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**United States
Department of
Agriculture**

Agricultural
Marketing
Service

Marketing
Research Report
Number 1145

Selecting A Dairy Plant Cooler and Dock Loadout Facility

Charles F. Stewart

STEWART
1967

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Summary

Selecting the proper arrangement of individual plant areas to fit a given set of conditions is a continuing problem to dairy operators. One area that presents particularly difficult choices is the cooler and dock loadout facility, where mistakes frequently are made due to the many variables to consider and the lack of available information on the subject. Factors that play a vital role in the decision process include the existing or planned location of the cooler in the overall plant layout, the availability of expansion space, the impact a particular arrangement may have on other operations, and the type and number of trucks and the volume of products distributed by each.

Twenty cooler and dock loadout arrangements commonly found in plants throughout the dairy industry are presented in this report. The coolers in 8 of the arrangements extend to the outside perimeter, and those in the other 12 arrangements are within the main body of the plant. The cooler illustrated in all of the arrangements is 30 feet wide by 80 feet long and has a maximum storage capacity of 25,000 gallons of products. Three types of trucks (wholesale, retail, and semitrailers) and two levels of emphasis on the numbers of each were used in developing the various combinations that could exist in plants handling comparable volumes. These combinations were used as a basis in developing the specific design characteristics and operational criteria of each arrangement. The types A and B series arrangements have greater application in the construction of new facilities than in remodeling existing plants, and types C, D, and E are normally used in remodeling existing plants where various restrictions exist.

A detailed description of the arrangements, including layout plans and improved operating methods, is presented in this report. Also presented are the conditions in which each would have direct application to a particular set of circumstances that could exist at any plant location. A cost analysis of the arrangements revealed that cost plays only a minor role and should not be a determining factor in the selection process. The small differences in cost between the various arrangements can be easily justified on the basis of selecting the one specifically designed for a given operation.

Dairy plant operators are constantly seeking information on the most efficient means of handling products that might be incorporated into the expansion of existing facilities or the construction of new facilities. The information contained in this report will enable them to compare the conditions that exist at their plants with those that apply to the different arrangements and to select the one best suited to their operations. In the unlikely event that the circumstances that exist at a given plant location are far different from those provided for in any of the presented arrangements, desired parts of any of them can be combined in developing one that meets the specific requirement. Maximum operating efficiency is attained by matching the functions to be performed to a properly planned facility.

Selecting A Dairy Plant Cooler and Dock Loadout Facility

By Charles F. Stewart¹

Selecting the proper arrangement of facilities to efficiently process and handle a given volume of products is a continuing major concern to dairy plant operators. The selection process has been compounded by many facility-related changes that have occurred within the dairy industry. The trend to fewer and larger volume plants has resulted in congested facilities, with little or no space available for expansion. This problem is due mainly to the failure of plants to acquire sufficient property initially and to the construction of other facilities adjacent to the plant site. Most of the plants operating today are older facilities that have been expanded on numerous occasions, to meet production demands, without proper consideration of the interior arrangement of the individual plant areas. The addition of new product processing is also responsible for a large share of the unfavorable conditions that exist in many plants. These changes and others not only have contributed to poor operating efficiency but also have created difficulties for plant operators in selecting an arrangement for individual areas that will best compensate for built-in restrictions and permit growth.

To increase efficiency and solve expansion problems, dairy plant operators can either construct new facilities or remodel existing facilities. Because of the high cost of constructing new facilities, the difficulties involved in relocating a business, and the enormous problems associated with disposing of an existing plant, remodeling, whenever possible, is the only reasonable choice. In most cases, existing facilities can be remodeled and expanded to accommodate growth by improving utilization of available floorspace; to the extent possible, keeping the operational-related areas together in a sequential flow pattern; and selecting the type of arrangement for each plant area that will be the most practical and efficient to fit a particular set of circumstances.

Dairy processing plants are composed of many individual areas, most of which can be expanded to handle increased volume by installing equipment with increased capacity and by utilizing multilevel construction. The cooler and dock loadout facility was selected for study because it constitutes a vital part of a total plant operation and its expansion presents a serious problem due to the additional ground level space normally required both within the plant and on the outside perimeter. It is also an area where mistakes are frequently made in selecting the proper type of arrangement due, in part, to the lack of available information on the subject.

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Selecting the Proper Arrangements

The purpose of this study was to secure information that can aid dairy plant operators in selecting the proper type of cooler and dock loadout arrangement that will best fit a given set of commonly found plant conditions. The major factors that must be considered in selecting a particular arrangement, either for an existing plant or for new facilities, are developed and discussed in detail. Layout plans, operating methods, and special features are presented for 20 common types of arrangements, including a description of the conditions in which each would have direct application. The report also includes a cost comparison of the various arrangements and conclusions on the effect of cost on the selection process.

The steps required in selecting the proper arrangement of individual plant operations to fit a given set of conditions are as follows:

- Determine the individual requirements for each operation.
- Consider the major factors affecting the selection.
- Choose the type of arrangement that best fits the requirements.

Several major factors that must be considered in the selection process apply to both the remodeling of existing plants and the construction of new facilities. The following is a discussion of those that are directly related to the selection of cooler and dock loadout arrangements.

Cooler Location in Overall Plant Layout

The location of the cooler in an overall plant layout places limitations on the types of dock loadout arrangements that can be utilized. In instances in which the cooler is located within the main body of the plant, a separate dock arrangement extending to the outside perimeter must be provided for loading trucks. When the cooler extends out from the main body of the plant, an adjoining dock is required for the loading and unloading operations. This latter arrangement is fairly typical throughout the industry and contributes to lower operating costs than those for the former arrangement, regardless of whether plant personnel or drivers are responsible for loading trucks:

Availability of Expansion Space

The availability of expansion space is probably the most important factor in selecting among alternative layouts and normally dictates the arrangement required for a given situation. When expansion space is readily available for a new dock and loadout facility at an existing plant or on the construction site, the cooler and adjoining dock are normally built on the outside perimeter. However, when an existing plant has space restrictions on its outside perimeter, the cooler should be expanded within the main body of the plant to avoid creating additional problems in providing accessibility of trucks to the dock. When expansion space is not available within the plant, the cooler and loading dock must be extended in some fashion to the outside perimeter. If space restrictions exist both within the plant and on the outside perimeter, expansion capability is severely hampered and the construction of new facilities should be considered.

Separation of Related Areas

Whether the cooler and adjoining dock area and the empty-case storage room area are together or in separate locations is of major importance in the selection process.

Description and Utilization of the Common Types of Arrangements

When new facilities are constructed, the areas are normally kept together or reasonably close to one another and connected by a common conveyor system. In existing plants where the areas are widely separated and cannot be served by a common conveyor, separate facilities is the only viable option available. Although this separation does not present a serious problem, it does complicate the loading and unloading operations and increases traffic congestion on the site.

Impact on Other Operations

The impact of a particular arrangement on other plant operations must be considered in the selection process. A cooler and dock loadout arrangement that interferes with other operations by preventing access by personnel and vehicles, disrupting the normal flow pattern within the plant, and restricting expansion capabilities should be avoided to the extent possible. This problem is more likely in older, more congested plants than in newer facilities and must be carefully evaluated to prevent a costly error.

Types and Number of Trucks

The types and number of trucks associated with an operation and the total volume distributed by each have a direct impact on the selection of a particular arrangement. In most cases facilities are required for loading and unloading both retail and wholesale trucks, as well as semitrailers. Retail trucks are van-type vehicles used to distribute products in small quantities to a large number of retail stores and to deliver them to homes, whereas wholesale trucks, which are of conventional design, normally distribute products in large quantities to a minimum number of outlets. Truck capacities range from 80 to 175 cases per retail truck and from 130 to 350 cases per wholesale truck, depending on the length of the vehicles. Semitrailers are over-the-road vehicles used to transport large volumes of products (approximately 800 cases), over substantial distances, with detachable trailers ranging from 38 to 45 feet in length. The loading and unloading of semitrailers has a greater influence on the selection process than does the loading and unloading of retail and wholesale trucks because of the additional dock space and equipment required for the semitrailer operation.

Cost of the Different Arrangements

The cost of constructing and operating a cooler and dock facility with the different arrangements could be an important factor in the selection process. However, the need of a given facility to perform a desired function may outweigh the differences in cost between different arrangements and render them of little importance. A detailed cost analysis of the different arrangements was conducted to determine the impact the cost factor has on the selection process and the results are presented in this report.

Five types (A, B, C, D, and E) of cooler and dock loadout arrangements, each series consisting of four possible choices, are commonly found in the industry. The type A series is the most common, followed by B, C, D, and E. The 20 arrangements represent the most advanced technology for storing, handling, and distributing a wide range of dairy products, and each is designed to accommodate both retail and wholesale trucks, as well as semitrailers. The coolers in 8 of the arrangements extend to the outside perimeter, and 12 are within the main body of the plant. These arrangements are not intended for high-volume plants, which normally process more than 100,000 gallons of products a day and handle them in palletized form for distribution in semitrailer lots to a minimum number of outlets over a broad geographical area. Plants of that type require a completely different concept for storing, handling, and distributing products and are not included in this report.

Layout plans are provided for each of the cooler and dock loadout arrangements to show how they can be used to accommodate a particular set of conditions that could exist at any plant location. The cooler used for illustrative purposes in all of the arrangements is 30 feet wide by 80 feet long and has a minimum ceiling height of 12 feet. It provides sufficient space for aisles and conveyor and for storing a maximum volume of 25,000 gallons of products. However, the cooler is fully capable of handling a much greater volume because of normal inventory rotation and direct passthrough loading. Retail route orders are either made up as loaded or assembled before loading, depending on the facility arrangement. Wholesale route orders are made up in advance, as products are received in the cooler, and stored in a predetermined sequence for loading. The products distributed by semitrailers are either held in a designated location within the cooler until ready for loading or allowed to flow by conveyor directly from the filling areas to the loading dock. Cooler personnel are responsible for receiving finished products for distribution, for assembling route orders, and for placing products on the conveyor for loading. The drivers are responsible for loading and unloading their own trucks.

Many design features are the same in all of the arrangements. In-floor power conveyors are used for moving cased products and returning empty cases. Loading flaps, dock bumpers, and electric plug-in lines or cords are provided at each loading point for the retail and wholesale trucks. Loading flaps and dock bumpers are also provided for semitrailers. Water outlets are installed on the docks in the arrangements in which all of the loading and unloading operations and the truck washing operations are conducted in one location. A gutter with drainage outlets is installed on the apron along the edge of the docks to facilitate the removal of wash water. Conventional drainage outlets are also installed on the aprons of the extended docks used in loading semitrailers. Guard rails are provided at specific locations to protect the building walls and docks from vehicular damage. The roof overhang extends 6 feet past the edge of the docks, and a maximum of 12 feet for the extensions required in loading larger numbers of semitrailers. The loading stalls for the retail and wholesale trucks are 10 feet wide, and those for semitrailers are a minimum of 12 feet wide.

The in-floor power conveyor system is not used for loading wholesale trucks in any of the arrangements because of the excessive space (approximately 6 feet) that would be required between the conveyor and the edge of the dock to hold the large-volume route orders that would have to be removed from the conveyor to prevent a tie-up of the conveyor system during the loading operation. The average distance that would be required to drag the cases from the dock onto the trucks would be approximately the same as dragging them directly from the cooler.

The widths of the wholesale and retail truck docks and the number of cooler doorways assigned to each dock vary in the different arrangements, depending on the requirements for a particular operation. In arrangements in which a conveyor is not used in loading trucks, the greater widths of the dock that are necessary when each doorway is used for loading two trucks rather than one increase the dragging distances for finished products and delay the loading operation. However, the narrower widths of the docks and the larger number of doorways (one doorway per truck stall) reduce loading time, but increase refrigeration losses.

In developing the specific design characteristics and operational criteria for each of the cooler and dock loadout arrangements, determinations were made concerning the potential combinations that could exist when considering three types of trucks, two levels of emphasis on the num-

bers of each, and the degree of probability of their occurrence in plants throughout the industry. They are categorized as follows:

Highly probable

Heavy wholesale	Light wholesale
Light semitrailer	Heavy semitrailer
Light retail	Heavy retail

Possible

Heavy wholesale	Light wholesale
Heavy semitrailer	Light semitrailer
Light retail	Heavy retail

Unlikely

Heavy wholesale	Light wholesale
Light semitrailer	Heavy semitrailer
Heavy retail	Light retail

Highly unlikely

Heavy wholesale	Light wholesale
Heavy semitrailer	Light semitrailer
Heavy retail	Light retail

Only the combinations that were identified as highly probable and possible were used in the development of the various arrangements. Table 1 shows the types and range in the numbers of trucks assigned to each emphasis level that was used in developing the combinations having direct application to a particular arrangement. The type and number of trucks in each category are based on the

Table 1.—Types and numbers of trucks used in developing combinations that are relatively common and applicable to a particular cooler and dock loadout arrangement

Type of truck	Emphasis level ¹	Number of trucks	Size of load (cases) ²	Average volume (gallons)
Wholesale	Heavy	14-18	200	12,800
	Medium	10-14	200	9,600
	Light	6-10	200	3,200
Semitrailer	Heavy	3-5	800	12,800
	Light	1-3	800	6,400
Retail	Heavy	14-18	100	6,400
	Medium	10-14	100	4,800
	Light	6-10	100	3,200

¹Represents the variations in the numbers of different types of trucks, from the largest to the smallest, normally found in each category.

²80 percent of maximum capacity.

volume distributed and the percentage relationship that normally exists between types of trucks found at plants throughout the industry. One of the exceptions to this relationship is that many plants no longer operate retail-type trucks because of the reduction in small-volume route order drops or the decline in home delivery. In those instances, the areas planned in the various arrangements for the retail operation will be used for loading and unloading wholesale-type trucks. The layout changes required would be minimal and would have little impact on operating procedures and costs.

For discussion purposes, the various dock arrangements are categorized and defined as follows:

- Common - the loading and unloading dock and the empty-case return dock are one and the same and equipped with a conveyor system.
- Separate - the loading and unloading dock and the empty-case return dock are in separate locations, and each has its own conveyor system.
- Common -extended - the loading and unloading dock and the empty-case return dock are in separate locations but are connected by an extension of the docks or by a passageway within the main body of the plant and equipped with a conveyor system.

Type A Series

In the type "A" series cooler and dock loadout arrangements, the coolers and docks are on the outside perimeter of the plant in close proximity to the empty-case storage rooms, and common docks with conveyor systems are used for loading and unloading trucks. The performance of all functions in one location reduces traffic congestion on the plant site. Furthermore, the various arrangements can be easily expanded to accommodate continuous growth without changing the basic flow pattern.

A-1 Arrangement Description—The A-1 arrangement (figure 1) extends out approximately 100 feet from the main body of the plant and has a common dock with a conveyor system for loading and unloading trucks. The cooler has 13 doorways—8 on the wholesale side, 2 on the retail side, and 3 to provide personnel access and operate the conveyor system. The dock area used by wholesale trucks extends out 2 feet and provides stall space for the direct loading of eight trucks simultaneously from the cooler. The 2-foot width minimizes the distance required in dragging the stacks of finished products from the cooler into the trucks. The two stalls near the end next to the conveyor are for unloading empty cases.

The dock area at the end of the cooler is 20 feet wide by 42 feet long and is used for storing empty cases and for loading and unloading semitrailers. The dock space provided was arbitrary and can be reduced or enlarged, depending on the storage space desired. Stall space is provided at the end of the dock for loading or unloading one semitrailer at a time through the vehicle side door. Additional trailers can be loaded or unloaded at the dock by the rear doors; however, the cost would be somewhat greater and more site space would be required to conduct the operations. The single stall is applicable when the emphasis level for semitrailers is light (less than three trailers a day).

The dock area used by retail trucks is 8 feet wide and provides 10 stalls for loading and unloading trucks. A 3-foot-wide space is provided between the conveyor and the outside edge of the dock. This space provides a temporary holding area for cases of finished products to prevent a tie-up of the conveyor system during the loading operation. The design provides flexibility for the rapid loading of either a small or large number of trucks without having an appreciable impact on operating cost. The 4-foot-wide area between the conveyor and the cooler wall provides space for storing empty cases and serves as a passageway for drivers and for cooler personnel. The two doorways are used to transfer product returns from the conveyor system and retail trucks back into the cooler.

Conditions Under Which Applicable.—

- a. Both cooler and dock are on the outside perimeter of the plant.
- b. Adequate space is available for expansion.
- c. A common dock with a conveyor system is used for loading and unloading semitrailers and retail trucks.
- d. Percentage of total fleet loaded daily, by type of vehicle (table 2), is as follows:

Wholesale trucks	50 to 65 percent
Semitrailers	5 to 10 percent
Retail trucks	20 to 35 percent
- e. Percentage of total volume distributed, by type of vehicle (table 2), is as follows:

Wholesale trucks	40 percent or more
Semitrailers	20 to 40 percent
Retail trucks	20 percent or less

A-2 Arrangement Description—The A-2 arrangement, not shown, is the same as for A-1 (fig. 1), except for the additional dock extension used for loading and unloading semitrailers, shown in figure 2. Stall space is provided for loading and unloading four trailers at a time. The multiple stalls are applicable when the emphasis level for semitrailers is heavy (three or more trailers per day). A detailed description of the extended dock is presented in the section of the report that describes the A-3 arrangement.

Figure 1.—Type A-1 cooler and dock loadout arrangement.

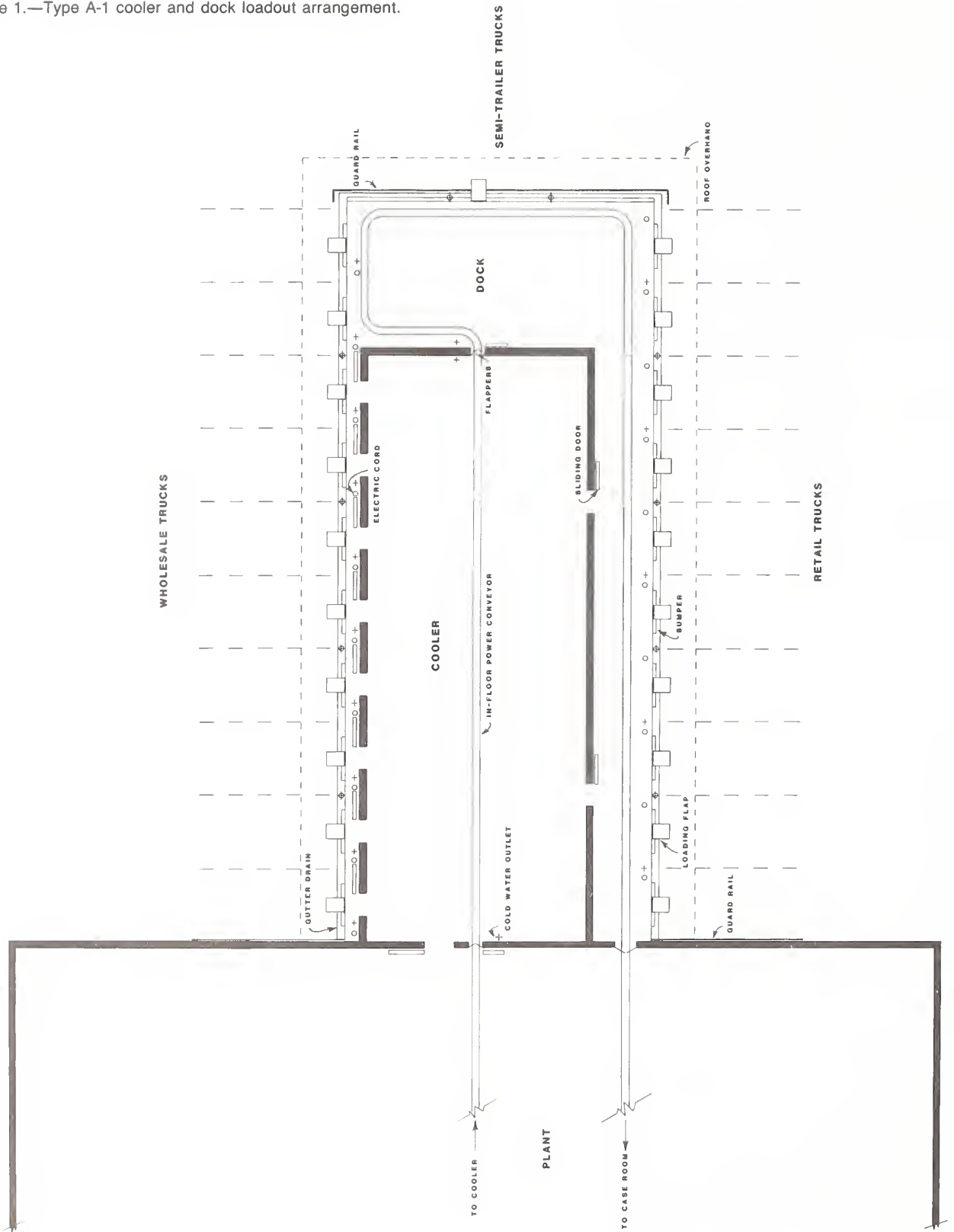
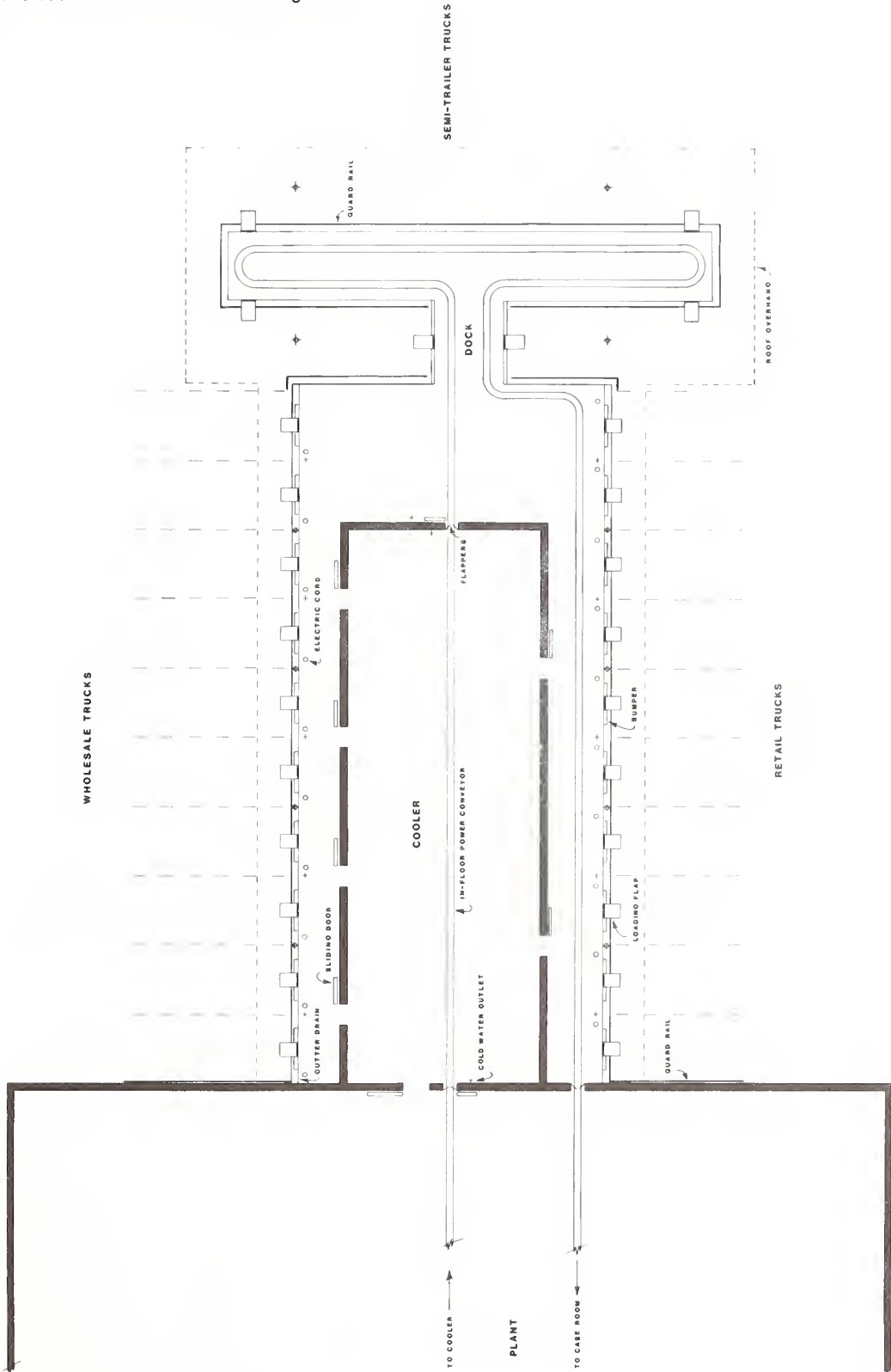


Figure 2.—Type A-3 cooler and dock loadout arrangement.



Conditions Under Which Applicable.—

- a. Both cooler and dock are on the outside perimeter of the plant.
- b. Adequate space is available for expansion.
- c. A common dock with a conveyor system is used for loading and unloading semitrailers and retail trucks.
- d. Loading a large number (10 to 15 percent of fleet) of semitrailers (table 2).
- e. An equal volume is distributed by wholesale trucks and semitrailers, and less than 20 percent is distributed by retail trucks (table 2).

A-3 Arrangement Description—The A-3 arrangement (fig. 2) is the same as for A-1 (fig. 1) except for A-3's greater width of dock (6 feet) used in loading wholesale trucks to compensate for the offset between the cooler doorways and the rear doors of the trucks, its reduced number of cooler doorways (nine), and its extended dock for loading and unloading semitrailers. The dock area used by wholesale trucks provides eight stalls for loading finished products and two for unloading empty cases. The cooler has four doorways on the wholesale side, each used for loading two trucks at a time.

The extended dock for loading and unloading semitrailers is T-shaped and provides stall space to accommodate four trailers simultaneously. Provisions are made for loading and unloading two trailers through their side and rear doors and two through the side doors only. The dock is 10 feet wide, with a 70-foot long section adjoining and parallel

with the end of the cooler. The conveyor is installed 2 feet from the outside edge of the dock and has a 4-foot-wide aisle in the center to allow for personnel movement.

Conditions Under Which Applicable—

- a. Both cooler and dock are on the outside perimeter of the plant.
- b. Adequate space is available for expansion.
- c. A common dock with a conveyor system is used for loading and unloading semitrailers and retail trucks.
- d. Percentage of total fleet loaded daily, by type of vehicle (table 2), is as follows:
 Wholesale trucks 20 to 35 percent
 Semitrailers 10 to 15 percent
 Retail trucks 50 to 65 percent
- e. An equal volume is distributed by wholesale and retail trucks, and 40 percent or more are distributed by semitrailers (table 2).

A-4 Arrangement Description—The A-4 arrangement, not shown, is the same as for A-3 (fig. 2) except that it does not have an extended, T-shaped dock for loading and unloading semitrailers. The equipment and facility design of the dock area at the end of the cooler is as shown in the A-1 arrangement (fig. 1).

Conditions Under Which Applicable.—

- a. Both cooler and dock are on the outside perimeter of the plant.
- b. Adequate space is available for expansion.

Table 2.—Combinations of types and numbers of trucks, the percentage range of total trucks in fleet, and total volume distributed for each of the types A and B series cooler and dock loadout arrangements

Type of arrangement	Type of truck	Emphasis level	Number of trucks	Percentage of total fleet	Percentage range of total fleet	Total volume distributed (gallons)	Percentage of total volume distributed	Percentage range of total volume distributed
A-1 and B-1	Wholesale	Heavy	16	61.5	50-65	12,800	57.1	40-60
	Semitrailer	Light	2	7.7	5-10	6,400	28.6	20-40
	Retail	Light	8	30.8	20-35	3,200	14.3	10-20
A-2 and B-2	Wholesale	Heavy	16	57.1	50-65	12,800	44.4	40-60
	Semitrailer	Heavy	4	14.3	10-15	12,800	44.4	40-60
	Retail	Light	8	28.6	20-35	3,200	11.2	10-20
A-3 and B-3	Wholesale	Light	8	28.6	20-35	6,400	25.0	20-40
	Semitrailer	Heavy	4	14.3	10-15	12,800	50.0	40-60
	Retail	Heavy	16	57.1	50-65	6,400	25.0	20-40
A-4 and B-4	Wholesale	Light	8	30.8	20-35	6,400	33.3	20-40
	Semitrailer	Light	2	7.7	5-10	6,400	33.3	20-40
	Retail	Heavy	16	61.5	50-65	6,400	33.4	20-40

- c. A common dock with a conveyor system is used for loading and unloading semitrailers and retail trucks.
- d. Loading a small number (5 to 10 percent of fleet) of semitrailers (table 2).
- e. An equal volume is distributed by all trucks (table 2).

Type B Series

In the type “B” series cooler and dock loadout arrangements, the coolers and empty-case storage rooms are widely separated, and each has its own dock and conveyor system for loading and unloading trucks. A description of the separate empty-case storage rooms and unloading docks are not provided because they do not have a direct impact on or play a critical role in the operations of the cooler and dock loadout facility. Except for the separate locations of facilities and the resulting increase in traffic congestion on the plant site, they can be operated relatively efficiently and are easily expanded to accommodate continuous growth.

B-1 Arrangement Description.—The B-1 arrangement (fig. 3) extends out approximately 85 feet from the main body of the plant, and the conveyor that extends from the filling areas is used for moving finished products into the cooler for order assembly and to the dock for the direct loading of semitrailers. The cooler has 16 doorways—8 on the wholesale side, 4 on the retail side, 2 to provide access by personnel, and 2 to provide for operation of the conveyor system. The dock area used in loading wholesale trucks is 2 feet wide, and a cooler doorway serves each of the eight stalls.

The 6-foot-wide dock at the end of the cooler is used for loading one semitrailer at a time through either the vehicle side or the rear door depending on the site space available. Since the dock is not intended for storing empty cases but is used primarily for personnel convenience, a width narrower than 6 feet may be desirable. The single trailer stall has application when the emphasis level for semitrailers is light (less than three trailers per day).

The retail truck dock is 6 feet wide and provides eight stalls for loading trucks. Four cooler doorways are provided, each used for loading two trucks at a time.

Conditions Under Which Applicable.—

- a. Both cooler and dock are on the outside perimeter of the plant.
- b. Adequate space is available for expansion.
- c. A separate dock is used for receiving empty cases.
- d. A conveyor system is used for the direct loading of semitrailers only.

- e. Percentage of total fleet loaded daily, by type of vehicle (table 2), is as follows:
 - Wholesale trucks 50 to 65 percent
 - Semitrailers 5 to 10 percent
 - Retail trucks 20 to 35 percent
- f. Percentage of total volume distributed, by type of vehicle (table 2), is as follows:
 - Wholesale trucks 40 percent or more
 - Semitrailers 20 to 40 percent
 - Retail trucks 20 percent or less

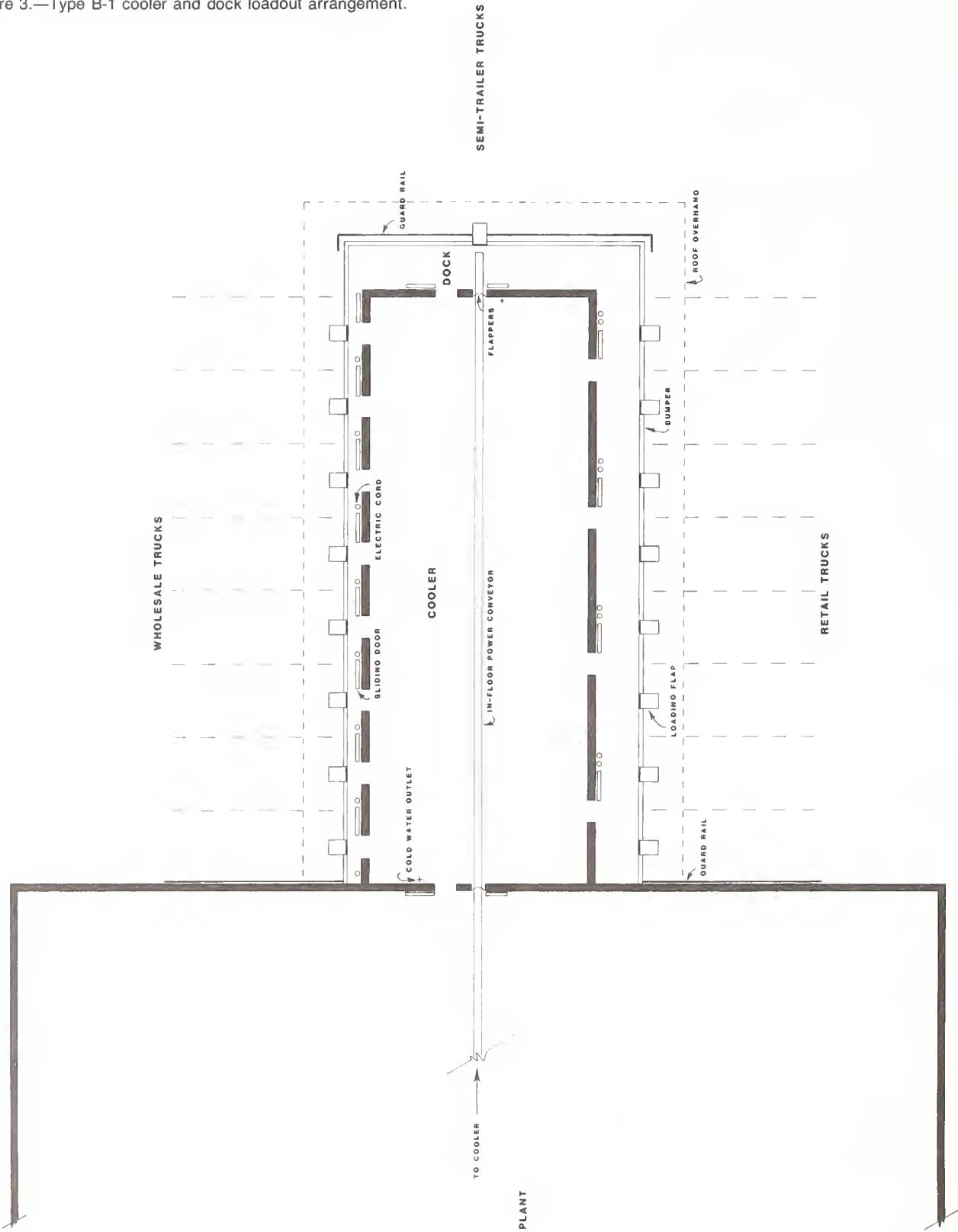
B-2 Arrangement Description.—The B-2 arrangement, not shown, is the same as for B-1 (fig. 3), except for B-2’s additional dock extension used for loading semitrailers, as shown in figure 4 for arrangement B-3. This arrangement is applicable when the emphasis level for semitrailers is heavy (three or more trailers per day). A detailed description of the extended dock is presented in that section of the report which describes the B-3 arrangement.

Conditions Under Which Applicable.—

- a. Both cooler and dock are on the outside perimeter of the plant.
- b. Adequate space is available for expansion.
- c. A separate dock is used for receiving empty cases.
- d. A conveyor system is used for the direct loading of semitrailers only.
- e. Loading a large number (10 to 15 percent of fleet) of semitrailers (table 2).
- f. An equal volume is distributed by wholesale trucks and semitrailers, and less than 20 percent is distributed by retail trucks (table 2).

B-3 Arrangement Description.—The B-3 arrangement (fig. 4) differs from B-1 (fig. 3) in the widths of B-3’s wholesale and retail truck docks, the reversal in the number of its cooler doorways that serve the wholesale and retail truck stalls, and its extended dock for loading semitrailers. The wholesale truck dock is 6 feet wide and provides eight stalls for loading trucks. Four cooler doorways on the wholesale-truck side are used for loading two trucks at a time. The retail truck dock is 2 feet wide, and a cooler doorway serves each of the eight loading stalls. The extended dock for loading semitrailers is T-shaped and provides stall space to accommodate four trailers simultaneously. Two trailers are loaded through the vehicles rear or side doors, and the other two are loaded through the side doors only. The dock is 5 feet wide and has a 64-foot-long section parallel to the end of the cooler. The conveyor, which terminates on the dock, is installed in the center of the dock, 2 feet from the outside edges.

Figure 3.—Type B-1 cooler and dock loadout arrangement.



Conditions Under Which Applicable.—

- a. Both cooler and dock are on the outside perimeter of the plant.
- b. Adequate space is available for expansion.
- c. A separate dock is used for receiving empty cases.
- d. A conveyor system is used for the direct loading of semitrailers only.
- e. Percentage of total fleet loaded daily, by type of vehicle (table 2), is as follows:

Wholesale trucks	20 to 35 percent
Semitrailers	10 to 15 percent
Retail trucks	50 to 65 percent
- f. An equal volume is distributed by wholesale and retail trucks, and 40 percent or more are distributed by semitrailers (table 2).

B-4 Arrangement Description.—The B-4 arrangement, not shown, differs from that for B-3 (fig. 4) in that it does not have an extended dock for loading and unloading semitrailers. The dock area at the end of the cooler is as shown in the B-1 arrangement (fig. 3).

Conditions Under Which Applicable.—

- a. Both cooler and dock are on the outside perimeter of the plant.
- b. Adequate space is available for expansion.
- c. A separate dock is used for receiving empty cases.
- d. A conveyor system is used for the direct loading of semitrailers only.
- e. Loading a small number (5 to 10 percent of fleet) of semitrailers (table 2).
- f. An equal volume is distributed by all trucks (table 2).

Type C Series

In the type “C” series cooler and dock loadout arrangements, the coolers are located within the main body of the plant and the docks on the outside perimeter. The coolers and case—storage rooms are in close proximity and have a common dock equipped with a conveyor system for loading and unloading trucks. Because trucks are loaded and unloaded at the docks, rather than directly from or to the coolers, the number of doorways needed is greatly reduced, thereby reducing refrigeration losses. These arrangements permit the performance of all functions in one location, and they can be performed relatively efficiently, even though additional labor is required of cooler personnel.

C-1 Arrangement Description.—The C-1 arrangement (fig. 5) has an L-shaped dock, the longer section of which is 15 feet wide and extends out 100 feet from the main body of the plant. The smaller section (10 by 25 feet) next to the plant supports the conveyor that returns the empty cases to the case-storage room. Stall space for loading and unloading 10 trucks at a time is available on the wholesale

side of the dock. A 6-foot-wide area is provided between the conveyor and dock edge for the temporary storage of finished products during the loading operations. The area at the end of the dock is used for loading and unloading one semitrailer at a time (light emphasis) by either the vehicle side or rear door, depending on available site space. Stall space for loading and unloading nine trucks at a time is available on the retail side of the dock. The 3-foot-wide area between the conveyor and dock edge serves the same purpose as the 6-foot width on the wholesale side. An additional stall is provided at the end of the smaller section of the dock, next to the plant, for unloading empty cases.

Conditions Where Applicable.—

- a. The cooler is within the main body of the plant, and additional loadout facilities are required on the outside perimeter.
- b. Adequate space is available for expansion.
- c. A common dock with a conveyor system is used for loading and unloading all trucks.
- d. Loading an equal number of wholesale and retail trucks (45 to 50 percent each of fleet) and a small number (5 to 10 percent of fleet) of semitrailers (table 3).
- e. An equal percentage range of total volume (20 to 40 percent) is distributed by semitrailers and retail trucks, and 40 percent or more are distributed by wholesale trucks (table 3).

C-2 Arrangement Description.—The C-2 arrangement (fig. 5) is the same as for C-1 (fig. 5) except for C-2’s additional dock extension used for loading and unloading semitrailers. The extended dock, which is applicable when the emphasis level for semitrailers is heavy, is designed to meet the same criteria as those for the A-3 arrangement (fig. 2).

Conditions Under Which Applicable.—

- a. The cooler is within the main body of the plant, and additional loadout facilities are required on the outside perimeter.
- b. Adequate space is available for expansion.
- c. A common dock with a conveyor system is used for loading and unloading all trucks.
- d. Loading a large number (10 to 15 percent of fleet) of semitrailers (table 3).
- e. Semitrailer volume is 40 percent or more of total, wholesale is 20 to 40 percent, and retail is less than 20 percent (table 3).

C-3 Arrangement Description.—The C-3 arrangement (fig. 6) differs from that for C-1 in that C-3’s dock is rectangular, 13 feet wide, and extends along the wall at the end of the cooler for the entire length of that side of the plant. Stall space is provided for loading and unloading six each of wholesale and retail trucks and one semitrailer through the rear door. The conveyor is installed 6 feet from the edge of the wholesale truck portion of the dock, and 3 feet

Figure 4.—Type B-3 cooler and dock loadout arrangement.

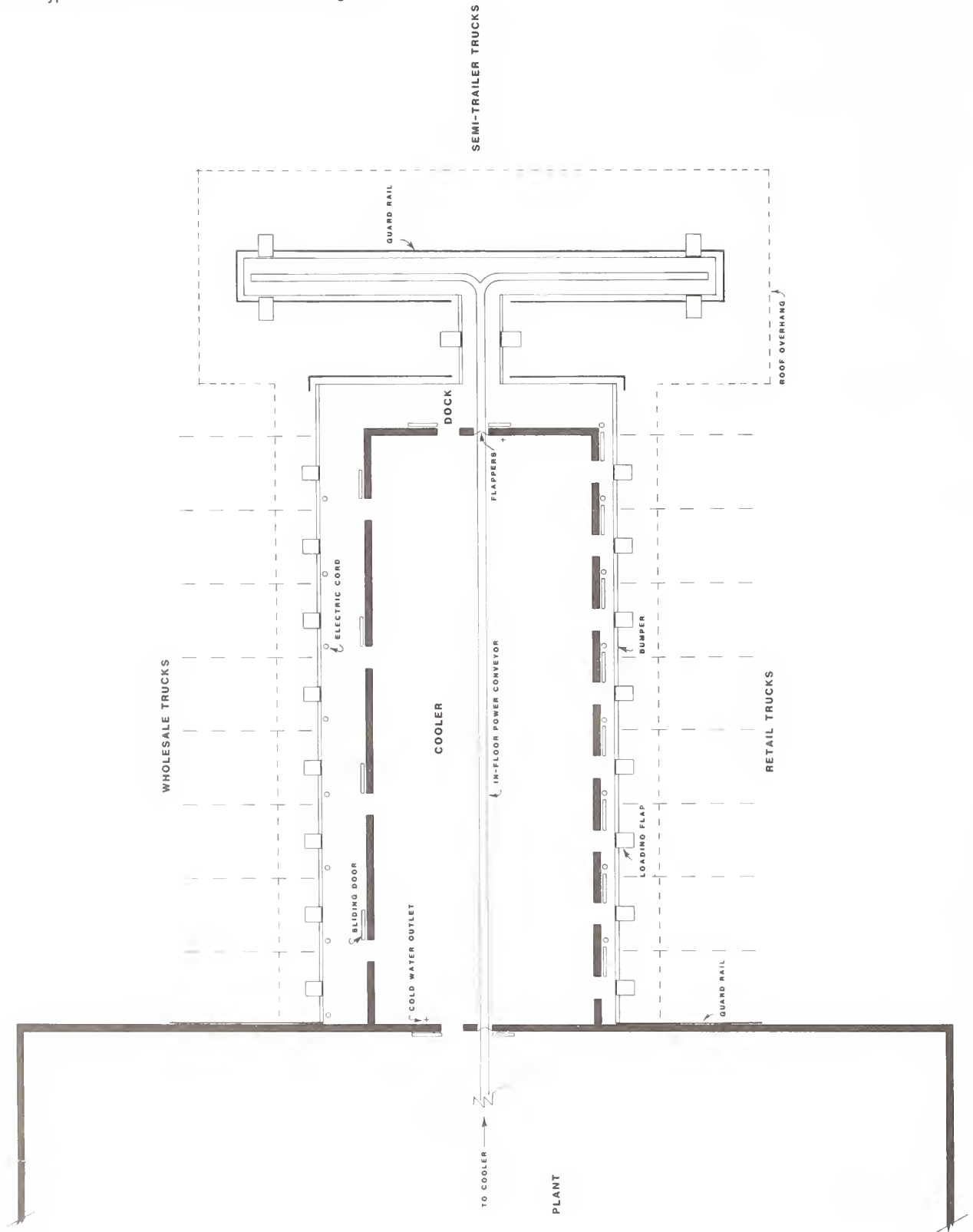
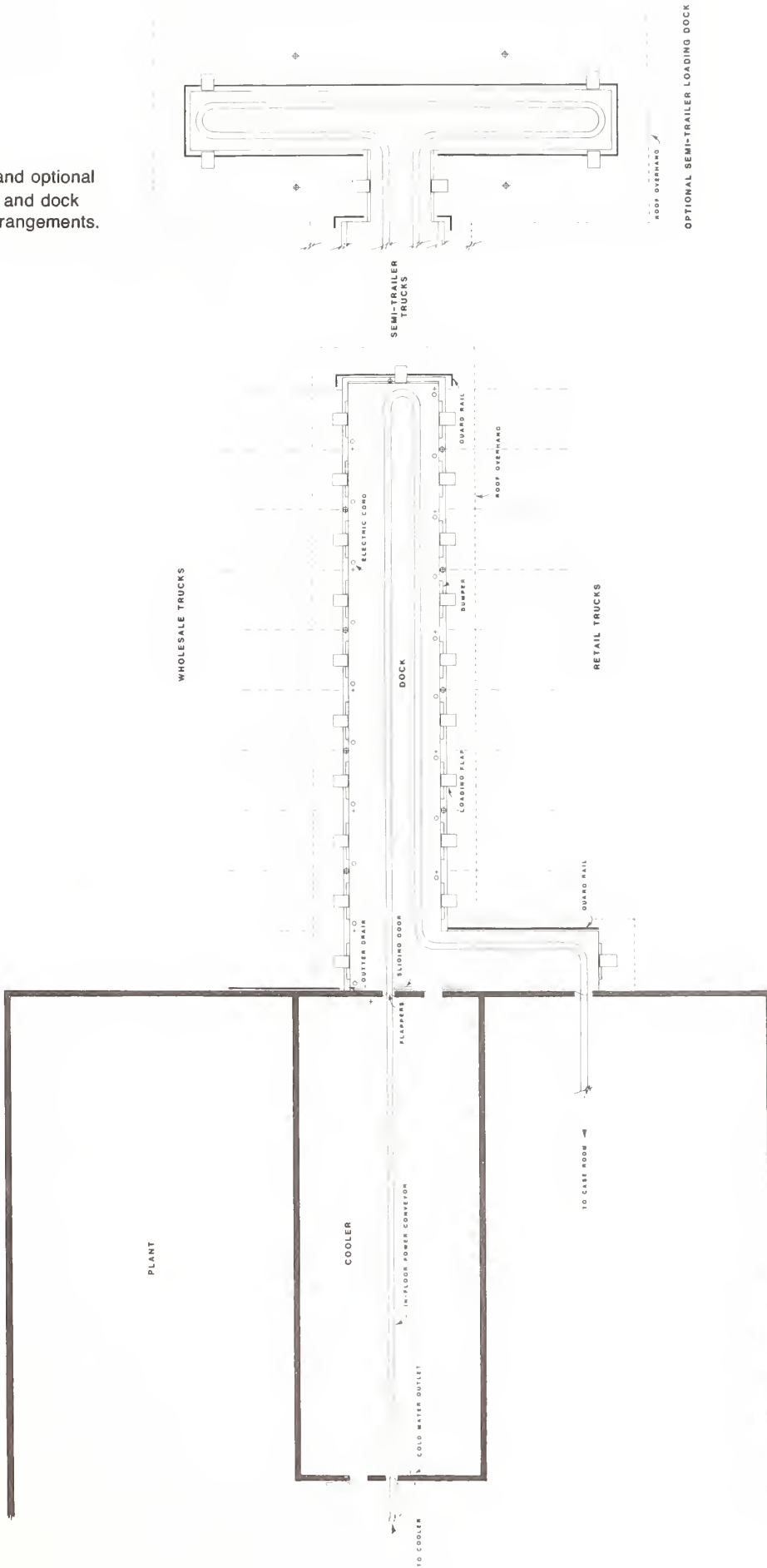


Figure 5.—Type C-1 and optional C-2 cooler and dock loadout arrangements.



from the edge of the retail truck and semitrailer portions. The semitrailer stall is at the conveyor location farthest from the cooler to avoid interfering with the loading of the larger number of smaller trucks and to minimize problems associated with unloading large volumes of empty cases. The dock space between the conveyor and the plant walls is used for the temporary storage of empty cases.

Conditions Under Which Applicable.—

- a. The cooler is within the main body of the plant, and additional loadout facilities are required on the outside perimeter.
- b. A common dock with a conveyor system is used for loading and unloading all trucks.
- c. Loading an equal number of wholesale and retail trucks (45 to 50 percent each of fleet) and a small number (5 to 10 percent of fleet) of semitrailers (table 3).
- d. An equal percentage range of total volume (20 to 40 percent) is distributed by semitrailers and retail trucks, and 40 percent or more are distributed by wholesale trucks (table 3).
- e. Sufficient space is available outside the plant. (A minimum distance of 130 feet must be available between the dock and any restriction to allow adequate space for maneuvering semitrailers.)

C-4 Arrangement Description.—The C-4 arrangement (fig. 6) differs from that for C-3 (fig. 6) in the number of stall spaces assigned to the different types of trucks and in the amount of space provided between the edge of the dock and the conveyor in the portion of the dock used in load-

ing and unloading semitrailers. In C-4, stall space is provided for four wholesale trucks, six retail trucks, and three semitrailers. A 2-foot-wide area is provided between the edge of the dock and the conveyor for loading and unloading semitrailers.

Conditions Under Which Applicable.—

- a. The cooler is within the main body of the plant, and additional loadout facilities are required on the outside perimeter.
- b. A common dock with a conveyor system is used for loading and unloading all trucks.
- c. Sufficient space is available outside the plant. (A minimum distance of 130 feet must be available between the dock and any restriction to allow adequate space for maneuvering semitrailers.)
- d. Loading a large number (10 to 15 percent of fleet) of semitrailers (table 3).
- e. Semitrailer volume is 40 percent or more of total, wholesale is 20 to 40 percent, and retail is less than 20 percent (table 3).

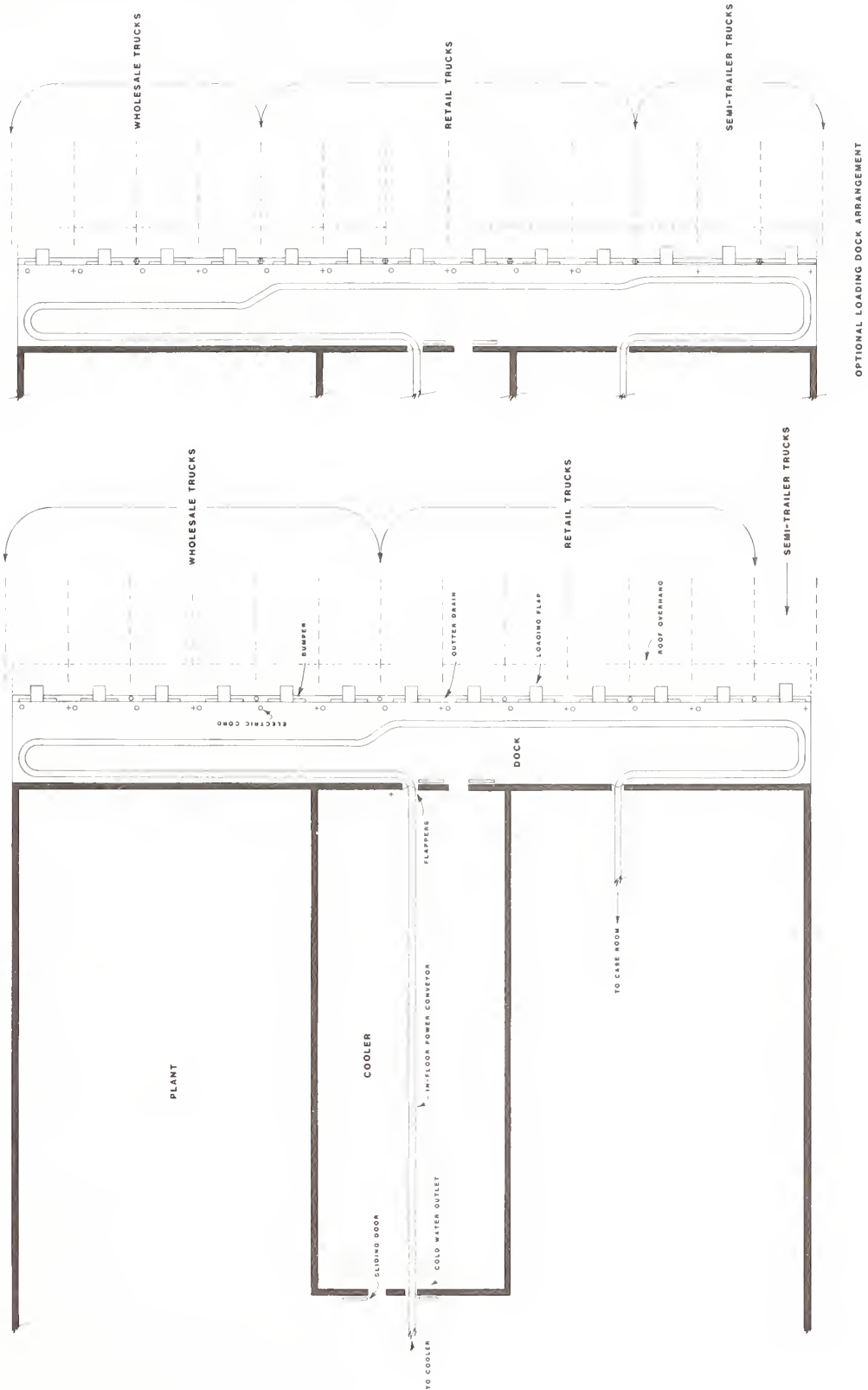
Type D Series

In the type "D" series cooler and dock loadout arrangements, the coolers and empty-case storage rooms are widely separated, and each has its own conveyor system for loading and unloading trucks. This separation increases traffic congestion on the plant site but presents a serious problem only where site restrictions exist. The coolers are located within the main body of the plants, and

Table 3.—Combinations of types and numbers of trucks, the percentage range of total trucks in fleet, and total volume distributed for each of the types C, D, and E series cooler and dock loadout arrangements

Type of arrangement	Type of truck	Emphasis level	Number of trucks	Percentage of total fleet	Percentage range of total fleet	Total volume distributed (gallons)	Percentage of total volume distributed	Percentage range of total volume distributed
C-1, D-1, and E-1	Wholesale	Equal	12	46.2	45-50	9,600	46.1	40-60
	Semitrailer	Light	2	7.6	5-10	6,400	30.8	20-40
	Retail	Equal	12	46.2	45-50	4,800	23.1	20-40
C-2, D-2, and E-2	Wholesale	Equal	12	42.9	40-45	9,600	35.3	20-40
	Semitrailer	Heavy	4	14.2	10-15	12,800	47.1	40-60
	Retail	Equal	12	42.9	40-45	4,800	17.6	10-20
C-3, D-3, and E-3	Wholesale	Equal	12	46.2	45-50	9,600	46.1	40-60
	Semitrailer	Light	2	7.6	5-10	6,400	30.8	20-40
	Retail	Equal	12	46.2	45-50	4,800	23.1	20-40
C-4, D-4, and E-4	Wholesale	Equal	12	42.9	40-45	9,600	35.3	20-40
	Semitrailer	Heavy	4	14.2	10-15	12,800	47.1	40-60
	Retail	Equal	12	42.9	40-45	4,800	17.6	10-20

Figure 6.—Type C-3 and optional C-4 cooler and dock loadout arrangements.



docks are on the outside perimeter. These arrangements minimize refrigeration losses but increase the labor requirements of cooler personnel.

D-1 Arrangement Description.—The D-1 arrangement (fig. 7) has an L-shaped dock, the longer section of which is 10 feet wide and extends out 100 feet from the main body of the plant. The smaller section (10 by 12 feet) provides for personnel access between the cooler and the dock. Stall space is provided for loading 10 wholesale trucks, 9 retail trucks, and 1 semitrailer at a time (light emphasis) through either the vehicle side or rear door, depending on available site space. The 6-foot width between the conveyor and the edge of the dock on the wholesale side and the 3-foot width of that area on the retail side provide space for the temporary storage of finished products to prevent a tie-up of the conveyor during loading operations.

Conditions Under Which Applicable.—

- a. The cooler is within the main body of the plant, and additional loadout facilities are required on the outside perimeter.
- b. Adequate space is available for expansion.
- c. A separate dock is used for receiving empty cases.
- d. A conveyor system is used for loading all trucks.
- e. Loading an equal number of wholesale and retail trucks (45 to 50 percent each of fleet) and a small number (5 to 10 percent of fleet) of semitrailers (table 3).
- f. An equal percentage range of total volume (20 to 40 percent) is distributed by semitrailers and retail trucks, and 40 percent or more are distributed by wholesale trucks (table 3).

D-2 Arrangement Description.— The D-2 arrangement (fig. 7) is the same as for D-1 (fig. 7) except for D-2's additional dock extension for loading semitrailers. This arrangement is applicable when the emphasis level for semitrailers is heavy. The design of the extended dock is the same as that of the B-3 arrangement (fig. 4)

Conditions Under Which Applicable.—

- a. The cooler is within the main body of the plant, and additional loadout facilities are required on the outside perimeter.
- b. Adequate space is available for expansion.
- c. A separate dock is used for receiving empty cases.
- d. A conveyor system is used for loading all trucks.
- e. Loading a large number (10 to 15 percent of fleet) of semitrailers (table 3).
- f. Semitrailer volume is 40 percent or more of total, wholesale is 20 to 40 percent, and retail is less than 20 percent (table 3).

D-3 Arrangement Description.—The D-3 arrangement (fig. 8) differs from that for D-1 (fig. 7) in the positioning of the

loading dock and the number of stalls assigned to the different types of trucks. The dock adjoins the outside wall that includes the end wall of the cooler and is 8 feet wide for its entire length. Stall space is provided for loading six each of wholesale and retail trucks and one semitrailer through the rear door.

Conditions Under Which Applicable.—

- a. The cooler is within the main body of the plant, and additional loadout facilities are required on the outside perimeter.
- b. A separate dock is used for receiving empty cases.
- c. A conveyor system is used for loading all trucks.
- d. Loading an equal number of wholesale and retail trucks (45 to 50 percent each of fleet) and a small number (5 to 10 percent of fleet) of semitrailers (table 3).
- e. An equal percentage range of total volume (20 to 40 percent) is distributed by semitrailers and retail trucks, and 40 percent or more are distributed by wholesale trucks (table 3).
- f. Sufficient space is available outside the plant. (A minimum distance of 130 feet must be available between the dock and any restriction to allow adequate space for maneuvering semitrailers).

D-4 Arrangement Description.—The D-4 arrangement (fig. 8) is the same as that for D-3 (fig. 8), except for rerouting of the conveyor and the different number of stalls assigned to the semitrailer and wholesale trucks. The conveyor is installed 2 feet from the edge of the dock in the portion used for loading semitrailers. Stall space is provided for loading four wholesale trucks, six retail trucks, and three semitrailers through the rear doors.

Conditions Under Which Applicable.—

- a. The cooler is within the main body of the plant, and additional loadout facilities are required on the outside perimeter.
- b. A separate dock is used for receiving empty cases.
- c. A conveyor system is used for loading all trucks.
- d. Sufficient space is available outside the plant. (A minimum distance of 130 feet must be available between the dock and any restriction to allow adequate space for maneuvering semitrailers.)
- e. Loading a large number (10 to 15 percent of fleet) of semitrailers (table 3).
- f. Semitrailer volume is 40 percent or more of total, wholesale is 20 to 40 percent, and retail is less than 20 percent (table 3).

Type E Series

In the type "E" series cooler and dock loadout arrangements, the coolers are within the main body of the plant, and the docks are on the outside perimeter. The coolers

Figure 7.—Type D-1 and optional D-2 cooler and dock loadout arrangements.

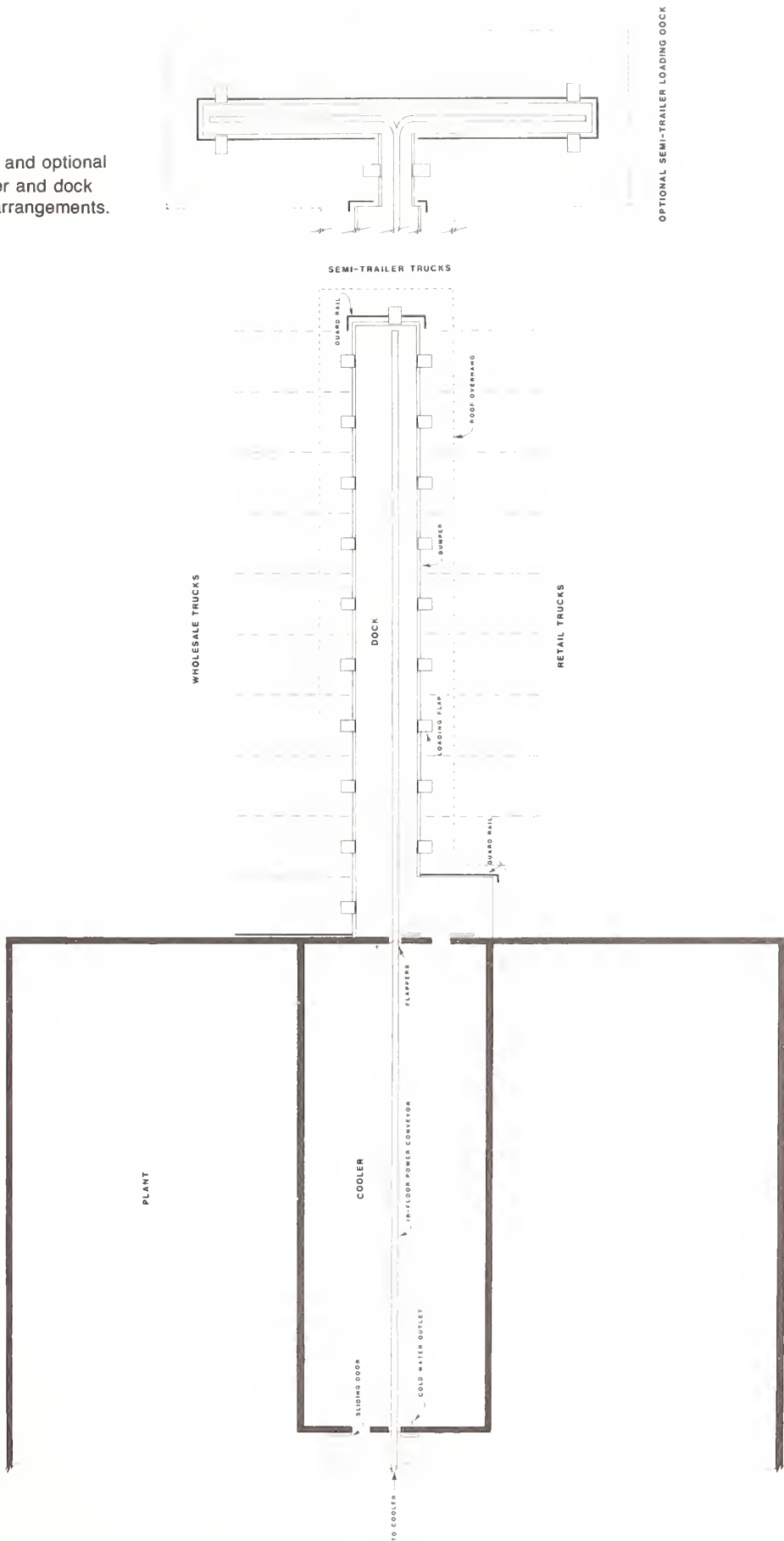
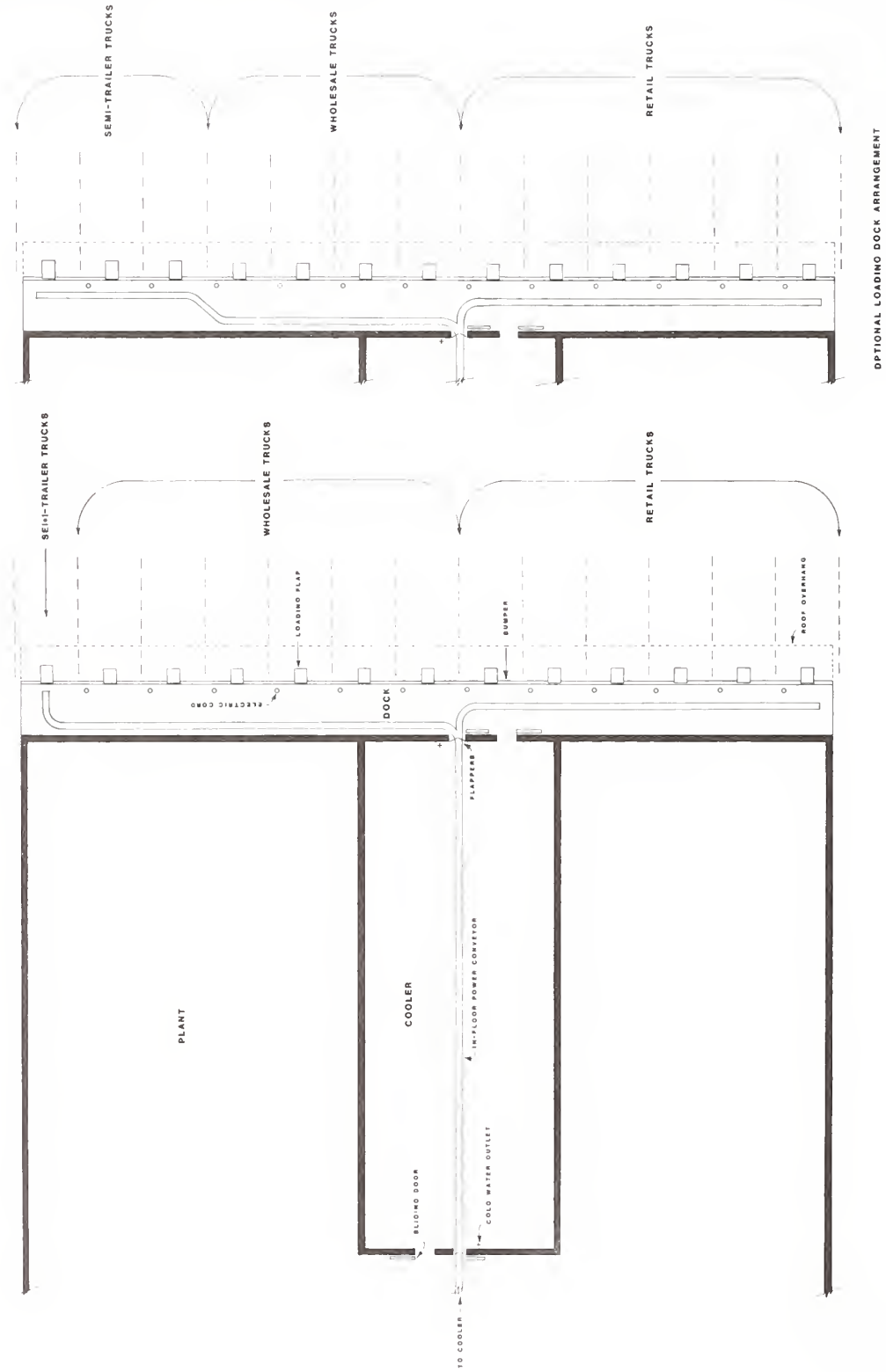


Figure 8.—Type D-3 and optional D-4 cooler and dock loadout arrangements.



and case-storage rooms are widely separated, with the coolers on one side of the plant and the loading and unloading docks and the case-storage rooms on another. A common/extended dock or passageway, equipped with a conveyor system, ties the areas together. These arrangements minimize refrigeration losses but increase equipment cost and the labor requirements of cooler personnel. Oral communication between the cooler personnel and truck drivers is also a problem, which can be handled reasonably well by installing an intercom system.

E-1 Arrangement Description.— The E-1 arrangement (fig. 9) has an I-shaped dock located on a side of the plant around a corner from the side abutting the end of the cooler. The dock is 15 feet wide and extends out approximately 115 feet from the wall of the plant. The dock's location is required because of the property line restriction, which is 14 feet from the outside wall of the cooler and parallels that side of the plant. The 4-foot-wide area that extends along the end of the cooler and around the corner of the plant to the loading and unloading dock supports the conveyor. The 10-foot-wide area that extends from the dock past the case-storage room also supports the conveyor and provides storage space for empty cases. Stall space is provided for loading and unloading 9 wholesale trucks, 10 retail trucks, and 1 semitrailer at a time (light emphasis) through either the vehicle side or the rear door, depending on the site space available. The 6-foot width between the conveyor and the edge of the dock on the wholesale side and the 3-foot width on the retail side serves the same purpose as discussed for the other arrangements.

Conditions Under Which Applicable.—

- a. The cooler is within the main body of the plant with insufficient adjacent space available on the outside perimeter for the construction of loadout facilities.
- b. Sufficient space is available on the outside perimeter of the plant in a location separate from the cooler. (A minimum distance of 60 feet is required between the loading and unloading dock and the property line or other restriction to allow adequate space for maneuvering retail and wholesale trucks.)
- c. The cooler, loading and unloading dock, and case-storage room are widely separated but can be connected by a common/extended dock equipped with a conveyor system.
- d. A conveyor system is used for loading and unloading all trucks.
- e. Loading an equal number of wholesale and retail trucks (45 to 50 percent each of fleet) and a small number (5 to 10 percent of fleet) of semitrailers (table 3).
- f. An equal percentage range of total volume (20 to 40 percent) is distributed by semitrailers and retail trucks, and 40 percent or more are distributed by wholesale trucks (table 3).

E-2 Arrangement Description.—The E-2 arrangement (fig. 9) is the same as for E-1 (fig. 9) except for E-2's additional dock extension for loading and unloading semitrailers. The L-shaped dock is 10 feet wide, and has a section 60 feet long that parallels the side of the plant. Stall space is provided for loading and unloading three trailers at a time, through either the side or the rear doors, or both. This arrangement has application when the emphasis level for semitrailers is heavy. Its design is different from those previously discussed because of the property line restriction.

Conditions Under Which Applicable.—

- a. The cooler is within the main body of the plant with insufficient adjacent space available on the outside perimeter for the construction of loadout facilities.
- b. Sufficient space is available on the outside perimeter of the plant in a location separate from the cooler. (A minimum distance of 60 feet is required between the loading and unloading dock and the property line or other restriction to allow adequate space for maneuvering retail and wholesale trucks.)
- c. The cooler, loading and unloading dock, and case-storage room are widely separated but can be connected by a common/extended dock equipped with a conveyor system.
- d. A conveyor system is used for loading and unloading all trucks.
- e. Loading a large number (10 to 15 percent of fleet) of semitrailers (table 3).
- f. Semitrailer volume is 40 percent or more of total, wholesale is 20 to 40 percent, and retail is less than 20 percent (table 3).

E-3 Arrangement Description.—Because of the property-line restriction, the loading and unloading dock in the E-3 arrangement (fig. 10) is alongside the plant rather than extended to the outside perimeter. The dock is 8 feet wide and of sufficient length to provide stall space for loading and unloading six wholesale trucks, five retail trucks, and one semitrailer (light emphasis) through the side door only. In this arrangement, the space limitation between the plant wall on the cooler side and the property line prevents the installation of a dock on the outside perimeter. Therefore, the section of conveyor that extends from the cooler to the loading and unloading dock is installed inside the plant, alongside the plant wall. The conveyor on the dock is 6 feet from the edge of the portion of the dock used by wholesale trucks and 3 feet from the edge of the portion used by retail trucks and semitrailers. Because of the restriction in space (60 feet) between the dock and property line, semitrailers must be pulled in and backed out from the loading and unloading dock. Therefore, additional site space must be available within a reasonable distance of the dock for reversing the direction of the trucks.

Figure 9.—Type E-1 and optional E-2 cooler and dock loadout arrangements.

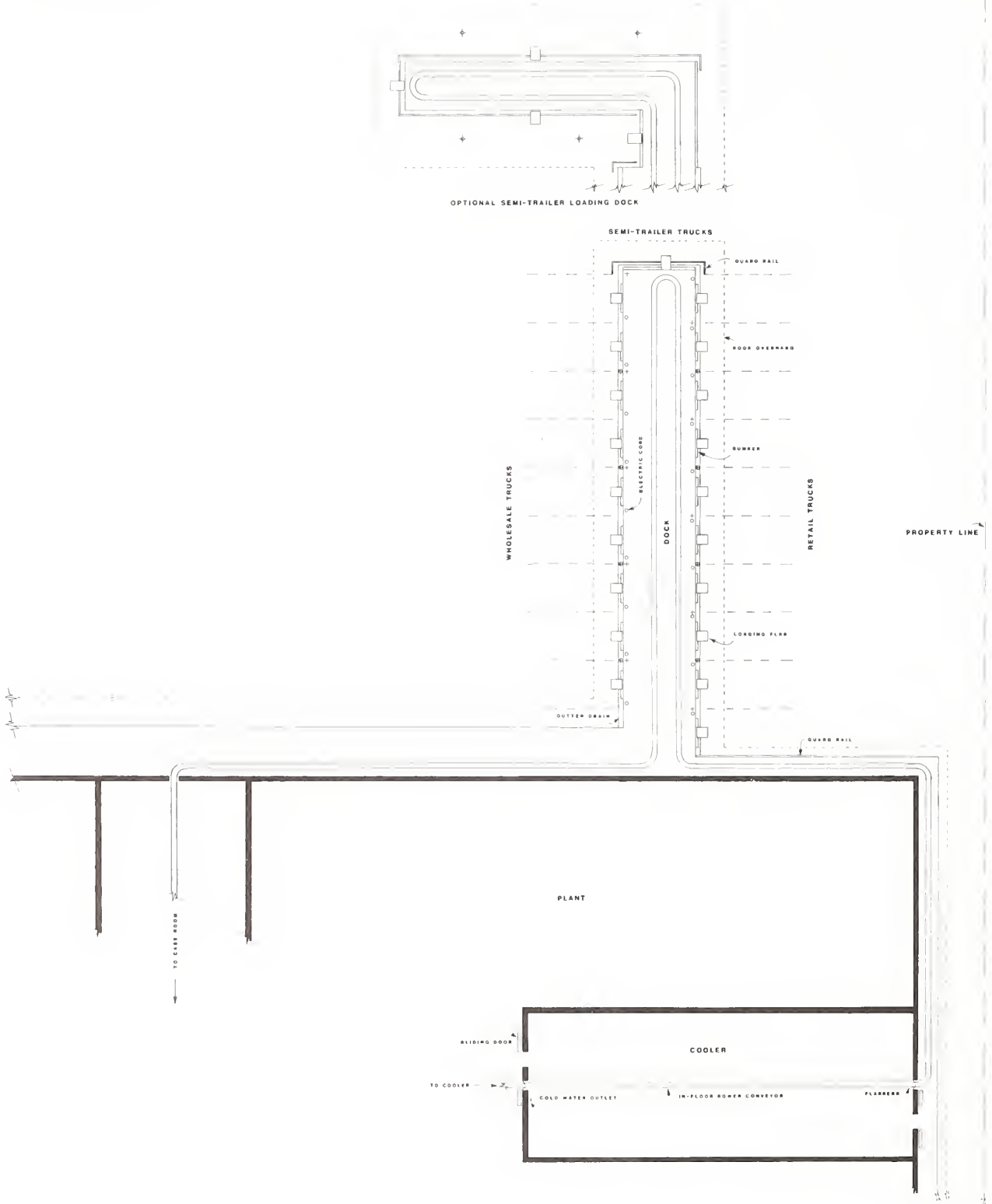
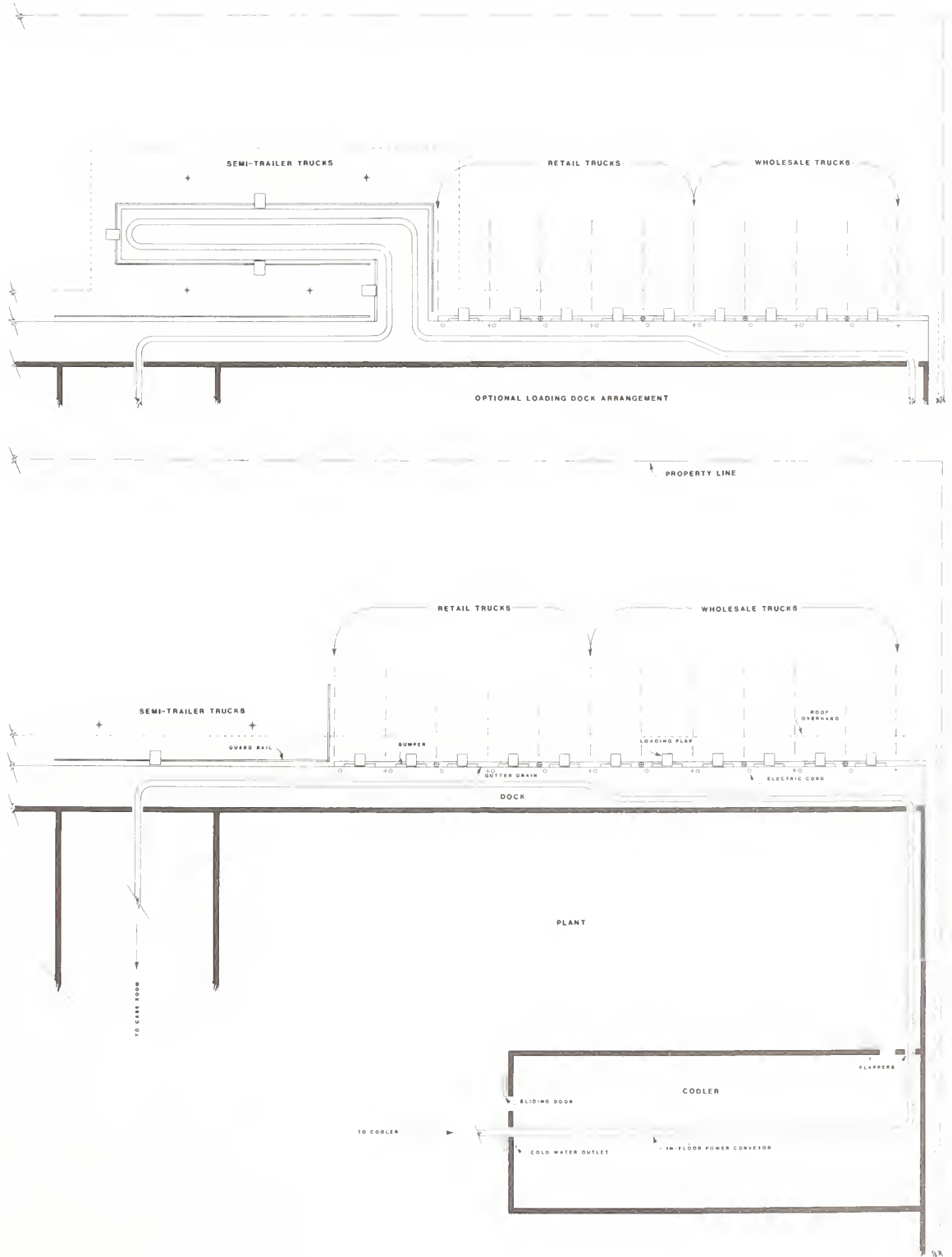


Figure 10.—Type E-3 and optional E-4 cooler and dock loadout arrangement.



Conditions Under Which Applicable.—

- a. The cooler is within the main body of the plant with insufficient adjacent space available on the outside perimeter for the construction of loadout facilities.
- b. A conveyor system is used for loading and unloading all trucks.
- c. Loading an equal number of wholesale and retail trucks (45 to 50 percent each of fleet) and a small number (5 to 10 percent of fleet) of semitrailers (table 3).
- d. An equal percentage range of total volume (20 to 40 percent) is distributed by semitrailers and retail trucks, and 40 percent or more are distributed by wholesale trucks (table 3).
- e. Inadequate space is available on the cooler side of the plant for constructing loadout facilities, and space

- limitations exist at all other potential locations. (A minimum distance of 60 feet is required between the loading and unloading dock and the property line or other restriction to allow adequate space for maneuvering retail or wholesale trucks.)
- f. The cooler, loading and unloading dock, and case-storage room are widely separated but can be connected by installation of a portion of the conveyor system within the main body of the plant.

E-4 Arrangement Description.—The E-4 arrangement (fig. 10) is the same as for E-3 (fig. 10), except for the number of stalls assigned to the different types of trucks and the layout of the dock used in loading and unloading semitrailers. Stall space is provided for loading and unloading four wholesale trucks, five retail trucks, and three semitrailers

Table 4 - Summary of major application factors for each of the 20 types of cooler and dock loadout arrangements

Type of arrangement	Location of cooler	Availability of space	Arrangement of docks	Type truck and percentage range of each in fleet	Percentage range of total volume distributed
A-1	Outside plant	Adequate	Common	Wholesale - 50-65 Semitrailer- 5-10 Retail - 20-35	40 or more 20 to 40 20 or less
A-2	Outside plant	Adequate	Common	Wholesale - 50-65 Semitrailer 10-15 Retail - 20-35	Equal Equal 20 or less
A-3	Outside plant	Adequate	Common	Wholesale - 20-35 Semitrailer - 10-15 Retail - 50-65	Equal 40 or more Equal
A-4	Outside plant	Adequate	Common	Wholesale - 20-35 Semitrailer - 5-10 Retail - 50-65	Equal Equal Equal
B-1	Outside plant	Adequate	Separate	Wholesale - 50-65 Semitrailer- 5-10 Retail - 20-35	40 or more 20 to 40 20 or less
B-2	Outside plant	Adequate	Separate	Wholesale - 50-65 Semitrailer - 10-15 Retail - 20-35	Equal Equal 20 or less
B-3	Outside plant	Adequate	Separate	Wholesale - 20-35 Semitrailer - 10-15 Retail - 50-65	Equal 40 or more Equal
B-4	Outside plant	Adequate	Separate	Wholesale - 20-35 Semitrailer - 5-10 Retail - 50-65	Equal Equal Equal
C-1	Within plant	Adequate	Common	Wholesale - Equal Semitrailer - 5-10 Retail - Equal	40 or more Equal Equal
C-2	Within plant	Adequate	Common	Wholesale - Equal Semitrailer - 10-15 Retail - Equal	20 to 40 40 or more 20 or less

Continued

at a time (heavy emphasis) through either the vehicle side or rear doors. The L-shaped dock used by semitrailers is designed the same as the one in the E-2 arrangement shown in figure 9.

Conditions Under Which Applicable.—

- a. The cooler is within the main body of the plant, with insufficient adjacent space available on the outside perimeter for the construction of loadout facilities.
- b. A conveyor system is used for loading and unloading all trucks.
- c. Inadequate space is available on the cooler side of the plant for constructing loadout facilities, and space limitations exist at all other potential locations. (A minimum distance of 60 feet is required between the loading and unloading dock and the property line or

- other restriction to allow adequate space for maneuvering retail or wholesale trucks.)
- d. The cooler, loading and unloading dock, and case-storage room are widely separated but can be connected by installation of a portion of the conveyor system within the main body of the plant.
- e. Loading a large number (10 to 15 percent of fleet) of semitrailers (table 3).
- f. Semitrailer volume is 40 percent or more of total, wholesale is 20 to 40 percent, and retail is less than 20 percent (table 3).

Table 4 summarizes the major application factors that must be considered in the selection process. The coolers in 8 of the 20 arrangements extend to the outside perimeter, and those in the other 12 arrangements are

Table 4 - Summary of major application factors for each of the 20 types of cooler and dock loadout arrangements — Continued

Type of arrangement	Location of cooler	Availability of space	Arrangement of docks	Type truck and percentage range of each in fleet	Percentage range of total volume distributed
C-3	Within plant	Restricted	Common	Wholesale - Equal Semitrailer - 5-10 Retail - Equal	40 or more Equal Equal
C-4	Within plant	Restricted	Common	Wholesale - Equal Semitrailer - 10-15 Retail - Equal	20 to 40 40 or more 20 or less
D-1	Within plant	Adequate	Separate	Wholesale - Equal Semitrailer - 5-10 Retail - Equal	40 or more Equal Equal
D-2	Within plant	Adequate	Separate	Wholesale - Equal Semitrailer - 10-15 Retail - Equal	20 to 40 40 or more 20 or less
D-3	Within plant	Restricted	Separate	Wholesale - Equal Semitrailer - 5-10 Retail - Equal	40 or more Equal Equal
D-4	Within plant	Restricted	Separate	Wholesale - Equal Semitrailer - 10-15 Retail - Equal	20 to 40 40 or more 20 or less
E-1	Within plant	Adequate	Common/Extended	Wholesale - Equal Semitrailer - 5-10 Retail - Equal	40 or more Equal Equal
E-2	Within plant	Adequate	Common/Extended	Wholesale - Equal Semitrailer - 10-15 Retail - Equal	20 to 40 40 or more 20 or less
E-3	Within plant	Restricted	Common/Extended	Wholesale - Equal Semitrailer - 5-10 Retail - Equal	40 or more Equal Equal
E-4	Within plant	Restricted	Common/Extended	Wholesale - Equal Semitrailer - 10-15 Retail - Equal	20 to 40 40 or more 20 or less

Cost Analysis of the Different Arrangements

within the main body of the plant. Expansion space is readily available on the site in 14 of the arrangements but is restricted in the remaining 6. Of the 20 arrangements, 8 have common docks, 8 have separate docks, and 4 have common/extended docks. The types of trucks, the percentage range of each in the fleet, and the percentage range of total volume distributed are appreciably different between arrangements and are prime indicators in identifying the one that best fits a given set of conditions.

The total initial investment cost of the 20 respective arrangements varies, depending on the type of facility and the amount of equipment required to conduct the specific operations and to compensate for imposed restrictions (table 5). The greater costs are attributed mainly to the additional dock space and power conveyors needed for loading larger numbers of semitrailers.

The total annual operating cost is composed of many items, two of which are utilities and labor. Those two items were selected for evaluation because they are the only ones directly affected by the arrangement and operations of the cooler and dock loadout facilities. The total annual costs for utilities and labor for the different arrangements do not differ appreciably because one tends to offset the other (table 5). The costs for utilities for types A and B are greater than for the other arrangements due to the large number of doorways used in loading trucks directly from the cooler. However, plant labor cost is less because of driver involvement in loading their own trucks and the reduction or elimination of the labor required in the cooler for placing products on the conveyor for loading. In types C, D, and E the labor cost is greater because all products must be placed on the conveyor by cooler employees for loading. In type E, where the loading dock is far removed from the cooler, additional labor is required to supervise dock operations during the loading periods.

In instances in which cooler employees are required to load drivers' trucks and the total differences in cost cannot be offset through adjustments in drivers' wages or through commissions, plant labor cost will be somewhat greater regardless of the type of arrangement selected. The additional labor cost when cooler employees load the trucks was not determined, because drivers load the trucks at most plants, and wide variations exist among plants in the methods used for adjusting drivers' income. Types A and B arrangements lend themselves better for loading drivers' trucks and are less costly than are the other types, because all cooler and dock loadout functions are conducted in the same general area, permitting good cross-utilization of labor. When type C, D, or E arrangements are required, labor cost can be expected to increase appreciably because of the separation of functions and the differences in loadout procedures.

Although cost information was developed for each of the 20 types of arrangements, cost plays only a minor role and should not be a determining factor in selecting the proper cooler and dock loadout arrangement. The small differences between the various types of arrangements in the lowest and highest total initial investment and the annual

operating cost for utilities and labor can be easily justified on the basis of selecting the one that will best fit a particular set of circumstances. Maximum operating efficiency, which is the main goal, is obtained by matching the functions to be performed to a properly planned facility.

Table 5.—Total initial investment and annual operating costs for utilities and labor for each of the 20 different types of cooler and dock loadout arrangements

Type of arrangement	Initial investment cost			Annual operating cost for utilities and labor		
	Building ¹	Equipment ²	Total	Utilities ³	Labor ⁴	Total
Dollars						
A-1	154,200	40,940	195,140	21,550	26,624	48,174
A-2	161,400	64,190	225,590	21,550	28,704	50,254
A-3	163,440	59,690	223,130	20,364	28,704	49,068
A-4	156,240	36,640	192,880	20,364	26,624	46,988
B-1	150,280	23,130	173,410	22,376	22,464	44,840
B-2	153,630	34,890	188,520	22,376	24,544	46,920
B-3	151,710	35,190	186,900	22,376	24,544	46,920
B-4	150,280	23,130	173,410	22,376	22,464	44,840
C-1	150,950	50,130	201,080	18,078	30,784	48,862
C-2	158,150	73,780	231,930	18,078	32,864	50,942
C-3	149,840	49,200	199,040	18,078	30,784	48,862
C-4	149,840	49,200	199,040	18,078	32,864	50,942
D-1	146,600	37,320	183,920	18,078	30,784	48,862
D-2	149,950	49,380	199,330	18,078	32,864	50,942
D-3	145,640	40,940	186,580	18,078	30,784	48,862
D-4	145,640	40,940	186,580	18,078	32,864	50,942
E-1	163,050	79,975	243,025	18,078	39,104	57,182
E-2	170,150	102,480	272,630	18,078	41,184	59,262
E-3	150,400	49,090	199,490	18,078	39,104	57,182
E-4	157,600	72,580	230,180	18,078	41,184	59,262

¹A complete facility including refrigeration equipment based on \$50 a square foot for the cooler, \$10 for dock space, and \$500 for each door.

²Includes power conveyors at \$150 a foot, bridge plates at \$100 each, dock bumpers at \$50 a stall, and guard rails at \$10 a linear foot.

³Differences in cost reflect the heat gain per door in Btu's/hour at a cost of \$0.07 a kilowatt hour for electricity.

⁴Based on a wage rate of \$8 an hour, including fringe benefits.

United States
Department of Agriculture
Washington, DC 20250

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