferable to have two separated routings so all cabling is not in a single confined area to minimize risk of damage to the entire dispatching system.

11.4.6 UNINTERRUPTIBLE ALTERNATE POWER SUPPLY (1991-2020)

In the event of loss of commercial power, alternate supply should consist of an uninterruptable power system for the computer and communications equipment with a minimum of 30-minute capacity, and an emergency generator of suitable capacity to operate the entire CDC. The generator fuel supply should be determined by historical outage patterns with adequate safety factor; 72 hours should be a minimum outage duration. In designing the alternate power supply system, care should be taken to minimize the number of single points of failure in the service and distribution equipment, such as transfer switches. Battery operated emergency light packs in key circulation areas and in rooms housing mission critical equipment should also be provided.
Design Criteria for Centralized Dispatch

Uninterruptible power supply (UPS) is required for computers and communications as well as any other critical real-time process being powered by the electrical system. Redundant power supplies are essential to reliable operation and may consist of standby generators, batteries and multiple primary power sources from the utility company. A typical UPS system should have 20 minutes of battery backup with an emergency generator sized to carry the battery charger, air conditioning and lighting systems. The fuel storage supply should be capable of sustaining full load generator operation for a three day minimum.

SECTION 11.5 ROOM FINISHES

11.5.1 DISPATCHER CONSOLE ROOM (1991-2020)

The room(s) or dispatchers space should have acoustical absorption on all surfaces; e.g. anti-static carpet tiles over raised access floor, carpet or sound soak type material on walls and acoustical ceiling tile. Non-reflective colors should be considered for all surfaces to reduce glare. Use of headsets can achieve additional noise reduction, especially in open floor plans.

The console room or dispatchers space should have acoustical absorption on all surfaces; e.g. anti-static carpet tiles over raised access floor, carpet or sound soak type material on walls and acoustical ceiling tile. Non-reflective colors should be considered for all surfaces to reduce glare. Hard, non-sound attenuated surfaces should be avoided, especially on the ceiling.
Design Criteria for Centralized Dispatch TC

11.5.2 COMPUTER AND TECHNICIAN’S SUPPORT ROOMS (19912020)

The computer room and technical support room should have hard smooth non-dusting surfaces; e.g., laminated plastic tiles for raised access floor, painted or vinyl covered dry walls, and vapor barrier ceilings. Subfloor should be sealed against dusting and vapor dispersion.

11.5.3 UPS AND BATTERY ROOM (19912020)

The Uninterrupted Power Supply (UPS) and battery room should have light colored chemical acid resistant finishes on the floor and walls suitable for the type of batteries used. Fire protection and ventilation should be provided as required by code for the type of batteries installed.

11.5.4 OFFICES (19912020)

The offices need no special finishes although the sound absorption wall and ceiling treatments in the dispatchers’ room are frequently carried over into the offices. Refer to Chapter 6, Part 2, Design Criteria for Railway Office Buildings for additional information.
Fig. 11-5  Dispatch Center Floor Plan for a Moderate-sized Regional Passenger Railroad

Dispatch Center Floor Plan
MODERATE-SIZED REGIONAL PASSENGER RAILROAD

- Passenger Information Display Operator
- Social Media Desk
- Police/Emergency Liaison
- M of T Trouble Desk
Design Criteria for Centralized Dispatch TC

Fig. 11-6 Dispatch Center Floor Plan for a Moderate Size Regional Freight Railroad