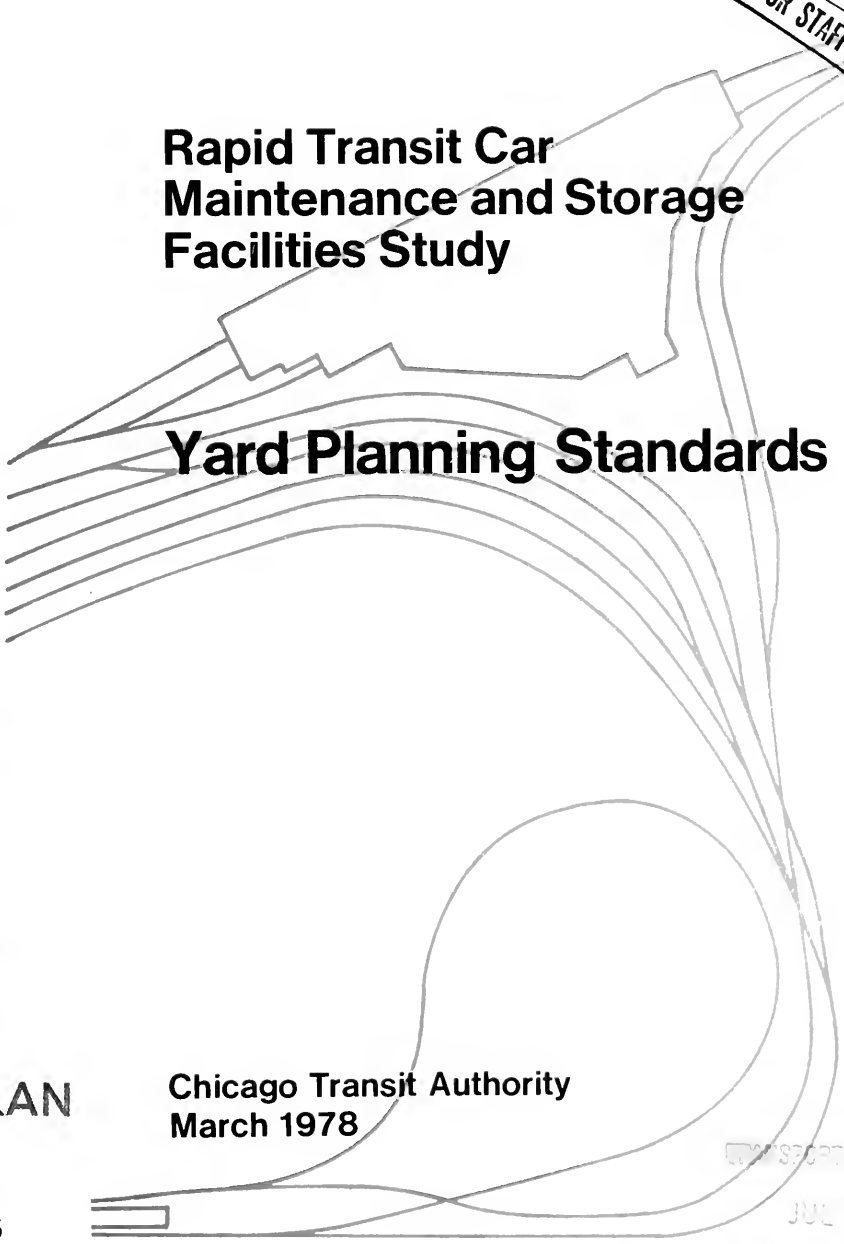
PRELIMINARY STUDY INFORMATION
FOR STAFF REVIEW

Rapid Transit Car Maintenance and Storage Facilities Study

Yard Planning Standards



Chicago Transit Authority
March 1978

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Rapid Transit Car Maintenance and Storage Facilities Study

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Chicago Transit Authority
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March 20, 1978

To: Operations Division and Department Managers

From: Howard P. Benn, Study Project Manager

Re: Draft Yard Standards

Attached for your review and comment is the second product of the Yard Study task force, the draft Yard Standards. (The first item released from the Yard Study task force was the Skokie Shop Master Plan.) It is respectfully requested that you return to me your comments by Monday, April 3. I am in room 707 and can be reached on extension 844.

Howard Benn

Howard P. Benn
Supervisor, Facilities Planning
Project Manager, J. O. 9262

HPB:mh
cc: Task Force Members
Study Participants
Attachment

PROJECT STAFF

This document is a product of work conducted by personnel of the Chicago Transit Authority.

The following persons composed the yard sub-task force (a portion of the total task force of the Rapid Transit Car Maintenance and Storage Facilities Study) by which it was developed:

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Project Coordinator	M. J. Daley	Operations Planning Department
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	L. Oomens	Transportation Department
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EXECUTIVE SUMMARY

This document contains standards covering three phases of yard planning: yard location, operational planning, and the planning of the individual facility elements that compose a yard. It was prepared by a task force of technical representatives from several CTA departments, primarily from the General Operations Division, as a product of the CTA Rapid Transit Car Maintenance and Storage Facilities Study. The standards identify planning and design ideals which should be included in the development/redevelopment of storage and terminal facilities. Therefore, the whole intent of this document lies in its eventual application in facility planning, programming, and design.

The key points in the document are:

-- Draft schedules should be prepared before extensive site specific study is undertaken. Only then can true cost analysis be undertaken and can different features be appropriately appraised.

-- Yards at other than terminal stations should be avoided, to keep operating costs to a minimum.

-- Access between storage and maintenance should be as direct as possible.

-- Yards should be short and wide (rather than long and narrow), be able to serve all related functions and have a capacity 1½ times the maximum projected requirements of either overnight or midday storage, whichever is greater. This permits maximum flexibility, testing of shop-released equipment, and the ability to lay up service consists without cutting, and have room to accommodate increased service due to growth in passenger traffic.

-- Holding areas equivalent to the length of the maintenance building should be provided to facilitate equipment movement in and out of buildings.

-- Cab signal buffer tracks and cab signal equipment testing facilities are requisite to smooth, safe, uninterrupted passenger service.

-- Loops turn trains around faster, are more efficient to operate, have greater capacity, and are cheaper to operate than pullbacks because of a lower net platform pay allowance.

-- More than one means of turning trains back should be provided at all terminals, for increased flexibility.

-- Contact rails should always be to one side of adjacent storage tracks, to eliminate walkway paths straddled by two contact rails.

-- Hard walkway surfaces should be provided in aisles in ballasted yards, facilitating movement and snow removal.

-- Yards should be double ended where feasible to facilitate rush period put-outs.

-- Shed-cover may be desirable for ballasted yards. The task force recommends further study of the concept, and joint usage for air rights development should be encouraged.

-- Within the yard communications system, in addition to the portable space radio system to be implemented, redundant, fixed wire systems should be provided as backup.

-- Low level aisle lighting is preferable to high tower lighting.

-- Power cutoff should be provided for each storage track.

-- Fire hydrants are preferable to water towers.

-- There should be designated cut and add areas, with suitable walking surfaces and lighting.

-- Employee convenience facilities should be combined as much as possible.

-- The task force recommends that study be given to developing systems for refuse storage and disposal.

With the approval of the Yard Planning Standards, evaluation of existing CTA facilities will proceed.

INTRODUCTION

This document contains recommendations for standards covering three phases of yard planning: Planning Standards for Yard Location, Planning Standards for Yard Operations, and Planning Standards for Yard Facility Elements. It was prepared by a task force of experienced technical representatives from the following CTA departments:

General Operations Division

- Transportation Department
- Maintenance Department
- Engineering Department
- Operations Planning Department

General Finance Division

- Materials Management Department
- Grant Programming/Administration Department

Staff Departments

- Safety Department

The standards are a product of the CTA Rapid Transit Car Maintenance and Storage Facilities Study, which is supported by an UMTA Technical Study Grant (Section 9). In this document the task force identifies planning and design ideals which should be included in development and rehabilitation of storage and terminal facilities.

Scope, Purpose, Basis, Goals

The scope of this portion of the Rapid Transit Car Maintenance and Storage Facilities Study is limited to those elements involved in, or directly impacting upon, car storage and terminal operations. For the purposes of this study and these standards, the term "yard" applies only to these elements, storage and terminal operations, and the site upon which they are located. It does not apply to car maintenance facilities located on or adjacent to the same site, which have internal operations independent of storage facilities operations. A similar document to follow will present recommendations for car maintenance facilities standards.

The purpose of the standards presented in this document is their subsequent application as parameters for the planning and design of new facilities and improvements and as guidelines for the analysis of existing facilities. Their progressive application is apparent. Location Standards will be applied first, in the analysis of a site location of a yard for a given rapid transit line; Operations Standards will be applied second, in the conceptual development and analysis of a yard layout on a given site; Facility Elements Standards will be applied last, in the more specialized design and analysis of individual systems within a yard. This document does not contain criteria for detailed engineering specifications. Such specifications are subject to ongoing improvements (or developments) in technology. While this study attempts to provide guidelines for

planning and design development which are as complete as possible, a contingent objective is to develop a document which will become a standard reference to be used over a twenty-year cycle in improving the various CTA facilities.

The basis of the development of the standards lies in several fundamental concepts, relating to the application of capital investment toward ultimate improvement in service to the rapid transit passenger. These concepts translate into goals attained through systematic facility development. The concepts and respective goals are as follows:

A) Concept: Capital investment should increase operations safety, reliability, and efficiency.

Goals:
1) maintenance of the integrity of mainline and storage operations;
2) minimization of the potential for conflicting movements;
3) simplification of required movements;
4) maximization of operation flexibility;
5) minimization of non-productive vehicle mileage; and,
6) minimization of manpower requirements.

B) Concept: Capital investments should be protected and secure.

Goals:
1) protection of facilities from extensive fire damage; and,
2) security of facilities (and employees) from intrusion.

C) Concept: Capital investment should improve employee working conditions while increasing employee efficiency.

Goals:
1) provision or improvement of equipment and facilities required for various work functions;
2) provision of safer, predictable, and efficient movement;
3) provision of adequate shelter; and,
4) improvement of employee conveniences.

D) Concept: Capital investment should allow reasonable plant maintenance.

Goal: minimization of plant maintenance without loss of operational capability.

E) Concept: Capital investment must conform to Federal requirements regarding environment impacts.

Goal: minimization of environmental impacts.

The task force developed the planning standards such that yards to be developed accordingly would realize these goals.

Approach

To attack the problems of developing a set of yard planning and design ideals, the task force identified:

1) those features which are contained in facilities at CTA and elsewhere that might be duplicated in new and redesigned CTA yards: and,

2) those deficiencies that might result in less than optimal operations.

The identification was accomplished in three distinct phases.

Initially, the task force visited typical CTA yards to quickly inventory current CTA facility capabilities (April and May, 1977). After receiving management approval, members of the task force visited the following rapid transit properties in North America: MBTA (Boston), TTC (Toronto), PATH (northern New Jersey), NYCTA (New York), SEPTA (Philadelphia), PATCO (southern New Jersey), WMATA (Washington, D.C.). The purpose of these trips was to compare CTA operations and capabilities with the operations and capabilities of other properties, and to discuss with operating personnel of these properties what their experiences had been and what their perspectives could provide (July and August, 1977). During both the CTA field trips and the foreign properties trips, staff members answered various questionnaires, which formed the basis for intensive staff discussion during November, December, and January, 1977-78. Task force experience and observations, and the experience of others as reported in the questionnaires, formed the basis for the recommendations made by staff in this document.

Document Development

After the task force started on development of the standards, it became apparent that previous CTA yard designs had been based on well-established experience, but generally without documentation. It was therefore necessary to lay out the various standards, both stated and non-stated, plus others that were non-existent; and, then to take these standards and to determine their interrelationships. It became clear in the development process that many of the standards were intertwined conceptually, in the manner of a geodesic dome.

The standards development process was an extremely difficult one, primarily because of the number and comlexity of the constraints involved. CTA has 11 existing yards, and with the possible exception of a few relocations all work will be site specific to existing yards. It became apparent that we were not to put together the ideal yard, but rather ideal elements that could be fit into yards. One of the more interesting occurrences during document development was the concomitant effort required to develop a wholly new yard on the O'Hare Extension at Rosemont (River Road). It was through that process as well, that the task force was able to see how varying elements can be put together to construct an entire yard. Still, it must be kept in mind that the major thrust of the study was to produce standard elements that can be applied to existing yards as well.

Cost Analysis

It will be noted that refined costs are generally omitted from the document. Because capital, operating, and maintenance costs related to the standards are

products of site-specific factors, they may be meaningfully developed only in specific applications.

-- Capital costs are based upon land availability and construction variables, such as requirements for preparation, etc., all of which are site-specific.

-- Operating costs of a given yard layout are products of operating schedules; yard operating costs can be determined only by analyzing a particular yard site with respect to a draft schedule prepared for a particular route.

-- Maintenance costs vary with each yard configuration, since movement patterns change.

Each standard presented in this document suggests an ideal for yard location, a yard function, or a design element. However, without reference to a specific site, with inherent operating and geophysical features, costs cannot be defined. The relative cost-effectiveness of each standard will be part of the site planning process for an individual yard.

Implementation

Once approved, this document will be used by task force members and CIP project managers for yard redevelopment projects. As indicated under Document Development above, in order to establish the cost effective designs needed, a trade-off study of the various elements will be required between site specific yard capital investments and the proposed operating costs as indicated by a draft schedule.

The next document to be prepared by the task force will be the car maintenance facility standards, which, hopefully, will be presented to management by the end of April, 1978. When approved, it will be the application of both that document and this that will establish priorities for the upgrading of the various CTA rapid transit car maintenance and storage facilities.

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PLANNING STANDARDS FOR YARD LOCATION

PLANNING STANDARDS FOR YARD OPERATIONS

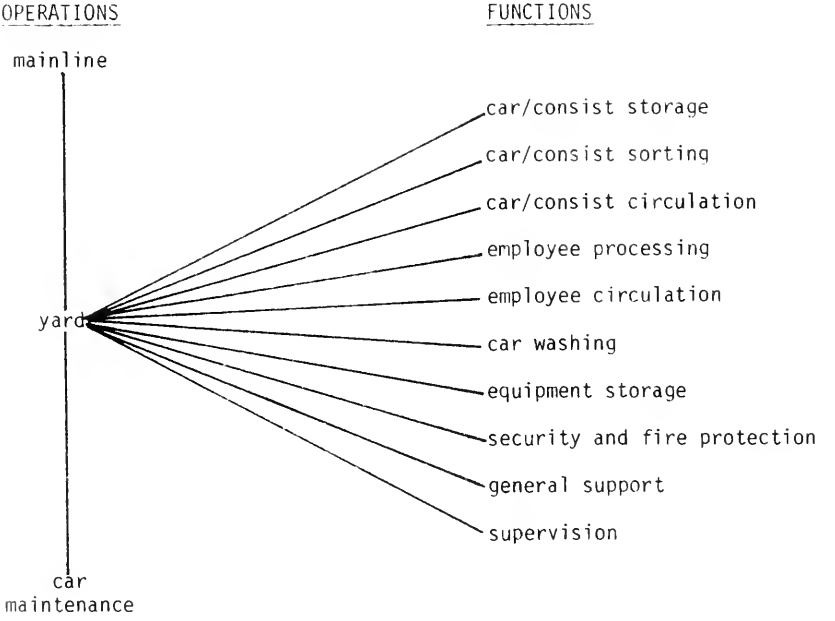
PLANNING STANDARDS FOR YARD FACILITY ELEMENTS

PLANNING STANDARDS FOR YARD LOCATION

A yard is a level tract of land -- adjacent to a mainline
straddled by a mainline
or "beyond" the mainline

in which -- personnel
(rail) cars/consists
automotive vehicles
emergency vehicles
maintenance-of-way equipment
and support elements

interact --



Proper yard location is a primary requisite for safe, reliable, and efficient operation. The Location Standards recommended in this section outline initial parameters for yard placement. In general, a yard location should facilitate the implementation of Operations and Facility Elements Standards, as outlined in further sections of this report. All the standards are meant to satisfy the schematic above.

L-1 SCHEDULE PRODUCTION

PRESENT STANDARD:

none stated

RECOMMENDED STANDARD:

An absolute prerequisite for yard planning is the production of draft schedules for the mainlines that a yard will serve.

DISCUSSION:

Schedule information is required to develop meaningful estimates of operating costs, in the analysis of cost-effectiveness of planning proposals.

RELATED STANDARDS:

L-2, all Operations Standards (which contribute to a total operating scheme)

L-2 RELATIONSHIP TO LINES

PRESENT STANDARD:

Yards should be located as close to the ends of rapid transit lines as possible. Lines which do not terminate in the CBD should have complete yard facilities at both ends. Lines which do terminate (or Loop) in the CBD may have all yard facilities at the non-CBD end.

RECOMMENDED STANDARD:

no change

DISCUSSION:

Such placement minimizes non-revenue vehicle mileage and minimizes interference between basic line and storage operations. Reductions in non-revenue vehicle mileage can be translated to operating cost savings on a case-by-case basis, by employing relevant schedules.

A yard located other than at the end of a line generates the increased operating costs of personnel paid to travel to/from car storage, hence spread, premium costs, travel time, etc. Mid-line placement also results in deadheading which interferes with in-service trains, and in short-turned runs, which can produce extra passenger transferring and imbalanced passenger loading.

RELATED STANDARD:

L-1

L-3 ADEQUATE SPACE

PRESENT STANDARD:

none stated

RECOMMENDED STANDARD:

A given yard site should have adequate space for all facilities necessary (as outlined in the Operations and Facility Elements Standards sections of this document) for optimal operating and maintenance conditions. A site should be capable of supporting expansion, as might be required through implementation of the 1995 Transportation Plan.

DISCUSSION:

The above requirements provide for the most complete realization of the goals outlined in the Introduction to this document, on a long term basis.

RELATED STANDARDS:

All Operations and Facilities Elements Standards

L-4 ROAD VEHICLE ACCESS

PRESENT STANDARD:

none stated

RECOMMENDED STANDARD:

Yards should have adequate access from arterial streets, to all areas and structures for emergency/security vehicles, and to maintenance facilities for delivery trucks.

DISCUSSION:

Effective access increases the effectiveness of security and fire protection measures and increases the efficiency of supply shipments. Currently, shipments occur at a rate of 1½ to 2 times a day to/from each shop. Increasing numbers of material and component shipments will be made with the further implementation of the unit exchange maintenance program.

RELATED STANDARDS:

L-5, E-18

L-5 ENVIRONMENTAL IMPACTS

ACCEPTED STANDARD:

Any environmental impacts of yard construction, operations, or maintenance should be minimized (in particular visual impacts and impacts of noise and vibration).

RECOMMENDED STANDARD:

Any environmental impacts of yard construction, operations, or maintenance should be minimized (in particular visual impacts and impacts of noise and vibration). Possibilities for joint usage, such as air rights development, should be explored as long as fundamental yard operations and passenger service are not detrimentally affected.

DISCUSSION:

Federal law calls for minimization of environmental impacts. Joint usage represents a method for minimizing environmental impacts by introducing additional structures/occupants to a given site.

RELATED STANDARDS:

E-11, E-12, E-16, E-19

PLANNING STANDARDS FOR YARD OPERATIONS

Operations Standards present criteria for yard operational capabilities, which should contribute to improving safety, reliability, and efficiency in overall rail system operations. Because yard operations support mainline operations, yard operational design reflects requirements established by scheduled mainline operations.

To examine the impacts of mainline operations, the following hypothetical path proved helpful:

Crew pulls consist into terminal station (pullback type)
leaves train
processes out through trainroom

First switchman boards train in station
pulls consist to cut and add area

Second switchman (on ground) makes cut
boards rear portion of consist
pulls new consist through cab signal tests
pulls new consist into station
leaves train

New crew boards new consist
leaves station on signal

First switchman receives directions from yard foreman
lays up train
walks through yard to cut and add area

In this example all of the steps must actually occur. Elements within the yard complex must be adequately provided and properly arranged to support such movements.

Several of the Operations Standards require brief introduction, most importantly, the standards regarding Cab Signal Testing, Terminal Station Turnback and Maintenance Facilities. Although it represents a relatively recent addition to CTA operations, cab signal equipment testing is an important safety function. Hence, cab signal testing facilities are important components in yard layout. In general, any time a train is placed in service or turned back by changing ends (without a loop), it should receive both a dynamic test of braking response and a static test of speed control indicator response. Although mainline train turnback operations should not conflict with yard movements, in many cases they serve as the interface between mainline and storage operations. Because of the implications of operational interaction, terminal station turnback facilities will be considered in this document. Car maintenance facilities, which will be the main topic of another document, are discussed only as they impact upon storage operations.

Impacting upon all of the standards, virtually all yard operations require switchmen. Therefore, because switchmen move about yards on foot, an important goal is the minimization of walking distances. Reducing walking distances reduces walking time and increases switchman safety and productivity.

0-1 ACCESS TO STORAGE

PRESENT STANDARD:

none stated

RECOMMENDED STANDARD:

Access to storage tracks hould be independent of any mainline operations, such that maintenance and storage activities do not conflict with revenue trains. Mainline tracks should not be crossed to enter or exit a yard.

DISCUSSION:

Conflicts with out-of-service trains can hinder the reliable operation of in-service trains. Minimizing the potential for conflicting moves minimizes requirements for interlocking plants. Interlocked facilities have characteristically high capital, maintenance, and operating costs.

RELATED STANDARDS:

L-1, 0-6, 0-8, 0-10, 0-11, 0-12, E-7

0-2 YARD STORAGE: CAPABILITIES

PRESENT STANDARD:

None stated

RECOMMENDED STANDARD:

Storage capacity should be distributed such that all consists scheduled for layup may be stored without cutting.

DISCUSSION:

Eliminating cutting and adding other than for regular revenue train length changes reduces total manpower requirements. Manpower requirements for a given yard are a factor of operating schedules.

RELATED STANDARDS:

L-1, 0-3

0-3 YARD STORAGE: PROPORTION

PRESENT STANDARD:

none stated

RECOMMENDED STANDARD:

Yards of several shorter storage tracks are preferable to those of few very long tracks. In general, storage capacities for individual tracks should be multiples of maximum length consists. Ideally, capacities should be equal to two maximum length consists.

DISCUSSION:

Yards composed of only a few long tracks tend to have characteristically high operating costs, since they often require considerable switchman work to perform normal sorting operations. Additionally, they tend to compound problems when they arise (yard derailments are harder to circumvent, bad order trains tie up significantly more consists, etc.). Conversely, shorter yards require switchmen to walk less and offer greater operational flexibility. Track capacities which are multiples of maximum length consists greatly contribute to overall storage capabilities. Capacities equal to two consists usually result in optimally proportioned yards, with minimal walking distances and reasonable fixed plant.

RELATED STANDARD:

L-1, 0-2

0-4 YARD STORAGE: CAPACITY

PRESENT STANDARD:

none stated

RECOMMENDED STANDARD:

A given yard should have a capacity one and a half times the maximum number of cars that it will be required to store at the time of maximum scheduled layups.

DISCUSSION:

Larger storage capacity provides greater operations flexibility and accessibility to maintenance buildings. Most importantly, it provides for unforseen changes in service (due to either total route growth or changes in line balance with respect to individual terminals). An increase in storage capacity is also useful for occasional maintenance-of-way equipment storage and for testing maintenance-released cars.

The task force recommendation of 150% capacity is based upon Transportation Department experience and reinforced by observations at other properties and discussions with their operating personnel (see next page).

RELATED STANDARDS:

0-2, 0-3, 0-8, 0-13, 0-14

Property and Line	Route Storage Capacity % of Route Car Assignment
MBTA	
Blue Line	315%
Orange Line	166%
Red Line	158%
PATCO	
Lindenwold Line	148%
TTC	
Bloor - Danforth Line	189%
Yonge - University - Spadina Line	121%
WMATA	
overall	125%

O-5 CURVED STORAGE TRACKS

PRESENT STANDARD:

none stated

RECOMMENDED STANDARD:

Curved storage tracks should be avoided, if possible.

DISCUSSION:

Curved storage tracks can cause problems in coupling, as couplers will not align properly and extra effort is necessary to attain proper alignment. Curved storage tracks can also position the cars such that access to the couplers is blocked from one side. Coupling might be required at any point on a storage track in an emergency. Additionally, straight storage tracks (hence straight aisles) improve visibility for yard employees, providing factors of efficiency and safety.

RELATED STANDARD:

E-18

0-6 DOUBLE-ENDED YARDS

PRESENT STANDARD:

none stated

RECOMMENDED STANDARD:

Yards should be double-ended (storage tracks should be accessible from either end).

DISCUSSION:

Dually accessible storage facilitates predictable car handling and permits cars to be removed from yards during blockages, thus circumventing delays to mainline service. In some cases, such as a yard straddled by a mainline, double-ending can greatly reduce unnecessary movement. The practicality of double-ending is particularly dependent upon the land requirements and schedule-related ramifications of each given configuration.

RELATED STANDARD:

L-1, O-1, O-10

0-7 CUT AND ADD AREA: LOCATION

PRESENT STANDARD:

none stated

RECOMMENDED STANDARD:

Cut and add areas should be located at yard entrances and/or near storage, positioned so as not to interfere with in-service trains. Cutting and adding at station platforms should be avoided.

DISCUSSION:

Positioning cut and add areas at yard entrances simplifies car handling thus increasing switchman productivity. Cutting and adding at station platforms should be avoided since many times it occurs at the expense of passenger convenience. The provision of efficient cutting and adding is essential to the policy of running trains of varying length to meet ridership demand.

RELATED STANDARD:

0-6, E-20

0-8 MAINTENANCE FACILITIES: ACCESS FROM STORAGE FACILITIES

PRESENT STANDARD:

none stated

RECOMMENDED STANDARD:

Maintenance facilities should be directly accessible from storage facilities (track connections should not cross mainline or turnback tracks).

DISCUSSION:

Direct access simplifies operations and reduces requirements for interlocking plants, by minimizing interaction between maintenance and service activities. Simplifying operations increases switchman productivity.

RELATED STANDARDS:

0-1, E-7

0-9 MAINTENANCE FACILITIES: HOLDING AREAS

PRESENT STANDARD:

none

RECOMMENDED STANDARD:

Car maintenance facilities should have holding tracks of capacity equal to the shop, ideally on both ends of the shop. (See Maintenance Facility Standards, to be distributed later, discussing double-ended buildings.)

DISCUSSION:

Holding areas allow for maximum flexibility in the use of switchmen while maintaining full maintenance operations. Cars spotted into holding areas, while other equipment is in the maintenance building, will maximize the efficient use of switchmen's time. When the repaired/inspected equipment is released, the cars in the holding area can immediately be moved into the building, permitting maintenance operations to begin almost immediately. Holding areas will be particularly effective if arrangements could be made for Maintenance personnel to move cars into and out of buildings.

RELATED STANDARD:

0-8

0-10 CAB SIGNAL BUFFER

PRESENT STANDARD:

none

RECOMMENDED STANDARD:

A length of buffer track should be provided between a mainline and yard entrance, where a maximum consist may come to a stop.

DISCUSSION:

A cab signal buffer track is an intrinsic requirement for the stated objective of minimizing interference between in-service and light trains. A stop is required before entering a yard, to allow the cab signals to display a flashing indication for yard operation.
(Note: In some designs, this track may also serve as the cab signal dynamic test track.)

RELATED STANDARDS:

0-1, 0-11

0-11 CAB SIGNAL TESTING: TEST TRACK

PRESENT STANDARD:

none

RECOMMENDED STANDARD:

Yard facilities should include a clear four hundred foot test track for static and dynamic testing of cab signal speed control indication and braking responses. Testing facilities intended to serve both yard and mainline turnback facilities should be easily accessible to/from both. Dynamic testing must be done without passengers, and facilities should be located accordingly.

DISCUSSION:

Static and dynamic testing is essential for providing reliable cab signal equipment operation. Dynamic testing must be done without passengers because if equipment is defective passengers would be on a moving train with unsafe equipment.
(Note: In some designs this test track may also be the cab signal buffer track.)

RELATED STANDARDS:

0-1, 0-6, 0-10, 0-12, 0-15, 0-16

0-12 CAB SIGNAL TESTING: STATIC TEST

PRESENT STANDARD:

All yard facilities should include a cab signal static test of speed control indicator response.

RECOMMENDED STANDARD:

All yard facilities which do not include a dynamic cab signal test should include provision for a cab signal static test of speed control indicator response. Testing facilities should be accessible to/from both storage facilities and adjacent mainline turnback facilities. The test should not be done with passengers on board, such as at a station.

DISCUSSION:

The cab signal static test confirms the reliability of cab signal indicator equipment. It should not be done with passengers on board because defective equipment must be removed from service immediately.

RELATED STANDARDS:

0-1, 0-6, 0-11, 0-15, 0-16

0-13 CAR TEST TRACK

PRESENT STANDARD:

none

RECOMMENDED STANDARD:

One track should be designated for, and have capability for testing cars released from vehicle and cab signal equipment maintenance.

DISCUSSION:

Testing increases the reliability of cars released for service. The track may be part of car storage capacity.

RELATED STANDARDS:

0-4

O-14 MAINTENANCE-OF-WAY EQUIPMENT STORAGE

PRESENT STANDARD:

none

RECOMMENDED STANDARD:

A single, accessible track, should be provided for the short-term storage of maintenance-of-way equipment. The track should have capacity for equipment used in routine mainline maintenance. It should be equipped with a pit.

JUSTIFICATION:

Providing equipment storage throughout the system reduces the movement of equipment required for routine maintenance-of-way operations. Due to the infrequency of its potential use, an equipment storage track could normally be considered part of regular car storage.

RELATED STANDARD:

O-4

0-15 TERMINAL STATION TURNBACK: WITH A LOOP

ACCEPTED STANDARD:

A loop is the most preferable single approach for turning trains back which are to remain in service.

RECOMMENDED STANDARD:

The most preferable combination of operating options would result from the combination of a loop with front and rear diamond crossovers, allowing the terminal to be operated by loop, stub, or pullback. If both front and rear diamond crossovers are not to be provided, a front diamond crossover (optional stub operation) is preferable to a rear diamond crossover (optional pullback operation) in combination with a loop.

DISCUSSION:

The loop is the simplest, most beneficial turnback arrangement. It provides the greatest amount of track capacity compared to any other simple configuration. It maximizes safety and efficiency by eliminating conflicting moves by in-service trains and by eliminating the need to change ends. Because passengers do not enter and leave trains at the same time or place passenger flows are smoother. Passengers are brought into station access quickly and smoothly and are less subject to terminal delays.

Loop operations are less costly because they do not require more than one crew per train, as opposed to pullback operations. Crew reliefs at pullback terminals are frequently made such that two crews are on board during pullback, resulting in greater platform time.

Recommendations for additional facilities (front and rear diamond crossovers) correspond to the overall goal of increasing operations flexibility. Operational flexibility would minimize the effects of a fouled loop upon service.

If a loop is available, it is always used in normal operations; any diamond crossover would be used only in emergencies. Therefore, given that only one emergency crossover is to be provided, it would be located in front of the station because:

1) the operation of a rear crossover requires more clear track for operation than a front crossover, making it more likely to be fouled along with a fouled loop; and,
2) trains can be turned more quickly with a front crossover, to clear up delays caused by a fouled loop.

RELATED STANDARDS:

L-1, L-2, O-1, O-6, O-7, O-11, O-12, E-7

O-16 TERMINAL STATION TURNBACK: WITHOUT A LOOP

PRESENT STANDARD:

none stated

RECOMMENDED STANDARDS:

1. If a loop facility is not feasible, a facility with front and rear diamond crossovers and tail tracks is recommended.

2. If only one diamond crossover is included, a pullback facility is preferable to a stub facility.

3. If a stub terminal is the only feasible design available at least three tracks are needed.

DISCUSSION:

The first and third recommendations are based upon the overall goal of maximizing terminal capacity. In general, pullback facilities accommodate closer headways than stub facilities, since trains may layover in the tail tracks while others arrive and depart from the station. Pullback facilities are also preferable to stub facilities because they simplify passenger flows and because tail tracks are useful for cab signal testing and temporary storage of bad order trains.

RELATED STANDARDS:

L-1, L-2, O-1, O-6, O-7, O-11, O-12, E-7

PLANNING STANDARDS FOR YARD FACILITY ELEMENTS

This section discusses design elements which impact upon the operational capabilities and flexibilities of yards. Discussion is limited to whole elements and does not include Engineering detail, which is outside the realm of this study. These elements are essential to the realization of the goals outlined in the Introduction.

Facility Elements Standards are applicable to both ballasted and elevated yards, unless otherwise noted.

E-1 TRACK CENTER SPACING: STORAGE TRACKS

PRESENT STANDARD:

Yard storage tracks should be placed with twelve feet between centers. Where low profile lighting is used tracks should be placed with thirteen feet between centers.

RECOMMENDED STANDARD:

Yard storage tracks should be placed with a minimum of thirteen feet between centers. Where high level lighting is used track spacing may be reduced to twelve feet between centers to conserve space.

DISCUSSION:

Present standards represent acceptable minima, as opposed to actual preferences, which are greater. This is reflected in the recommended changes. However, since in every case limited amounts of land and capital are available for yard facilities, ultimately a compromise must be made between the spacing of tracks and the number of tracks.

RELATED STANDARDS:

E-2, E-5, E-6, E-11, E-16, E-18, E-19

E-2 TRACK CENTER SPACING: YARD TRACKS ADJACENT TO MAINLINE TRACKS

PRESENT STANDARD:

none stated

RECOMMENDED STANDARD:

A storage track and running track should be separated by a minimum of eighteen feet between track centers.

DISCUSSION:

Tracks must be separated to provide a safe working space near high speed trains.

RELATED STANDARDS:

E-1, E-3

E-3 YARD PERIMETER SAFETY BARRIER

PRESENT STANDARD:

none stated

RECOMMENDED STANDARD:

If less than eighteen feet are available between a storage track and running track, a handrail or similar device is recommended, placed equidistant from the two tracks. Such a safety barrier should be electrically safe.

DISCUSSION:

A safety barrier would minimize the possibility of an employee accident.

RELATED STANDARD:

E-2

E-4 CONTACT RAIL PLACEMENT

PRESENT PRACTICE:

Contact rails are generally paired in alternate aisles between storage tracks.

RECOMMENDED STANDARD:

Contact rails should generally be located to one given side of all storage tracks, such that no more than one third rail will be between a given pair of tracks.

DISCUSSION:

The recommended standard will improve safety by eliminating aisles with two contact rails.

E-5 WALKING SURFACES

PRESENT STANDARD:

Presently, hard walking surfaces are restricted to wood decking in elevated yards. In ballasted yards, no special walking surface is provided.

RECOMMENDED STANDARD:

All yards should have walkways with hard, even surfaces.

JUSTIFICATION:

Such walkways provide greater employee safety and increase efficiency, particularly by facilitating snow removal.

RELATED STANDARD:

E-6

E-6 WALKING SURFACES: PLACEMENT

PRESENT STANDARD:

Elevated yards must have continuous decking.

RECOMMENDED STANDARD:

Elevated yards must have continuous decking. In ballasted yards, hard surface walkways should be located between all storage tracks and at the cut and add area.

DISCUSSION:

Locating hard surface walkways in pathways which personnel traverse in ballasted yards should reduce unsafe walking conditions.

RELATED STANDARDS:

E-1, E-2, E-3, E-4, E-5, E-18, E-22

E-7 INTERLOCKING PLANT

PRESENT STANDARD:

Switches at yard entrances should be interlocked; switches in yard interiors should not be interlocked.

RECOMMENDED STANDARD:

no change

DISCUSSION:

The yard entrance is the interface between the yard and mainline; interlocking protects the integrity of mainline operations. Interlocking yard interior switches (along leads at storage tracks) would significantly reduce the storage capacity that could be provided in a given space, because stopping distances must be accounted for in interlocking plants.

RELATED STANDARDS:

L-2, O-1, O-8, E-9

E-8 SWITCHES: MECHANICS

PRESENT STANDARDS:

Interlocked switches should be powered and fixed; switches which are not interlocked should be handthrow and trailable.

RECOMMENDED STANDARDS:

no change

DISCUSSION:

Given current technology, present standards minimize the total need for towermen and switchmen.

RELATED STANDARDS:

E-7, E-10, E-11

E-9 SWITCHES: GEOMETRY

PRESENT STANDARD:

Yard switches may diverge at an angle of 11^{O} 25' 16" (#5) or less.

RECOMMENDED STANDARD:

Switch angles should be as small as practical space considerations permit and not larger than 11^{O} 25' 16" (#5).

DISCUSSION:

Smaller switch angles provide greater allowable operating speeds and require less maintenance.

RELATED STANDARDS:

E-8, E-10

E-10 DOUBLE-SLIP SWITCHES

PRESENT STANDARD:

Double-slip switches may diverge at angles greater than or equal to 9^{O} 31' 38" (#6) and less than or equal to 11^{O} 25' 16" (#5).

RECOMMENDED STANDARD:

Double-slip switches may diverge at angles greater than or equal to 9^{O} 31' 38" (#6) and less than or equal to 11^{O} 25' 16" (#5). The use of double-slip switches should be kept to a minimum.

DISCUSSION:

Although they conserve space in a yard layout, double-slip switches have characteristically high construction and maintenance costs. The use of double-slip switches to conserve space often results in constricted yard movement: more tracks converging on a single switch requires more trains to pass through the same switch.

RELATED STANDARDS:

L-2, E-9, E-10

E-11 COVERED STORAGE (BALLASTED YARDS)

PRESENT STANDARD:

none

RECOMMENDATION:

The development of shed-covered storage facilities should be given further study.

DISCUSSION:

Although it would represent a significant investment, covered storage would greatly facilitate operations during adverse winter weather conditions. Because train movements over yard storage tracks are infrequent, CTA's uncovered overrunning third rail is vulnerable to icing in open yards. Snow protection would also minimize the potential for snow-bound ballasted yards caused by blown and drifted snow. Currently, drifting snow often settles in switches faster than it can be melted by switch heaters. Additional problems arise from melted snow re-freezing before it can drain away. Development of air rights over yards could provide such covered storage at a nominal cost.

RELATED STANDARDS:

L-5, E-1, E-5, E-12, E-13

E-12 DRAINAGE (BALLASTED YARDS)

PRESENT STANDARD:

none stated

RECOMMENDED STANDARD:

A drained subgrade is required in all ballasted yards.

DISCUSSION:

Proper drainage reduces track maintenance.

RELATED STANDARDS:

L-5, E-11, E-13

E-13 TRACK MATERIALS (RAIL, TIES, BALLAST)

PRESENT STANDARD:

none stated

RECOMMENDED STANDARD:

Track materials should be of types selected based upon site requirements.

DISCUSSION:

Material selections based upon usage will result in the least overall costs.

RELATED STANDARDS:

L-1, E-11, E-12

E-14 SUPPORT SYSTEMS: CONTROL

PRESENT STANDARD:

none

RECOMMENDED STANDARD:

Master controls for all yard support systems, including communications, lighting, switch heat, emergency traction power cut off, and fire alarm systems, should be located in the Yard Foreman's Office.

DISCUSSION:

Such location places control in the proper authority, preventing misuse of the systems.

RELATED STANDARDS:

E-15, E-16, E-17, E-18, E-20, E-21

E-15 SUPPORT SYSTEMS: COMMUNICATIONS

RECENT DEVELOPMENTS:

A yard communications system is currently being developed utilizing portable space radios.

RECOMMENDATION:

The task force recommends the implementation of the portable system and of additional redundant fixed wire systems in each yard, as backup.

DISCUSSION:

A portable communications system will provide maximum flexibility; backup fixed systems would insure maximum reliability.

RELATED STANDARDS:

E-14, E-18, E-20, E-21

E-16 SUPPORT SYSTEMS: LIGHTING

PRESENT STANDARD:

none stated

RECOMMENDED STANDARD:

Minimum acceptable illumination is two footcandles at ground level in all working areas, and five footcandles along emergency access roads and in cut and add areas. This is best provided by a multiple-fixtured, low profile lighting system between tracks.

DISCUSSION:

Adequate lighting (illuminating aisles, contact rails, and personnel on foot) provides safety and efficiency factors. Low profile lighting is particularly well-suited for these purposes because it provides more evenly distributed light, with less shadowing and less overflow into surrounding areas than high-level lighting. However, because low profile lighting requires additional space between tracks, high level lighting is well-suited to providing compact storage on sites of very limited dimensions.

RELATED STANDARDS:

L-5, E-1, E-12, E-14, E-18

E-17 SUPPORT SYSTEMS: TRACTION POWER CUTOFF

PRESENT STANDARD:

none

RECOMMENDED STANDARD:

A traction power cutoff switch for an entire yard should be located in each yard foreman's office. Manual re-energization switches should be provided for each storage track and leads.

DISCUSSION:

Adequate traction power control is necessary for security and safety. In the case of a fire in a yard, this would allow a maximum number of endangered cars to be moved, while still providing a safe working area for firemen.

RELATED STANDARDS:

E-14, E-18

E-18 SUPPORT SYSTEMS: FIRE PROTECTION

PRESENT STANDARD:

none

RECOMMENDED STANDARD:

Suitable and adequate fire protection systems must be provided for respective use by CTA personnel and by local municipal fire departments. Fire extinguishers and alarm boxes must be adequately spaced and strategically located. By law, 20 lb. multi-purpose fire extinguishers must be located in every aisle a maximum of two hundred feet apart. Alarm boxes should be located along access roads, in each aisle, so that a fire location may be adequately identified to the responding municipal fire department. Alarms should be received in the Yard Foreman's Office and nearest Transportation Department Office. Fire extinguisher and alarm boxes should be mounted such as to provide visibility and access.

Readily available access to a yard by emergency vehicles is essential. Such access would best be provided by twelve-foot-wide, paved roadways traversing all tracks at intervals of regular full consists, placed to take best advantage of surrounding public roadways. In addition to providing emergency access, such roads would facilitate all lateral movement across a yard and inhibit the spread of fire down a yard. Fire hydrants should be strategically located along each access road so that a fire anywhere in the yard could be fought from two sides simultaneously. Hydrants should have couplings approved by the local municipal fire department.

DISCUSSION:

Replacement costs, for capital investments that could be lost in an uncontained fire in a car storage facility, justify capital expenditures for adequate fire protection systems.

Provisions for fire protection of yards are based upon the premise that CTA personnel are, and should only be trained in limited fire fighting techniques. The responsibility of CTA personnel in case of a fire is to 1) sound an alarm, 2) attempt to extinguish or contain a fire with a fire extinguisher only, 3) move endangered cars, equipment, etc.

Facilities should be provided to enable CTA personnel to perform those functions and to facilitate additional fire fighting by a municipal fire department.

RELATED STANDARDS:

L-3, L-4, O-3, O-5, O-6, E-1, E-5, E-6, E-7, E-14, E-15, E-16, E-17

E-19 SUPPORT SYSTEMS: REFUSE DISPOSAL

PRESENT STANDARD:

none

RECOMMENDATION:

The task force recommends that intensive study be given to the development of systems for the disposal and storage of refuse from the routine cleaning of trains.

DISCUSSION:

Such systems could greatly increase employee efficiency.

RELATED STANDARD:

L-5

E-20 CUT AND ADD AREA: FACILITIES

PRESENT STANDARD:

none stated

RECOMMENDED STANDARD:

Cut and add areas should be provided with suitable walking surfaces on both sides of trains, with adequate lighting and fixed-wire switchman communications, if located considerable distance from the yard foreman's office. A heated switchman's shelter should be provided near the cut and add area.

DISCUSSION:

Adequate facilities provide optimal conditions for efficient operations. The provision of efficient cutting and adding is essential to the policy of running trains of varying length to meet ridership demand.

RELATED STANDARDS:

O-8, E-5, E-6, E-15, E-21

E-21 EMPLOYEE WORK FACILITIES

PRESENT STANDARD:

none stated

RECOMMENDED STANDARD:

Employee work facilities (such as foreman's offices, switchman's shelters, and signal maintainer's storage) should be adequate and located to provide optimal use of employee time.

DISCUSSION:

Adequate and properly located facilities increase employee efficiency and improve general working conditions.

RELATED STANDARDS:

0-7, E-14, E-15, E-17

E-22 EMPLOYEE CONVENIENCE FACILITIES

PRESENT STANDARD:

none stated

RECOMMENDED STANDARD:

Employee convenience facilities (such as washrooms, lunchrooms, and locker facilities) should be adequate and consolidated as much as possible.

DISCUSSION:

Adequate facilities improve general employee working conditions. Consolidation increases the effectiveness of each capital investment.

RELATED STANDARD:

E-20