CHAPTER 5
OPEN STORAGE

5-1. General.

Open storage areas are portions of the depot that are used for the storage of goods that do not require extensive protection from the elements. They are generally unimproved or semi-improved areas which do not provide any cover for the materials stored therein. These areas should be provided with the same access that is given to warehouses and sheds as well as shipping and receiving facilities that are necessary for open storage functioning. For planning purposes, a partial list of materials that may be stored in open storage can be found in Department of the Army Supply Bulletin SB 740-1.

a. Improved areas. Open storage areas which are the most flexible as storage sites are the improved areas. These sites are cleared of vegetation, graded, and provided adequate drainage, and then given some sort of hard treatment. This allows the storage of many items that would not be suitable on unimproved areas due to the increased bearing capacity of the surface and the high level of control of runoff. Typical materials used to surface the area are concrete slab and asphalt pavement. Less suitable materials would be steel mat and crushed and rolled stone. These latter methods of improving the surface will not allow maximum bearing capacities on the ground surface.

b. Semi-improved areas. These areas are similar to improved areas in that they are graded and drained, but they are not provided with a hard top surface. The bearing capacity of semi-improved areas will change with the moisture content of the soil and in wet conditions will not bear as heavy a load as in dry conditions.

c. Unimproved areas. Surfaces that have not been graded, drained, or hard-surfaced are classified as unimproved. Irregular surface contours do not allow uniform storage heights, and lack of grading and drainage tends to promote localized areas of water ponding and to reduce bearing capacity due to saturation of the soil. This is the least desirable form of open storage area since it does not promote dense storage practices nor does it provide for acceptable access to the storage area.

5-2. Surfacing requirements.

a. Choice of pavement type. The factors that affect the surfacing requirements of improved open storage areas include vehicle characteristics, traffic volume and flow patterns, material accessibility, and weight requirements of the stored material. Types of surfaces that are frequently used on improved storage areas: rigid pavements, flexible pavements and roller compacted concrete pavements (RCCP). The choice of type depends upon the usage requirements listed above. Rigid pavement applications such as concrete slabs are durable, long lasting, capable of resisting larger loads, and unaffected by the normal range of temperature fluctuation experienced throughout the year. They do require considerable labor in fabrication and are generally the more expensive method of providing improved surfacing. Flexible pavements are less durable, more sensitive to high temperatures, require greater base and subbase preparation, deflect more than rigid pavements under load, and in recent years have not provided much of a price advantage over rigid pavements. For flexible pavements, the mechanical handling equipment (MHE) wheel characteristics vary to such an extent that for similar load-carrying capacities, different vehicles may require different surfacing requirements. The wheel loads, number of wheels per vehicle and their arrangement on the vehicle, the tire contact pressure, and the tire contact area all determine the pavement loading and consequently its thickness. Because of this variation in pavement requirements, the engineering construction and maintenance effort may be several times greater for one vehicle than for another with equal load-carrying capability.

b. Traffic volume and flow patterns. Traffic volume is a primary consideration in the selection of the type of surfacing and its required thickness. It is essential that an adequate study be made to determine the number of passes and the operational flow patterns of each vehicle under consideration so that a reasonable design volume for a particular facility and vehicle can be selected. The material selectivity will also affect the type and thickness of the pavement. Selectivity involves the relative ease with which material can be located and removed from the storage area. Items stacked such that other items must be moved in order to access the needed item will require a number of vehicle passes dependent on the size and number of items to be moved. In this situation, the expected life of the pavement would be shortened due to the increased number of passes.

c. Weight requirements. The bearing capacity of the pavement will essentially determine the height to which open storage material can be stacked or the maximum weight of items in one area. The type and thickness of pavement will depend on these storage requirements. Summer heat affects most flexible pavement surfaces; and, subsequently, improper base and subbase construction can cause sinking and puncturing of the pavement surface under heavy loading.

5-3. Aisle and track layout.

Each open storage area will require specialized attention to provide the proper aisle and track layout for the particular material being stored on the area. The type of material will generally dictate the dimensions used and the proper MHE needed to accomplish transportation of the material. In general, though, efficient open storage layouts provide for straight-line flow of stock from loading and unloading areas to storage areas, ready access to each stock location, and both maximum and efficient utilization of road and track facilities. Aisles in open storage areas will be essentially roads since the dimensional requirements for MHE are large. Main aisles should be located in the longitudinal direction of the storage space, while cross aisles should be placed perpendicular to the main aisles. One efficient layout of main and cross aisles produces rectangular storage areas that are twice as long as they are wide. In large open storage areas, every alternating main aisle should be equipped with double track to accommodate cars to be loaded on one track while rail-mounted loading cranes occupy the other track to facilitate loading or unloading. Double-track layouts shall have crossovers at intervals of 300 to 1500 m (1,000 to 5,000 ft). Single-track layouts of more than 300 m (1,000 ft) should have rail connections at both ends. Figure 5-1 shows one example of open storage layout, and additional layout information can be found in DOD manual 4145.19-R-1.

5-4. Loading and unloading platforms.

a. Size. Within each open storage area there should be at least one rail car loading and unloading platform. Side-loading platforms should be at least 6 m (20 ft) wide and at least one car length long. The length is preferably two car lengths. The platform should be located such that the side face is 1880 mm (6 ft 2 in) from the center line of the track, and the elevation of the top of the platform should be 1150 mm (3 ft 9 in) above the top of the rail. Ramps up to the platform should have a slope no greater than 15 percent. If the platform is also to serve flat cars in which the cargo is to be unloaded from the end of the car, and end-loading platform should be constructed. The dimensions should be similar to the side-loading platform except that the width of the platform at the end-loading portion should be 10 m (32 ft) wide (fig 5-2).

b. Materials. The platforms can be constructed of concrete, wood, or earth-filled timbers. The type of construction should be based on the expected service loads and environmental conditions that the ramp and platform will experience.

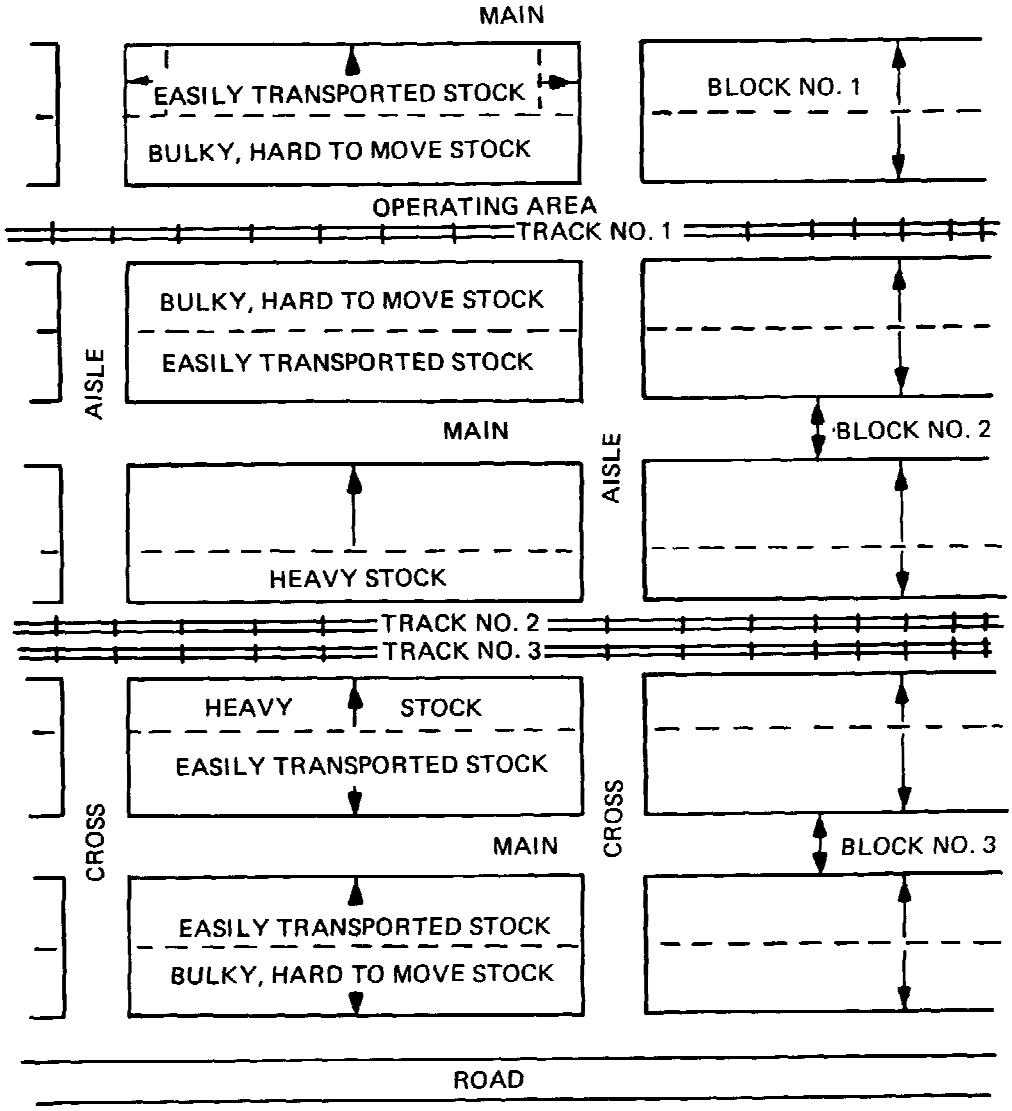

Figure 5–1. Example layout for open storage area.

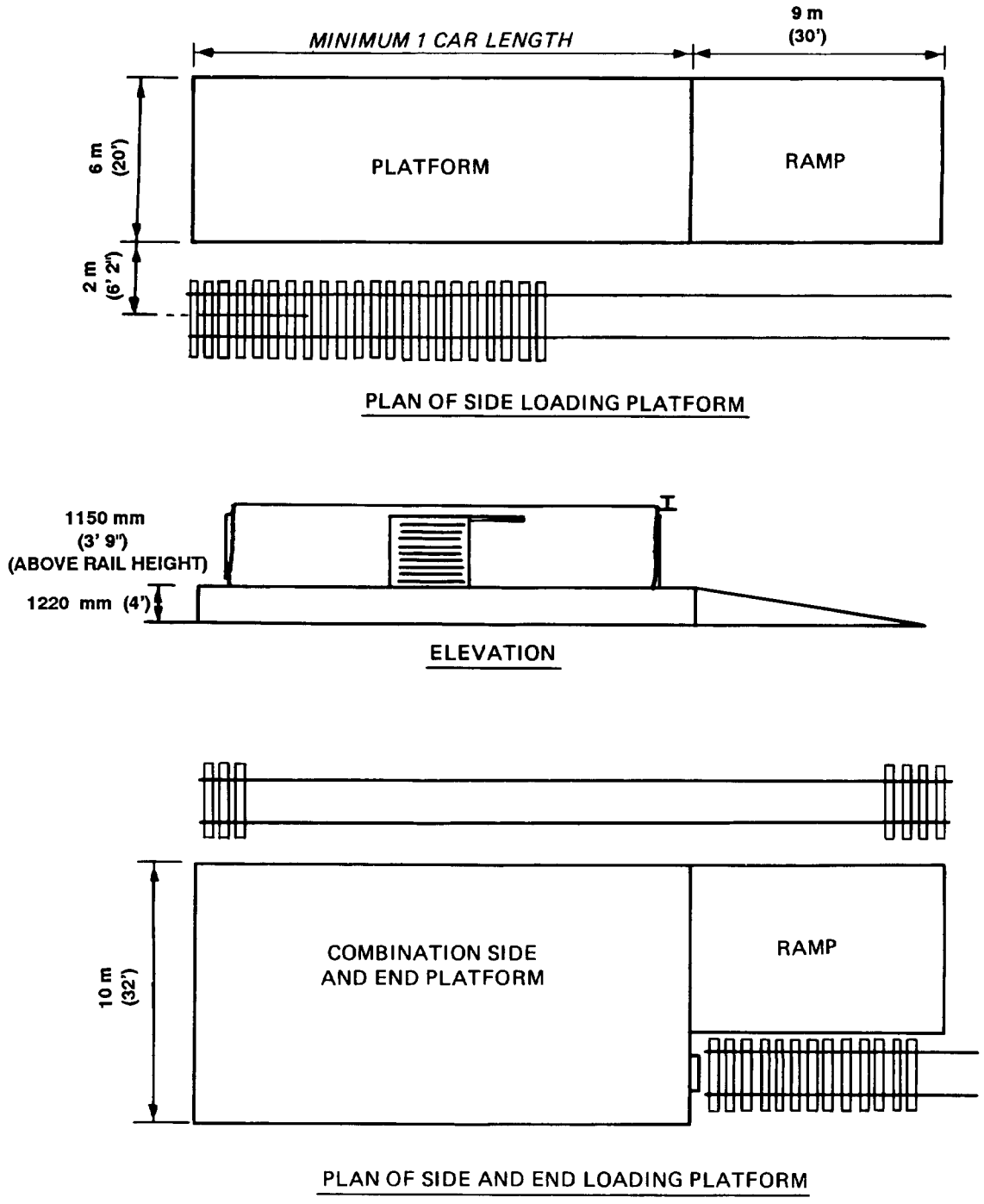

Figure 5–2. Sketch of end- and side-loading platforms.