Bulletin No. 3

Standards for War Housing
Excluding Temporary Housing

U.S. Administration
~~Federal~~ Public Housing ~~Authority~~ - National Housing Agency

Bulletin No. 3 will include previously released "Standards for War Housing (excluding Temporary Housing)" dated May 15, 1942. It will also include all revisions, additions, and corrections to these "Standards" necessary from time to time, in the form of revised sections, which material heretofore has appeared in the FPHA Development Manual.

3/10/43

GENERAL POLICIES

These standards are issued to guide the design of War Housing Projects (other than temporary housing) constructed by the Federal Public Housing Authority under the Lanham Act as amended January 21, 1942. Temporary housing developed under the Lanham Act as amended and P-9 (77th Congress) as amended will be covered in standards for temporary types of housing which will be issued separately.

The amendments to the Lanham Act referring to the disposal of housing reflect the desire of the Congress that private enterprise, or individual owners whereever possible, acquire homes constructed under the terms of the Act. The Federal Public Housing Authority interprets these amendments to mean that permanent housing should be designed for future sale.

Designers should consult with local officials and should inform themselves thoroughly concerning local conditions, plans, and projects, and also, concerning the housing traditions of the people for whom the project is being built. In this connection the essential factors of shelter and land use should be distinguished from superficial characteristics.

However, because of the demands of the war emergency, projects must be designed to achieve every possible economy in man-power and materials, especially the critical materials urgently needed in the war effort. Special care must be used in designing mechanical and utility installations in order to economize on such critical materials, but all aspects of the design of a project should be considered from the point of view of the total war effort. Requirements of the War Production Board must take precedence over any of the standards contained herein. Where such requirements would prevent construction of housing adequate for permanent use provision should be made for future changes or alterations to permit the standards prescribed herein to be maintained. With these basic considerations these standards are pointed toward safe, comfortable, and economical housing for war workers. They are to be considered as definite requirements, except where the language permits discretion in their application in exceptional cases.

Local building, plumbing and electrical codes, and zoning and subdivision regulations should be followed except where such conformance will increase costs, or quantities of critical materials, beyond that needed to meet the standards prescribed herein. No evidence of conformance to local ordinances, such as building permits or occupancy certificates, is needed, nor should they be sought. It should be clearly understood that the exemption from local codes and ordinances stems from Federal operation under an Act of Congress and not from the fact of the Federal ownership of property.

These standards will be most useful in guiding the design of such permanent housing as may be built during the emergency. They supplement but do not take the place of painstaking care, observation, thought, and imagination on the part of those planning the projects. Appearance and livability, the quality of domesticity, of human scale and interest - these can never be supplied simply by standards, but result only from the devotion and skill of the architects, planners, and engineers engaged in the work. Imaginative planning produces a desirable effect which heightens the appreciation of the families living in the project and, at the same time, increases the project's economic value to the community.

HERBERT EMMERICH
COMMISSIONER

STANDARDS FOR WAR HOUSING

Excluding Temporary Housing

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Federal Public Housing Authority

May 15, 1942

STANDARDS FOR WAR HOUSING

(Other than Temporary)

SITE SELECTION

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Sites for housing projects should be selected with great care. Consultations should be had with local housing authorities, planning agencies, municipal officials, military authorities, industrial experts, and other persons in a position to give information and advice. These conferences should include consideration of the racial character of the vicinity, since it is important that the people of the project should fit in smoothly with existing neighborhoods. Such negotiations, carried through at the time of site selection, will insure public support and prevent later delays.

Relation to Defense Activity - The prime consideration in the selection of a site is its relation to the defense activity which is to be served by the project. It must have convenient access to such defense activity and preference shall be given to sites requiring a minimum of daily travel for prospective tenants. The site should, in all cases where possible, be located within walking distance, normally defined as not more than 2 miles for men and 1 mile for women. Where not possible to locate within walking distance, adequate public transportation service must be assured either through present services or assured extensions. This is important because of the probable scarcity of private automotive facilities. Where public transportation is relied on, the site must be within easy walking distance of such service.

Relation to Normal Employment - In so far as possible, sites should be located so as to have convenient access to probable sources of post-war employment. This requirement, however, shall not take precedence over the requirement as to accessibility to defense activity.

Site should be vacant - A few sub-standard dwellings may be demolished, but Central Office approval is necessary if they number more than 3% of the proposed housing units. No limit on demolition of old commercial and industrial buildings.

Area required should be calculated upon the basis of the proposed number of units and the proposed type or types of dwellings. The range of "property density" appropriate to the various dwelling types is indicated below. Dwelling type and number of dwelling units per acre of usable land:

Detached houses, 1 and 2 stories	4 - 9
Twin houses, 1 story	5 - 12
Twin houses, 2 stories	6 - 13
Row houses, 1 story	8 - 16
Row houses, 2 stories	12 - 21
Flats, 2 stories	16 - 32
Apartments, 3 stories	25 - 45

The "Property density is based on the land purchased, minus any larger areas which cannot be used for buildings or playgrounds. The higher densities are feasible only on sites of favorable shape and topography which will not require wide street rights-of-way or other exceptional land uses. For projects believed by military authorities to be probable objectives of air attack, densities at or near the lower limit should be used in estimating the site area.

Improved property (such as unbuilt land subdivisions) should be considered if its use will expedite construction, save critical materials, give satisfactory living conditions, and meet other requirements. If this implies division of the project into parts these should not be so small nor so widely separated as, in the opinion of competent advisers, to cause difficulty of operation or undesirable economic or social effects upon existing neighborhoods or upon the project.

Future expansion of the project should preferably be possible. Probable extent and advisability of optioning land should be taken up with persons competent to advise and authorized to give approval.

For air raid protection sites should be at least one mile from military objectives.

Paved highway access must be good but a location a short distance from a main highway has advantages. Site should permit development of two access points, preferably on different roads.

Local plans for highways through or near the site, or other proposed public works, should be considered in order that the project may not interfere with, or be undesirably affected by, these developments.

Municipal services should if possible be available: fire and police protection, street maintenance and lighting, health and welfare services, refuse removal, libraries, recreation facilities, etc.

Public school facilities should exist within a reasonable distance or be contemplated for immediate construction. In large projects special arrangements may be necessary to assure the construction and operation of schools.

Effect on financial condition of the city or other governmental unit should be investigated and the likelihood that public services may become the responsibility of the project should be considered.

Zoning of vicinity should be such as to preserve the livability of the project.

Utility services must be adequate. Investigate fully the availability of water, gas, electricity, and sewer outlets both storm and sanitary. In order to conserve critical materials, favor sites not requiring long connections to utilities.

Utility rates should be investigated and agreements as to rates and services should be made before final determination of site.

Shopping facilities should be available or capable of being satisfactorily supplied.

Sanitary conditions of site must be good. Avoid swamps, flooded areas, and nuisances such as smoke, noise, noxious fumes and exceptional accident hazards. Favorable exposures to sun and wind are desirable.

Soil conditions should be favorable to low construction and maintenance cost and good livability. Obtain data from local city records and maps, on the underlying formations and history of the area; whether site previously included a ravine, swamp, pond or gully, subsequently filled in; if site has been used as a dump; or surface conditions have changed. Question residents in the neighborhood, excavating contractors, and utility companies as to underground conditions and surface changes. Inspect neighboring buildings, and those on site for evidences of unequal or excessive settlements, the types of foundations used, and the dry or wet condition of basement or cellar spaces.

Shape of site preferably should be compact, but practicability of laying out economical street and sewer system takes precedence over regularity of outline. "Exceptions" to avoid high-cost property or the demolition of housing are permissible if awkward land shapes or uneconomical utility layouts do not result.

Hilly sites imply higher development costs; these rise sharply when grades exceed 8%. Large tracts or level land may also cause high site improvement costs.

Wooded sites are preferred in locations where the project might be an air raid objective.

Cost of land shall be considered along with the other factors influencing the total cost of the project and the general desirability of the site.

Full reports upon the factors involved in the selection of each site shall be prepared by the representatives of the government who participate in the investigation.

STANDARDS FOR WAR HOUSING

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SURVEY REQUIREMENTS

Federal Public Housing Authority

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The survey map or maps of the project site must show all field and record information of the nature herein outlined required for site acquisition and housing project design. Separate property line, topographic and utility maps are not required.

The surveys comprise all field work required for preparing such maps. The survey work must be performed with care and with all checks necessary to insure accuracy.

The map or maps must be accurately drawn, all data shown to be scaled and platted in correct position. The scale used should be one inch to fifty feet, or such larger scale as may be necessary to show clearly all information required.

The map or maps must be signed and certified to by the Surveyor.

So far as practicable, the map or maps should be drawn on sheets of standard size for project drawings, using such number of sheets as are necessary.

. Property Line Map

The property line map, based on the field survey and on record data, must show not less than the following information for the entire site:

Outline of existing buildings, streets crossing or bordering the site, alleys (public or private), easements, any subdivision lines, all encroachments on outside boundaries as determined by the survey, parcel boundaries, parcel ownerships, and the computed area of each parcel and of the entire site.

Courses, distances, curve data and interior angles of outside boundaries and of block boundaries. (Where the site comprises more than one block, the blocks should be tied together so that continuous closure can be calculated. The closure error must be computed and must not exceed 1 in 5,000.)

Courses and distances of boundaries of individual parcels, as adjusted between actual field conditions and record data.

Dimensioned location of any connecting streets along the border of the site and of intersecting property lines of adjoining tracts.

The site area must be identified fully with the subdivisions of the original United States Survey or State Grant and, by reference to recorded plats and by means of lot and block numbers, with any subsequent subdivision within which the area lies.

The Surveyor should obtain deed information on individual parcels comprising the area and compare the same with field conditions.

Near one corner of the map there should be drawn a small scale situation map showing the location of the site with reference to principal streets, adjacent business districts, employment centers, nearby schools and the limits of the municipality, the scale of such map to be shown graphically.

The topographic map, based on the field survey, should show not less than the following information for the entire site:

Outside and block boundaries, block dimensions, street and alley widths, and pavement and sidewalk widths.

Elevations (to nearest 1/100 of a foot) on street curbs and street center lines (including both sides of boundary streets) at intervals not exceeding 100 feet and at breaks in grade and at street intersections. (When streets are unpaved and without curbs, show topography for full width of such streets as set forth in item (4).)

Established grades (if any), as obtained from the City, of streets referred to in item (2).

Two-foot contours (one-foot contours where average slope of site does not exceed 1%) accurately drawn; spot elevations (to nearest 1/10 of a foot) at high and low points, at top and bottom of retaining walls, on basement floors, and at trees referred to in item (9) following.

Retaining walls and basement walls; catch basins and storm drains; cisterns, cesspools, etc., so far as information concerning them is available; water courses, ponds and other physical details.

High water marks of streams on or near the area.

Kind and condition of street and alley paving and of sidewalk and curbing.

Established building lines along streets (show dimensions).

Kind, caliper and accurately platted location of isolated trees worth saving which are over 4 inches in diameter and, in wooded areas, of the most conspicuous and best trees at a rate of approximately 16 per acre.

The datum upon which elevations are based. (Use city datum when possible.)

A recommended method for taking topography--in cases where it is practicable--is to utilize as a base line a conveniently located property line and take elevations on ordinates extended across the site area. Such lines may later be shown on the site of block plans and the location of project buildings fixed by coordinates.

Utility Map

The utility map must show not less than the following information, as derived from the field survey and from examination of available records:

Rights-of-way, sewers, storm drains, water mains, gas mains, steam mains, conduits, tracks, pole lines, street and alley lighting, and other public utilities (not including services) within the site or in abutting streets, together with manholes, catch basins, fire hydrants, police and fire alarm boxes, and similar appurtenances.

Manhole top and invert elevations of storm and sanitary sewers within the site or in abutting streets, including invert elevations of all connecting sewers in manholes; sewer invert elevations beyond the site as necessary to establish the grade elevations of all sewers within the site or in streets abutting the site.

Depths and approximate working pressures for water mains and gas mains.

Monuments

The location of existing monuments on the outside boundaries of the site must be checked and a permanent concrete monument set at each corner or angle therein where there is no existing permanent monument. (No monument is required at any block corner at which there is no change in direction of the site boundary.) Offset monuments, where required, are to be in Government property if possible. The property line map should show the precise position and description of each monument.

Bench Marks

A master permanent bench mark should be established on the property and its location, description and carefully checked elevation shown on the topographic map. The elevations of all corner monuments should likewise be established and noted on the topographic map.

Soil Investigation

Test pits, borings, etc., may be included in the survey work, if desired. (See "Structural Design.")

Photographs

The necessary 8" x 10" photographs to show the site, existing improvements and surrounding neighborhood may likewise be made a part of the survey work. An aerial photograph may also be included.

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SITE PLANNING

Federal Public Housing Authority

May 15, 1942

In preparing preliminary studies of the site plan, members of the FPHA staff and the project designers should consult with local housing and planning officials. They should secure full information concerning zoning ordinances, subdivision codes, and proposed plans for streets and other public improvements. Further, they should discuss fully the special circumstances of war housing--the need for speed and economy, the absolute necessity for conserving critical materials, and the great importance of the site and utility plans in this connection. If any of the customary construction items can be deferred, the desirability of doing so should be pointed out.

Existing utility installations should be used as effectively as possible. New installations should be given maximum efficiency by the fullest practicable application of modern planning technique.

In the selection of dwelling types, preference should be given to types economical in cost and in the use of critical materials. Experience shows that dwelling types not common in a community are acceptable if designed attractively and in an effective community plan.

While the variety of types for dwelling units or buildings should be kept to a minimum in each project, some variety--such as one-story single or twin units with buildings that include several dwellings, or one-story housed grouped with two-story buildings -- favors good planning and appearance. Apartment buildings may be used when unavoidable limitations of location and building space make them necessary.

1. In the critical areas within 200 miles of the Atlantic and Pacific Coasts and 100 miles of the Gulf of Mexico, projects should be planned with a view to protection against enemy aerial attack. Local designers should communicate with the District Engineer (U. S. Engineer Department) responsible for dispersion, camouflage, and concealment of military establishments adjacent to War Housing Projects. Pending more detailed investigation of protective measures, the following recommendations should be used as a guide in site planning:

a) The pattern of site plan arrangement should be irregular in appearance. This is important to reduce the possibility of the project being identified from the air, and to reduce the hazard in case of strafing attack. Long straight rows of houses are more vulnerable than irregular arrangements.

b) Closed courts should be avoided since bomb explosions produce greater damage in such courts than in more open areas between buildings.

c) Site plans should be so arranged that there is more than one means of vehicular access to the project area. In addition, the layout of buildings should permit access for fire-fighting equipment.

d) The extent of pavement and other hard surfaces which will tend to stop bombs at the surface should be minimized.

e) Natural camouflage, such as trees, woods and foliage, forms a highly desirable type of protection and should be considered in site selection and preserved in site planning.

The above recommendations concerning air raid protection should be followed as closely as possible, but the specific conditions of each project must be considered. Planning for inconspicuousness will be affected by the existing environment. Irregularity of the plan should not be carried to the point of sacrificing livability or making it difficult to move through the project in a blackout. Rows of buildings are objectionable when they are long and straight, thus facilitating low level attacks with bombs and machine guns. Curved or bent rows give substantially the same protection (at a given density) as a scattered placing of the buildings and are more convenient and economical.

Density will be influenced by the need for economy in cost and critical materials and for the reduction of travel distances. For the purpose of the air raid protection standards quoted above, a property density of eight families per acre would be commonly practicable on large outlying sites. Urban projects should be studied to determine the most favorable balance between the density and other protective factors.

An advantage of a density as low as possible considering cost and critical materials is that it reduces the danger of large conflagrations. Unless an extremely wide spacing of buildings is feasible, it is usually well to arrange the buildings in groups or strips separated by effective fire breaks. Economy of site improvements and ease of access are also favored by this kind of planning. Since most site improvements are of a linear nature - such as streets and utility lines - it is possible to combine efficiency of site improvements with a low property density by using strips or loops of intensive development, surrounded by relatively undeveloped open areas.

The distribution of dwelling units, by number of bedrooms shall be:

One bedroom 0 to 10%	Three bedrooms, 25% minimum
Two bedrooms 60 to 75%	Four bedrooms, 0 to 5%

One-bedroom units are high in cost per person housed; the proportion of them should be kept low. Inclusion of some four-bedroom units is usually advisable.

The number of large units should be determined (as far as cost limitations permit) by the distribution of family sizes in the normal community, not by family sizes of in-migrant workers which are commonly smaller. The extra bedrooms during the emergency may be utilized for lodgers.

Density

Densities should be within the limits of the following table unless exceptionally favorable or unfavorable conditions justify densities falling outside these ranges. In order to conserve critical materials, high densities, approaching or, in some cases, exceeding the top figures as site conditions permit, are desirable.

	Density: D. U./Acre	
Dwelling Type	Property	Net
Detached houses, 1 story	4 - 7	5 - 8
Detached houses, 2 stories	4 - 8	5 - 10
Twin houses, 1 story	5 - 12	7 - 14
Twin houses, 2 stories	6 - 13	8 - 16
Row houses, 1 story	8 - 16	10 - 20
Row houses, 2 stories	12 - 21	14 - 28
Flats, 2 stories	16 - 32	20 - 40
Apartments, 3 stories	25 - 45	30 - 60

Property density, used for rough calculations of the capacity of sites before planning, is the number of units per acre of land purchased, minus areas unfit for buildings or for playgrounds or other project use.

Net density cannot be calculated closely until plans are completed but gives the best comparison of livability if same dwelling type is used in plans compared. It is number of dwellings per acre of area within property lines (to be used for immediate development) including narrow service drives, small play areas, sitting-out areas, laundry drying yards, and automobile parking areas, but excluding all public streets which traverse the site (whether existing or to be dedicated), land reserved for future development, unbuildable land, major recreation or park areas or major automobile parking spaces which are additional to the over-all project pattern of open spaces, and the land covered by or immediately associated with community buildings, central or group heating plants, commercial buildings, and other non-residential structures.

Density (Continued)

Density should be correlated with dwelling type, air raid protection, land cost, topography, economy in critical materials, city plans and zoning laws, local customs, etc. Densities should not be so high (for each dwelling type) as to imply early obsolescence nor so low as to cause high site improvement costs, high project and municipal maintenance costs, and tenant yards greater in area than can be well maintained.

Spacing

When buildings lie in parallel rows, recommended minimum average spacings are:

One story	50 feet.
Two story	55 feet
Three story	60 feet

It is usually desirable to reduce the space at one side (up to 15%), increasing the other by at least the same amount.

Minimum separation of single and twin houses, in the row or group, (measured end-to-end of twins and side-to-side of singles) shall be 20 feet. End-to-end spacing of buildings containing over two units should be about half the minimum spacing of the rows, given above. Under some conditions the separation of groups of not over six units by spaces of at least 25 feet results in reduced insurance rates; for details consult local underwriters.

Offsets and bends in the alignment of buildings in a row may be desirable for appearance and to increase livability by securing better outlooks for end windows. Distance between offset ends and between buildings in corner-to-corner relation should be adjusted to permit convenient allocation of yards and satisfactory light, ventilation and privacy. In angular relationships, corner-to-corner distances less than 10 feet should be avoided.

Buildings in end-to-end relation, with the end completely overlapped by the side, should be at least 30 feet apart if one story, 35 feet apart if more than one story.

On military reservations spacing of buildings is controlled by special rules.

Relation to Topography

All physical features of the site must be considered in making the site plan. Existing trees should be incorporated in the design. For economy and speed of construction, buildings usually should follow the contour lines. Although modern machines have facilitated heavy grading, the demand for this equipment for other defense work makes it desirable to restrict its use in housing.

Grading shall be designed to carry off surface water. Between buildings, reverse curves at moderate gradients are preferable to straight and steep terrace slopes.

Breaks in floor level should be avoided when practicable to do so. Breaks in floors in reinforced concrete construction should preferable be limited to 18 inches.

Existing utility lines should be used as fully as possible. New buildings must clear existing underground pipes by safe distances (10 feet is a common requirement) unless special construction is used.

Orientation

Follow locally desirable exposure to sun and wind if this can be done without undue sacrifice of good relation to topography and other livability factors.

Outdoor effect of orientation (desirability of building-shadows in summer and undesirability of walls, entrances, ground and pavements having no winter sun in regions of heavy snowfall) should be considered as well as indoor effect. In northern states, to avoid north exposure long buildings should lie at least 30 degrees off an east-west line; preferred alignment is north-east to south-west, with the longer walls facing southeast and northwest. In the South, east-west alignment, giving full south exposure, is generally preferred.

The street plan, when practicable, shall be so designed as to permit dedication of streets, service drives, and possibly parking areas. Construction of pavement, curbs, and sidewalks should be held to a minimum, but for convenience in servicing, no entrance door (preferably rear) shall be at greater distance than 200 feet from a paved street measured from the pavement edge to door via a paved walk.

Superblock planning should be used wherever practicable. Streets traversing the project preferably should be planned to reduce their use for through traffic. Cul-de-sac streets are useful as a means of protecting small neighborhoods from traffic danger. The loop or "U" drive, however, is preferred to the dead-end drive because the "U" plan combines convenience of circulation with protection from through traffic.

For surface drainage, natural drainage courses should be used as street locations, or other provision made for safe flow of storm water, to reduce damage by rains exceeding capacity of storm sewers.

Access to projects should be from secondary streets. More than one point of access is required (See "Air Raid Protection", pages 2 and 3). A main traffic street forming a boundary of a project should be kept a freeway, when possible, by avoiding traffic connections with the project.

Fire protection must be considered in laying out streets. Plans should be checked with local fire officials.

Single-lane service drives may be used to serve no more than four dwelling units.

On military or naval reservations these standards apply only in so far as they do not conflict with the regulations of the military or naval organization concerned.

Setbacks from boundary streets (right of way line) should be related to the probable future traffic load. Fifteen feet is the usual minimum or secondary or residential streets which are not likely to be widened; along a heavy traffic street, particularly if it is the principal street from which the project will be seen, a liberal setback should be used, such as 30 or 40 feet. Projects located on major fast traffic highways should preferably provide a greenbelt of around 100 feet in width, to protect the project from noise and traffic danger. When a project includes a corner formed by public streets, one of which carries through traffic, a special setback from the corner should be used to insure good visibility.

Street Plan (Continued)

Setbacks from adjacent buildable property should protect all dwellings from serious loss of livability. The effect of municipal setbacks should be considered in this connection. In general, the setback at party boundaries should be 30 feet from residential buildings which are parallel to boundary and 15 feet from ends when buildings are perpendicular to boundary. In low-density projects, greater setbacks than these should be maintained.

Parking

Parking for 100% car ownership shall be used as the normal standard. Any smaller percentage must be clearly justified. In all cases the site plan shall permit the future development of 100% parking. Parking on perimeter streets shall not be included in a calculation of the parking space available in a project.

Off-street parking is preferred. For single and twin houses, best parking is stub from street pavement, preferably long enough to bring parked cars near or between buildings.

For row and apartment dwellings, or when topography makes stub parking impossible, off-street parking courts should be used. Except when density is high, or if court serves community building, number of cars preferably should not be more than ten.

Allowance for future construction of garages or car ports shall be made when locally desirable.

Parking areas preferably should be located at ends of buildings rather than between parallel rows of dwellings.

Roadway widths, between curbs or from edges to edge of pavement when curbs are omitted, are:

	Minimum	Preferred
Two lanes (service drive)	16 ft.	16 ft.
Two lanes (main access driveway; parking provided elsewhere)	18 ft.	20 ft.
Two traffic lanes plus parallel parking on one side--or one free lane and parallel parking on both sides	24 ft.	26 ft.
Two traffic lanes plus parallel parking on both sides	30 ft.	32 to 34 ft.
Two traffic lanes, plus diagonal parking on one side	36 ft.	36 ft.
Two traffic lanes, plus diagonal parking on both sides	52 ft.	52 ft.
Two traffic lanes, plus perpendicular parking on one side	38 ft.	40 ft.
Two traffic lanes, plus perpendicular parking on both sides	54 ft.	56 to 60 ft.

In regions of heavy snowfall a two-lane service drive with curbs should be 18 feet and the two-lane access drive should be 20 feet.

The 24-foot and 30-foot widths, for two traffic lanes and parallel parking on one side and both sides, respectively, give only 9-foot lanes for traffic and 6-foot lanes for parking and should be used only in low-density projects. (See Parking)

At least the indicated "preferred" widths shall be used on curved streets and drives, since slightly more space is needed on curves for traffic and parking. Still greater widths should be used at sharp turns.

In order to provide a walking margin, fencing and shrubs should not be placed directly adjacent to drives used as walks. Where it is necessary that drives pass between two closely spaced buildings, sufficient space should be provided for at least one sidewalk.

To prevent damage by (and to) car and truck overhangs, street and parking pavements should clear obstructions (as buildings, walls, poles, trees) by 2' - 6" unless the topographic or plan conditions make a reduced clearance preferable.

In the walk plan the emphasis should be on a logical system of main through walks, avoiding nonessential connections for casual convenience. The pavement should be distributed where it will be most used, entrance walks being made narrow to permit circulation walks to be wide. In most plans comprising grouped dwellings, walk access to front and rear doors is desirable. Waste collection (or transportation by tenant) must be by walks or other pavement.

Walk widths. For sidewalks and other public walks 4' should be used as general standard. If a walk collects the traffic from a considerable area (say 100 units) 5' will be necessary. A walk serving a very small number of units may be 3' wide. If a street has two sidewalks, these need not be of the same width. Entrance walks serving one or two units, two feet minimum.

In projects above or below the ordinary range of size and density, the walks should be dimensioned to meet the special conditions of the project.

A sidewalk on one side only of a project street carrying general traffic is permissible under favorable circumstances such as: (a) very low pedestrian load on one side of street, as when street parallels project boundary; (b) project small or street short; (c) topographic conditions unfavorable to sidewalk on both sides. Sidewalks are the favorite play place of young children; they should not be omitted unless there is available elsewhere a complete system of walk communication between the dwelling units.

Sidewalks may be omitted on both sides of residential lanes, not carrying general traffic, under the conditions stated in the preceding paragraph.

Stepping stones may be used to give access to one door of a house when another door has standard walk access. Stones 18" square, set 2' - 4" center, are recommended. Stepping stones are useful for taking up moderate surface gradients.

All public walks should clear obstructions (as poles and planting) by two feet; entrance walks should clear by one foot.

Avoid steps in walks. Single risers should never be used. Outside steps should not be steeper than $7\frac{1}{2}$" riser and 10" tread; 6" riser and 12" tread is preferred. Avoid stepped ramps. A gradient as high as 15% may be used in preference to steps, provided that a handrail is installed along walks steeper than 10%.

Walks at parking areas where cars stand perpendicular to curb should be dimensioned to allow for car overhang. Five feet plus curb is minimum unless strip of special pavement (as used paving blocks) is provided at curb.

If a grass strip is left between sidewalk and curb, recommended minimum width is four feet.

The site plan must provide adequate facilities for carrying out the contemplated scheme of servicing. The scheme of waste removal must be correlated with the site plan at an early stage. Municipal regulations should be ascertained.

Garbage collection. Where possible, arrange and plan for direct municipal house-to-house pick-up as an economy to project and convenience to tenants. In all cases except where place for receptacles is incorporated in house construction, provide, preferably at kitchen door or near service drive, a paved or gravelled area for waste receptacles, with suitable screen, such as a low fence and planting.

The type of heating affects the arrangement and cost of the site development; for coal-burning equipment, pavement should be within the distance locally practicable for the economical delivery of coal. Maximum distance for delivery by chute varies locally from 8 to 25 feet. Use of hand-operated carts and of bagged coal should be investigated if conditions are unfavorable to drive access to all units.

Local oil delivery limit from truck to storage tank should be checked. It is usually between 100 to 200 feet, from which deduct 10 feet for handling hose.

Yards should be provided for all families. Rear yards used for clothes drying should be at least 25 feet deep when feasible, with 12 feet as a minimum. Steeply sloping yards should have at least 12-foot depth having a gradient of 10% or less. Front yards may be reduced in depth to 8 feet, the normal minimum setback from project walks to insure reasonable quiet and privacy. Large yards preferably should be given to large dwellings.

Traditional conceptions of front and rear yards (and relation of dwelling units thereto) need not be followed, but all plans must be convenient. Drying clothes in yards fronting on city streets or main project streets, or on living room side of house, is usually not acceptable.

Walk plans must permit entering the dwelling unit by a door giving access to the living room without passing through the kitchen. A plan which confines access to kitchen side of building is permissible only if dwelling unit plan provides access to living room without going through kitchen.

Front-to-rear arrangement (in which all units face the same way, bringing front yards of one row in contact with rear yards of next row) is permissible if planting separates rear yards from dwelling fronts (and walk giving access to them) and if servicing arrangements are satisfactory. Three-story buildings preferably should be paired or grouped so as to provide "front" courts not used for clothes drying.

Relations between yards and dwelling units, and between fronts and rears of buildings (with accompanying yards) must be worked out carefully, adhering to a consistent scheme and avoiding awkward and exceptional relations that may cause inconvenience to the tenants and friction between them.

Planting, site, or address plan must show all yard or lot lines. Unless easily recognized from structural features (as party walls or walks), yard lines must be indicated on the ground by planting, posts, marks on walks, concrete markers set flush with surface, or other satisfactory means.

Laundry Drying Yards

In tenant yards, provide space for clothes lines measuring at least 50 feet for one-bedroom units, 60 feet for two-bedroom units, and 75' for larger ones. Normally, supply each unit with one wood post (round cedar-post usually cheapest) with hook or wood pin; additional hooks in house wall. A heavy post at yard division may serve two units. One run of line should be close to a walk. If this is impracticable and if soil conditions require it, supply narrow gravel or other walk paralleling a run of line. If exposure to sun is favorable and total length of line is sufficient, avoid placing posts over 25 feet from house, for visual effect of rear yard space.

Lighting

Outdoor lighting should be effectively related to planting and to layout of play and sitting areas, walks, steps and ramps. The illumination provided should be of conservative intensity but sufficiently distributed to eliminate dark areas especially at steps. Lamps attached to non-dwelling buildings may be used in place of posts.

Flagpoles

Provide a wood flagpole, 30 to 50 feet high, at management office or community building preferably near a paved portion of the play area, for convenience in patriotic ceremonies, etc. With the approval of the military authorities, flagpoles may be omitted in projects on army posts.

Street Signs

Provide street name posts, also traffic control and other signs required. Their location may advantageously be shown on a plan also showing house numbers as required for postal delivery.

Recreation Areas

Space, well correlated with the rest of the site arrangement, should be provided for the community building and outdoor recreation facilities specified in the section on "Community Facilities."

Schools

If investigation indicates that the project must include space for a new school and grounds, the site plan should include an appropriate area, conveniently related to other features on the project. Unless otherwise agreed with the local authorities, seven acres should be allocated for each elementary school. The usual enrollment limit per school is 1200. The anticipated elementary school-age population in defense projects is .7 child per family. The school playground site preferably should not slope more than 4%. For high school requirements, consult local officials.

Commercial Facilities, etc.

In projects distant from towns, appropriate measures should be taken to assure such community services as stores, fire and police stations, post offices, churches, transportation terminals, etc. If most of these are to be on private property, an effort should be made to bring them into convenient plan relation to the project. When an area is to be included for commercial buildings within the project site, the approximate amount of space required (subject to modification after study of the specific case) will be one foot of building frontage per dwelling unit, which (counting a lot depth of 100 feet and an additional 100 feet as a liberal provision for parking) will make 200 square feet per unit.

A public telephone accessible day and night should be provided in a management, community, or residential building if none is otherwise conveniently available.

STANDARDS FOR WAR HOUSING

Excluding Temporary Housing

SITE ENGINEERING

Federal Public Housing Authority

May 15, 1942

Critical Materials

The foremost consideration in site engineering design must be the conserving of critical materials. Economy in construction should be sacrificed, increased maintenance and operating costs assumed, and somewhat inferior construction employed, wherever necessary to attain this end. So far as the standards described herein may prove inconsistent with this policy, or at variance with rulings of the War Production Board, they should be disregarded.

The designer should be well informed on the critical materials situation at the time the project is planned and, in every detail of the work, he must be prepared to lay aside "standard practice" in order to minimize the use of metals and other scarce materials.

Rapid Construction

Other important factors to be taken into account are simplicity of design and the use of materials on which best deliveries can be obtained, so as to permit completing site improvement construction by the time the housing is ready for occupancy.

* * * * * * * * *

Engineering Layout

The engineering layout of the project consists of plans giving the full information needed for staking out buildings, roadways, parking areas, walkways and similar surface improvements, also for establishing street lines and house lot lines. Essential curve data should be given for streets and drives. For site plans laid out on rectilinear lines, building locations may be fixed by reference to streets and driveways; for irregular site plans they should be established generally by coordinates, to which the street system should also be referenced.

Grades and Surface Drainage

The project grade design consists of the fixing of building floor elevations and of finished grades for project streets, drives, walkways, lawns and other site areas. Prerequisites to the grade design are:

An accurate topographic survey of the site.

Established grades for city streets bordering or traversing the site.

Grade elevations of existing sewers (unless such sewers are of ample depth to serve all parts of the site).

Adequate information on soil conditions.

The establishing of the maximum and minimum permissible heights of building floors above finished grade at buildings.

Fixing the cross section of new streets and drives.

The principal design features, apart from surface drainage, to be considered in developing project grades include the following:

A reasonable balance of cut and fill.

Avoidance of fills which will add to depth of building foundations.

Elimination, so far as possible, of steps in yard walks and at building entrances.

Guarding against wavy profiles in walks and drives.

Avoiding earth banks wherever possible.

Meeting satisfactorily actual ground levels at existing trees which are to be preserved.

Keeping finished grades as high as practicable, where rock will be encountered close to the surface, in order to minimize the cost of utility trenching.

Effective surface drainage of all project areas should be insured by:

Giving adequate, continuous slopes to all parts of the site not occupied by buildings, walks not adjoining gutters to be given both cross slope and longitudinal slope; providing positive slopes away from buildings.

Sloping lawns and planted areas toward streets, driveways, walks, and other surfaced areas.

Providing for surface drainage directly into public streets to the greatest feasible extent, in order to obviate or limit the need for project storm sewers.

Avoiding generally drainage from walks or other paved surfaces onto grassed areas; particularly avoiding flow across walkways.

Providing storm water inlets, where necessary, to intercept the maximum run-off for which the storm sewer system (if any) is designed. In localities where heavy rains occur, the following may be used as a rought guide for determining the spacing of storm water inlets:

Location of Storm Flow	Recommended Maximum Drainage Area
In street gutters	60,000 to 90,000 square feet
In service drives	30,000 to 60,000 square feet
Along walkways	15,000 to 30,000 square feet

Avoiding pockets where stoppage of a drain would result in damage to buildings or serious wash across planted areas.

Grading with utmost care the ground surface under buildings, which have pier foundations, so as positively to eliminate any depressions in which water might collect and to provide drainage to the exterior.

<u>Maximum</u> <u>and</u> <u>minimum</u> <u>slopes</u>: So far as site topography and cost considerations permit, project slopes should be kept within the following limits:

	Maximum	Minimum
Circulation and approach walks	15.00%*	0.50%
Entrance walks	6.00%**	1.00%
Project streets and driveways	8.00%***	0.50%
Surfaced play areas, sitting areas, etc.	2.00%	0.50%
Grassed areas	15.00%****	1.00%
Earth banks	3 to 1*****	---

*For slopes exceeding 10%, in projects in the north, provide wood handrail.
**Steeper slopes permissible provided grade flattens at building platform.
***5.00% for gravel, sand-clay and water-bound macadam.
****Use maximum slope of 10.00% in yards for a width of at least 12 feet around buildings.
*****Slopes steeper than 15% are usually sodder or planted with ground cover or shrubs.

<u>Grading</u> <u>Plans</u>: Show finished grades, by spot elevations, in the full detail necessary for the precise staking out of site grading and the construction of surface improvements. Give building floor elevations and finished grade elevations at building entrances, at corners of buildings, at intersections, termini and breaks in grade in roadway, walks and other paved areas, and at breaks in grade of lawns and planted areas.

It is not essential that the project drawings include roadway profiles but, in any event, curb grades (or grades at the side of the roadway when there are no curbs) should be shown on the grading <u>plans</u>. Such grades should be given at the returns into intersecting streets and roads, and elsewhere as required. Vertical curve data should also be shown.

Finished grade contours should be used only when the required grading cannot be shown practicably by spot elevations. Do not show grade <u>contours</u> crossing roadways or other surfaced areas.

Roadway design, including the selection of pavement type, must be based on a competent consideration of all factors involved: the nature of the subgrade, climatic conditions, method of surface drainage, comparative costs (including maintenance), probable wheel loads, the character of the project, and cost limitations. It is important that the designer be well informed on local construction practice, paving materials locally available, etc.

The crowned roadway section with curbs is definitely the most desirable for project streets and main drives. However, the provision of curbing will result generally in too high site improvement costs for projects of very low density. Protruding wood curbs, or sodded earth banks in lieu of curbs, are not recommended.

The dished section of roadway (inverted crown) is adapted principally to service drives, and to concrete as a surfacing material.

The crowned roadway section with roadside ditches offers and economical and generally acceptable type of roadway for low density projects. However, ample space must be allowed for a shoulder at each side of the pavement, and for a grassed strip between the ditch and the sidewalk (or possible future sidewalk location). The site plan should not be fixed definitely until the roadway section is decided upon. Figure SE-7 shows typical cross sections.

Roadside ditches, in earth, should be grassed or sodded and, preferably, be shallow and rounded. However, ditches of increased cross section, with culverts crossing the roadway where necessary, offer a means of handling storm water at less cost than by storm sewers. When such method of surface drainage is employed, storm flows should be calculated and the ditches designed accordingly. Wood "checks" may be set in the bottom of ditches if the flow velocities will be seriously erosive.

Affecting roadway design is the fact that the use of metal gratings for storm water inlets must be avoided. One method of accomplishing this is to construct inlets of the "curb" type. These, with short sections of curb, can be located most conveniently at roadway intersections.

Surfacing types will vary generally from light surface treatment on gravel, macadam or similar base, for roadways in projects of very low density, to Portland cement concrete or heavy bituminous concrete (in localities where asphalt or tar is available) for projects of higher density. Do not specify sheet asphalt, or other pavement requiring a concrete base and a separate wearing course. Use untreated surfacing such as water-bound macadam, gravel and sand-clay, for roadways only when cost limitations, or restrictions on the use of bituminous products, preclude laying a better type of surfacing.

Parking area surfacing should generally be materially lighter than surfacing on roadways. Bituminous surfacing can not be used for parking areas in regions where the use of tar and asphalt is restricted.

Concrete pavement, for the character of traffic common in housing projects, should have a slab thickness of 5, 5-1/2 or 6 inches, depending largely on subgrade and climatic conditions, the thickness at free edges and free joints to be approximately 50 per cent greater than interior thickness. (Integral curb may be considered to serve the purpose of thickened edge.) Provide longitudinal, construction, contraction and expansion joints according to standard practice. Show detailed layouts of joints required at roadway intersections and in parking areas. The use, if any, of steel must be confined to dowels, tie bars, etc.

Design bituminous pavement generally to conform to local standards for roadways carrying similar traffic, the base to be ample to take care of the probable loading as well as unstable conditions of the subgrade. Select a type of paving which local plants are equipped to produce and local contractors are experienced in laying.

The crown for concrete and bituminous roadways should be parabolic averaging 3/16 to 1/4 inch per foot. Inverted crown should be about 3/8 inch and 1/4 inch per foot for single-lane and two-lane roadways, respectively.

Where practicable, grade service drive and parking area entrances to cross sidewalks at the walkway grade.

Recommended roadway widths are given under "Site Planning."

Minimum curb radii for intersections and turns are as follows:

Respective widths of intersecting roadways	Minimum curb radius
10 feet and 10 feet	25 feet
10 feet and 16 feet	20 feet
10 feet and 20 feet	15 feet
16 feet and 16 feet, and greater widths	10 feet

Streets, drives and, in some cases, parking areas should, when cost limitations permit, be so designed and specified that they may be accepted in dedication to the municipality or other political subdivision having jurisdiction over the site. When not so designed, the streets may be so planned as to adapt them to possible future widening and/or to increasing in the future their section to meet local standards. (See Figure SE-7).

State highway department specifications may be referred to in housing project specifications, but only after careful examination and the voiding of any requirements which would be impractical or would involve unwarranted cost in their application to project work.

Walkways

Project walks, excepting building entrance walks, should generally be constructed of concrete. Gravel or cinder sub-base is necessary only under the most unfavorable soil conditions. When sub-base is required, provide drainage outlets at locations where water would otherwise be pocketed.

The use of stepping stones (natural stone or concrete flags) should generally be confined to entrance walks. With natural stone costing approximately the same as concrete, stone should be used.

Specify bituminous surfacing for walks (1) only in locations where asphalt and tar are not critical materials, (2) only for extensive wide walkways on which a power roller can be operated practicably, (3) only when a definite saving can be made by the use of such material and (4) only where seasonal climatic conditions will not delay placing the material.

Recommended walk widths are given under "Site Planning."

Avoid steps in walkways whenever possible. In climates where snow and ice are common, provide a wood handrail on one side, for runs of steps having over 6 risers.

Surfaced Areas

Following are surfacing types generally suitable and desirable for ordinary uses in housing projects:

Small or intensively used play areas	Bituminous concrete Sand-clay
Sitting areas	Concrete flags Brick on sand Concrete
Central drying yards	Bituminous concrete

However, cost limitations and restrictions on the use of certain materials may preclude specifying the most desirable surfacing types and necessitate employing only such materials as are available locally (sand-clay, gravel, slag, etc.).

For bituminous surfacing on play areas, provide for a fine-grained, impervious surface, comparable to sheet asphalt. Do not specify "cork asphalt" for any project surfacing.

The method of disposing of domestic sewage from the project -- whether by means of existing sewers or otherwise -- should be determined, if possible, at the time the site is selected. Following are the general policies to be observed in such determination:

Provide for the discharge of project sanitary sewage into existing sewers (or sewers provided by the local government) when it is by any means practicable to do so -- even if it is necessary to pump the sewage and conduct it for a considerable distance, and even if estimates indicate that first cost and/or operating cost will be appreciably greater by this method of disposal than by either of the following.

When no existing sewers are available, and none will be made so by the local government, provide a sewage treatment plant designed to meet the minimum requirements under the given conditions. Strive for:

(1) the least possible use of critical materials, such as reinforcing steel, metal piping, valves, and mechanical equipment, and

(2) simplicity of design, permitting the most expeditious preparation of plans and utmost speed in construction,

at the same time giving attention to the ordinary considerations governing the type of plant to be built.

Resort to sewage disposal by septic tanks and tile beds for individaul dwellings or groups of dwellings, only when percolation tests indicate that the method can be employed safely. When this method is adopted, employ State Board of Health requirements and the findings of the percolation tests to determine the yard space required for tanks and tile beds, bearing in mind the fact that tile beds must be abandoned after some years of use and new beds provided. Space project buildings accordingly. Septic tanks should be filled with water and "seeded" before sewage is introduced.

Make an investigation of existing sewers to determine whether they will be adequate at all times to carry away sanitary sewage and storm water without overflow or backflooding. This is important both in connection with site selection and project design -- especially so in the case of a combined sewer system to which basement drains will be connected.

In the general layout of sewer lines:

Locate sewers in or along project streets and driveways so far as feasible. However, to achieve important economy, sewers may be located in "easements," that is, in yard areas.

Design main and lateral sewers in straight lines and at uniform grades, insofar as the site plan and topography permit.

Coordinate the sewer design with that of other utilities; check particularly for conflicts in the grades of storm and sanitary sewers.

Lay out sewers so as to avoid existing trees which are to be preserved.

Provide manholes on all sewers (1) at maximum intervals of about 400 feet, (2) at definite changes in direction or breaks in grade, and (3) at junctions of main sewers and principal laterals. (Some exception to this rule may be made where, due to rugged topography, excessive cost would be involved).

Provide clean-outs at the upper end of sanitary sewer laterals (except when the lateral is not over 150 feet in length from a manhole) and at changes in direction where manholes are not proposed. In unsurfaced areas, clean-outs may terminate about one foot below finished grade or, for very shallow lines, they may consist simply of a removable plug in the end of the line.

Show clearly on the sewer plans the locations and necessary invert elevations of all lines, also existing ground contours and finished grades at buildings and at occasional intervals along roadways, walks, etc. Sewer profiles are not required as contract drawings.

So far as feasible, use concrete, in lieu of cast iron, for manhole tops and design storm water inlets of a type that will not require metal gratings.

Design sanitary sewers for a maximum flow of approximately 600 gallons per day per DU, with sewers flowing half full. Make additional allowance for infiltration if the lines are to be laid in water-bearing sand.

House connections to sanitary sewers may be 4-inch or 6-inch; short laterals should generally be 6-inch; all other sanitary sewers, particularly those in streets and drives, should not be smaller than 8-inch.

Where sufficient fall can be had without laying sewers at excessive depths, provide grades which will produce a velocity of at least 2 feet per second, with sewers flowing full.

Sanitary sewers are in no case to be laid in the same trench with water supply piping.

Avoid any surface drainage connections to separate sanitary sewer systems.

When a sewage pumping station is necessary, provide two pumps (except under the condition noted below), each having a capacity in gallons per minute equal to 1/60th at the maximum hourly rate of sewage flow. Pumping equipment should be located in a dry well. Design the sewage sump of such capacity that float settings will permit at least a 15-minute operation of one pump. Whenever possible, provide an overflow from the sewage sump, such overflow to operate only in case of power or pump failure. If the discharge from the overflow can be disposed of for a reasonable period of time without creating a nuisance of health menace, one pump should be omitted for the duration of the emergency.

Storm and Combined Sewers

Storm sewers must in general be provided to the extent that in the project grade design, surface drainage can not be shed directly into public streets.

Employ the rational method in the design of storm and combined sewers. The sanitary sewage flow may generally be disregarded in combined sewer design.

Assume a rainfall frequency in each case which is related to the risk involved. For example, if the only result of surcharging a storm sewer will be some little ponding between street curbs, a 2-year rainfall frequency (corresponding, say, to a rainfall rate of 2 to 3 inches per hour) may be deemed satisfactory, while if the sewer drains a deep "pocket" and inadequate capacity might result in serious property damage, a frequency of 25 years or more (corresponding, say, to a rainfall rate of 4 or 5 inches per hour) may reasonably be assumed.

Rainfall rates may be taken from the accompanying chart, Fig. SE-3, entitled "Rainfall Intensities", or from local records.

For convenience, sewer sizes may be taken from the chart, Fit. SE-4, entitled "Requisite Diameters for Storm Sewers." If the rainfall rate varies from that upon which the chart is based, adjust the drainage areas proportionately.

When sufficient fall can be had without laying the sewers at excessive depth, provide grades for storm and combined sewers that will produce a velocity of at least 2½ feet per second, with sewers flowing full.

Minimum pipe sizes for storm and combined sewers are as follows (these do not apply in regions having a very low rainfall intensity):

Sewers draining streets and main drives	12 inches
Sewers draining service drives	10 inches
Connections to storm water inlets in streets and main drives	10 inches
Connections to storm water inlets in service drives	8 inches
Connections to storm water inlets in yard areas	8 inches
Downspout connections	6 inches

Storm water inlets must be located in general at points determined by the grade design. However, the sewer designer should check the need for and the adequacy of inlets so located. (The grading and the storm sewer design can be performed advantageously by the same engineer.)

In general, provide catch basins with trapped outlets or combined sewers, and simple inlets without catchment space on storm sewers.

Arrange drainage facilities in such way that reliance will not be placed on the functioning of single storm water inlet or drain, if its stoppage would cause the flooding of a building floor or other serious damage. Set inlet gratings 2 or 3 inches below finished grade.

Where soil conditions and slopes permit, let roof downspouts discharge onto splash blocks at the ground level; otherwise, provide storm sewer connections.

Locate fire hydrants so that they will be accessible, protected from traffic hazards, and will not obstruct walks, roadways or parking facilities.

Provide a systematic arrangement of valves, the length of main to be cut out of service to be approximately 1,200 feet. Valves are required on hydrant branches only on large size mains or when hydrants are subject to damage by unusual traffic hazards.

Specify piping materials, primarily, so as to avoid the use of critical materials and, secondly, for permanence, taking into account ground conditions and the water analysis.

The primary consideration in gas distribution system design, as in other phases of site engineering, is the conserving of critical materials. To this end:

(1) High pressure distribution should be employed whenever a high pressure main is available at or near the site, or when it proves feasible and economical -- in the use of critical materials -- to lay a new high pressure main to the site.

(2) All pipe sizes should be calculated carefully, providing adequate capacities yet avoiding over-sizing.

Following is a simplified design procedure, applicable to low pressure systems and intended primarily for projects supplied through one or more master meters (steps 1 to 3 inclusive are applicable also to high pressure systems):

1. Ascertain from the gas company the characteristics of the gas and its pressure at the point of supply (generally the project side of the meter).

2. Select the longest run of piping from the point of supply to any dwelling unit, noting the number of dwelling units served at critical points along its length.

3. Given the characteristics of the gas, also its uses as determined from the Utility Analysis, refer to the diagram entitled "Approximate Peak-Hour Gas Demand," Figure SE-5, for the peak-hour loads at each of the critical points. Note that this diagram does not cover space heating, additional allowance for which should be made as follows:

   For 1 to 10 DU's - 100% of the specified input of connected heating appliances.

   For additional DU's - 80% to 90% of the specified input of such appliances.

4. Determine the available pressure loss in the distribution system by deducting from the initial pressure (at the point of supply) the requisite residual pressure at the appliance (generally about 3 inches) and a drop of 0.5 inch within the building. (One inch of water column equals 0.58 ounce.)

5. Take pipe sizes from the diagram entitled "Requisite Diameters for Low Pressure Gas Mains," Figure SE-6, by entering this diagram on the horizontal line corresponding to the total length of the piping run. Where such line intersects the diagonal line representing the available pressure drop, draw a vertical line. Proceed upward and/or downward on this line to the "cubic feet per hour" at each of the critical points above selected, and note required pipe sizes. (For artificial gas use S=0.45; for natural gas use S=0.60.)

6. Follow the same procedure for shorter runs in the system, but maintain a reasonable uniformity in sizing.

Miscellaneous site improvements comprise retaining walls, garbage collection platforms, fences, clothes line supports, flag poles, spray pools, and other similar construction items not included in building or utility work.

Retaining walls: Avoid entirely reinforced concrete retaining walls; use plain concrete or stone walls only when necessary under the site plan and topographic conditions. Where high walls must be constructed, provide a fence or rail along the top.

Fences: Use wood fences only.

Clothes line supports: When posts are employed use wood only. A 6-inch round post is strong enough for all such uses. If sawed lumber must be employed, e. g., for central drying yards, design the supports for the following clothes line pulls:

One 20-foot line	80 lbs.)	
One 25-foot line	120 lbs.)	Add 30% for each
One 30-foot line	160 lbs.)	Additional line
One 35-foot line	200 lbs.)	

Design for a stress in the wood of about 2,000 lbs. per sq. in.

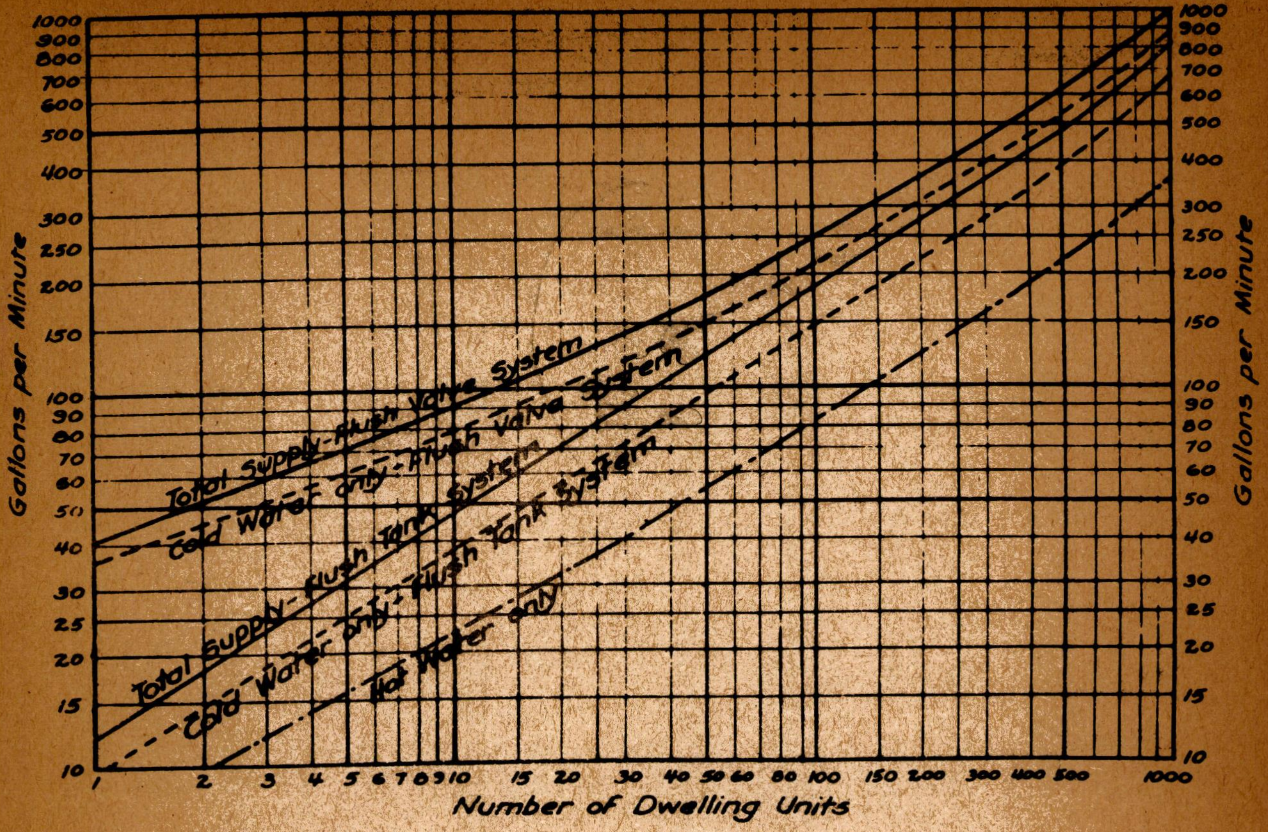
Flag poles: Specify wood poles only. Set pole in sleeve provided in plain concrete base, filling annular space with dry sand and sealing top with calking compound.

Street and Directional Signs: Specify wood only.

Sand Boxes and other apparatus or permanent fixtures in most cases should be located on impervious surfacing.

Spray pools: Use concrete for the spray area surface, but only with temperature reinforcement and without joints. Provide gravel or other sub-base only when soil conditions are unfavorable.

Grade the spray area flush with the surrounding surface; avoid curbs. Do not drain outside areas onto the spray area.



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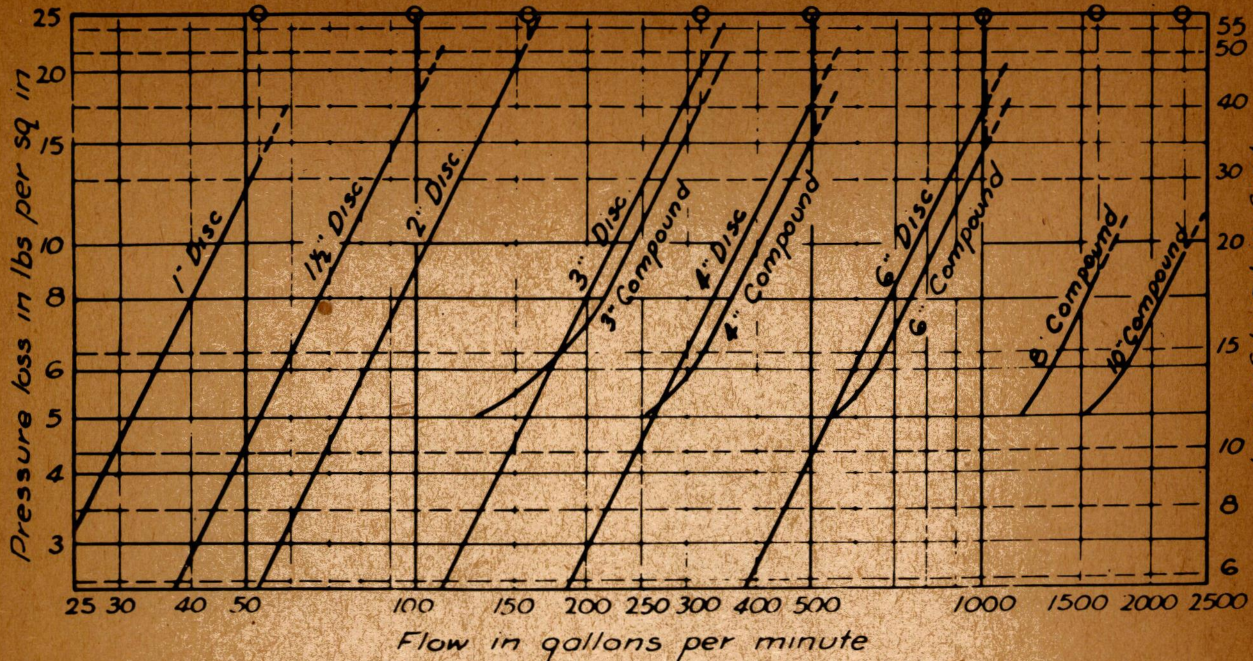
DATE	MAX. MOMENTARY DEMAND FOR DOMESTIC WATER SUPPLY	FPHA
FEB. '42	NATIONAL HOUSING AGENCY - FEDERAL PUBLIC HOUSING AUTHORITY	FIG. S.E.-1



Note Circles show flows required by AWWA specifications for pressure loss of 25#/□"

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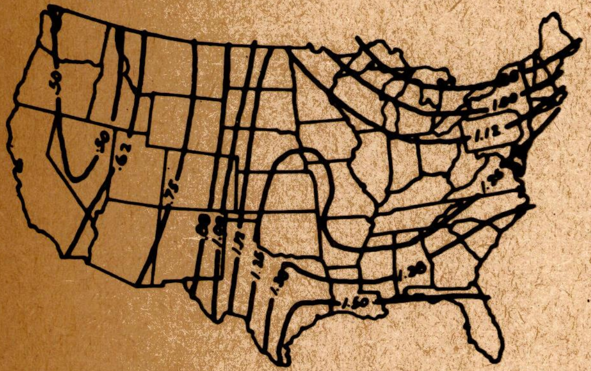
DATE	APPROX. PRESSURE LOSSES THRU COLD WATER METERS	FPHA
FEB. '42	NATIONAL HOUSING AGENCY - FEDERAL PUBLIC HOUSING AUTHORITY	FIG. S.E.-2

15 minute rainfall, in inches, to be expected once in 2 years

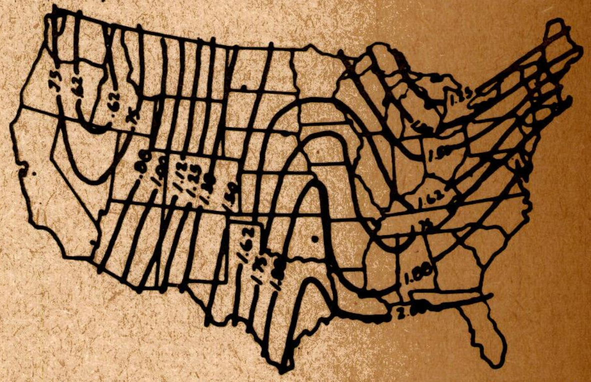
15 minute rainfall, in inches, to be expected once in 5 years.



15-minute rainfall, in inches, to be expected once in 10 years.

15 minute rainfall, in inches, to be expected once in 25 years

15 minute rainfall, in inches, to be expected once in 50 years.



15 minute rainfall, in inches, to be expected once in 100 years.

NOTE:

Approximate adjustments in rainfall rates for other than 15 minute periods:

For 5 minute period	add 45%
For 10 minute period	add 15%
For 30 minute period	deduct 30%
For 1 hour period	deduct 45%

From "Rainfall Intensity-Frequency Data" by David L. Yarnell - U.S. Dept. of Agriculture, Miscellaneous Publication No. 204.

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DATE	RAINFALL INTENSITIES	FPHA
FEB. '42	NATIONAL HOUSING AGENCY - FEDERAL PUBLIC HOUSING AUTHORITY	FIG. S.E.-3

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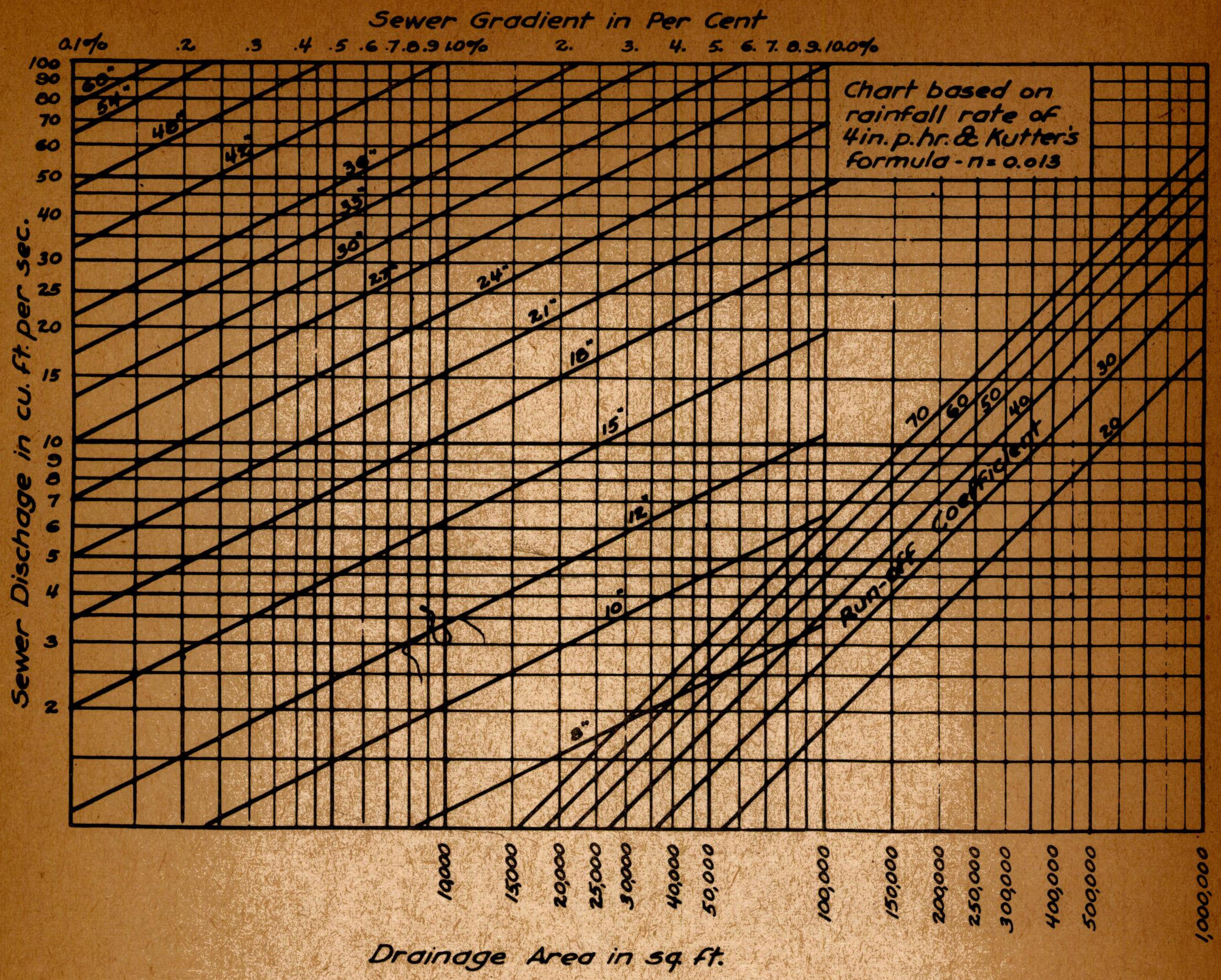

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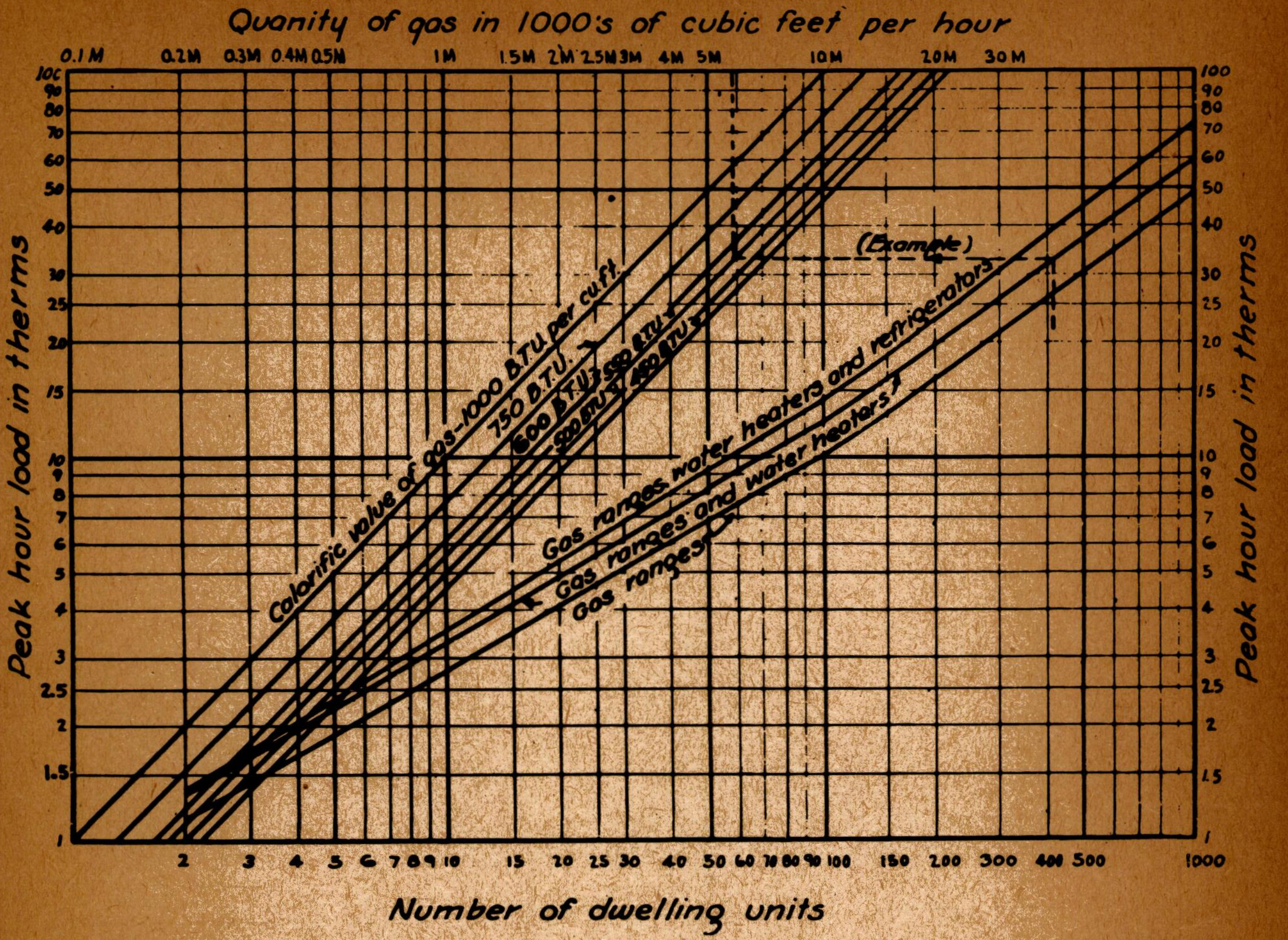
DATE	REQUISITE DIAMETERS FOR STORM SEWERS	FPHA
FEB. '42	NATIONAL HOUSING AGENCY - FEDERAL PUBLIC HOUSING AUTHORITY	FIG. S.E.-4



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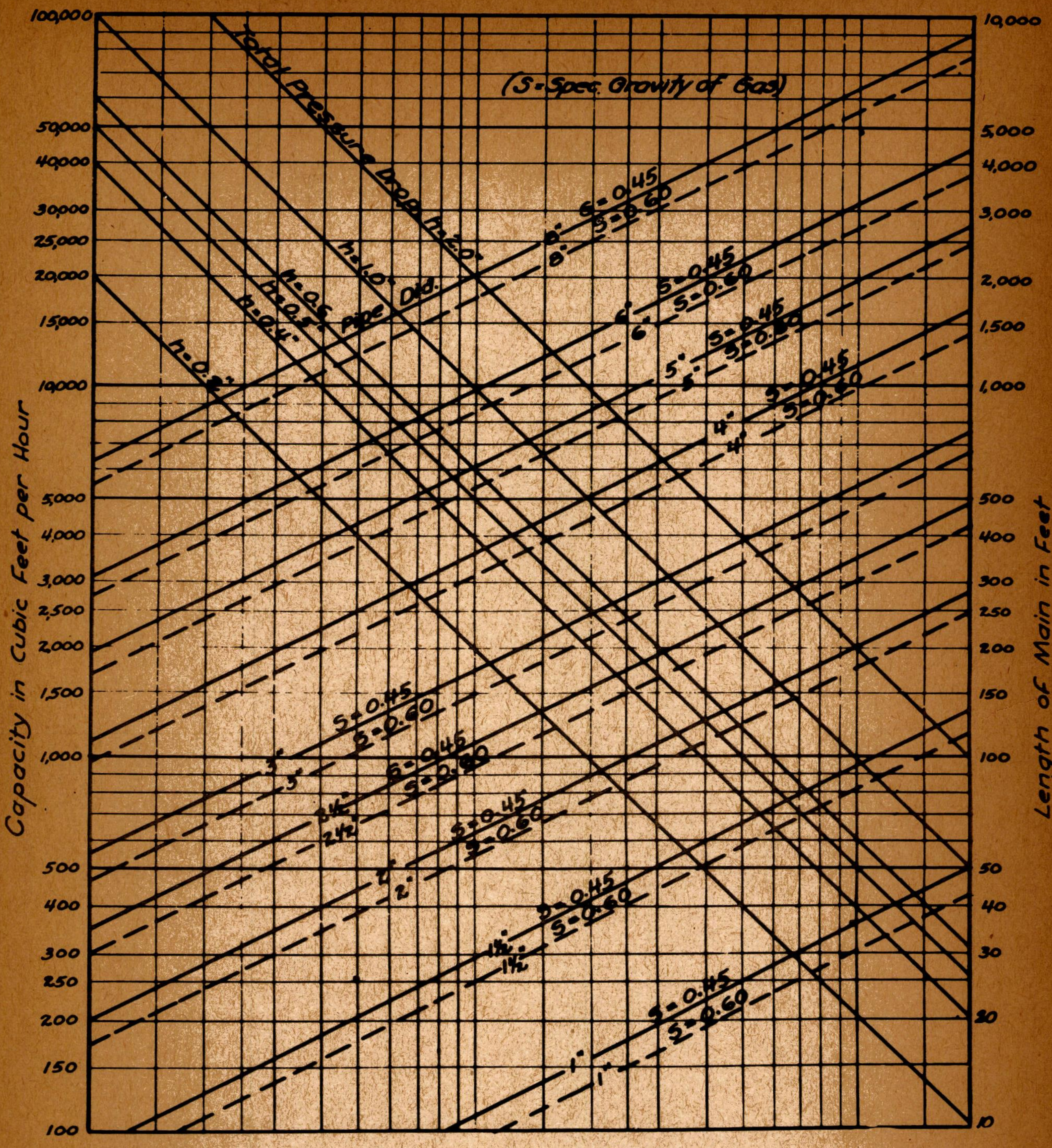
DATE	APPROXIMATE PEAK-HOUR GAS DEMAND	F.W.A.
FEB. '42	DEFENSE HOUSING · FEDERAL WORKS AGENCY · WASHINGTON D.C.	FIG. S.E.-5

9781



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DATE	REQUISITE DIAMETERS FOR LOW PRESSURE GAS MAINS	FPHA
FEB. '42	NATIONAL HOUSING AGENCY - FEDERAL PUBLIC HOUSING AUTHORITY	FIG. S.E.-6

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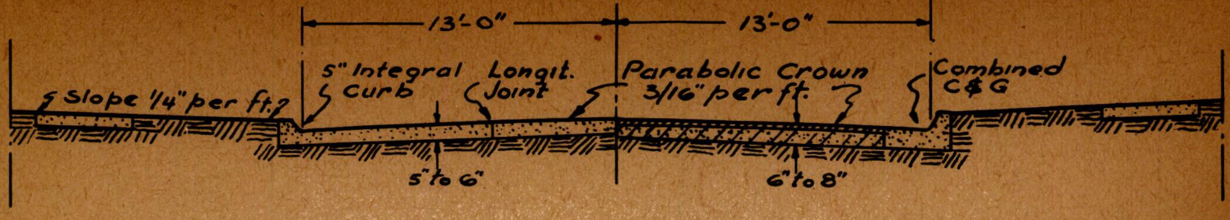

TYPICAL HALF-SECTIONS OF ROADWAY WITH CURBS

concrete

Bituminous surfacing on - macadam, gravel or stabilized base, etc.

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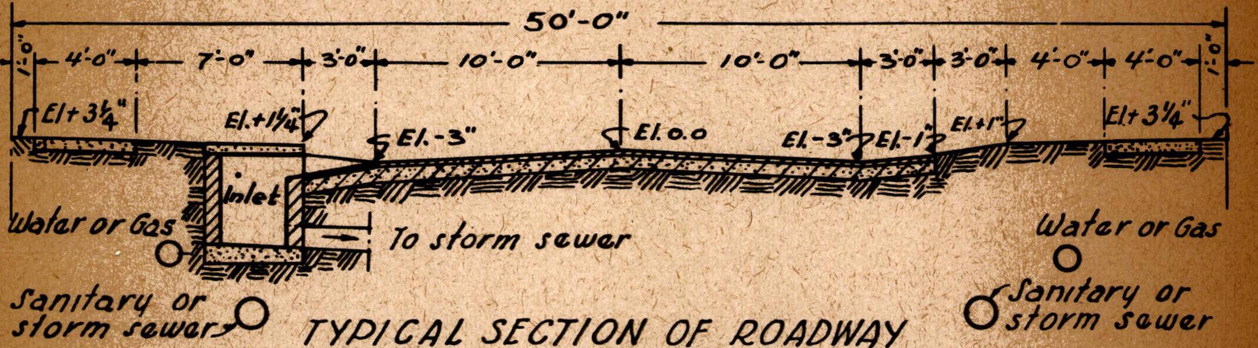

TYPICAL SECTION OF ROADWAY WITH BITUMINOUS PAVED GUTTERS

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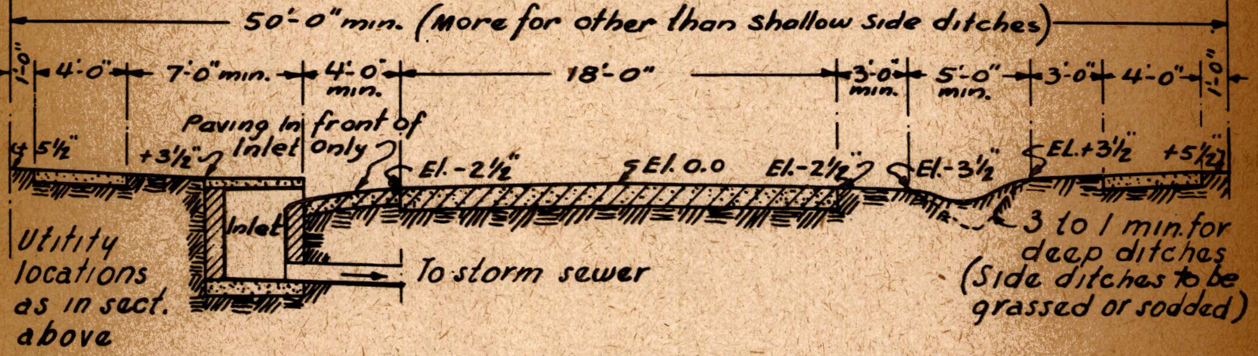
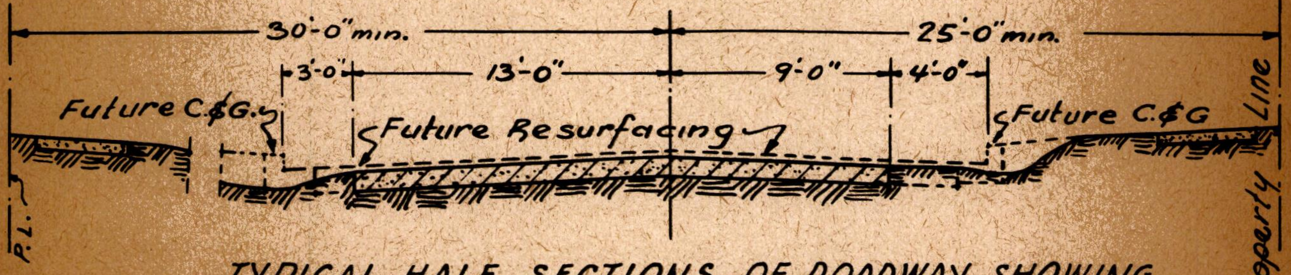


TYPICAL SECTION OF 18-FT. ROADWAY WITH EARTH SIDE DITCHES

APPROVED



TYPICAL HALF SECTIONS OF ROADWAY SHOWING FUTURE WIDENING AND CURB CONSTRUCTION

Note: Present roadway grades must be adjusted to probable future grades.

REVISED

DATE	TYPICAL ROADWAY CROSS SECTIONS	F. P. H. A.
MAY-'42	NATIONAL HOUSING AGENCY - FEDERAL PUBLIC HOUSING AUTHORITY	FIG. S.E.7

STANDARDS FOR WAR HOUSING

Excluding Temporary Housing

LAWNS AND PLANTING

Federal Public Housing Authority

May 15, 1942

The objectives of these standards are ease of maintenance, satisfactory appearance, and economy. These objectives can be attained by simplicity of design and of specification and suitability of plant materials.

Long range considerations of air raid protection and the camouflage value of plant materials should influence the design to a reasonable degree. The immediate camouflage value of such planting as is economically possible in housing work cannot be very great. It is not possible to foresee, however, how long this war will last or when another will occur. Funds available for planting should be spent to attain as much protection, immediate and future, as can be had without serious loss of amenity and convenience.

Existing trees and other vegetation should be saved and used to the fullest possible extent. Growth having a height of as little as six or eight feet has value as protection against strafing and as camouflage, through its shadow-breaking effect. Highly inflammable growths and soil covers (as pine thickets), however, should be cleared from the vicinity of buildings. Free-standing trees should be shown accurately on the survey. In wooded areas, road and building locations should be checked after staking but, where possible, before clearing the site, to permit changes of location to save trees. Correlate grading plan with tree locations and elevations. During construction protect trees and surrounding soil with strong fences; provide fertilizers, pruning, watering, etc., as required in each case.

Planting design should be studied in elevation as well as plan. Consider ultimate height and spread of each plant to avoid future pruning, respacing, and moving. Do not let the planting become a trivial decoration of individual buildings. Plant for breadth and an effect of simple practicality; plant to facilitate land use. Endeavor to secure maximum camouflage value within these basic principles.

Planning for economy of maintenance is a primary requirement. Plant lists should be short; using a large variety of material increases initial cost, maintenance and replacement. Avoid rare and expensive plants. Do not plant easily damaged flowering trees and shrubs in unprotected public areas. Avoid the use of scattered and intricately outlined shrub groups; keep down the number of free-standing trees in lawn areas which may be cut by a power mower. Give the planting effective protection, either by its location or by fences or by thorny hedges. This is especially important in high density projects and near play areas. Budget the planting work. Reduce the number of plants rather than cut the allowance for soil preparation, fertilizers, and drainage, particularly where unfavorable soil conditions exist.

Trees, though planted for their present or future camouflage effect, should not be used in such numbers as to make a forest of the project. Excessive shade makes houses dark and damp, stops air circulation, and may injure lawns and gardens. Southern projects require more shade than northern ones. Shade requirements also vary with land use. Tree plantings tend to reduce conflagration danger through their effect as windbreaks, but the central part of a firebreak should be kept free of trees.

Wide streets, especially if straight, should be planted with scattered trees and "drift" planting crossing street lines. Regularly planted trees are usually to be avoided. Narrow streets may have most of the trees on one side only, preferably on the south or west side, for more effective shading. Long curves in the street plan usually have better visual effect if trees are used on both sides or on outside curves.

Street trees should stand, where practicable, at least three feet from pavements and sidewalks. It is usually preferable to plant them on the house side of the sidewalk. Trees should be located so as to avoid interference with poles, overhead service lines, and underground utilities.

Service drives can be improved in appearance by planting trees; usually they should be placed informally at points where shade will not interfere with clothes drying and other rear yard uses.

Through the project, a mixture of large and small trees, vines, some shrubbery and miscellaneous planting, such as is likely to be produced if the tenants are encouraged to plant freely in their yards, is the most practicable protection. Such a texture tends to obscure the artificial lines and areas on the ground and to break or blur the shadows of buildings. From ten to fifteen large trees per acre of open area is a fair range. In areas in which inexpensive, hardy, rapidly growing evergreens are available, they should be used with or in place of deciduous trees, because of their advantage for camouflage.

Under some conditions the large trees can be concentrated in groups at the ends of buildings, breaking long vistas and giving dark shade to contrast with sunny courts. Between the ends of buildings, trees have the desirable effect of separating the wall planes of the buildings as seen in a perspective view. In locating shade trees, study the orientation and plant the trees to give shade when and where it is wanted. Where feasible locate trees to define tenant yard divisions.

Small trees, or kinds that do not cast dense shadows, can be planted close to buildings where they will compose well with the lines of long architectural vistas. Small trees planted near the center line of a rear court will reduce noises, give privacy to the dwellings, and improve the rear yard area visually.

Good growing conditions are necessary for good tree growth. When the existing conditions are unfavorable, use a few clumps of trees and provide them with good soil and effective protection.

Shrubs should be used in large masses only when required for practical reasons, as to prevent erosion on slopes or as a ground cover. Most shrub plantings should be as individuals or in small groups. At fronts of buildings shrubs are planted to mark the location of entrances and (in long rows) to break the view of steps and platforms. At rears of grouped dwellings shrubs are advantageously planted to mark the boundaries between units and to screen the waste receptacles, etc., that are kept at the kitchen door. Near the corners of buildings or between their ends, shrubs tend to make a project seem less crowded by separating the structures visually and reducing the amount of exposed wall.

Do not plant too close to buildings. Allow ample space along walks to permit normal growth without crowding.

Continuous shrub plantings around foundations of buildings should be avoided. The lawn may extend up to the buildings at intervals. If planting is done at windows, use low growing varieties. Plants at corners may be large-growing shrubs or small trees. High shrubs usually should not be used in front of lattice work intended for vines.

Hedges may be used in small amounts at the management building, in connection with play areas, and at a few strategic points in the site plan, as at street corners and along project boundaries. Preference should be given to species that have an acceptable appearance if pruning is not done. Satisfactory maintenance of clipped hedges cannot be assured in rental housing.

Vines are usually easy to maintain and should be used liberally. On masonry walls, especially on blank ends of buildings and in narrow courts, vines reduce noise and glare and tend to diminish the crowded effect of large projects. On frame construction use vines only on supports and use kinds that do not damage the construction of supports and buildings. Appropriate vines should be used on fences. Strong growing vines are useful as ground covers, especially on banks.

Herbaceous Plants. Avoid the use of herbaceous flowering plants. Ample space should be provided where possible for beds for annuals or perennials to be prepared and planted by tenants.

Selection of Plants should be based on these factors:

Climate: Limit plant selection to varieties which, by local experience, have proved tolerant to seasonal temperatures and precipitation.

Soils: Select plants to suit soil conditions, particularly extreme soil conditions such as light, dry sandy soils with limited water supply or heavy, wet, low, poorly drained soils.

Availability: Only stock that is normally grown in nurseries within reasonable distances of the project should be considered.

Freedom from Insects and Diseases: Only those varieties known by local experience to be resistant to insect and disease attack should be planted.

Life and Rate of Growth: As a rule, long-lived plants should be selected, provided they are not too slow in growth. Plants of such rapid growth that they require frequent pruning should be avoided in most cases. Fast growing trees and large shrubs may be used for quick shade, but avoid planting such trees as poplars too close to buildings or walks where strong growing roots may cause damage. Avoid trees that damage underground utility lines.

Durability: Avoid the use of delicate plants. The planting will be subject to relatively heavy wear and will not always have skilled maintenance.

Standards for Spacing: It is recognized that spacing of plant materials may vary according to the function of the planting. The following chart is a guide to minimum spacing under the sizes and shapes indicated. The tree spacings refer to streets and courts, not to screen or shelter plantings or groups of erect trees, which should be closer. In hedges, shrubs should usually be 18 inches apart and up to 3 feet if strong shrubs are planted as an unclipped hedge. Special consideration should be given to spacing of shrubs and vines for erosion control.

MINIMUM SPACING TABLE BASED ON ULTIMATE HEIGHTS

Type of Plant	Large Height	Large Dist. Apart	Medium Height	Medium Dist. Apart	Small Height	Small Dist. Apart
Trees:						
Erect	50-100'	35'	25-50'	30'	15-25'	25'
Round-headed	"	40'	"	35'	"	30'
Spreading	"	50'	"	40'	"	35'
Shrubs:						
Erect	6-15'	4'	4-6'	3'	Under 4'	2'
Round-headed	"	5'	"	4'	"	3'
Spreading	"	6'	"	5'	"	4'

Note: Spacings for trees refer to permanent trees. For camouflage effect, additional trees may be added, reducing spacing.

6 LAWNS AND PLANTING.
Grass
Cost Limitations

Grass. In order to protect the project site from erosion by water and wind, and to form an earth surface on which people can walk, all disturned land (including disturbed or trampled areas, outside the contract limits, resulting from the contractor's work) should be planted with grass. In order to preserve as much as possible of the existing surface soil and natural growth, any areas not actually necessary for contract operations should be reserved and protected.

Suitable soil shall be assured through appropriate specifications. Existing soils should be utilized wherever practicable. Under some circumstances use of existing soil conditioned by addition of clay, sand, humus, or fertile topsoil may be more economical than the supplying of all new topsoil.

Topsoil shall not be brought in unless tests indicate that it is needed. Tests shall be made by local agronomist. Approval of need of topsoil shall be by construction agency.

Cost Limitations: The following costs should not be exceeded, unless justification is made for unusual site conditions.

"Planting" includes material and labor cost of planting trees, shrubs, and vines, and of work on existing trees normally done by the landscape contractor.

DENSITY UNITS PER ACRE PROPERTY	DENSITY UNITS PER ACRE NET	PLANTING PER D. U.
5	9	$35.
10	15	30.
15	20	27.
20	25	25.
25	30	22.
30	40	18.

Property density is based on the land acquired for the project, minus areas unfit for buildings or for playgrounds or other project use. Net density is in general project area minus playgrounds, unbuildable land, and public streets. (For detailed definition, see section on "Site Planning.")

STANDARDS FOR WAR HOUSING

Excluding Temporary Housing

DWELLING DESIGN

Federal Public Housing Authority

May 15, 1942

183643 H

Before proceeding with the dwelling plan studies, determine the following:

Limiting neighborhood customs

Local climatic conditions

Heating system and fuels

Type of construction and kinds of materials

Handling of garbage and wastes, and storage of fuels

Topographical and subsurface conditions which may affect the plan, its entrances, servicing, etc.

Established density and its bearing on the prospect from the various rooms of the dwelling

Relation of utility services

Cost limitations

DWELLING DESIGN.

General

Due care should be given to develop designs which take appropriate advantage of site conditions, views, trees, and influencing climatic conditions, in order to produce homes with esthetic expression and appeal.

Planning should be studied for correlation with construction. For economy, avoid offsets in walls and partitions where reasonably possible. Limit bearing partition openings to eight feet. Plan generally for use of stock sizes, of control materials and manufactured parts. The use of stock lumber lengths, however, is often less important than maintaining minimum floor areas and stock sizes in other materials.

Ascertain fire insurance classifications and rates and adjust the design so as to obtain protection economically.

Variety of types for dwelling units and/or buildings should be kept to a minimum in each project.

Grouping dwelling units in buildings: Breaks in exterior walls and roofs should be avoided unless required by the plan of the adjacent unit. Avoid straight lengths of buildings exceeding 200 feet unless expansion joints are provided. In concrete construction avoid lateral offsets of more than 6' - 0" and changes in floor levels of more than 18-inches.

Floor levels should be in definite relation to the established finished grades at each individual building.

Orientation of buildings should be favorable for the effects of sun and breeze in localities where important.

Basements in other than apartment buildings should not be planned. However, where deep foundations (3' - 6" or more) are necessary, or where steep grades make them economical they may be permitted. For apartment buildings they should be limited to actual requirements.

If basements or part basements are used, they shall be provided with means for light and ventilation of not less than 2% of the floor area.

No basement shall be considered habitable unless finished grades are below the floor level on one side and below 4' - 0" high window sills on the opposite side.

Crawl Spaces, should be provided under buildings with closed in foundations or supported on pier foundations. Earth shall be graded to provide positive slopes away from buildings, with no pockets or depressions left to collect water under or adjacent to the building.

All crawl spaces shall provide a clearance of at least 24-inches from ground to bottom of wood joists. In the case of closed in foundations an exterior access door to the crawl space shall be provided. This door should be located near the low point of the grade at each building, and its sill should be at least 2-inches above the outside finished grade.

Concrete floors on ground for habitable rooms may be used only in warm, dry climates and where it is accepted practice in the locality, or for hillside units as indicated above. (See 3rd paragraph).

Plumbing stacks. Make layout of plumbing fixtures in each unit so that stacks may be combined where feasible.

Chimney flues of adjacent units should be grouped.

Mechanical ventilation is not acceptable in lieu of natural ventilation.

Minimum ceiling height in spaces used for living purposes shall not be less than 7' - 0" in the clear. In special cases only, where Regional Director deems it reasonable and/or desirable, ceiling height may be as low as 6' - 4" at the eave line of a pitched roof and slope up under roof to a minimum clear height of 7' - 6".

Furniture placement should be carefully checked in the preliminary stage and again in the working drawing stage in its relation to electrical and heating layouts, windows, and door swings.

Eliminate all unnecessary projecting corners.

Items Affecting Unit Planning

Distribution of dwelling units: See Standards on "Site Planning" herein.

Standards for planning the unit are discussed in detail in the following pages under headings for the various rooms or other spaces which make up the dwelling. See also the accompanying typical dwelling unit plans, indicating suggested layouts which meet the requirements of the Standards. These plans are not intended to discourage the development of others to better meet local conditions or environment.

Plans permitting the interchangeable assignment of a bedroom from one dwelling unit to an adjacent unit may be developed. In such cases, however, provision should also be made to change over the electric lighting and heating to the dwelling having control.

Minimum Room Sizes

Living room..	160 sq. ft.*
Kitchen..	50 " "
Principal bedroom..................................	120 " "
Additional bedrooms for 2 person occupancy...........	100 " "
Additional bedrooms for single occupancy.............	70 " "
Storage space in addition to required closets........ (See "Closets" p. 12).	30 " " **

The minimum aggregate area of the living room and kitchen shall be increased 10 square feet for each person as shown on the following table, to accommodate dining.

Minimum area of living room and kitchen and dining space:

2 persons	1 bedroom	230 sq. ft.
4 persons	2 bedrooms	250 " "
5 persons	3 bedrooms	260 " "
6 persons	3 bedrooms	270 " "
7 persons	4 bedrooms	280 " "
8 persons	4 bedrooms	290 " "

*When space heater is in living room add 15 sq. ft.

**Minimum in 1-bedroom units is 25 sq. ft.

Minimum facilities shall be provided in each dwelling unit as follows:

Rooms and room sizes in accordance with the previous table (including at least one principal bedroom).

Dining space, allowing for standard table and chairs, sufficient to accommodate the family. (See Dining space p. 7.)

Kitchen range, refrigerator, sink and laundry tray with movable drain board, base cabinet, and kitchen shelving.

Hot and cold running water inside the house; also water connections outside for watering yards front and back.

Private toilet and bathing facilities.

Electirc lighting.

Heating adequate to maintain 70 degrees (See Heating).

One coat closet, one linen closet, and bedroom closets containing space of approximately two lineal feet for each person. (See "Closets".)

General storage space of not less than 30 sq. ft. and at least two 12-inch shelves on one side. (See "Storage Space,") except that one bedroom units may have not less than 25 sq. ft. Two thirds of general storage space shall be within the dwelling, except in apartments. (See Page 13.)

Ranges and refrigerators shall be furnished by the project when deemed needed. (See Defense Manual).

The minimum width is 10' - 6". The layout of the living room should be such as to accommodate a couch or davenport (6' - 9" x 3'-0"), two easy chairs (2' - 6" x 3' - 0") a desk or table (2' - 0" x 3' - 4"), radio (2' - 8" x 1' - 4"), and other incidental furniture. The room area required will depend on how many persons the dwelling will accommodate, whether the room will be used for dining, and whether it contains a space heater.

The use of a strip kitchen (equipment in the living room) should be limited to one-bedroom dwelling units in which the tenant has access to a separate or central laundry.

If an open plan is used - omitting a section of partition between living room and kitchen - the kitchen equipment should be shielded from the living room by a jib-partition, and a rod provided on which the tenant can hang a curtain.

Provide seating and table space for the maximum number of persons the unit will accommodate. It is preferable to locate this dining space in the kitchen but it may be in an alcove off the living room and adjacent to the kitchen. In either case the space should be proportioned to fit the dining requirements.

The space for dining is to be in addition to the minimum living room and kitchen areas.

The clearance around dining table should not be less than as follows:

Main passage--3'-0"; if seating is contemplated at this passage--3'-6"; where 2'-6" wide table is used and seating is between table and wall allow 2'-6" between table and wall if table is 3'-0" wide allow 2'-0" clearance

For design purposes the minimum sizes of dining tables shall be not less than as follows:

2	people	2'-6" x 2'-6"
4	"	2'-6" x 3'-6"
5	"	3'-0" x 4'-0" (seating at one end)
6	"	3'-0" x 6'-0", or 3'-0" x 4'-0" (seating at each end)
7	"	3'-0" x 6'-0" (seating at one end)
8	"	3'-0" x 8'-0", 4'-0" x 4'-0", or 3'-0" x 6'-0" (seating at each end)

Refer to detail sheet Fig. DD-1, showing spaces for equipment, and "Minimum Requirements." More than the minimum required kitchen area is usually desirable.

Good kitchen equipment planning calls for the following:

Sink should have work surfaces - drain board or work top - on each side.

In units having more than one bedroom the range should be adjacent to work surface.

Range and refrigerator should not be placed together.

End of laundry tray and kitchen sink should not come within 6" of wall or high refrigerator to provide space for working and cleaning.

Provide a minimum clear space of 3'-0" in front of kitchen equipment, and 3'-6" in front of the sink and tray for use of washing machine.

Provide access to the water heater as required for its operation and maintenance.

Provide adequate and convenient shelving, none of which shall be located over the range. The required amount of kitchen shelving, not less than 12" wide, and not counting base cabinet, shall be not less than:-

1-bedroom unit	- 22	lineal	feet
2 "	" - 28	"	"
3 "	" - 34	"	"
4 "	" - 40	"	"

About one half of this shelving should be inclosed as wall cabinet space.

In addition to the above 12" shelving a $5\frac{1}{2}$" deep shelf is desirable over the sink and tray and base cabinet. See detail sheet referred to above.

Locate ranges at least 2'-0" away from any window jamb. This is to reduce the fire hazard which exists when window drapes can blow over the range.

Where jamb of opening between kitchen and living room is within 12" of the range, provide door at this opening.

If coal is used for cooking, allow space and clearance of 4'-6" x 2'-6" for coal burning range, and provide flue in masonry chimney.

Provide a base cabinet with work top at least 2'-0" long, see Fig. DD-1. It is desirable to provide space in the kitchen for a small tenant-supplied table in addition to the required base cabinet.

As much storage capacity as possible should be developed where it can be reached without stepping on a chair or ladder. Shelves within convenient reach can be located on any wall of the kitchen. A kitchen or utility closet is desirable as an adjunct to the kitchen, and kitchen shelving in addition to that required may be located therein.

The kitchen, or storage closet opening off kitchen should have space to keep a washing machine. An opening through which washing machine is frequently moved must be 2' - 8" clear.

Preferably, the back door and entrance to utility closet should be near each other.

Laundry facilities for all size units shall consist of a combination sink and laundry tray in the kitchen, 42" long.

Where fixtures and equipment will be provided by the Government use only sizes so supplied.

A desirable feature in a kitchen is a wood strip (4'-6" from the floor and 3'-5" long) to which can be attached certain kitchen equipment such as can openers, towel racks, etc.

Each dwelling must be equipped with a bathtub or shower (See LD-210), lavatory, and inside flush toilet.

The bathroom should be accessible from each bedroom and from the living room without passing through a bedroom or the living room.

The bathroom must have a window (or ventilating skylight).

Generally the bathroom should be back to back with a bathroom in an adjacent unit, or with a kitchen. For economy, the bathroom fixtures should be aligned along the pipe stack wall. If the stack is to be exposed, the unit should be planned so that the stack will come in a utility room or closet.

Provide a medicine cabinet with a mirror approximately 12" x 16". Set with the center of the mirror approximately 5' - 3" from the floor.

Install a wood strip on the wall (4' - 6" from floor), for attachment of towel bar and other accessories. Provide one 24-inch towel bar and a toilet paper holder.

In large units the lavatory (wash basin) may be in separate compartment.

Each bedroom should be designed definitely for either one or two person occupancy, but <u>one person bedrooms are not recommended</u>. The maximum area for a single person bedroom is 80 sq. ft.

No bedroom should be less than 7' - 0" wide.

Bedrooms are to accommodate the following furniture:

Principal bedroom: twin beds, child's crib, dresser, and chair.

*Secondary bedrooms for two persons: twin beds, dresser, and chair.

Secondary bedrooms for one person - single bed, dresser, and chair.

The plan should not be predicated on the use of Doubledecker beds, but beds should be so placed as to permit their use.

For design purposes, the size of bedroom furniture can be taken as follows:

Double bed	4' - 6" x 6' - 9"
Twin or single bed	3' - 3" x 6' - 9"
Child's crib	2' - 6" x 4' - 6"
Dresser	1' -10" x 3' - 0"
Chair	1' - 6" x 1' - 6"

Minimum areas for bedrooms are sufficient for placement of furniture and circulation, if they are carefully designed and properly proportioned for the purpose. Up to 10% more than the minimum required area is often desirable.

The standard closet or closet recess should be accessible directly from the bedroom. A door should be provided for each bedroom.

*One secondary bedroom for two-person occupancy in units of 3 or more bedrooms may accommodate a double bed in lieu of twin beds.

Closets

Refer to detail sheet, Fig. DD-2, illustrating requirements for closets.

In each dwelling unit provide a coat closet, a linen closet, and a closet for each bedroom, the latter to have at least two lineal feet per person. Minimum depth for open bedroom closets is 24 inches; with closed or partly closed fronts, 22 inches in the clear.

Linen closet: Preferable size approximately 14" deep by 20" wide.

Provide doors to closets in or directly visible from living room. Bedroom closets shall have open front to ceiling and be provided with wood curtain rod, on wood supports.

Provide closet shelves, hook strips and hooks, wood hanging rods, and wood curtain rods. Coat and bedroom closets to have two 12" shelves each (see closet detail).

Closets under public stairs are not recommended. If used, their construction must have a 3/4 hour minimum fire resistance rating.

General storage space shall be not less than 30 sq. ft. except in dwelling units with one bedroom this area may be reduced to 25 sq. ft.

Provide a minimum of two 12" shelves on long wall.

It is preferable that the general storage space be self-contained and separated from the space containing the heater; however, a maximum of 8 sq. ft. general storage space may be planned in heater room. If possible, part of the general storage space should be either outside or convenient to the outside for storage of garden tools, bicycles, wheeled toys, screens, etc. (See Minimum Facilities)

If coal is used for fuel, the heater (except circulating space heater) must be located in a separate heater room or basement, and sufficient space provided for stoking and removing ashes, minimum of 3' - 6" from wall to front of furnace, or 2' - 6" if door or opening is in front of heater.

Provision must be made for access to the furnace breeching, flue thimble, temperature controls, blower fan, and domestic water heater burner. This may be arranged through movable panels.

A narrow, deep space is inefficient for storage (minimum width 3' - 8"). Such a space is better divided into two closets.

Where adequate general storage within the dwelling unit is not practical - as in apartment units - space for storage should be provided in central project locations. However, at least 8 sq. ft. of general storage space must be within the dwelling unit; preferably, adjacent to the kitchen.

Coal bins at individual dwellings shall have a minimum 1-1/4 ton capacity.

Height is affected by fuel delivery scheme. Coal may be delivered to bins by means of chutes from the coal truck; manually by use of bags where economically feasible.

The distance that coal can be chuted will depend on nature of coal and delivery equipment. Sized coal can be chuted, as measured horizontally, about 2 to 2-1/2 times the fall of the coal. The distance coal falls will be the distance to which the spillway of truck can be elevated less bin height. High lift trucks are available which can be raised about 10 feet above ground. However, if chuting is depended upon, make investigation regarding local coal dealers' equipment to determine maximum chuting distance. This distance may also be limited by local labor regulations which prohibit the use of chutes above a maximum distance. It may not be local practice to chute deliveries of small amounts.

Bin should be so designed that it forms an integral part of the dwelling unit either within the building or as an exterior feature combined possibly with a covered porch and storage space. It shall have two openings with hinged covers or slides; one opening for depositing coal, the other for removal of coal at floor of bin. Detail coal bin so as to prevent coal dust entering dwelling when filling bin.

Bottom of access door for removal of coal shall always be at level of coal bin floor without any threshold. Provide baffle over shovel door on interior of bin.

For chute delivery of coal it is advantageous to have the filling opening of the bin reasonably low.

Where access to coal may be arranged directly from the heater room, the floor of the latter and that of the coal storage bin shall be on the same level. Provide a depression in floor at coal removal door to prevent water from wet coal running in onto heater room floor. Where coal bin floor is at a lower level and access is from the exterior, some feature to give shelter from house to the point of access, such as projecting eaves or roof should be provided.

Straight run stairs are preferable. Winders must not be used.

Stairs with 7-3/4" risers, and 9-1/2" treads, exclusive of nosings, are recommended. Stair risers should not be greater than 8 inches and treads not less than 9 inches.

Treads should be of wear-resisting wood or non-slip cement. Open risers shall not be used, except to individual basements.

The minimum width of stairways and hall is 3' - 0" between wall finishes. A minimum head-room for stairs of approximately 7 feet, measured vertically from the top of a riser, is desirable. Stairs to individual basements may be 2' - 6" wide, with 6' - 6" head-room.

A continuous hand rail must be provided for each stair run. These should be well anchored and their ends should be returned to the wall to avoid catching clothing.

Windows and electric outlets for stairs or halls may furnish illumination of only moderate intensity, but should be located so as to avoid dark areas.

All habitable rooms shall have direct outside exposure of one or more windows having a total glass area of not less than 10 per cent of the floor area of the room. In kitchens the minimum total glass area of windows and glass (if used) in the door shall be 15 per cent of the floor area.

Fifty per cent of the required glass area shall be arranged so that it can be opened. When double-hung windows are used, both sash (upper and lower) shall open for ventilation. Windows should be located as near the ceiling as practicable and should preferably open to the top.

Generally the height of window sills should be between 28 and 36 inches. It is preferable to keep window jambs 12" from walls.

Windows in bathrooms shall have a minimum glass area of 4 square feet.

Windows in bedrooms shall be accessible without having to reach across bed.

Windows of stock types and standard sizes should be used.

Weathertightness, facility for window cleaning, and ease of operation are essential factors. Casement operators or sash balances of types that will require excessive maintenance should be avoided. Wide casement windows should have ventilator sections in the middle rather than at the sides where likely to be obstructed by drapes.

Prevent heat losses through air leakage, as follows:

- Calking around window and door frames
- Weatherstripping of sash and doors where suitable materials are available
- Detailing of frames to provide fins or wind breaks at contact with walls and lintels

Full length screens at all windows which open are preferable but 1/2 length screens will be acceptable on double hung windows in order to conserve materials during the emergency.

Storm sash and storm doors should be provided in special cases where design temperature in -0 and annual degree days 5000.

Provide shades and supports, also brackets for curtain poles at all glazed exterior openings, (windows and doors).

Use stock doors generally.

The following door widths are recommended:

entrance	- 2' 8" or 2' 10"
bedroom	- 2' 6"
coat closet	- 2' 6" or 2' 0"
bathroom	- 2' 0"

Any opening through which a washing machine is frequently to pass must have a minimum clear width of 2' 8".

It is desirable to locate exterior doors to swing back against side walls when standing open.

In exterior doors do not use glass in the lower part; but glass in the upper part of front entrance doors is desirable and provides an effective surface for street numbers.

Thresholds for exterior doors--non-ferrous.

Hang doors and screen doors so that their swing will not obstruct passage. Hang screen doors on the same jamb with doors (not reversed).

For screen doors provide a center rail about 40 inches high to serve as a push bar. Provide a protective guard on lower screen panel or panels, or make lower panel solid.

Equip screen doors with coil spring and hooks for fastenings, in preference to mechanical latch.

Establish the level of entrance stoops and porches as low as feasible in relation to surrounding finished grades. Provide a railing on stoops or porches more than 18 inches high and on steps more than 4 risers high.

Design <u>entrance steps</u> not steeper than obtained by 7-inch risers and 10-inch treads; risers not less than 5 inches high. Finish cement treads (where used) so that when wet they will not afford a slipping hazard.

Rest wood construction on concrete or masonry and observe requirements for termite control.

Provide a simple hood over the main entrance unless the eaves of one-story buildings project enough to give protection. Divert or drain roof water so as not to spill at entrances.

<u>Porches</u> should be either (1) entrance platforms enlarged for sitting-out or (2) kitchen porches to be used for warm-weather work space and sitting-out. Roofs or work porches should overhang to protect from rain. Also, see "Coal Bins."

SUBJECT: Wall and Ceiling Finish

Wall finishes shall be one of the following:

1. Painted, smooth, hard white plaster;

2. Gypsum wall board covered with washable factory coated fabric; joints filled;

3. Plywood covered with washable factory coated fabric;

4. Wood (solid or laminated) or first quality finish;

5. Exposed masonry where climate is suitable;

6. Painted or prefinished combustible wall board in accordance with Standards under "Structural Design".

Note: See "Fire Resistance Standards, STRUCTURAL DESIGN".

Floor Finish

Do not use flat grained soft wood for finished flooring.

Water-impervious floor covering such as linoleum is recommended to be placed over wood construction in kitchens and bathrooms.

Do not place linoleum on concrete floors laid on the ground. Floor finish in such cases should be asphalt tile or equavalent, of marbleized or similar colors to avoid difficulty in keeping clean.

* "Standards for War Housing, Excluding Temporary Housing".

Superseded by rev. p. 19
but kept for p. 20
still in effect.

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Paint or stain exterior woodwork. Paint tops and bottoms of all exterior doors and sash after fitting.

Paint exposed exterior fuel tanks the same color as the body of walls.

Painting for interior plaster walls of units shall be of resin emulsion.

Plaster ceilings need not be painted, provided they are left in clean condition.

Paint interior dry wall and ceiling construction with semi-gloss oil paint, except factory coated fabric or plywood. Plywood may have special treatments.

Paint front edge and under side of shelving and hook strips of all closets same as walls. Paint all surfaces of kitchen shelving.

Oil top of shelves which are not painted.

Paint exposed plumbing pipes and exposed heating ducts the color of surrounding surfaces. Breeching unpainted.

Where interior woodwork is stained finish with coat of varnish or varnish and wax.

<u>Camouflage:</u> See Lanham Defense Manual inserts LD-213, LD-213-LHA, or FPHA Defense Manual insert DD-408, DD-407-LHA.

Use stock details and dimension the work to utilize standard manufactured materials.

Design eaves simply; avoid parapets.

Gutters and downspouts with splash block shall be provided for two-story buildings. The eaves of one-story buildings without gutters and downspouts should project at least 12 inches.

At areas and ramps provide gratings or railings where protection is necessary.

Ramps to basement areas should have a slope not steeper than 1 to 8. Avoid placing outswinging windows where they may interfere with headroom or passage.

Provide means of closing foundation vents and gable vents in all but the most moderate climates, arranged to be operated from the outside.

Access doors in foundation walls should be at least 2 x 2 feet. No access to foundation space should be from inside the house.

Provide access to attic space. One door in row buildings is sufficient unless attic space is divided by fire wall; in this case provide access to space on both sides of fire wall.

Flash all exterior openings in frame buildings unless protected by roofs.

Wood siding should have not more than 8-inch exposure. Flush joint wood siding unless specially detailed is not recommended. If wood siding is used over gypsum sheathing or fiberboard, break joints at studs and nail into studs.

Roofing materials; mineral surfaced roll roofing, asphalt shingles or cement asbestos shingles shall be used only on roofs with a pitch of 4" to the foot or over. Use built-up roofing of 3, 4, or 5-ply only on roofs having a pitch of 2" to the foot or less. Use of wood shingles should be avoided because of fire hazard.

Chimneys at or near the ridge shall extend at least 24 inches above the ridge; and chimneys elsewhere should extend high enough to avoid down-draft.

Vents must be provided for all gas-fired equipment, except ranges.

Thresholds of hardwood bedded in mastic should be used at exterior doors.

Weatherstrip exterior doors all around in cold climates.

Mail boxes of ordinary exterior type, complying with United States Postal Regulations, shall be provided for each dwelling unit (except that gang mail boxes should be used in entrance vestibules of apartment buildings).

Provide street numbers (contrasting with background see Exterior Doors, p. 17). Omit door bells or knockers except where knockers may be required for apartments or flats removed from the entrance.

To avoid visibility from the air at night, do not select light colored roof coverings nor coverings having reflective qualities.

Provide scuttle doors giving access to attic spaces. Make openings 22" x 36" with hinged doors fastened with hook and eye. Where firewalls do not occur, build slat partitions in attic dividing dwelling units.

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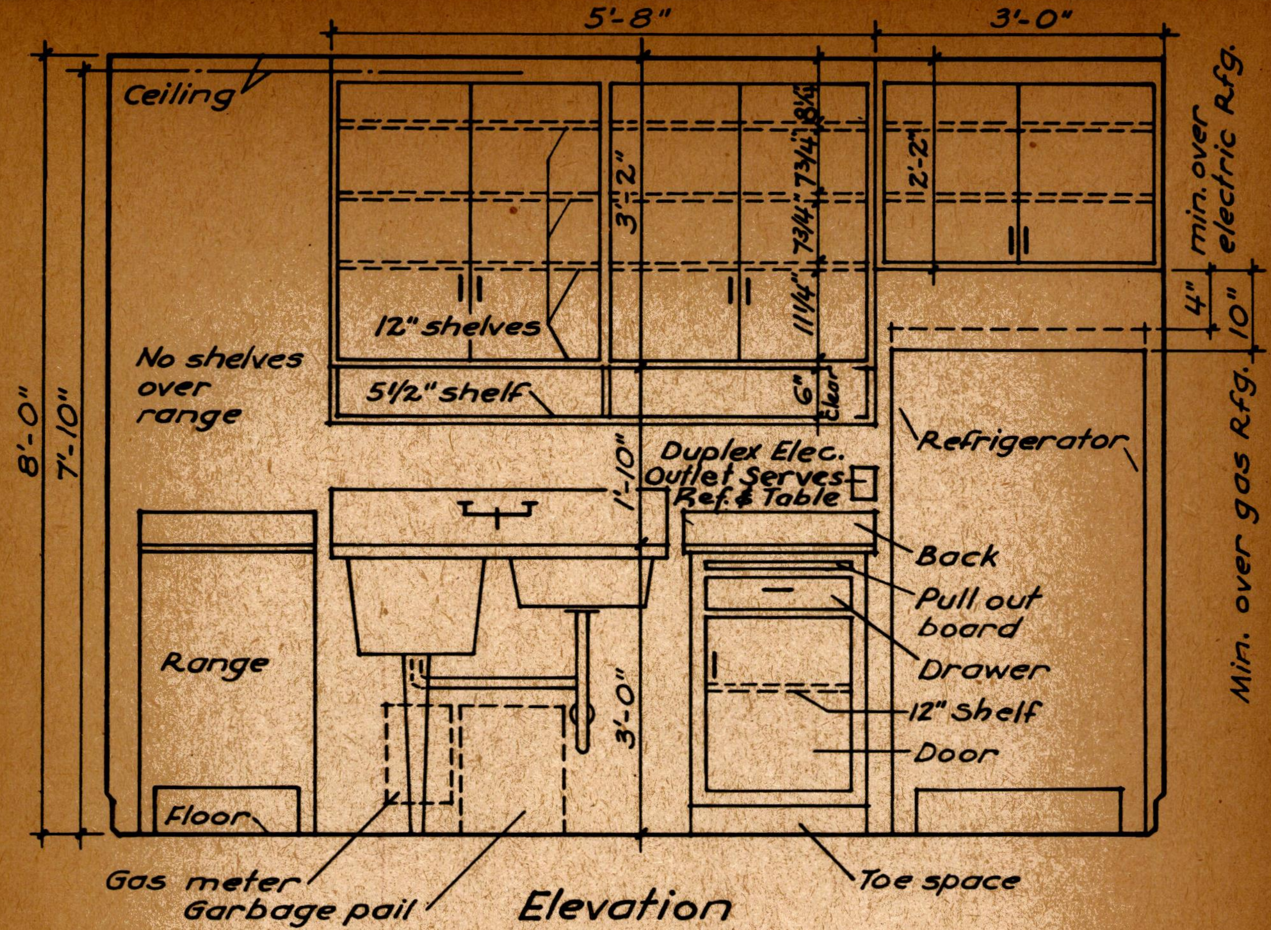
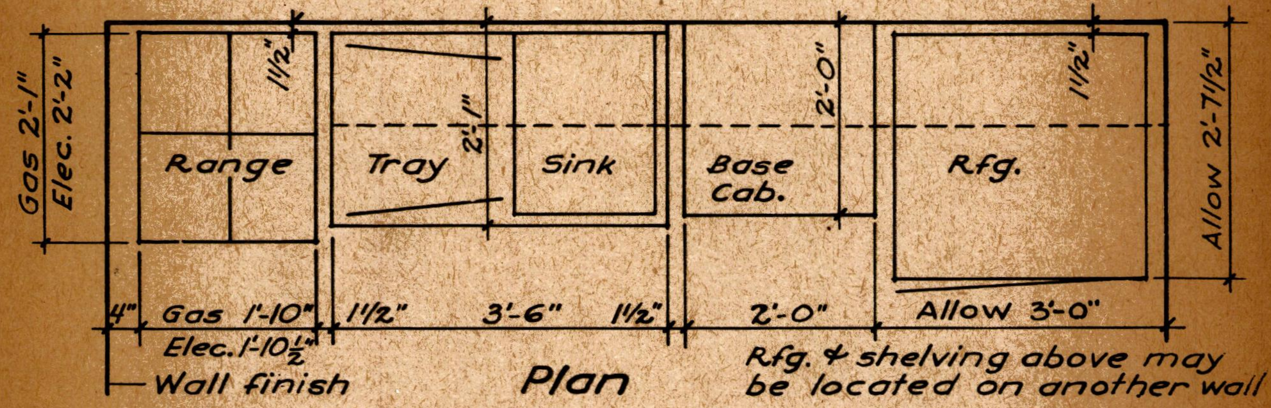


Elevation



Plan

Notes:

1. Required linear ft. of 12" shelving, in addition to that contained in base cabinet: 1BR unit-22, 2BR-28, 3BR-34, 4BR-40. Required shelving in addition to that shown on above elevation may be in storage space. This must be in addition to required general storage shelving.
2. Sink to have drain board on one side and a base cabinet or work top on the other.
3. End of laundry tray and kitchen sink to be at least 6" from wall or Rfg.
4. The range and Rfg. are to be within reaching distance of a drain board, base cabinet, or work top.
5. No shelves over range, no part of range within 2'-0" of window opening.
6. Size of oil or coal range to be determined and space provided.

REVISED 5-42

DATE	KITCHEN EQUIPMENT	F.P.H.A.
FEB. '42	DEFENSE HOUSING - NATIONAL HOUSING AGENCY - WASHINGTON, D.C.	FIG. DD-1

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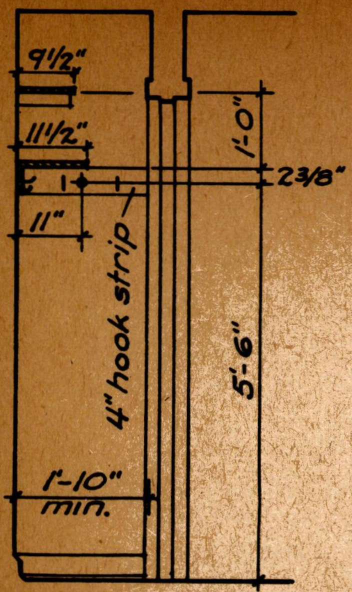
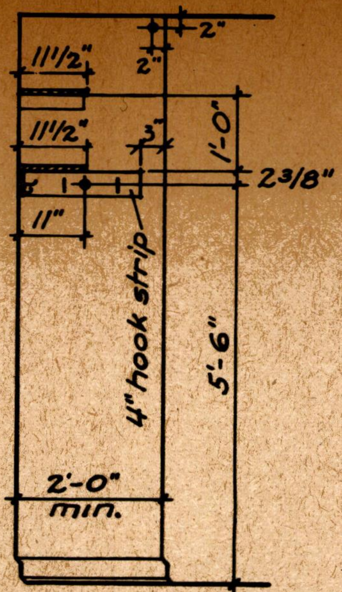
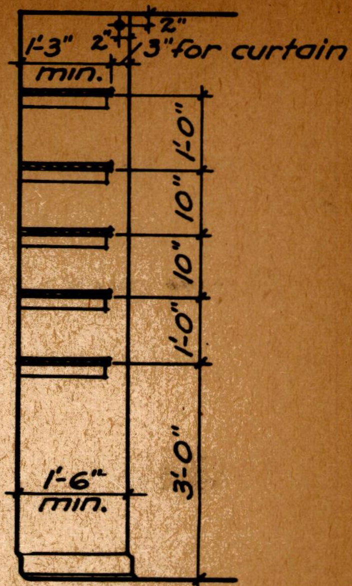


Coat Closet



Bedroom Closet
2 lineal ft. per person.

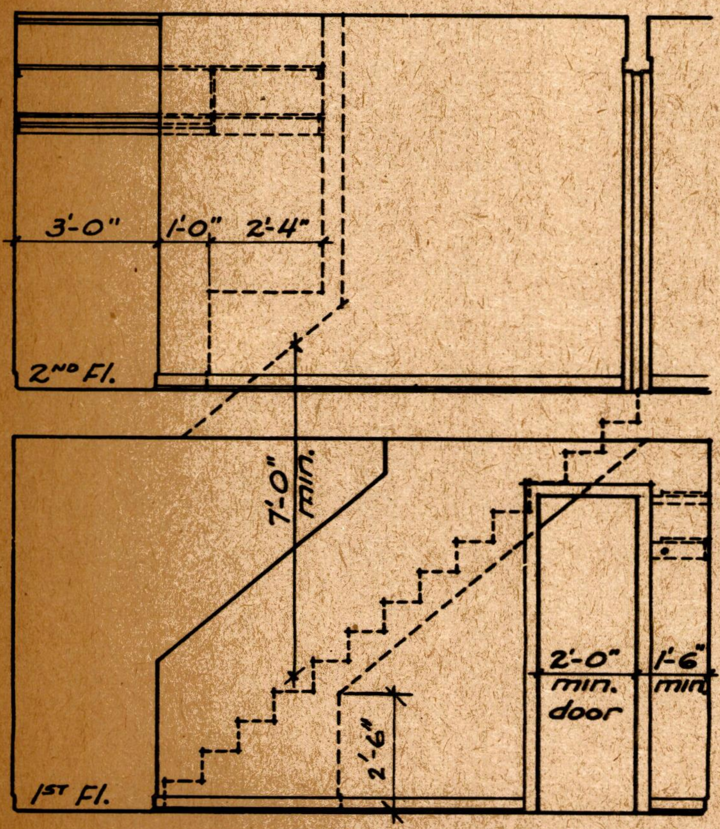


Linen Closet
If visible from L.R., front should be closed type, preferably having door with cupboard door above.

Note: Curtain rods are to be removable.

General Storage
Min. floor area for one bedroom dwelling unit 25 sq. ft., 30 sq. ft. for two or more bedrooms. The floor area of the kitchen closet is considered as part of the required storage space.

Kitchen Closet
When the general storage space is provided in a central location outside the dwelling unit, a kitchen closet of at least 8 sq. ft. with two shelves and hook strip must be provided in the unit. See "Dwelling Design General Storage Space."



Closets at Stair for 2-Story Dwelling Units

REVISED

DATE	CLOSETS	F.P.H.A.
MAY '42	DEFENSE HOUSING - NATIONAL HOUSING AGENCY - WASHINGTON, D.C.	FIG. DD-2

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STANDARDS FOR WAR HOUSING

Excluding Temporary Housing

COMMUNITY FACILITIES

Federal Public Housing Authority

May 15, 1942

Facilities for management and maintenance purposes shall be provided in all projects.

Facilities for social or tenant activities shall be provided in projects of 50 dwelling units or more. To the extent, however, that such facilities as are called for in these standards are available to the tenants in nearby buildings and outdoor recreation areas, such facilities may be omitted from the project only with Central Office approval.

Requests for such omissions shall state the type, location and adequacy of available non-project space, and the basis on which such space will be available to the tenants. Prior to submission of such requests adequacy of existing off-site facilities should be checked in cooperation with the local department of recreation.

Where both management and maintenance, and tenant activities spaces are to be provided they usually should be incorporated in one Community Building, with outdoor areas serving such building, unless existing on-site structures are suitable for conversion.

Where only management and maintenance space is to be provided it should be, where practicable for projects of 150 dwelling units or less, in a building designed for conversion into dwelling units. This building shall be in addition to the number of dwelling units required for the project.

The Community Building (or management and maintenance building) should be located preferably in a central position, easily accessible from all the project and from the principal point of entrance to the project, but preferably not on a main traffic highway.

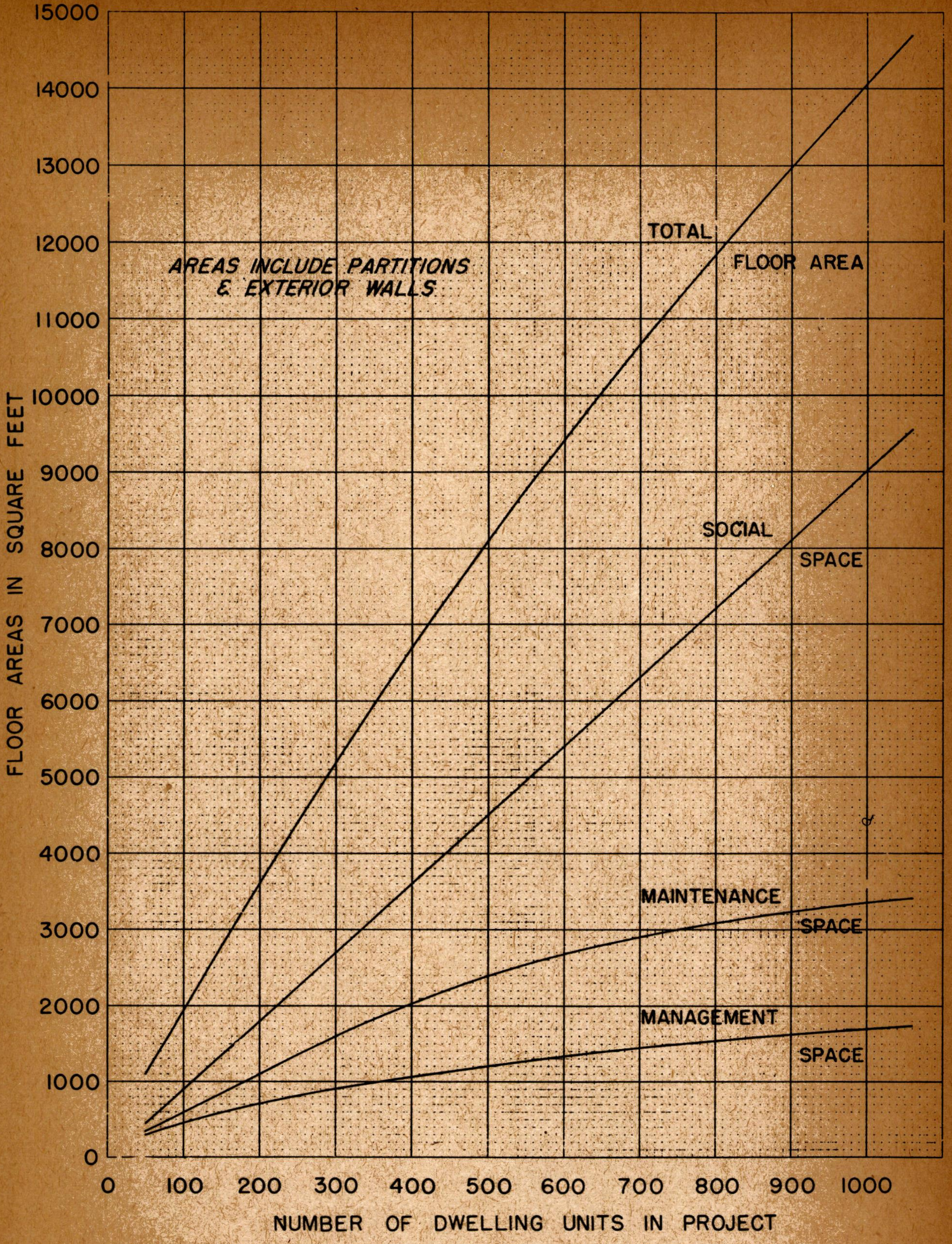
Whenever practicable such building shall be constructed and used for the field construction offices of the government and the contractor.

For suggested plans of Community Facilities layouts see Figs. CF-1, 2, 3, 4, 5, 6, and 7.

Cost of Community Facilities (building, or buildings, new or altered, housing the Management, Maintenance, Social Space, and space for auxiliary facilities and equipment therefor), shall not exceed 3% of the total cost of the project.

Space Requirements for maintenance and repair, management, social space, and outdoor general play area are as called for on the accompanying graph (Fig. CF-11) and tables.

Public Telephones: Telephone pay stations on project are essential unless public telephone facilities are available immediately adjacent to project. Stations should be accessible at all times.



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DATE	SPACE REQUIREMENTS FOR COMMUNITY FACILITIES	F.P.H.A.
FEB. '42	DEFENSE HOUSING · NATIONAL HOUSING AGENCY · WASHINGTON, D.C.	FIG. CF-11

5-15-42.

COMMUNITY FACILITIES--APPROXIMATE ROOM AREAS BASED ON NUMBER OF DWELLING UNITS

	50 D.U.	100 D.U.	200 D.U.	300 D.U.	500 D.U.	750 D.U.	1,000 D.U.
Management Space							
Waiting Room	60	75	120	180	230	300	300
General Office	120	120	180	260	300	460	480
Manager's Office	-	120	180	180	180	180	180
Rental Office	-	-	-	-	150	180	180
Asst. Manager's Office	-	-	-	-	-	-	150
Vault or Storage Space	20	25	60	60	60	60	80
Toilet, Coat Closet	30	30	60	80	100	100	100
Circulation, Walls	70	80	100	140	180	220	230
Total Management Area	300	450	700	900	1,200	1,500	1,700
Maintenance Space							
Repair	220	220	380	600	800	1,000	1,100
Stock Storage	-	200	380	550	770	800	1,000
Paint Shop	30	60	120	160	200	260	300
Superintendent's Office	-	-	-	-	100	180	180
Toilets, Showers, Lockers	40	40	100	120	200	220	220
Yard Station (if needed)	-	-	-	-	80	160	240
Circulation, Walls	60	80	120	170	250	300	310
Total Maintenance Area	350	600	1,100	1,600	2,400	3,000	3,350
Social Space							
Community Hall	250	500	800	1,200	1,800	2,500	3,200
Other Social Rooms (total)	-	-	300	550	1,250	2,400	3,400
Kitchen	75	115	130-140	140-155	180-200	210-240	210-240
Storage	50	50	110-100	150-135	230-210	340-310	490-460
Toilets	-	60	100	120	240	300	350
Circulation, Walls	75	175	360	540	800	1,000	1,350
Total Social Area	450	900	1,800	2,700	4,500	6,750	9,000
Total Gross Area of Building	1,100	1,950	3,600	5,200	8,100	11,250	14,050

1. Exterior walls are computed at 6 inch thickness.
2. Refer to graph for total gross area to accommodate intermediate number of dwelling units not shown in tabulation; adjust room areas proportionately.
3. In social space number of small rooms varies from 1 to 8.
4. If yard stations are not needed, the area may be added to shops or storage.
5. Heater rooms, space for fuel storage and garages are in addition to gross area of building (see charts in text).

Management space should be on ground floor. Good office light required, exposure preferably not west. Convenient access from main project circulation; bench and parking place for prams preferably at entrance; nearby parking for visitors' cars. Management space may be reduced if several projects are managed by central office.

As noise protection, offices (particularly manager's) should be away from play areas; if practicable, arrange other parts of building to form screen; also avoid proximity to dwellings. In internal plan of building, arrange storage, etc., to reduce noise transmission.

Management space should connect with maintenance (for janitor service and for convenient communication between manager and superintendent) and with social space, particularly in small projects to facilitate supervision and for intercommunication between manager's office and community hall.

Subdivisions of management space are:

Vestibule, if climate requires one; may also serve the social space if separate locked door gives access to each.

Waiting room; for tenants and others while waiting turn at counter, also for informal conferences. Should have public telephone booth. Convenient access to one private office for confidential interviews. Good light required, particularly at counter. Person standing either side of counter should not look against light.

General office or work space; for bookkeepers, clerks, receiving rents and serving as point of communication between tenants and management. Ordinarily separated from waiting room only by counter; gate or door also needed. For detailed drawing refer to Fig. CF-12.

Manager's office; if the only private office, should have very convenient access from waiting room. Should not be separated from general office by waiting room; east communication with all members of staff is essential. If possible, provide small coat closet. In projects of 50 to 99 units the manager's office should be so arranged as to permit private interview by the manager. This may require a dividing partition in manager's office unless adjacent waiting space is convenient.

Second private office; in larger projects; for management aide, rentals, visitors. Direct access from waiting room.

Vault or storage closet; for storage of records, supplies and expensive equipment. Direct access from general office.

Coat and office supply closets; toilets (for office staff only). If possible arrange access to these from all offices without crossing public space or other offices. Toilet should not be next to manager's office unless sound insulation is provided in separating partitions.

Maintenance space may be in basement story if good light and ventilation are assured, and topography permits service access at grade on one side. Should connect with rest of building for janitor service, etc. Wheeled access required, preferably from main project street via service court. Court should permit truck turning, parking of staff cars, storage of materials, plus space for possible future additions; court preferably to be fenced. Maintenance space may be reduced if maintenance or handling of materials is done by central shops.

Closed garages shall be provided for maintenance cars and trucks. Following is a schedule indicating the number of cars for which space should be provided in relation to the size of the project.

Number of Small Trucks	Number of Dwelling Units
1	50 - 299
2	300 - 749
3	750 - 1500

For projects larger than 1,500 dwellings a special study shall be made.

Repair shop; general work place. Preferably not contiguous with management offices. Light and wall space to be arranged with a view of favorable bench locations. Five-foot delivery door. May also have normal width outside door. In large projects shop space may be informally divided into (a) general repair shop for carpentry, sheet metal, and repair of small objects, and (b) mechanical repair shop for plumbing, heating, and electrical work. Usually no partition separation. Both require good access to outside door and storage room door.

Superintendent's office; near delivery door, preferably with window toward service court.

Storage room; for storing everything but paint, oil and other inflammable material. Should have wide door opposite or convenient to delivery door. This room is locked; not to be used for circulation. Partition to be of light framework, as paling or rectangular latticework.

Paint shop; for storage of paint, equipment, and other inflammable material (long ladders are kept in main storage room) and for small paint jobs. Requires good natural light; corner location adjacent to repair shop door preferred. In some circumstances an entrance only from outside reduces insurance rate. If so, provide convenient walk connection to repair shop entrance.

Heating plant for management and maintenance space (and social space, if any) if project does not have central heat. Requires good ventilation; outside window desirable. Location depends on fuel; fuel delivery should be from service court; provide convenient ash removal. Convenient access from shop. The following approximate areas (in addition to "gross area of building" as shown in chart), are based on a coal-fired plant and may be reduced for gas or oil:

AREAS REQUIRED FOR HEATING PLANT
(in Sq. Ft.)

D.U.'s	50	100	200	300	500	750	1,000
Heater Room	80	80	80	125	200	250	300
Coal Storage	30	30	50	75	110	160	200

Coal storage should be checked against annual consumption and purchasing policy.

Toilet, shower and lockers, janitor's closet. Locate near shop but preferably not close to management space or superintendent's office unless sound insulation is provided in separating partitions.

Yard stations are storage rooms for ground maintenance tools (lawn mowers, hose, etc.), for the use of project maintenance employees. Required only where large areas requiring project maintenance are located at some distance from maintenance shops. May be freestanding, attached to building, or in basement, the latter preferable if topography permits ramp access.

Note: In defense projects it is important that space should be available for tenant activities of a social, recreative, and educational nature. Many tenants will be newcomers, without local social ties, and their happiness (which is the best insurance against high labor and tenant turnover) will depend on the new friendships they will form. There will be cases, however, where existing buildings or neighborhood facilities will meet the need for space for tenant activities, in whole or in part. Such conditions should be considered in the design of the community building and the play areas associated with it.

For buildings housing social or tenant activities see attached chart which indicated recommended room areas for various size projects.

The main entrance should be near grade, with a paved and well lighted area large enough for a crowd of people and connecting with main project circulation. Some rooms, as craft and gamesrooms, may be in basement or second story. Rooms for small children's use should have access to and be substantially at grade of outdoor play space. The entire plan should be closely correlated with outdoor terraces, walks, planting, and play areas.

Avoid northern exposure for all social rooms except kitchen, crafts and shops. A southern exposure is preferred for small children's playrooms. In hot climates prevailing wind may affect orientation.

Social or tenant-activity space contains the following subdivisions:

Lobby, extended by corridors in large buildings; should give access to all social space. Lobby is best location for required drinking fountain (2'-6" high unless special children's fountain is provided); also pay phone unless otherwise available.

Community hall; the large meeting room for lectures, parties, etc. Entrance off lobby should be near outside entrance. Avoid freestanding columns. Design one end wall with suitable speaker's platform or stage, permanent or movable; in large projects with entrance from dressing room. Floor should permit dancing. In small projects plan community hall for use also as children's playroom, since space will normally not be available for special playroom.

Kitchen; demonstration of use and care of equipment, of preparation and preservation of food; also frequently used in serving meals or refreshments at parties, and in preparing lunches for small children's play groups. Should have window (10% of floor area minimum) preferably at end (not in front of audience) looking toward north or east. In small projects, kitchen should open toward community hall; in large projects, preferably toward secondary meeting room, circulation being arranged so that a party centering in community hall may be served refreshments in secondary room or elsewhere. Outside or convenient corridor access for delivery of supplies. If practicable, arrange counter connection with room where food is to be served.

Provide overhead illumination lighting all equipment. Provide two electric outlets near demonstration counter.

Shelf space; should correlate roughly with number of dwelling units, varying from a minimum of 40 square feet for projects of 100 dwellings to a maximum of 100 square feet for projects of 1000 dwellings. Of this space 20-24 square feet, for nursery utensils, should be in closed cabinets or closets. In addition, provide one base cabinet and a wall cabinet 2 or 3 feet long for food storage. Storage space for food and utensils should be provided with locks and keys.

Equipment needed: Double-bowl sink (20" x 42"); range (14" oven height, 4 burners, split-type cooking top preferred), plus in projects over 600 units, a 3-burner gas or electric plate; refrigerator (7 cu. ft. in projects under 150 units, 8 cu. ft. in larger ones).

Layout of Kitchen. Provide work counters on both sides of sink, on one or both sides of range, and also on one side of refrigerator. Provide storage space adjacent to sink, range and work counter, the largest amount preferably being located near the sink. Whenever possible, provide closet for pots and pans directly adjacent to range. Design room so that sufficient wall space is available for necessary shelving and storage cabinets. Do not locate shelving over range.

For demonstrations, range and adjacent work counter should be visible from adjoining social room; provide low fixed partition (36" high) between the rooms, with sliding or folding panels or rolling shutter above low partition, to height of approximately 6'-8". The opening should be 8' to 12' wide. Provide door 2'-6" wide in low fixed partition unless convenient access from kitchen to adjoining room is provided by means of hall or lobby. Place range directly against low partition (preferably to the left of center), or against adjacent wall. Provide continuous work surface between pieces of equipment.

For convenient service to an adjoining social room, provide serving counter with sliding panel over (about 3' high by 5' long) between kitchen and social room.

In projects of 50 to 100 dwelling units make adjustments in equipment and layout as required to meet space limitations.

For illustrations of kitchen layouts refer to Figs. CF-13 and CF-14.

Toilets: accessible from all social rooms (including rooms subdivided by folding doors) and kitchens without crossing other rooms; also accessible from play area.

Storage: Provide chair storage convenient to community hall; also miscellaneous storage and coat room or space usable as such.

Janitor's closet or, in small building, a service sink; tenants clean up after meetings, requiring suitable equipment.

Other social rooms include:

Office for recreation director; preferably close to door giving access to play areas and with window giving good view over them.

Playrooms for small children; nursery schools, day nursery groups, etc. Playrooms are usually planned for a group of 30 children. Minimum area required for such a group is 500 sq. ft. For all-day nursery program including lunches and naps, provide total area of approximately 800 sq. ft., preferably in two adjoining rooms. Otherwise use large room that can be subdivided by folding partition. Convenient access to storage space, toilets and play yard is essential. Toilets should also be easily accessible from play yard. Where practicable, provide separate toilet space, with low fixtures, for use of small children, at least two toilet bowls and one lavatory for 30 children.

Craft rooms and tenant work shops; Provide large window areas and distribute light fixtures to light entire room. Storage for tools and materials, as in closets (not over two feet deep) with removable shelves; locate on partitions to reduce noise. Shelves and cupboards sometimes built by tenants. Service sink essential unless available in janitor's closet. Floors of easily cleaned durable material, as concrete. Craft rooms located under used space should have sound-proof ceiling.

Club and committee rooms: If several, size and shape should vary, some being formed by folding partitions.

Health clinic; to be designed with assistance of sponsoring agency. Accessible from public street, have own outside door and waiting room. Northern exposure best for doctor's office. A "well baby" clinic should have connection to children's playroom and small children's play yard. Toilets accessible from clinic waiting room. Private lavatory and toilet should serve doctor's office.

Library and reading room: If a branch of public library, provide outside entrance--in addition to inside access. Make quiet as possible by location and construction. Good light. Besides shelves, provide storage space since reading rooms are used for quiet table games, as checkers.

Combination School - Community Building

When a school must be built as part of the project, it ought, if possible, to be planned to serve also as a community building. The design of the building will be governed by the allocation of responsibility for its construction and operation. If the cost of construction of the school and community building is borne by the project, the two functions can be closely integrated, with practically all of the facilities of the building being designed for dual use. If the school wing is built and operated by another agency, a greater degree of separation may be necessary. These factors should be determined promptly and the building should be planned for the greatest possible service to the community.

Floors: Avoid concrete in meeting rooms. In kitchens and rooms where children will play, linoleum and asphalt tile are preferred but hard wood is acceptable. Concrete is preferred for craft and shop rooms.

Walls: In management and social space, all walls should be of durable material, easy to maintain. A dark wainscot or chair rail reduces redecoration cost. In maintenance space, no surface finish.

Ceilings: In social space, use acoustical finish where economically feasible, particularly in the community hall and playrooms.

Folding partitions: Select carefully for ease of operation and sound insulation.

Doors: Outside, wire glass in panels above lock rail, wood below. Inside doors to meeting rooms, obscure glass in upper panels.

Windows: In rooms planned for pre-school play use, make sills low--about 1'-6" above floor. Use wire glass in windows located where they may be easily broken.

Lighting: In social space built-in and concealed lighting is desirable. Exposed bulbs must have wire guards. Provide key switches in the office of recreational director or elsewhere for control of lights in stair halls, corridors, toilets.

Plumbing: Shall conform with Emergency Plumbing Standards for Defense Housing.

Boiler rooms, vaults, and paint shops shall be completely enclosed with one-hour minimum incombustible construction and equipped with self-closing Class B doors. Basement spaces shall be cut off from public halls and assembly rooms by incombustible construction and Class B doors.

Bulletin board required, in lobby or corridor of social space.

Properly located and designed play areas tend to prevent accidents to children and to reduce damage to spaces not intended for play. Restrictions on use of automobiles will increase demand for field space suited to adult play.

Central Recreation Area

A central recreation area shall be provided for each project. The following tabulation lists the minimum areas required; also the types of special play spaces for which provision should be made in the design of this area:

TABLE OF AREAS FOR CENTRAL OUTDOOR RECREATION FACILITIES (Sq. Ft.)

	50 D.U.	100 D.U.	200 D.U.	300 D.U.	500 D.U.	750 D.U.	1,000 D.U.
General Play:							
Minimum Area	10,000	45,000	55,000	70,000	90,000	115,000	140,000
Special Play:							
Play Yard	1,200	1,200	1,800	2,400	3,000	3,500	4,000
Water Play	1,200	1,600	1,800	2,000	2,500	3,000	3,500
Court Games	--	1,800	3,600	5,400	8,000	10,500	13,000
Fixed Apparatus	600	1,200	2,000	2,800	4,000	5,000	6,000
Crafts	--	200	800	1,400	2,500	3,000	3,500
Total	3,000	6,000	10,000	14,000	20,000	25,000	30,000
Grand Total (Sq. Ft.)	13,000	51,000	65,000	84,000	110,000	140,000	170,000
Grand Total (Acres)	.3	1.2	1.5	1.9	2.5	3.2	3.9

The area required for the community building and surrounding lawns, planting, service court, and garage, varies greatly. For purposes of preliminary studies and estimates this area may be considered as being approximately equal to the total area provided for Special Play.

For projects of an intermediate number of dwelling units not shown in tabulation, adjust Central Recreation Area proportionately. For projects of less than 50 dwelling units, provide area equal to at least 60 square feet per dwelling unit.

The General Play Area should be larger than shown above if space is available.

Water Play Area includes spray pool and surrounding pavement.

Location. The central recreation area should be near the community building or management and maintenance building. To reduce noise and dust nuisance, it is preferable that ends of residential buildings be toward playground. If this is impracticable, rears or fronts may be toward the playground, the latter preferable, with boundary treatment of walk, trees, hedge, and fence. A railway right-of-way bordering the site may, if well fenced, be used as a boundary for a large play area, that arrangement being preferable to house construction near railway. Same applies to river banks, steep slopes, school grounds. Avoid locations adjacent to cemetery, also rear lot lines of residence outside project. Avoid extensive frontage on project streets. Provide good walk access from all parts of the project. Use traffic warning signs where these main walks cross vehicular ways.

General Play area, open field for games and running play. Should be accessible from the community building, but where insufficient land is available in one piece may be located apart from community building and Special Play area; in latter case provide, where practicable, shelter with storage space and toilet facilities if project is larger than 200 dwellings. Grass surface preferred; subsoil should be permeable and topsoil sandy. Plant trees only near boundaries; a few existing trees may remain if they leave usable play areas. Maximum grade of most of area should be 3%. Provide drinking fountain, preferably on building wall for economy.

The special play areas must be located adjacent to the community building social rooms for reciprocal use, convenient supervision, and use of toilets. Locate noisy play away from management offices. Except the play yard, these forms of play need not be separated from each other by fences and may overlap. Paving and benches placed near community building may form a terrace available for outdoor meetings or parties.

Play yard for small children should have morning sun and afternoon shade, should be accessible from playrooms and convenient to children's toilets, and should be well drained. Provide fencing, three to four feet high, separating yard from other areas, walks, and tenant yards. When practicable, surface should be largely turf, otherwise sand-clay or stabilized earth. About 25 percent should be paved for wheeled toys and wet weather use. Play interest is added if pavement encircles tree, leads to a bench or open place and has a moderate gradient at some point. Provide gravel, sand or natural earth, with good drainage and at least 150 square feet in area for digging; sandboxes are acceptable only on paved areas with assured supervision and maintenance. Drinking fountain is required and should be 2'-6" high with broad low steps on one side for use of small children.

Digging areas and sandboxes should have sun during part of day. A tree with low branches suitable for climbing makes an attractive addition to play equipment.

Water play. Spray pools are preferred to wading pools, being cheaper to build and operate, more sanitary and safer. A spray area of about

400 square feet is recommended for projects under 100 units. For larger projects, increase area about one square foot for each unit. Around sprayed area, additional pavement 8 or 10 feet wide must be provided. Should be accessible from play yard and general play area. Provide shade and benches, not too close; spray area must have sun part of day. Keep at least 25 feet away from sandboxes.

Spray area is sloped depression in pavement without vertical edges or curb. Oval or circular are easy to keep clean. Maximum depth of 3" is recommended. (Shallow pool, with moderate floor slope, can be used for roller skating, etc.) Spray heads designed and located to give a rising and spreading movement of water are preferred, giving children of various sizes a variety of exposure to the spray. One spray pool is preferable to several, due to need of supervision. Additional spray areas may be required if part of project cannot use central pool because of distance or intervening obstacles. In such cases use well-drained hard-surfaced paved area with water connection for portable spray.

<u>Court games</u>; some are played on paved surface, others on turf, sand-clay, or stabilized earth. Players should not face west. Provide shade and benches, also light for night use.

<u>Fixed playground apparatus</u>. Space for simple fixed playground equipment should be provided along the sides of the large general play area. Surface, preferably grass or natural earth. No appartus, however, shall be included in the construction contract.

<u>Crafts and story-telling</u>. Any odd space, preferably not too near noisy play; should have afternoon shade, and should be near the community building.

13 COMMUNITY FACILITIES.
Outdoor Recreation Areas
Secondary Recreation Areas

Secondary recreation spaces are desirable, under special conditions, outside central recreation area.

Secondary or local play areas should be used where, due to obstructions, to the size or shape of the project site, or to traffic streets, access to the central play area is not convenient to a section of the project. Local play areas are also used to supplement private yards too small or steep to have much play value.

No schedule of recommended areas can be set up. If the purpose of the local play yard is to make it unnecessary for small children to go to central recreation area, each should consist of at least 1,200 sq. ft. for a group of 50 dwellings, or where a larger group is served, 25 sq. ft. for each dwelling. If the local play area is intended also for children of school age and for adult play, allow at least 50 sq. ft. for each dwelling unit.

Keep local play areas away from wheeled circulation or use fence plus planting as protection. When possible, locate in end relation to dwelling buildings to reduce noise. Plan for informal play without paid supervision, using simplified planning and construction to reduce maintenance costs.

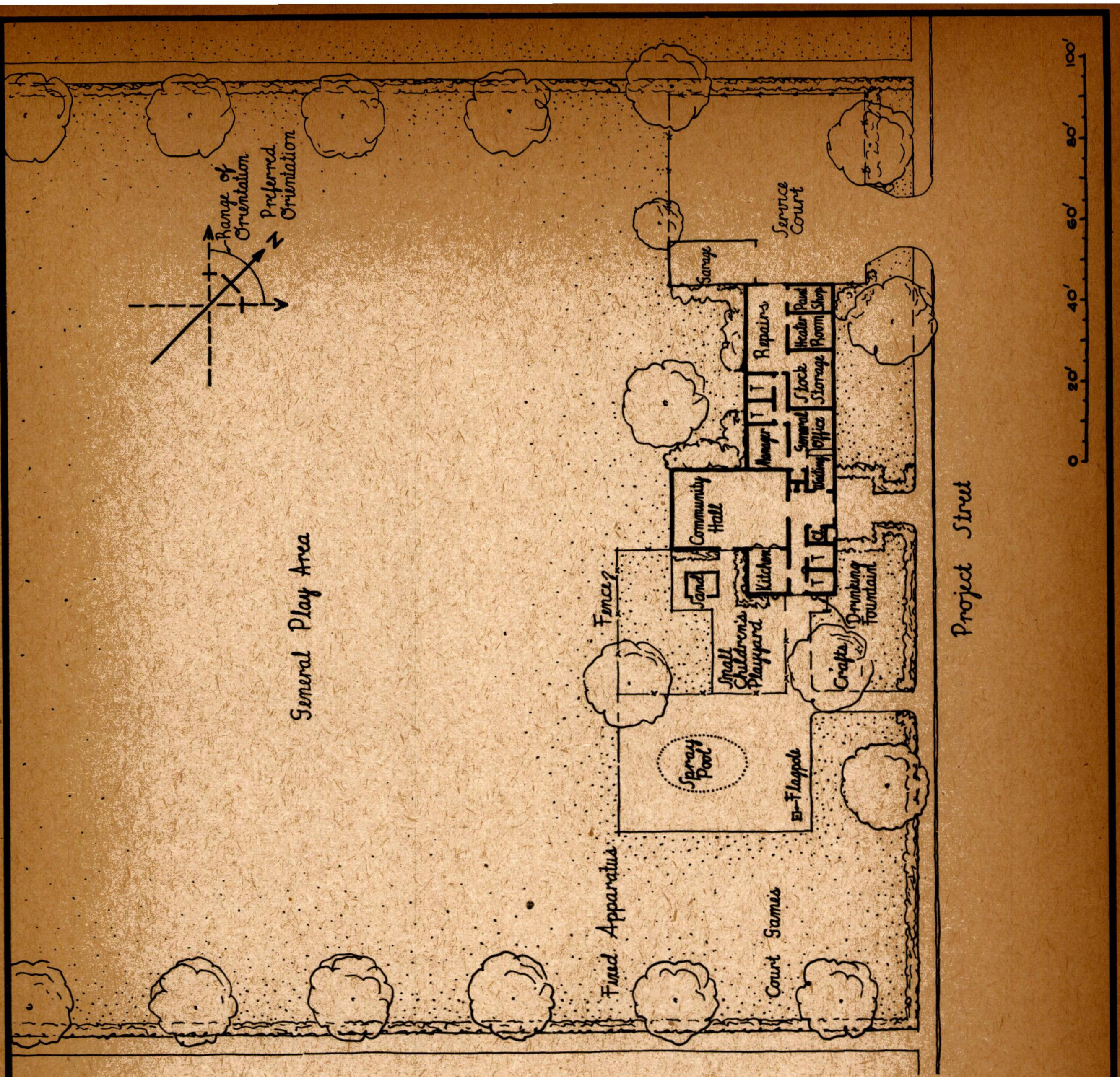
Sitting Areas. A few small sitting areas ought to be included in all projects. These may take such forms as a small plaza at the community building, benches at some point that commands a fine view, a widened section of walk, or a single bench at an entrance. Should have space to park prams, grass or dirt for small children to play on, shade and interesting environment, as a busy street or playground. The benches may be arranged to permit conversation. A light standard will make area useful as a nearhome evening play place for children.

Fences; should be used for protection of planting and against streets and parking areas.

Roller Skating. In planning play areas, provide incidental opportunities for roller skating, such as a wide walk, rounded at the corners, making a wide circuit around a play area. Preferably it should not run parallel to residential buildings.

Temporary Shade Structures. Shade is necessary for health and comfort. Playgrounds not including existing trees need sun shelters, pending the growth of trees. Pergolas and arbors built of rough poles and covered with fast-growing vines or simple roofed pavilions or canopies can be used.

Professional Assistance in Planning. Planning for community recreation requires specialized knowledge. Competent professional assistance should be secured at every step in the development and organization for operation, also in evaulating the existing recreation facilities and in negotiating with local agencies concerning participation in the project recreation program.



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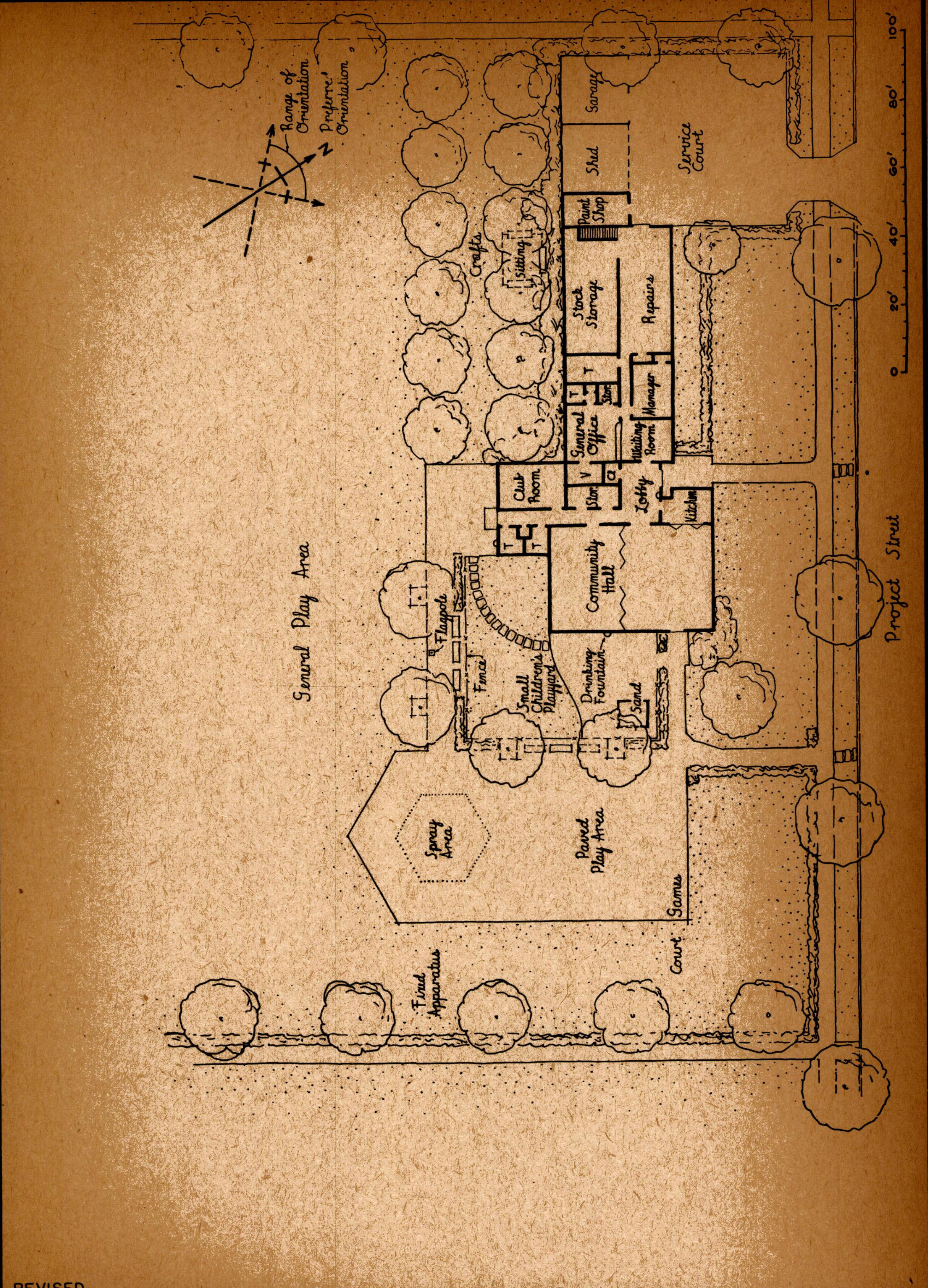
DATE	DIAGRAMMATIC STUDY · COMMUNITY FACILITIES · 100 D.U. PROJECT	F.P.H.A.
5-1-42	DEFENSE HOUSING · NATIONAL HOUSING AGENCY · WASHINGTON, D.C.	FIG. CF-1



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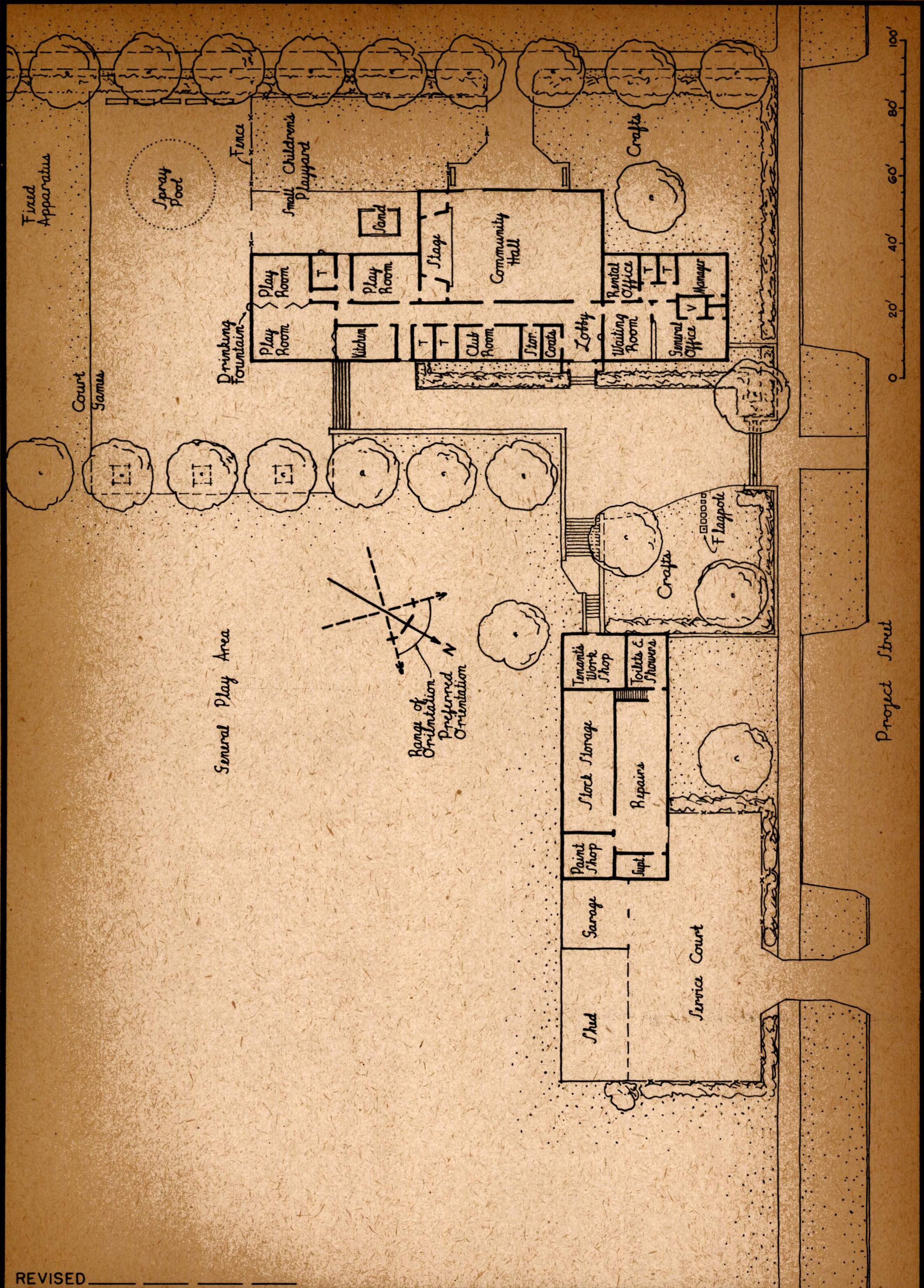
DATE	DIAGRAMMATIC STUDY · COMMUNITY FACILITIES · 300 D.U. PROJECT	F.P.H.A.
5-1-42	DEFENSE HOUSING · NATIONAL HOUSING AGENCY · WASHINGTON, D.C.	FIG. CF-2



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DATE	DIAGRAMMATIC STUDY · COMMUNITY FACILITIES · 500 D.U. PROJECT	F.P.H.A.
5-1-42	DEFENSE HOUSING · NATIONAL HOUSING AGENCY · WASHINGTON, D.C.	FIG. CF-3

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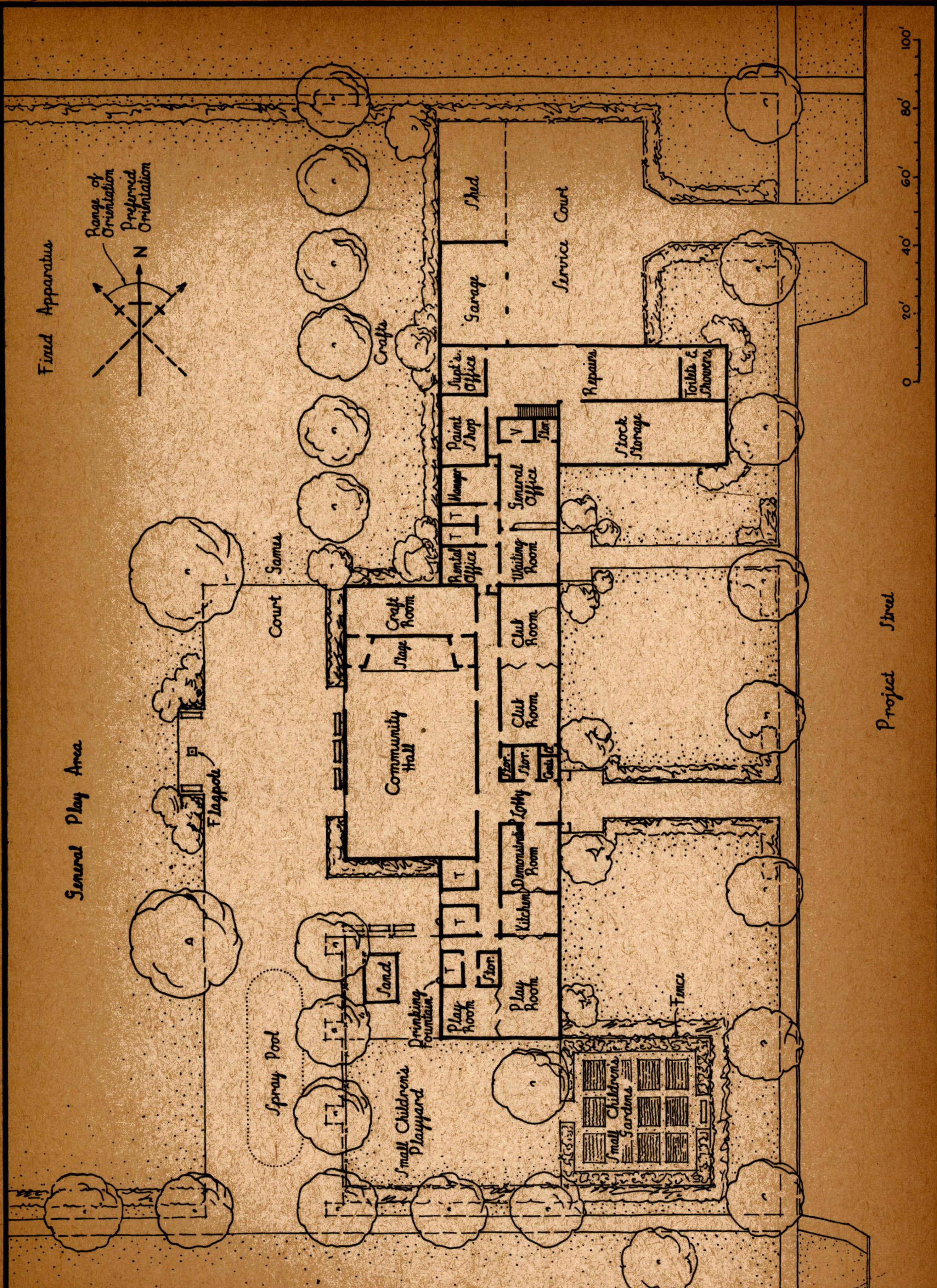

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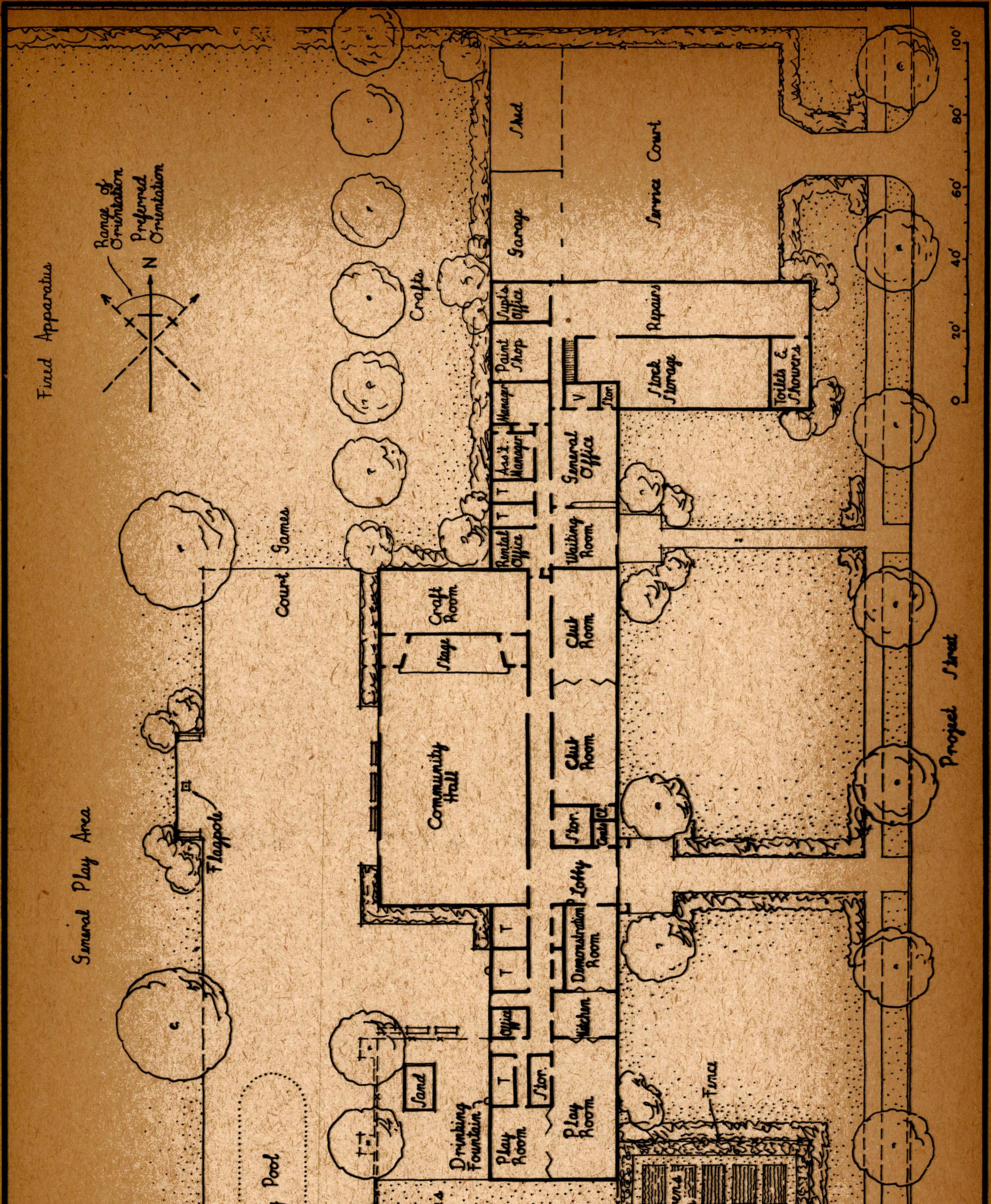
DATE	DIAGRAMMATIC STUDY · COMMUNITY FACILITIES · 750 D.U. PROJECT	F.P.H.A.
5-1-42	DEFENSE HOUSING · NATIONAL HOUSING AGENCY · WASHINGTON, D.C.	FIG. CF-4



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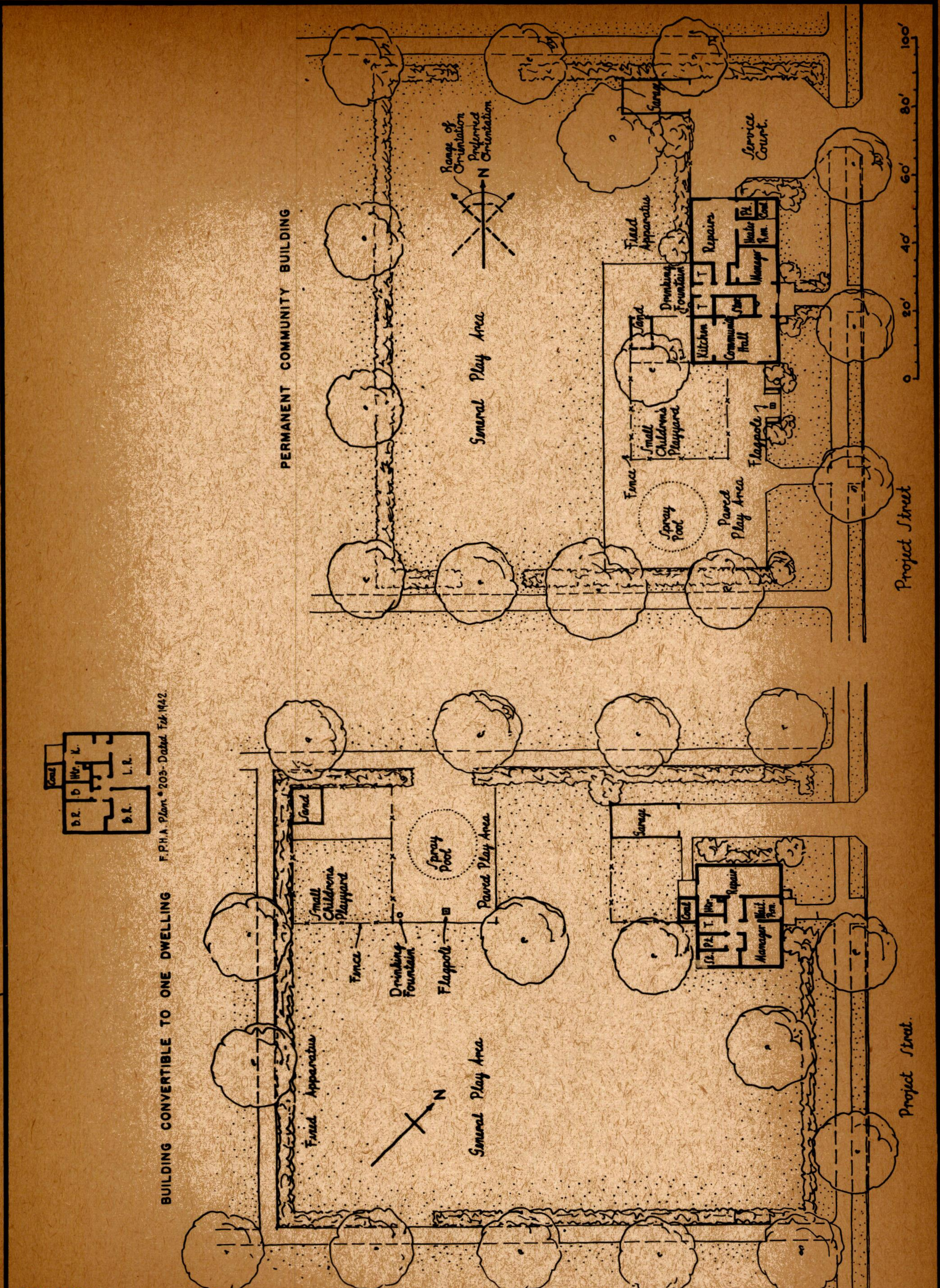
DATE	DIAGRAMMATIC STUDY · COMMUNITY FACILITIES · 1000 D.U. PROJECT	F.P.H.A.
5-1-42	DEFENSE HOUSING · NATIONAL HOUSING AGENCY · WASHINGTON, D.C.	FIG. CF-5

9781



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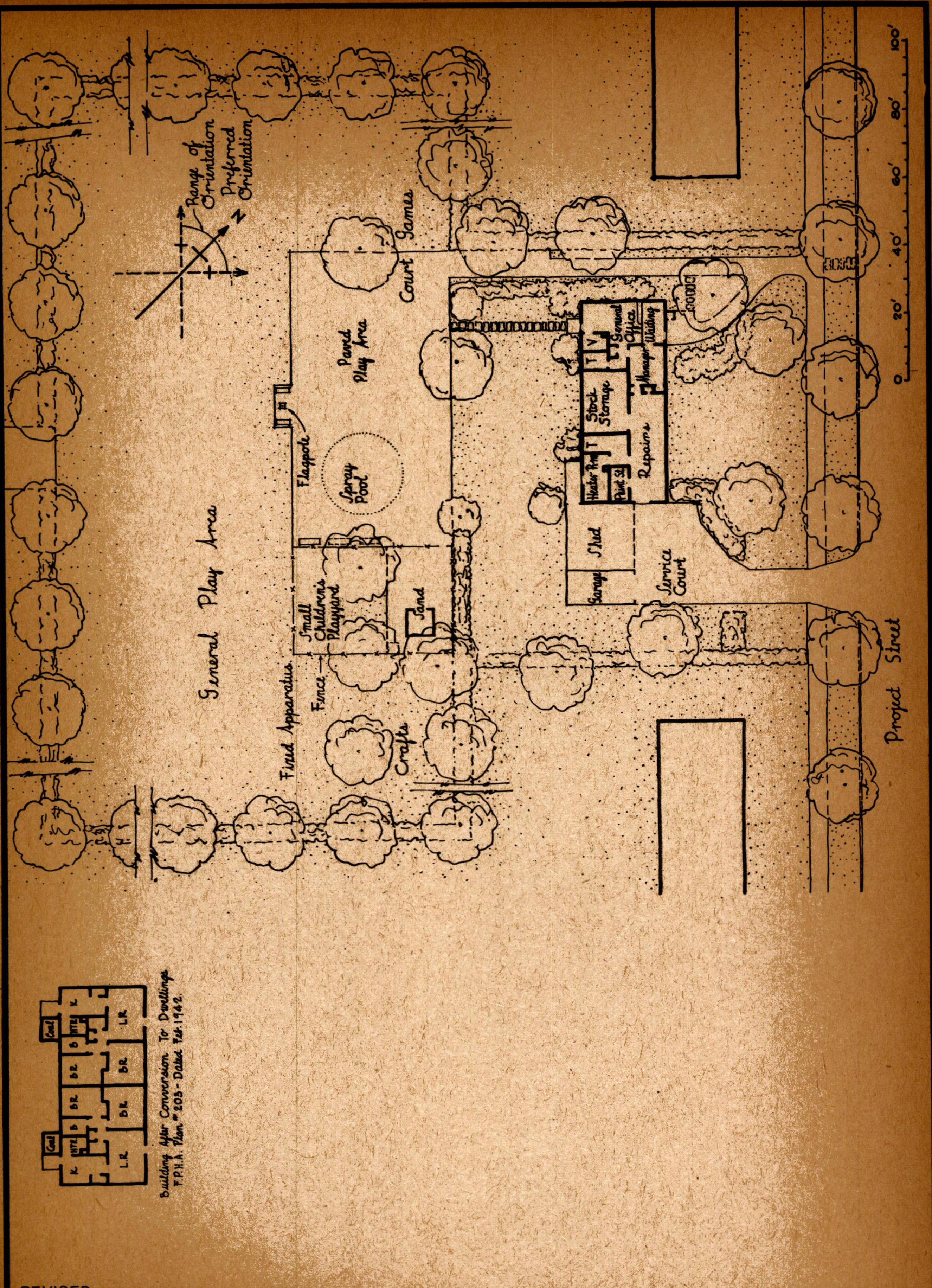
DATE	DIAGRAMMATIC STUDY · COMMUNITY FACILITIES · 50 D.U. PROJECT	F.P.H.A.
5-1-42	DEFENSE HOUSING · NATIONAL HOUSING AGENCY · WASHINGTON, D.C.	FIG. CF-6



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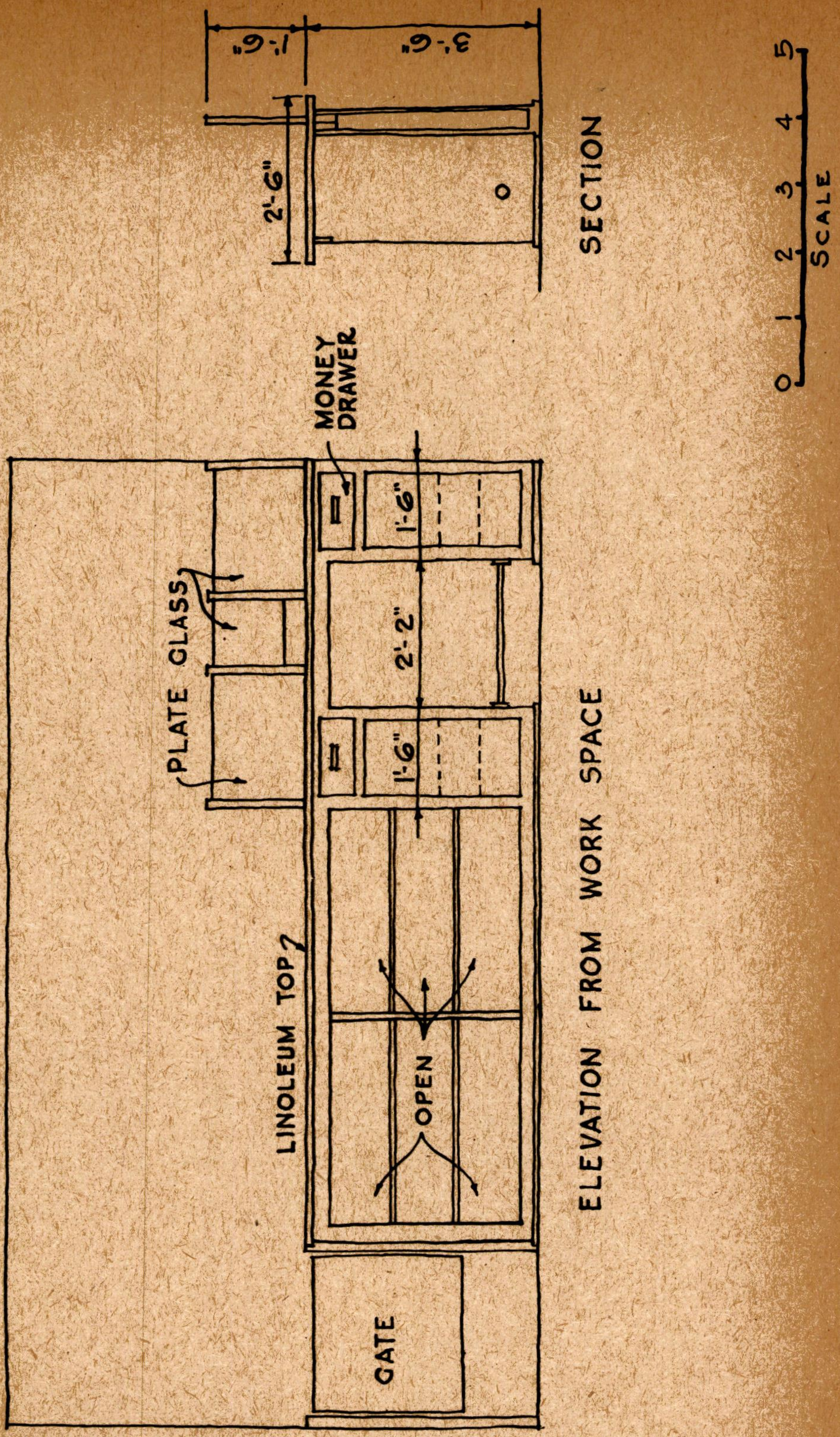
DATE	DIAGRAMMATIC STUDY · MANAGEMENT & MAINTENANCE FACILITIES BUILDING CONVERTIBLE TO TWO DWELLINGS - 150 D.U. PROJECT	F.P.H.A.
5-1-42	DEFENSE HOUSING · NATIONAL HOUSING AGENCY · WASHINGTON, D.C.	FIG. CF-7



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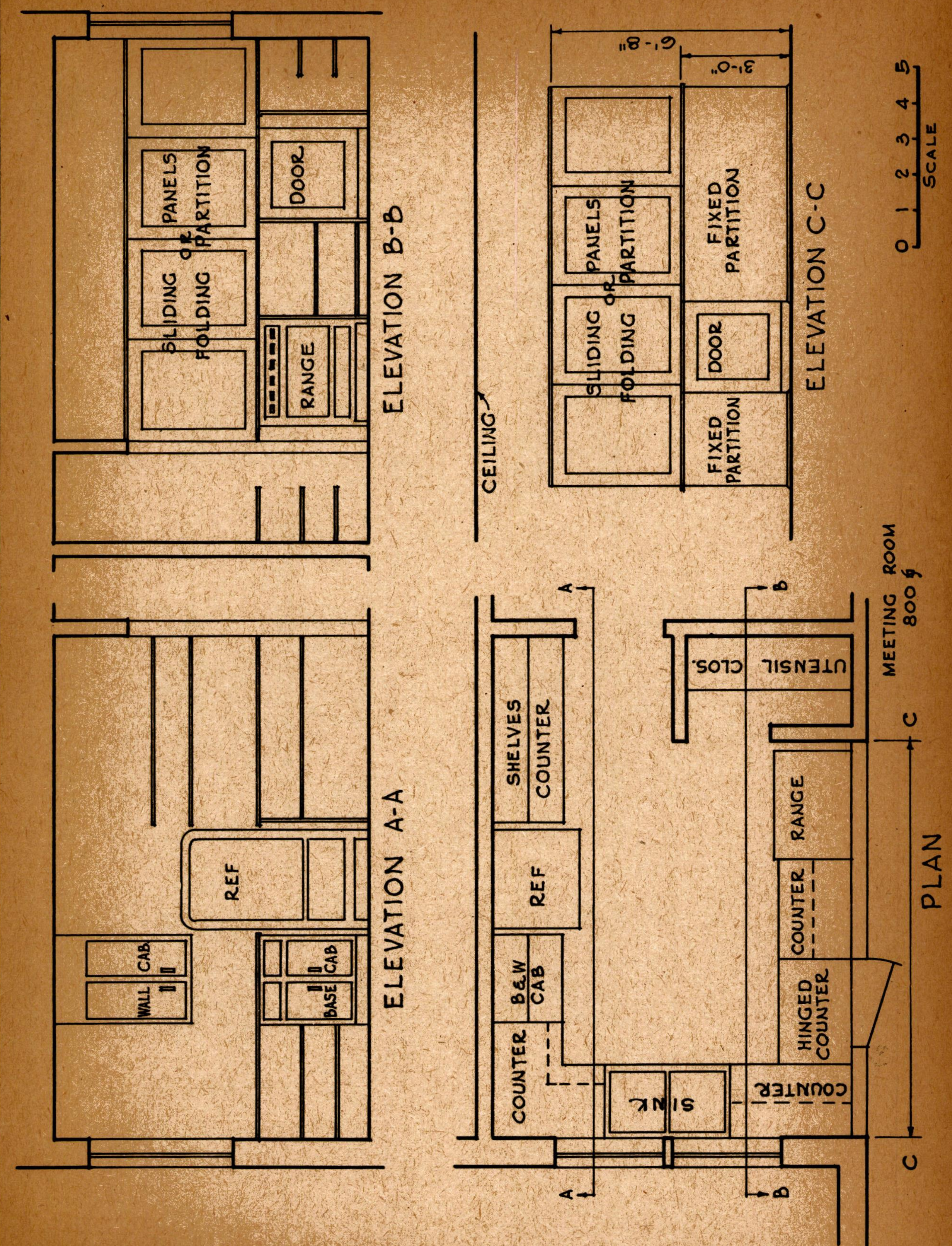
DATE	DETAIL OF COUNTER FOR MANAGEMENT SPACE	F.P.H.A.
5-15-42	DEFENSE HOUSING · NATIONAL HOUSING AGENCY · WASHINGTON, D.C.	FIG. CF-12

9781



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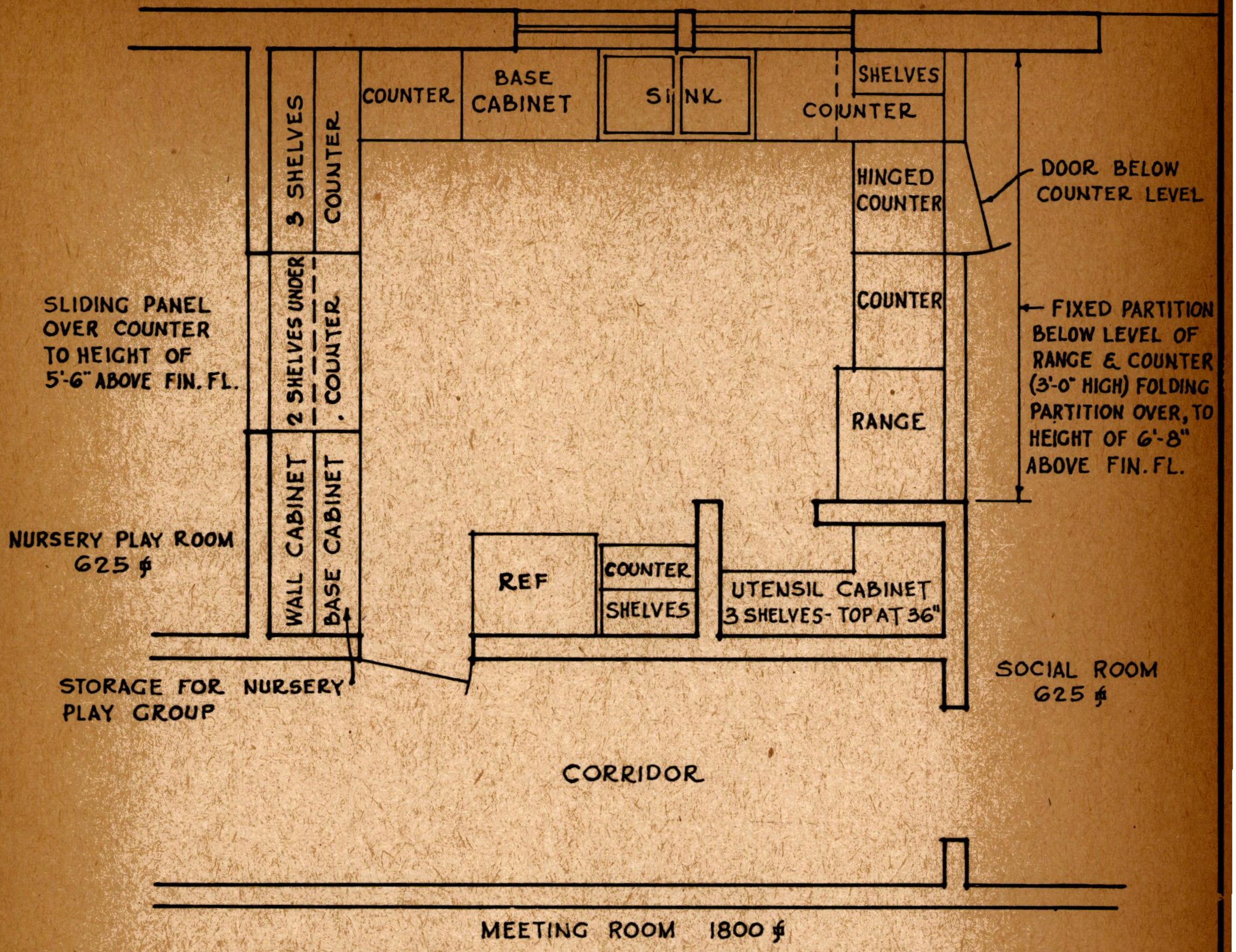
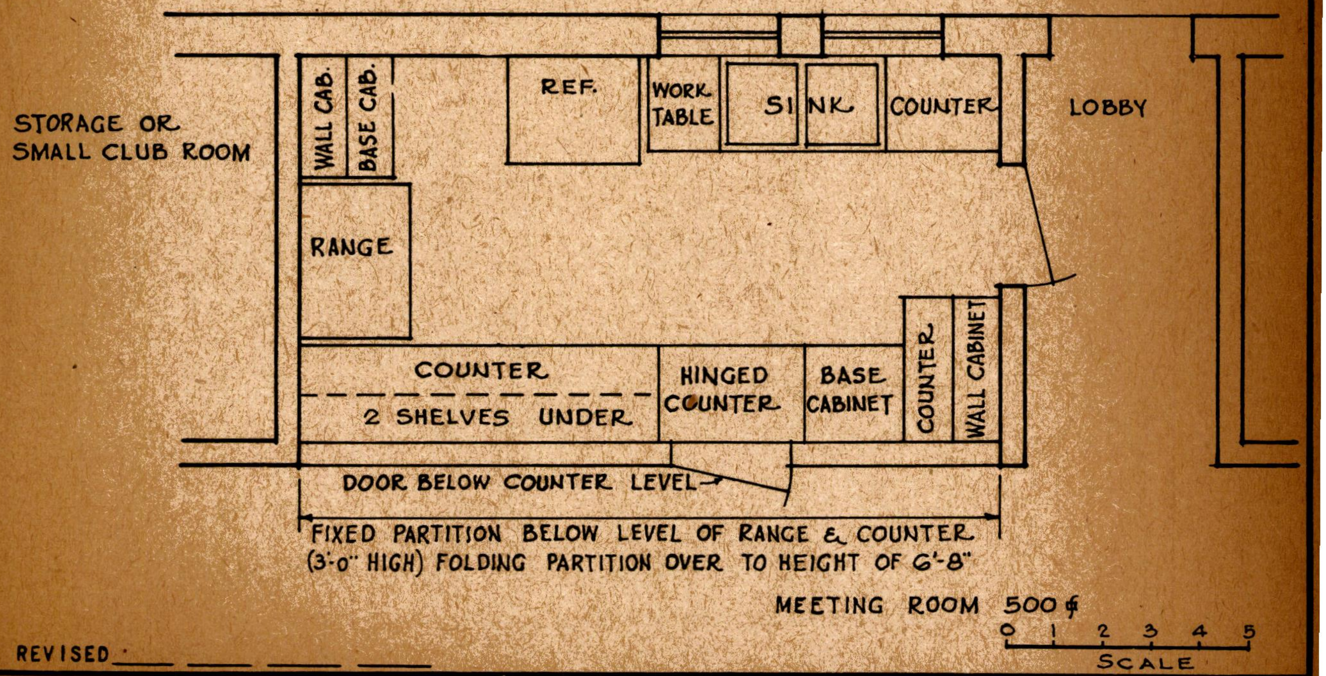
DATE	TYPICAL LAYOUT FOR KITCHEN IN COMMUNITY BUILDINGS	F.P.H.A.
5-15-42	DEFENSE HOUSING NATIONAL HOUSING AGENCY · WASHINGTON, D.C.	FIG. CF-13

9781





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DATE	TYPICAL LAYOUT FOR KITCHEN IN COMMUNITY BUILDINGS	F. P. H. A.
5-15-42	DEFENSE HOUSING · NATIONAL HOUSING AGENCY · WASHINGTON, D.C.	FIG. CF-14

STANDARDS FOR WAR HOUSING

Excluding Temporary Housing

STRUCTURAL DESIGN

Federal Public Housing Authority

May 15, 1942

The following national code recommendations shall be minimum requirements for the construction they cover.

"Building Regulations for Reinforced Concrete" of the American Concrete Institute (ACI 318-41).

"Recommended Practice for Design of the Joint Committee on Standard Specifications for Concrete, 1940".

Current "Specification for the Design, Fabrication and Erection of Structural Steel for Buildings" of American Institute of Steel Construction.

Current "Code for Arc and Gas Welding in Building Construction, (Tentative) 1941, issued by American Welding Society.

Current "Code" issued by Steel Joist Institute.

In Regions having earthquakes, provide adequate design for buildings to resist earthquake shock, in accordance with the Uniform Building Code of the Pacific Coast Building Officials' Conference 1940.

In Regions having hurricanes, provide an adequate design for buildings to resist tornado damage in accordance with local building code requirements or with local practices where no code exists. Exterior wall studs should be continuous, securely strapped to foundations and to roof framing. Exterior masonry walls may require vertical ties from foundations to the roof framing, also a continuous concrete spandrel, capping the wall. Pitched roofs without overhanging eaves are favored in preference to flat roofs in such regions.

Minimum Loads

Design framing for full construction dead loads, including partition loads, plus, as minimum, the following live loads in pounds per square foot:

Floors

Dwelling rooms	40
Community building	
rooms smaller than 400 sq. ft.	60
rooms 400 sq. ft. or larger	80
Offices	40
Maintenance shops	100
Public corridors, hallways and stairways	100

Roofs, on horizontal projected plane

Pitch less than 6" per foot	20
Pitch 6" per foot or more	15

Walls, on vertical projected plane 20

Partition loads must be considered spread uniformly, or be supported on extra joints.

Reduce live loads 50% for loads on girders, posts, walls, piers, foundations and soil.

Design for actual loads where they are known to exceed assumed minimums.

Arrangement of Framing

Preserve uniformity, repetition of typical elements, and continuity of framing.

Correlate stepped floor levels to multiples of exposure of exterior face wood sidings or shingles, or the coursing of face brick or masonry units; where concrete framing is used, they should not exceed 1' - 6", unless units are separated by expansion joints and double dividing walls and/or partitions.

General Requirements

Provide complete fire-stopping in wood stud walls and furred spaces, at floors, ceilings under attics, and roofs. Provide draft stops around chimneys.

Keep all combustible framing and furring 2" from chimneys.

Chimneys shall be 4" minimum thickness of masonry, with terra cotta flue lining, supported on masonry foundation or framed concrete slab, and shall have clean-out door on heater side, except that: for gas fired apparatus, chimneys may be of asbestos-cement, asbestos covered metal, or insulated porcelain enameled metal, or other equivalent material meeting requirements of the National Bureau of Fire Underwriters, without clean-out door, but extending at least 2 feet below smokepipe connection.

Smoke pipe should not pass through combustible partition, but when necessary surround with metal collar, full thickness of partition, packed with 2" minimum of asbestos, and keep smokepipe 6" clear of combustible material.

Protection at heating apparatus. Partitions and ceilings less than 6" away must be incombustible. If partitions are between 6" and 18" away from the apparatus and are combustible, they must be covered for at least 12" beyond the apparatus with 3/4" gypsum plaster on incombustible lath or 1/8" asbestos cement wall board over 3/8" gypsum boards, joints staggered. Likewise, where the ceiling is combustible and is only 6" above the apparatus it must be covered as above for a minimum distance of 18" from the line of the apparatus and for a diminishing distance, to a minimum of 12", as the clearance between the apparatus and ceiling increases to 18".

Where smoke pipe is between 6" to 18" from combustible ceilings and partitions they must be faced as above with incombustible material.

Metal clad incombustible pad over combustible floors shall be provided as a minimum protection under gas and oil burning heaters and coal buring space heaters. Under coal furnaces, provide concrete slabs, 4" minimum thickness if framed or over fill, and 2" minimum if over wood subfloor. Where such concrete slabs are over combustible construction, the furnace must be raised a minimum of 3" to provide through ventilating space.

Individual basements, where planned, shall be separated by masonry walls, or by partitions faced with incombustible material, having a one hour minimum fire resistance rating.

Public halls and stairways, in building of combustible construction shall have walls and ceilings, (including soffits of stairs) and ceilings over basement spaces where special fire hazards may occur, of incombustibel wall board with plaster filled or lapped joints, plaster on incombustible lath or masonry, or exposed masonry. The partition and floor construction for same shall have 3/4 hour minimum fire resistance rating. (See "Interior Walls and Partitions").

Exit doors of public spaces at or near grade shall open outward and be fitted with door closers and hardware permitting easy opening from inside.

For buildings containing more than 2 dwelling units but not more than 2 habitable stories high, the following, in addition, shall apply.

> With wood exterior wall and first floor construction, there shall not be more than 4 dwelling units between fire walls or exterior walls.
>
> With either masonry exterior wall (not masonry veneer) or masonry first floor construction, there shall not be more than 6 dwelling units between fire walls or exterior walls. Such floor construction must be at least 4" thick, not including combustible finish.
>
> With both such masonry exterior and first floor construction, there may be 9 dwelling units between fire or exterior walls.

Fire walls shall start from ground and extend continuously to a tight fit against, or through roof and exterior wall sheathing or masonry, and shall be of 2 hour minimum fire resistive construction masonry, at least 6" thick, or other incombustible construction, supported on masonry. If the wall supports combustible members there must be at least 4" of masonry beyond the ends and between any 2 members, with connections of supported members arranged to release in event of their collapse. (See illustrations on Figures Nos. S.4 and S.5)

Interior surfaces of walls and ceilings shall be of at least 3/8" incombustible wall board, or plaster on incombustible lath, or exposed masonry, or plaster on masonry.

Partitions and floor construction between dwelling units, except as otherwise stated, and except fire walls, shall have 3/4 hr. minimum fire resistance. (See "Interior Walls and Partitions" and illustrations in Figure No. S.3)

Fire resistance ratings shall be as established in accordance with ASA-A2 standard furnace test, or as approved by the Central Office.

For three story buildings or two story buildings with dwelling units in basement, and containing more than two dwelling units.

Shall meet the foregoing requirements, and have exterior walls of masonry, and have interior stairs to basement surrounded by an incombustible enclosure with self-closing incombustible door, except that:

> Where floors and partitions between dwelling units have a one hour minimum fire resistance, and not more than one dwelling unit is in basement, there may be four dwelling units on each floor of a 2-story building, and three on each floor of a 3-story building, between fire or exterior walls, or
>
> Where floors over first story of 3-story building, or over basement of 2-story building is continuously incombustible or slow burning of one hour minimum fire resistance, the stories above may have combustible wall and floor construction, if they have not more than 6 dwelling units between fire walls.

Termite and Rot Protection

All wood debris, stumps, logs, etc. on or in the ground of site, near surface, must be removed, before starting construction.

Prevent burial of wood in the ground. Remove any accumulation of wood, such as form boards, stakes, chips, and scraps.

Drain water away from foundations.

Due to prevailing restrictions, metal termite shields cannot be used in all States; however, foundations must be made as impervious to termite penetration as practicable. See "Defense Housing Critical List," effective Feb. 24, 1942, which permits limited use of ferrous metal for shields in Florida, Alabama, Mississippi, Louisiana, Texas and Hawaii. Ferrous metal flashing may be extended to provide a termite shield where masonry terrace, platform or porch slab and steps abut wood construction at exterior walls.

Monolithic concrete provides the greatest protection.

Masonry foundation walls and piers shall be capped above the ground with concrete at least 4" thick, reinforced with steel wire mesh or bars lapped for continuity, or, as a last resort, such capping may be of solid concrete blocks or brick having all joints completely filled with mortar or lean grout, or of hollow concrete units completely filled with poured-in-place lean grout or concrete. Details, reinforcements, and workmanship required shall be effective in prevention of open shrinkage cracks. (Termites are known to penetrate cracks 1/32" wide).

Permit no contact between woodwork in building and the ground. Terminate stair carriages, door frames, partitions, posts, etc., on concrete pedestals or curbs extending 6" minimum above floor levels.

Seal tightly, with coal-tar pitch, all expansion joints, and all spaces around pipes, bolts, anchors, etc., penetrating floors and walls in contact with ground.

Provide at least 24" below all wood joist floor framing for inspection crawl spaces. Provide access and ventilation for each enclosed space. For ground floor area of 400 sq. ft. or less, under normal conditions, use 4-8" x 12" vents or equivalent. For each additional area of 150 sq. ft. or fraction thereof, add an additional 18" x 12" vent, or equivalent. In localities where moisture is prevalent, or local conditions warrant, additional vents must be provided.

At exterior faces of buildings, keep all wood siding, trim, sheathing, etc., 6" minimum above grade. See Fig. S-1.

Isolate all masonry of porches, steps, and terraces from contact with wood on exterior faces of buildings by clear space of 1-1/2".

Wood which cannot be given the required clearances from ground, such as sleepers laid on concrete slabs, shall be impregnated with standard preservatives applied under pressure, and insulated from the ground by at least 3" of concrete.

Provide means for regular inspection, after completion of construction, to detect presence of any termite infestation.

Sound Insulation

At dividing partitions between dwelling units and where required in community building it is essential to provide more noise reduction than is effected by ordinary partitions. This can be done by using double stud partitions supporting lath and plaster independently on each face of the partition. Another effective method of sound insulation is to attach gypsum lath to the studs with resilient clips instead of rigid nailing. Hollow tile partitions, for effective noise reduction, generally need to be furred on one side with wood strips before lathing and plastering. Where bathrooms or kitchens are planned back to back against the dividing wall, no provisions for sound deadening need to be made, except that medicine cabinets back to back should be separated with 1/2" thickness of gypsum board.

For constructions which meet the above requirements, see details on Figures No. S.3, S.4 and S.5.

General

The Defense Housing Critical List prohibits the hourly heat loss of a building in B.t.u. per hour from exceeding 66 times the dwelling area in square feet or 80,000 B.t.u. per dwelling unit, whichever is the smaller. Dwelling area is the total area used for dwelling purposes contained within the exterior walls at each principal floor level.

Ceilings or Roofs: Generally provide insulation at top-story ceilings, except in mild climates such as the Pacific Coast where no extremes occur. (This protection is justified either for economy in heating in winter or for comfort in summer.)

In wood frame construction (whether roofs are flat or sloping) the insulation should be placed just above the ceiling. Material may be loose fill, bat, or blanket type, but must be resistant to vermin and decay. Thickness shall be such that the thermal conductance of the insulating material will be approximately .083 B.t.u. per square foot, per hour, per degree F. temperature difference. Immediately beneath the insulating material install vapor seal and provide for ventilation above. (See Condensation.)

In the case of solid slab roof construction, use rigid insulation board ranging from 1 to 2 inches in thickness, on top of roof construction.

Floors: Where insulation is used on underside of wood floor construction it must be either rigid, bat, or blanket type insulation, dampproofed and vermin protected, and installed between the joists.

Exterior Walls

For the purpose of fuel conservation reduction in the heating capacity of the system and to increase comfort exterior walls of the dwelling units should not transmit more than 20 B.t.u. per square foot, per hour, for an inside temperature of 70° and for the outside design temperature of the locality.

Thus to ascertain the rate of heat loss in a contemplated type of wall construction, multiply the heat loss coefficient of the proposed wall by the difference in degrees F. between the inside and outside design temperatures for the locality. The product should not exceed 20 for an acceptable wall construction.

The following table indicates the coldest localities in which the noted wall constructions can be used without additional thermal insulation. (For more detailed information concerning the properties of walls see "Heating Ventilating Air Conditioning Guide" published by the American Society of Heating and Ventilating Engineers - latest edition.)

Description of Wall	Coefficient of Transmission (U)	Minimum Outside Design Temperature Degrees
Frame (3/8" wood siding, building paper, 7/8" wood sheathing, studs, plaster)......................	.27	-5
Frame (3/8" wood siding, building paper, 7/8" wood sheathing, 1/2" blanket insulation, studs, plaster)......................	0.18	-40
Brick veneer on frame (3-3/4" brick, building paper, wood sheathing, studs, plaster)..............	.27	-5
Brick veneer on frame (3-3/4" brick, building paper, wood sheathing, 1/2" blanket insulation, studs, plaster)......................	0.18	-40
8" cinder block, plaster.....	.39	+20
8" cinder block, cores filled with dry cinders, plaster......................	0.29	0
8" cinder block, furring, plaster......................	.27	-5
8" cinder block, cores filled with dry cinders, furring, plaster.............	0.22	-20
8" concrete block, plaster...	.52	+30
8" concrete block, cores filled with dry cinders, plaster......................	0.36	+15
8" concrete block, furring, plaster......................	.32	+10
8" concrete block, cores filled with dry cinders, furring, plaster.............	0.25	-10

Description of Wall	Coefficient of Transmission (U)	Minimum Outside Design Temperature Degrees
4" brick, 4" tile backing, plaster............	.39	+20
4" brick, 4" tile backing, furring, plaster.....................	.29	0
4" brick, 4" tile backing, 1/2" blanket insulation between furring, plaster....	0.19	-35
Cavity wall (3-3/4" brick, 2" air space, 3-3/4" brick, plaster.....................	.29	0
8" brick, plaster...........	.46	+25
8" brick, furring, plaster..	.30	+5
8" brick, 1/2" blanket insulation between furring, plaster.....................	0.20	-30

Loose insulation and structural parts within walls or ceilings are subject to damage from condensation when the temperature within the construction becomes lower than the dew point.

In order to protect insulation and construction at the top story ceiling, install an effective vapor barrier immediately above the ceiling, below the insulation in climates north of the January 35° isotherm. (See Diagram in Figure No. S2). Furthermore, a moderate ventilation of the roof space is essential to prevent accumulation of water and vapor and possible resultant condensation in winter. A satisfactory amount of ventilation for this purpose is provided by blocking out the facia board at eaves to provide a 3/4-inch continuous opening. (Additional ventilation in some localities may be desirable for comfort in summer). Provide screens at ventilating openings. See details in Figure No. S2.

If insulation is used in exterior walls, similar protection should be provided by a vapor barrier on the warm side of the insulation, and by provision for dispelling water vapor from the wall construction. (Insulation should not be placed between the inner and outer shell of cavity wall construction).

Pipe spaces or other vertical voids, extending from a crawl space under first floor to attic space, must be tightly sealed at top and bottom.

Where natural gas is used for kitchen ranges, provide vent flues from kitchen through roof.

Make adequate subsurface investigation prior to foundation design (See pages 29 and 30).

Foundation walls may be of concrete or masonry units on continuous spread concrete footings, and interior supports may be piers of concrete masonry units on isolated spread concrete footings, when at normal depths not subject to excessive changes in level. The bottom of all foundations shall be at elevation below frost.

Reinforced concrete grade beams, serving as shallow walls, resting on piers, caisson, or piling, shall be considered versus walls on continuous footings, when excavation for satisfactory bearing exceeds 4 feet.

See "Concrete floors on ground", page 20, for possible use of thickened portions of slabs as foundations.

Walls built of masonry units shall not be used on soils having a safe bearing value of less than 3,000 pounds per square foot. When concrete walls are placed over such soils, at least two 5/8" round continuous reinforcing bars must be used at the top and at the bottom. Such walls should have additional reinforcing where full height doors or large windows occur.

Brick and concrete block walls below grade enclosing basement spaces, must have 1/2" portland cement parging and dampproofing on the exterior surface.

Brick or masonry units shall not be used for walls enclosing basements, or crawl spaces, where a constant head of water will occur above the footing, or where walls support earth fills more than six feet high.

Dense 3,000 pound concrete made with ordinary materials, using customary methods, will be watertight without addition of integral compounds and application of impermeable coatings, if proper precautions are taken.

 STRUCTURAL DESIGN.
Exterior Walls
Conventional Wood Framed

Wood studs shall be not less than 2" x 4" (nominal) spaced not more than 16" on centers, except that where 5-ply plywood, 5/8" min. in thickness, is used for interior finish on the studs the spacing may be 24" on center, maximum.

Brick veneered walls must have exterior wall studs extending continuously from foundation to top of wall in one length without splices (balloon framing).

Exterior Sheathing: In building more than one story in height, where sheathing is wood laid horizontally on walls less than 50 feet in length, or of fibre board on walls of any length, diagonal bracing must be used between the studs at each corner of the building, extending continuously from floor to floor and/or floor to roof.

See "Wood Framing" on page 23.

Concrete masonry units shall have an applied exterior finish of 2 coats of portland cement paint. See specifications.

Brick, clay tile, and concrete units shall all be permitted as optional back-up construction, subject to thermal insulation requirements. (See page 9).

Brick-faced cavity walls afford resistance to rain penetration. In the evaluation of costs and maintenance with other masonry walls this will be given consideration, particularly in regions subject to heavy rainfall with high winds.

Stucco exterior finish may be used only after approval of the Central Office. Submit detailed specification.

Units and mortars for exposed surfaces, or surfaces in contact with soil in the presence of moisture, must be carefully specified to suit the local climatic conditions. See specifications for various grades of units and mortars and their respective conditions of use.

Wall thicknesses, (nominal) for brick, clay tile, or concrete unit materials, shall be limited for stability to the following minimums:

1-story and attic gable bearing walls; and non-bearing curtain walls.

Solid Walls of one or more units with grade M mortar - 8"
Cavity " " two " " " " " H " - 9½"
Solid " " single units with grade H mortar - 6"

Top 2 stories and attic gable bearing walls:

Solid Walls of one or more units with grade M mortar - 8"
Cavity Walls of two or more units " " H " - 9½"

First story of 3-story bearing walls

Solid Walls of one or more units with grade M mortar - 12"
Cavity " " two " " " " " H " - 13½"

Furring and Dampproofing: Except where specifically waived because of demonstrated satisfactory local experience, all masonry-faced walls 8-inches or less in thickness shall be furred for interior finish. Masonry-faced walls, 12-inches or more in thickness shall be furred or have troweled-on plastic dampproofing, except that cavity walls need not be furred or dampproofed. Furred walls shall have no applied dampproofing. See "Masonry Construction", pages 25-27.

16 STRUCTURAL DESIGN.
Exterior Walls
Special Constructions

Hollow concrete units may be insulated by filling them with granular or flaked materials such as cinders, burnt clay, slag, or vermiculite.

Monolithic concrete spandrels and belt courses above first floor level shall not be exposed to the exterior.

Special Wall Constructions must be submitted to the Central Office for approval.

Non-bearing incombustible construction should be supported by incombustible floors or framing members; bearing partitions or walls supporting incombustible floors must be incombustible.

Lateral stiffness to resist impact such as from swinging doors.

Compressive strength to sustain vertical loads with a safety factor of 6 for masonry and 4 for wood.

For partitions within dwelling units:

Non-bearing:

Wood studs - 2" x 3" min. - 16" o.c. max.
Masonry block - 3" min. thick; except fireproofing around columns and short runs between cross partitions may be 2" min. gypsum block may be used except for first course above floors and around kitchens, bathrooms or spaces subject to high moisture content.

Solid plaster partitions, using 16" wide strips of 3/8 plaster board, full story high, adequately secured at the butt joints also at floor and ceiling with metal clips 16" o.c. and both sides of the board covered with plaster to a total thickness of 2".

Bearing:

Wood studs - 2" x 4" min. - 16" o.c. max.
Masonry block - 6" min. thickness of brick, clay tile or concrete units.

For partitions between dwelling units, additional requirements are:

Sound reduction factor of not less than 40 decibles:

Fire resistance rating of not less than 3/4 hour, and where more than 6 dwelling units are placed within exterior walls, or within portions surrounded by exterior and fire walls, not less than 1 hour.

Partitions which meet the above requirements are illustrated in Figure No. S.3.

18. STRUCTURAL DESIGN.
Interior Walls and Partitions
Minimum Masonry Fire Walls

For Fire walls between dwelling units, additional requirements are the following:

Sound reduction factor of not less than 40 decibles;
Fire resistance rating of not less than 2 hours;
Self sustaining in the event of collapse on one side.
See "Fire Resistive Standards", page 3 to 5.

Masonry wall construction, laid in Grade M mortar which meet the above requirements are illustrated in Figures Nos. S.4 and S.5. (See "Masonry" specifications for grades of mortars).

The maximum nominal depth of wood joist generally shall be 10" and the maximum spacing of joists for 1 inch sub-floor and for standard lath, shall be 16 inches o.c.

Wood sub-flooring, of not less than 1 inch nominal thickness, laid diagonally, or 5/8" plywood shall be used over joists.

Concrete may be used only with no steel reinforcement for concrete slabs supported on the ground, or reinforced for framed concrete slabs where it is essential to meet fire resistance requirements.

For the reinforced concrete slabs the following standards must be observed:

Where ceilings are to receive plaster, use slabs of concrete joists and hollow tile fillers.
Where ceilings may be of exposed concrete, use solid concrete slabs.
Use maximum permissable depths and other expedients to reduce the amount of reinforcing steel to a minimum.
Thickness of solid slabs shall be 4" minimum and effective depth, not less than L/60 for fs = 20,000, L/50 for fs = 25,000, and L/40 for fs = 30,000.

Steel reinforcing bars having higher yield strength than intermediate grade steel may be used as tensile reinforcement at design stresses of 50 percent of guaranteed minimum yield strengths of the bars used, but not exceeding 30,000 psi., for one way solid slabs only, subject to the following limitations:

Design should be in accordance with the "Building Regulations for Reinforced Concrete" ACI 318-41 with proposed revisions published in November 1940, ACI Journal, or the "Recommended Practice for Design of the Joint Committee on Standard Specifications for Concrete and Reinforced Concrete, 1940".

Expansion joints shall not be used unless such joints extend also through the exterior walls above normal foundation walls.

"Weakened plane joints" shall be used for controlling location of inevitable shrinkage cracks, in preference to expansion joints. These are partial vertical joints in the slab, made sufficiently "weak" to localize shrinkage movement to the joints. The shrinkage reinforcement should extend across the joint, fully bended on each side by complete embedment in the concrete, in order to restrain movement in the slab sufficiently to prevent transference of excessive stresses to the exterior walls. The weakened joints should be located under partitions which extend continuously, without openings, across the building, thus concealing the joint. Score the slab from the top to within 2-1/2 inches of the bottom, just prior to initial set of the concrete.

Concrete floors supported on ground, for habitable rooms, may be used only in warm climates and dry localities and where they are accepted practice. They may be used on any projects for basements.

Where loads are light, such as frame buildings, and no frost occurs, ground supported slab may be thickened to 1' 0" or more to serve as foundations under the exterior and interior bearing walls. For fills over 2' 0" extend thickened portions down to firm undisturbed soil.

Earth fills, compacted by hand-tamping or light rolling shall not exceed one foot in depth unless the floors are designed to be self-supporting. Deeper fills used to support concrete floors shall be laid in 6-inch layers sufficiently dampened, thoroughly rolling each layer not less than 4 passes with a roller weighing at least 5 tons, unless the fills are of sand or bank-run sand and gravel thoroughly wetted and drained.

All concrete floors supported on ground shall have minimum thickness of 5". "Weakened plane joints" as described on page 19, except that reinforcement across joints shall be omitted, should be provided under partitions to localize shrinkage movement. Except for basement floor slabs, laundries, store rooms, etc., a 6" layer of coarse gravel should be laid directly on the compacted fill, and a kraft fibre-reinforced waterproof paper laid on the gravel subgrade, before placing the floor slab. The slabs should bear on the foundation walls, or be monolithic with them.

Surfaces graded to drains shall have even pitch of not less than 1/8" per foot, without depressions to collect water.

Precast concrete joists shall be used only with monolithic slabs of 2-1/2 inch minimum thickness.

Cement finishes should assure complete bond with slab and maximum surface strength with minimum shrinkage. (See specifications)

Use lumber which is graded and trademarked.

Over wide openings, the ends of lintels should be fixed with blocking; or use truss bridging between the studs, to avoid excessive lintel depths required for bending stresses. See Details.

The following standards shall be observed:

Framing lumber for joists, rafters, lintels, beams, studs, posts, plates, and other ordinary members, shall be common dimension, of the species and grades, in the specifications for carpentry.

The maximum stresses to be used in the design of members of the above species and grades shall not exceed the following:

Extreme fibre in bending and direct tension		1,100 psi.
Horizontal Shear		100 psi.
Compression perpendicular to the grain		300 etc.
Compression parallel to the grain,	1/d-11	800
	1/d-17	716
	1/d-23	519
	1/d-30	304

Deflections shall be limited to 1/360 of span on members supporting plaster.

Maximum clear spans for the various joist sizes (nominal) of the above species and grades, shall not exceed the following:

Floors (not including partition loads)

When deal load = 10 psf. live load = 40 psf.

2" x 6" @ 16" o.c. 9'-0"; @ 12" o.c. 10'0"
2" x 8" @ 16" o.c. 12'-6"; @ 12" o.c. 13'9"
2" x10" @ 16" o.c. 15'-9"; @ 12" o.c. 17'6"

Flat roofs

When dead load = 15 psf. live load = 20 psf.

2" x 6" @ 16" o.c. 10'-9"; @ 12" o.c. 11'9"
2" x 88" @ 16" o.c. 14'-0"; @ 12" o.c. 15'0"
2" x 10" @ 16" o.c. 18'-0"; @ 12" o.c. 19'0"

Joists or beams over 10 inches in depth generally should not be used, to avoid excessive shrinkage.

Pitched Roofs

When deal load = 15 psf. live load = 20 psf. (horizontal projection.)

Maximum clear spans, horizontally from plate to ridge, for various rafter sizes (nominal) with minimum ceiling joists, supported at or within 2'-0" of center (under ridge), and minimum eave joint detail, must be as follows:

Rafters		Pitch of Roof (vertical rise per horizontal run)							
		4" in 12" min. to 6" in 12"				6" in 12" to 8" in 12" incl.			
Spacing	Size	Ceil. Span	Ceil. Joist (1)	Eave Rise (2)	Jn't. Spikes or RC (3)	Ceil. Span	Ceil. Joist (1)	Eave Rise (2)	Jn't. Spikes or RC (3)
12" oc	2x4"	8'0"	2x4"	$4\frac{1}{2}$"	5-20d	8'3"	2x4"	$6\frac{1}{2}$"	4-16d or 3-20d
	2x6"	12'6"	2x4"	7"	7-20d	12'9"	2x4"	$10\frac{1}{2}$"	6-16d or 5-20d
16" oc	2x6"	11'0"	2x4"	6"	7-20d	11'3"	2x4"	$8\frac{1}{2}$"	7-16d or 5-20d
	2x8"	14'6"	2x6"	8"	10-20d	14'9"	2x6"	$12\frac{1}{4}$"	9-16d or 7-20d
20" oc	2x6"	9'6"	2x4"	$5\frac{1}{2}$"	$2\frac{1}{4}$¢ RC	9'9"	2x4"	$8\frac{1}{4}$"	6-20d
	2x8"	12'9"	2x6"	$7\frac{1}{2}$"*	11-20d	13'0"	2x6"	11"	10-16d or 8-20d
24" oc	2x6"	8'9"	2x4"	5"	$2\frac{1}{2}$¢ RC	9'0"	2x4"	$7\frac{1}{4}$"	6-20d
	2x8"	11'6"	2x6"	7"	*12-20d	11'9"	2x6"	10"	11-16d or 8-20d
	2x10"	14'6"	2x6"	8"	4"¢RC	14'9"	2x6"	12"	10-20d

*See Typical Rafter Detail in Figure No. S.6

Ceiling joist, to be connected to every rafter at or near eave to resist horizontal thrust from rafter.

Ring connectors shall be Split-Ring metal timber connectors, with bolt and washers, or Toothed-Ring connectors of size required for equivalent strength. Ring connectors are preferable for joints requiring over 7 spikes. All joints not otherwise marked may use a $2\frac{1}{2}$¢RC with $\frac{1}{2}$"¢ bolt. Ring connectors shall be 4"¢ with 3/4"¢ bolt for joints marked*. Where RC is called for in above table, the normal lap of rafter and ceiling joist at eave joint will not accommodate sufficient 20d spikes for the horizontal thrust.

No spikes larger than 20d shall be used for members shown.

Roof trusses. Where roofs are pitched, precut and assembled trussed roof rafters, which may be joisted into place, are usually found cheaper in housing project design than customarily pitched rafters with or without interior supports.

They eliminate all bearing partitions in the story below the roof thus facilitating the closing in of the structure.

For usual roof loads and spans, 2" x 6" (nominal) wood members may be used for clear spans of 26' - 0" maximum, spaced 24" o.c. when suitably detailed as illustrated. See detail in Figure No. S.7.

The same truss may be used where clear spans are reduced not more than 16" (8" maximum at each side). In such cases the truss would project beyond the wall forming projecting eaves.

By the introduction of an additional member (see Figure No.) a still shorter clear span may be used, in which case the eave projection would be correspondingly greater.

General framing requirements: Where platform framing is used, the exterior wall studs in each story shall be tied to the studs in the story above or below by diagonal or plywood sheathing extending across floor framing, or by other equivalent means.

Where doubt exists if platform or balloon is the more economical system of framing they should be shown as optional.

Support of floor and roof members should be arranged to equalize shrinkage in exterior walls with that in interior bearing partitions. No lintels of wood should exceed 6" in depth.

Use balloon system of framing for buildings faced with masonry veneer or stucco.

Studs shall be doubled at each side of openings. The doubled studs may be separated to 6" maximum but solid wood blocking, not over 2 feet on center, should be provided between the studs. One of the doubled studs shall be terminated under the lintel bearing and the lintel shall extend to a tight fit with the other stud and be securely nailed thereto.

Where joists frame over or immediately adjacent to studs use single plates, with splices at joints; otherwise plate under joists shall be doubled.

Cross furring shall be used under ceiling joists or trusses spaced over 16" o.c. for attachment of standard ceiling lath, except for 1/2" minimum thick plaster board, when spacing may be up to 24" without furring.

Unless specifically detailed to suit stress conditions joists should not be notched more than one-fourth their depth at bearings, (nominal) nor should either top or bottom edge be notched.

more than $1\frac{1}{4}$" between bearing and $\frac{1}{4}$ point of span, and nowhere within the center half of span. No holes of diameter more than $\frac{1}{4}$ the joist depth, should be placed through joists; they should be centered between top and bottom edges.

Stresses in special framing members, such as roof trusses or built-up girders, shall be designated on member details or on a stress diagram.

For Masonry units suited to different conditions of exposure and use, see specifications for Masonry, and "Exterior Walls", page 14.

Brick and clay tile, shall be thoroughly wet when laid, if they have a high rate of absorption. Concrete units always shall be laid dry and special attention given to high durability and water-retentivity properties of the mortar.

Tooling of face joints shall be done after the mortar has its initial set. Method of tooling shall be capable of compressing the mortar to a smooth dense surface and tight adherence to the masonry unit at exposed edges.

To avoid difficulties from soluble salts, causing efflorescence masonry units, mortars and mortar materials for exterior walls shall be tested. (See specifications.)

Do not use parapet walls.

Chases in bearing walls should be carefully located on drawings; and be built in place, not cut out after wall is constructed. Omit them in walls less than 12-inches thick.

Dimension story heights and stepped floor levels to suit standard masonry unit size, avoiding special units and cutting of standard units.

Optional types of lintels should be indicated. Where steel angles are not obtainable, exposed reinforced precast concrete, or smooth face clay tile, is permissible.

Use parging where severe weather requires increased resistance. Apply to either the back of facing units or surface of back up, prior to placing the facing. Omit parging in relatively dry climates.

Flashings should be corrosion resistant, protectively coated or approved membrane.

Spandrel flashings are not required.

Masonry cavity walls shall have outer and inner wythes separated by a continuous air space, not less than two inches wide, and connected by metal ties. Floors should bear only on the inner wythe. Use Type "H" mortar in both wythes.

Keep the cavity clear of mortar droppings; to permit free drainage.

Drain the bottom of the cavity by weep holes in vertical joints of the bottom course of facing wythe, made with 3/8 or ½ inch oiled steel rods or short lengths of rubber hose, withdrawn after the mortar has set.

Metal Ties: Galvanized or zinc-coated metal ties are not considered safe from chemical action of free limes that may be present in the wall. Use cement coating on plain steel ties. Asphalt coatings shall not be used. Submit other types of corrosion protection for approval.

Arrange ties to have ends bedded in horizontal joints of each wythe so the equivalent of at least one 3/16" round steel tie between wythes will be used for each 3 square feet of wall surface.

For solid masonry units, the tie may be bent in the shape of a Z with ends forming outstanding legs not less than 2-inches long, at right angles to the stem.

For hollow masonry units, the tie should be one of the following shapes:

Bars bent to shape of a rectangle, ends butted (not welded) on one side lying in mortar bed of wythe; each end of tie lying over at least one web of units.

Welded steel wire in strips of 2 longitudinal wires lying in mortar beds of both wythes, and cross wires equivalent to ties specified above.

Flashings shall be used over all openings to deflect the water outward through weep holes or sidewise into the cavity on each side of the opening. If no basement is provided and the cavity extends sufficiently below the lowest floor level to prevent water from filling the bottom of the cavity to the underside of the floor, no flashing need be provided at the bottom of the cavity. Continuous flashing should be provided under all other circumstances.

Masonry Cavity Walls (Continued)

Where dampness prevails in the soil against the foundation, a damp course should be placed slightly above grade and below the underside of the first floor construction to prevent water from rising into the wall by capillary action. This should be an approved flashing, or two layers of slate with joints broken, extending the full thickness of the wall.

In cases where the first floor construction is close to grade, the cavity should terminate at the top of the floor and flashing provided to deflect water outward from the interior wythe.

Omit insulating material in the cavity space. Moisture penetration and condensation will cause deterioration, high conductivity, and the formation of fungi.

Monolithic Concrete Construction: In order to produce satisfactory concrete, it is important that the specification for concrete work be followed.

Completely investigate bond and shear stresses, probable shrinkage and temperature stresses, and probable reversals of stress, as well as simple flexural and compressive stresses. Use no unnecessary reinforcement. Increase depths of sections and reduce concrete working stress as much as practical to reduce amount of reinforcing steel required. Use plain concrete, without reinforcement for footings.

Omit temperature reinforcement in portions of walls below grade, except reinforcing around openings. See "Foundations" page 12.

Obtain full embedment, lap, or anchorage, to fully develop design stresses in reinforcement.

Porches, Balconies, Canopies

Avoid framed porches and balconies. Place porch slabs on ground wherever possible; where framed, simplify with minimum foundation structure. Thickened edges and reinforced as grade beams, supported on concrete filled post holes at outer corners. Use no balconies above the first floor except in arid climates where exposure is not severe. See illustrations in Figure No. S.8.

Canopies may be of concrete where concrete floors are used inside buildings. Cover them with waterproof composition roof covering, flashed at intersections with walls.

Finish exposed surfaces of porches, balconies, etc., with approved type cement wash or cement paint, properly cured. Provide temperature steel in two directions, not less than .50% of cross sectional area, placed near each face.

Subsurface Investigation for Foundation Design - The extent of such investigation should be determined by the architect's structural engineer, who will use the data for his design.

Where the preliminary data indicate favorable bearing soils lie close to the surface, a few open pits shall be excavated to verify the assumed data. Where preliminary data or open pits indicate the presence of fills or soft grounds, or the presence of questionable underlying strata, make a number of borings. These may be few in number, located in well distributed, representative areas of the site, if the subsurface strata are found to be definitely uniform in character and level. If the evidence indicates varying fills or underlying strata, pockets or unfavorable character, or wide and rapid changes in stratification, make a sufficient number of intermediate borings to determine the extent and variation of such areas.

The depths of borings should extend sufficiently to assure at least four feet of uniform bearing stratum under the footings. Where soft underlying strata or rock are indicated or suspected, sounding bars may be used to augment data disclosed by the pits or borings.

Where soil bearing is doubtful, make load tests to determine the safe allowable load.

Make accurate observation of ground water levels and obtain information from local sources regarding variations in levels, particularly where footings are to rest in clay, or other relatively impermeable strata which will hold water against the foundation walls and the underside of the basement floors, and require drainage and water proofing in construction of the proposed buildings.

Recording and Analysis of Data - Keep field notes of all matters and conditions pertinent to the work, including the elevation of the surface at each pit or boring, the depth at which each stratum is encountered, the kind of material in each stratum, and whether the material is hard or soft.

Make a drawing showing a complete log of the exploration data, together with a site plan showing the dimensional location of all pits, borings and soundings, kind of soil in each stratum, the ground water levels, the surface elevation of the ground and the depth to, or the elevation of, each stratum. Each kind of soil should be adequately described to show whether it is hard or soft, its moisture content, and its relative permeability or capacity to drain free of water. The various soils and their condition should be indicated by symbols and description.

A load test area shall closely approximate the proposed footing areas. Where this is not practical, adjustments must be made to the bearing capacities obtained under small test areas for soils that are relatively cohesive.

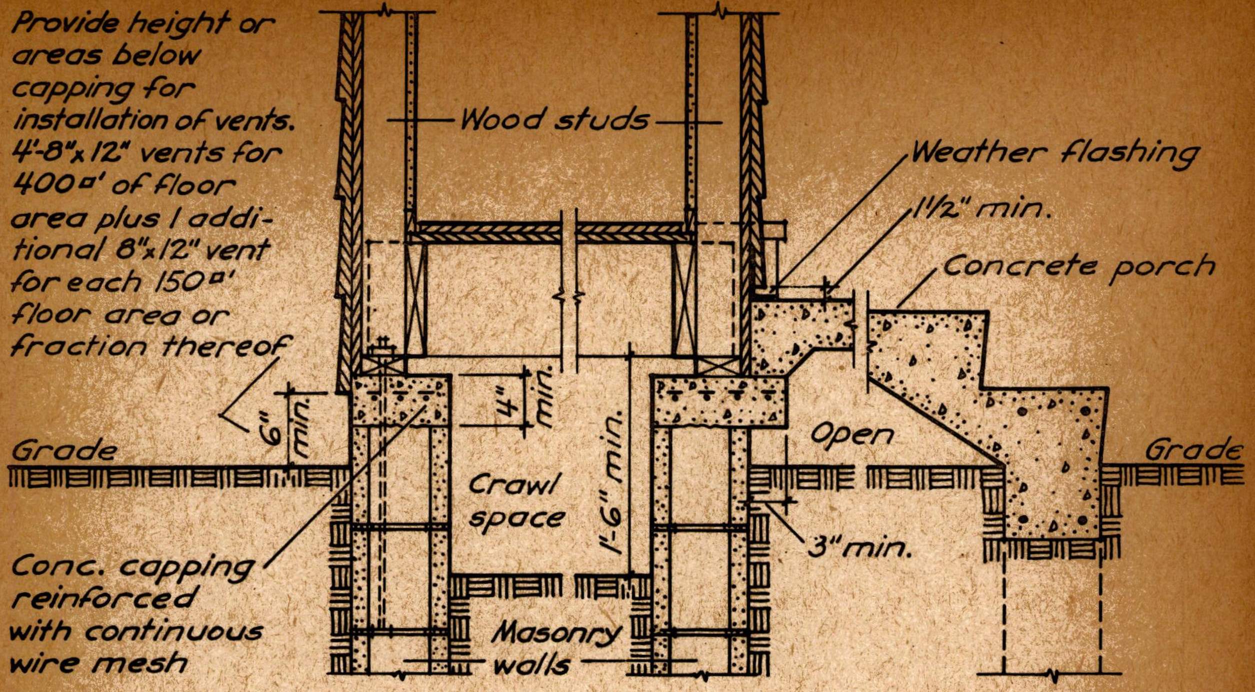
The soil to be tested should be at the proposed footing level, and if possible, in an undisturbed state.

The following requirements should be carefully observed in the design of testing apparatus:

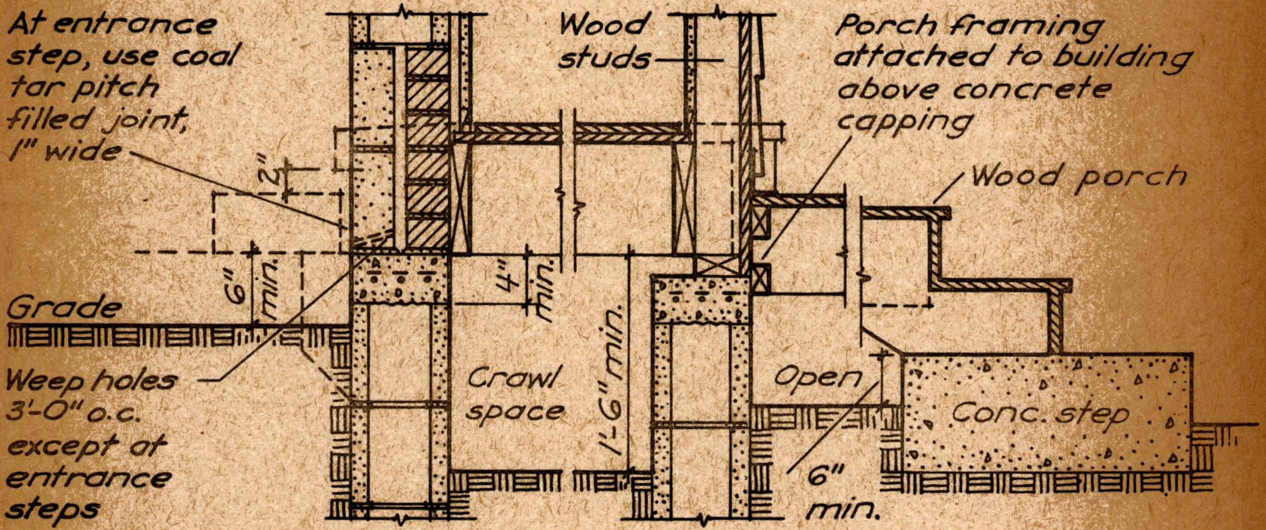
> A testing capacity equal to the bearing capacity limitations of ordinary soils, or to twice the allowable load desired.
>
> A sufficient sensitivity to give compression values for soils of a very low bearing capacity.
>
> Simplicity permitting its construction with ordinary labor and materials available on the construction site, and requiring, for pressure producing weight only materials easily obtainable in the locality of the project.
>
> Lateral bracing to maintain the vertical direction of the applied pressure without interfering with the full compression of the soil under the pressure.

Load the apparatus in small increments and measure the resultant compression of the soil after each increment of the load has been placed. An interval of at least 12 hours should elapse before the next increment is placed and measured.

After the final increment of load has been applied, a period of at least 48 hours should elapse before the load is removed. The compression should be measured each 24 hours after the final load application, unless an increasing rate of settlement, indicating failure, is noted. The rebound after removal of the load should also be measured. A chart of the compression for each application of load shall be prepared, showing the rate of compression and the rebound.



Concrete capping placed on kraft paper impregnated with coal tar pitch.
Wood sills bedded and anchor bolts pointed with coal tar pitch.



Concrete cappings to be continuous of poured concrete of 2000 lb. strength-dry consistency. Interior masonry piers and walls to be similarly capped.

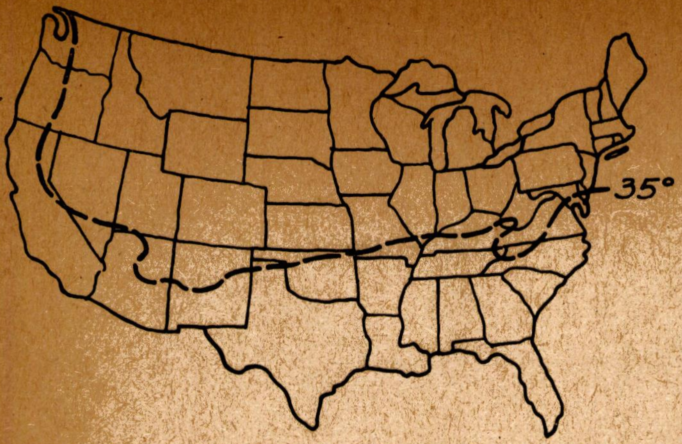
Protection of Woodwork over Unit Type Masonry Foundations from Hidden Termite Infestation

REVISED____ ____ ____ ____

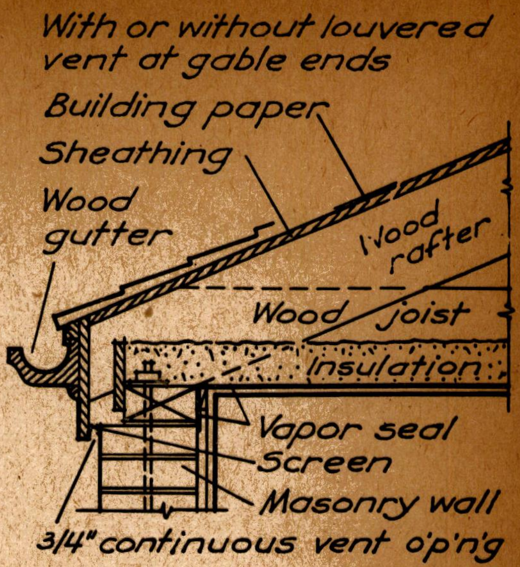
DATE	TERMITE PROTECTION	F.W.A.
FEB. '42	DEFENSE HOUSING • FEDERAL WORKS AGENCY • WASHINGTON D.C.	FIG. S-1

9781

APPROVED



Normal January 35° Isotherm



A

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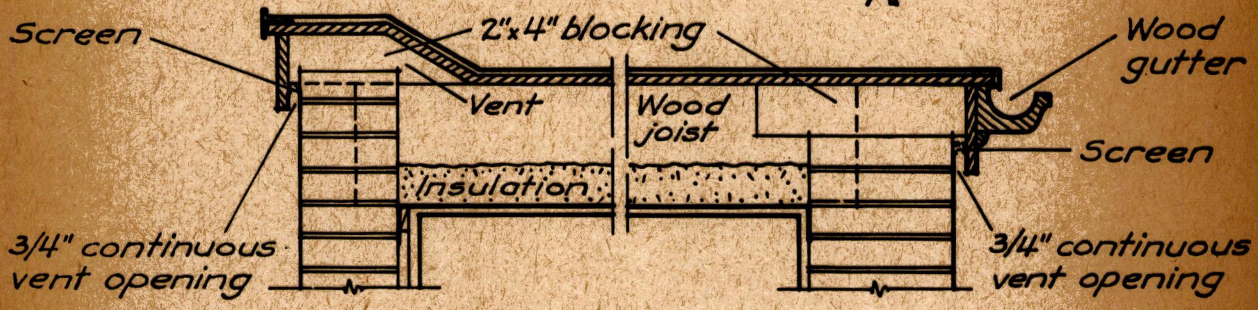
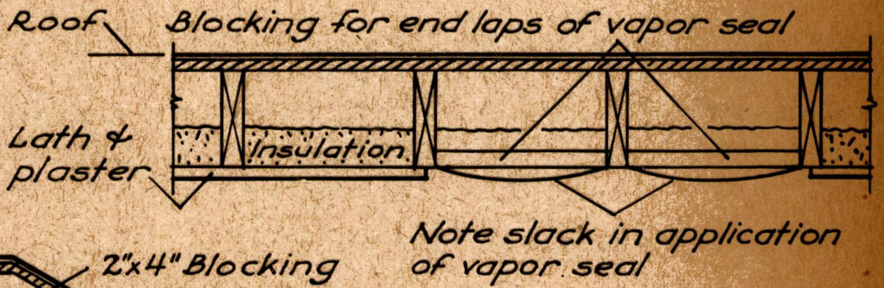


B

C



E

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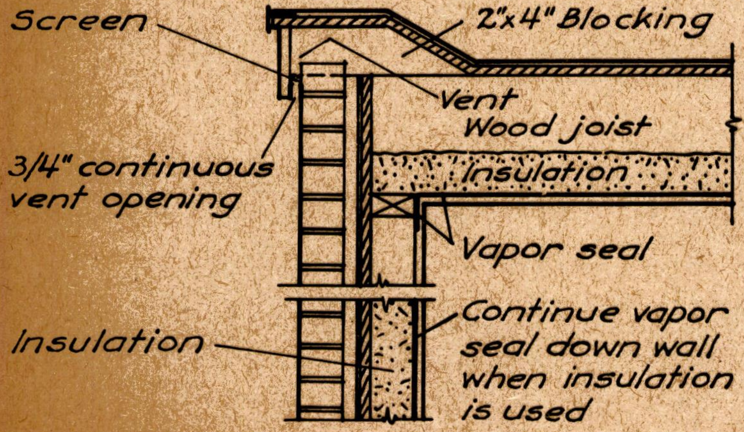


D

A Pitched roof wood joists and rafters

B Flat roof on wood joists

C Flat roof on wood joists wood gutter

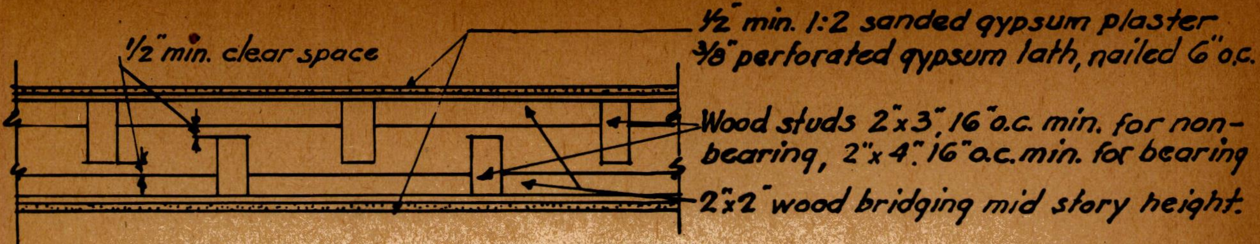
D Flat roof on wood joists brick veneer wall constr.

E Vapor seal application details

REVISED____ ____ ____ ____

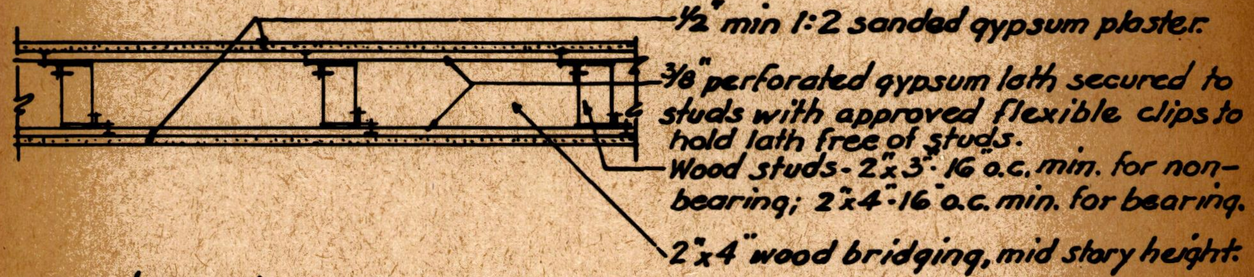
DATE	ROOF INSULATION AND VENTILATION	F.W.A.
FEB. '42	DEFENSE HOUSING • FEDERAL WORKS AGENCY • WASHINGTON D.C.	FIG. S-2

9781

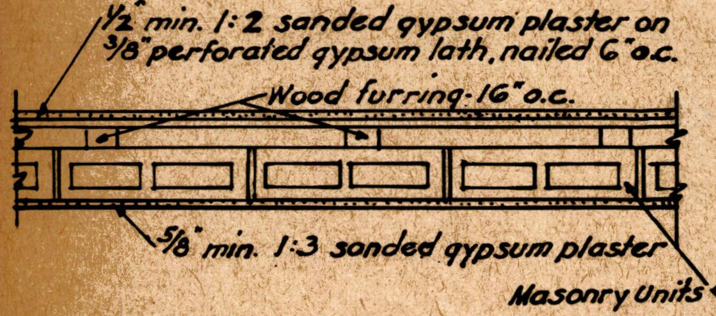


No connection between studs on one side of partition to studs on other side shall be made, except at floor and at ceiling.

Wood Stud

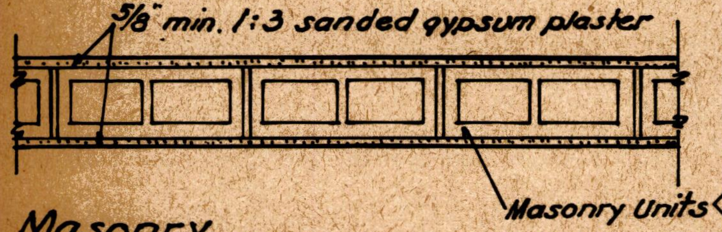


Wood Stud



3" gypsum block
3" med. burned clay tile or 4" shale tile, 50% solid, 4" concrete block of any aggregate 73% solid.
4" concrete block, 62% solid, or 3" - 73% solid, if not containing any calcareous or siliceous sand or gravel.
<u>For 3/4 hour fire resist. rating</u>
3" shale tile, 50% solid, or any of the above.

Masonry



4" brick
4" concrete block weighing not less than 25 pounds per superficial square foot and 73% solid if containing calcareous or siliceous sand or gravel, Otherwise 62% solid.

Masonry

All partitions shown have sound reduction factors in excess of 40 decibles, the minimum required between dwelling units. All thicknesses are nominal dimensions. All partitions not otherwise designated have one hour min. fire resistance rating.

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DATE	PARTITIONS BETWEEN DWELLING UNITS	F.W.A.
FEB. '42	DEFENSE HOUSING • FEDERAL WORKS AGENCY • WASHINGTON D.C.	FIG. S-3

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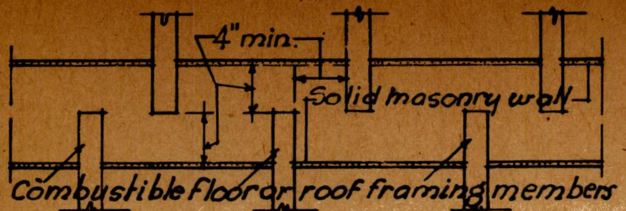
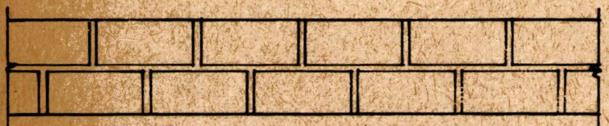


Where plaster is required to obtain fire resistance rating, the plaster shall be 1/2" minimum 1:3 sanded gypsum and extend continuously past and tightly against all framing members

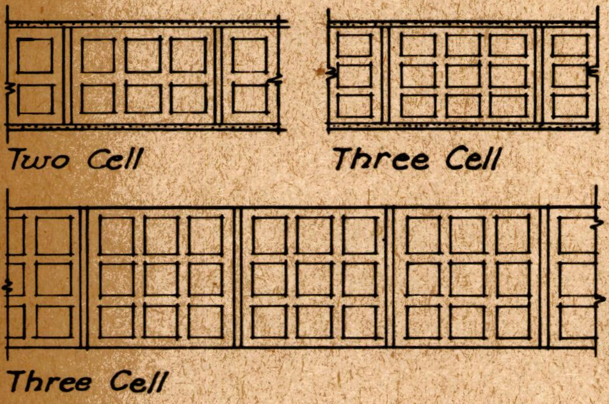
Detail Plan of Required Arrangement of Combustible Members framing into Masonry Fire Walls

Two Hour Min. Fire Resistance Rating Require the Following:



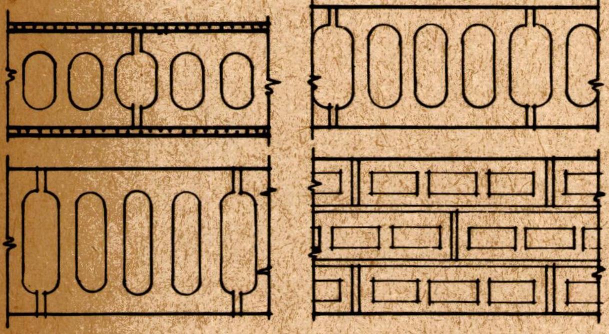
Brick

Solid brick of clay, shale, concrete, or sand lime, and 8" minimum thickness, in 2 courses, unplastered; or hollow brick, 85% solid, of clay or shale, and 8" minimum thickness, in two courses, unplastered.



Hollow Tile

Hollow tile of clay or shale, and 8" minimum thickness, in single units of 2 cells, 49% solid, plastered 2 sides; or single units of 3 cells, 53% solid, plastered 2 sides; or hollow tile of clay or shale, and 12" minimum thickness, in single units of 3 cells, 40% solid, unplastered.



Hollow Concrete Units

Hollow concrete units, not containing calcareous or siliceous sand or gravel, of 8" minimum thickness, in single units, 75% solid, plastered 2 sides; or 10" minimum thickness, in single units, 75% solid, unplastered; or 12" minimum thickness in single units 62% solid, unplastered; or 13" minimum thickness, in 3 units, each 65% solid, with 1/2" air space between units, unplastered.

All thicknesses are in nominal dimensions. All walls shown will have min. sound reduction factors of 40 decibles, if plastered 2 sides. Any wall shown may be used to support incombustible framing members or for non load bearing walls. See Fig. S-1 for "Termite Protection."

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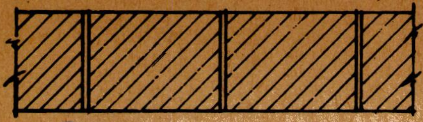
DATE	MASONRY FIRE WALLS SUPPORTING COMBUSTIBLE FRAMING	F.W.A.
FEB. '42	DEFENSE HOUSING · FEDERAL WORKS AGENCY · WASHINGTON D.C.	FIG. S-4

9781



BRICK

Two Hour Fire Resistance Ratings Require the Following:

Solid brick of clay, shale, concrete, or sand lime, and 6" min. thickness, in single units, unplastered; or

hollow brick, 85% solid, of clay or shale, and 6" min. thickness, in single units, unplastered.

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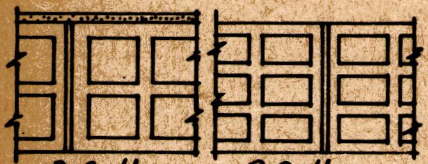

2 Cell 3 Cell
HOLLOW TILE

Hollow tile of clay or shale, and 8" min. thickness, in single units of 2 cells, 40% solid, plastered 1 side; or single units of 3 cells, 43% solid, unplastered.

HOLLOW CONCRETE UNITS

Hollow concrete units, not containing calcareous or siliceous sand or gravel, of 6" min. thickness, 62% solid, plastered 1 side; or 73% solid, unplastered; or 8" min. thickness, 62% solid, unplastered.

Load Bearing Walls Which Support Incombustible Framing

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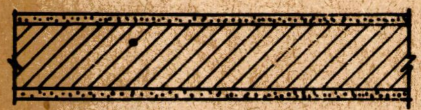
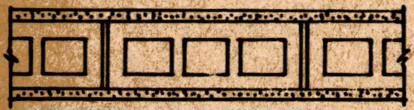
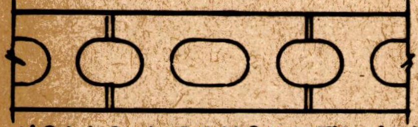


BRICK

Solid brick of clay, shale, concrete, or sand lime, and 4" min. thickness, plastered 2 sides.





HOLLOW CONCRETE UNITS

Hollow concrete units, not containing calareous or siliceous sand or gravel, of 4" min. thickness, 62% solid, plastered 2 sides; or 6" min. thickness, 73% solid, unplastered.

Non Load Bearing Walls

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Notes: All walls shown will have sound reduction factor of 40 decibles, if units weigh not less than 25 pounds per superficial square foot, and walls are plastered 2 sides.
All thicknesses are in nominal dimensions.
Where plaster is required to obtain fire resistance rating, the plaster shall be ½" min - 1-3 sanded gypsum.
See Fig. No. 51 for "Termite Protection."

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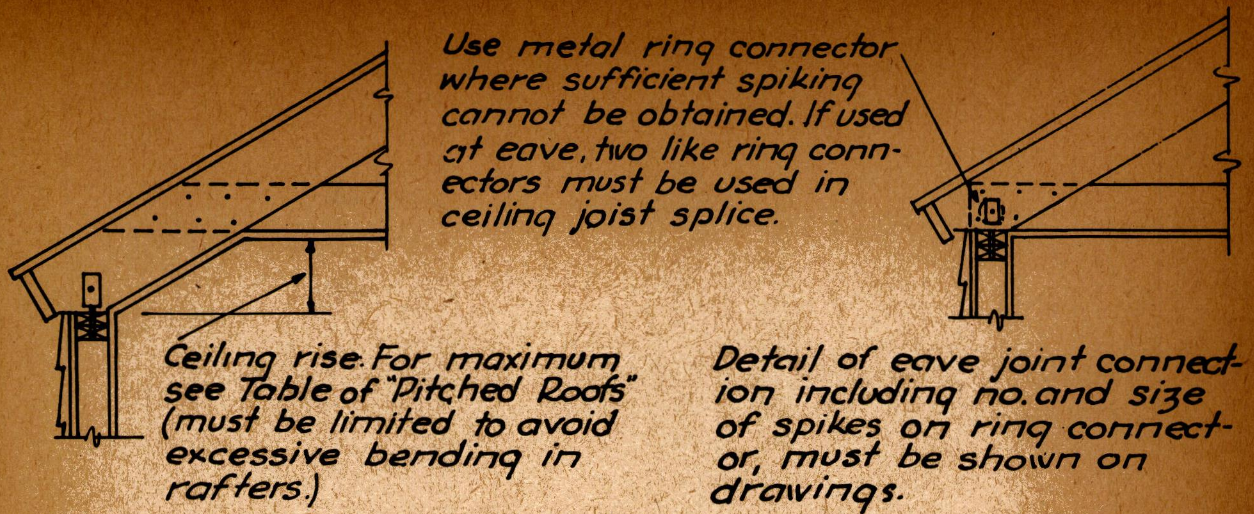
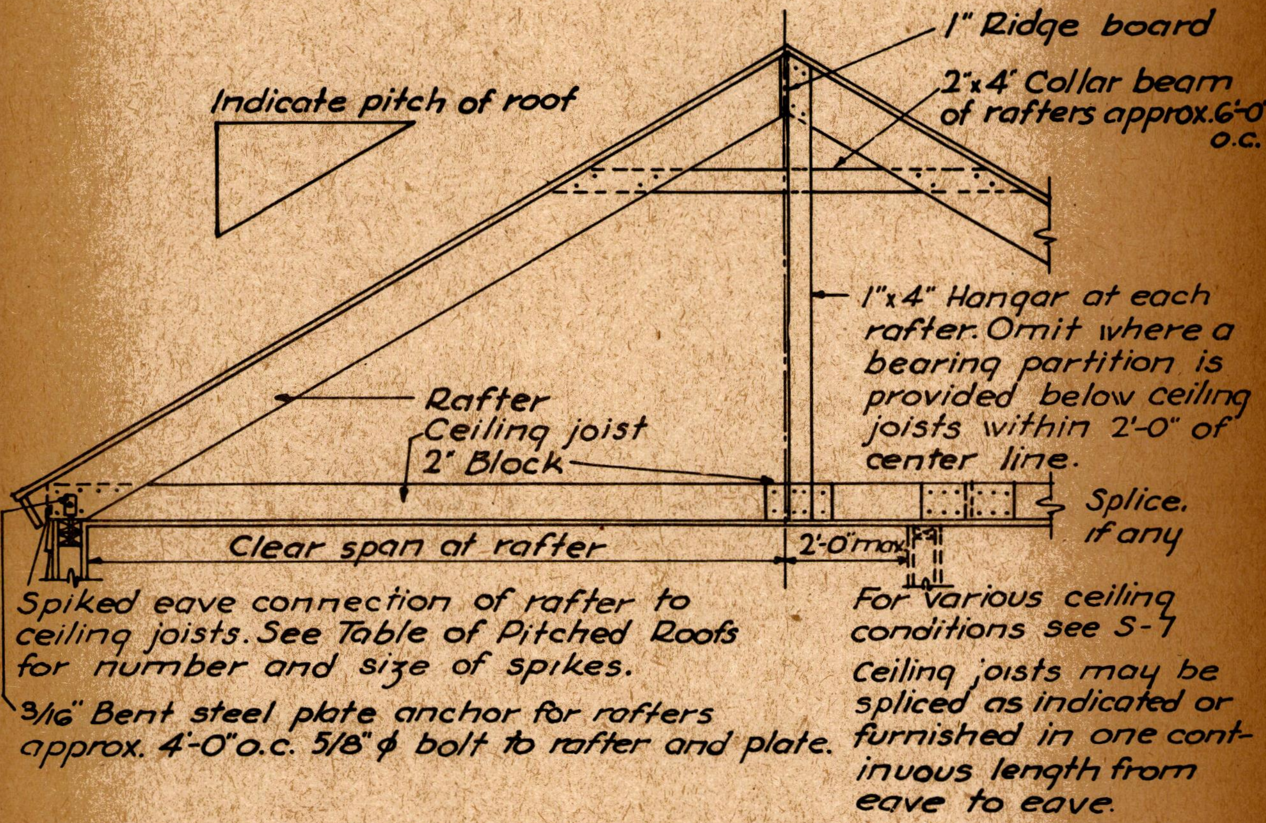
DATE	MASONRY FIRE WALLS WITH NO COMBUSTIBLE FRAMING	F.W.A.
FEB. '42	DEFENSE HOUSING • FEDERAL WORKS AGENCY • WASHINGTON D.C.	FIG. S-5



Alternate Eave Connections



Illustrating table for "Pitched Roofs" in text. See table for size and span of rafter and ceiling joists for a typical loading for various roof pitches. Where loads exceed loads used in table, computed stresses in rafters must include bending and direct axial stresses for section of joist normal to edges. Adequate eave connection must be provided to fully transmit horizontal thrust of rafter to ceiling joist or to equivalent tie across building to opposite eave. See S-7 for alternate trussed rafter framing (Prefered.)

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DATE	PITCHED ROOF RAFTER FAMING	F.W.A.
FEB. '42	DEFENSE HOUSING • FEDERAL WORKS AGENCY • WASHINGTON D.C.	FIG. S-6

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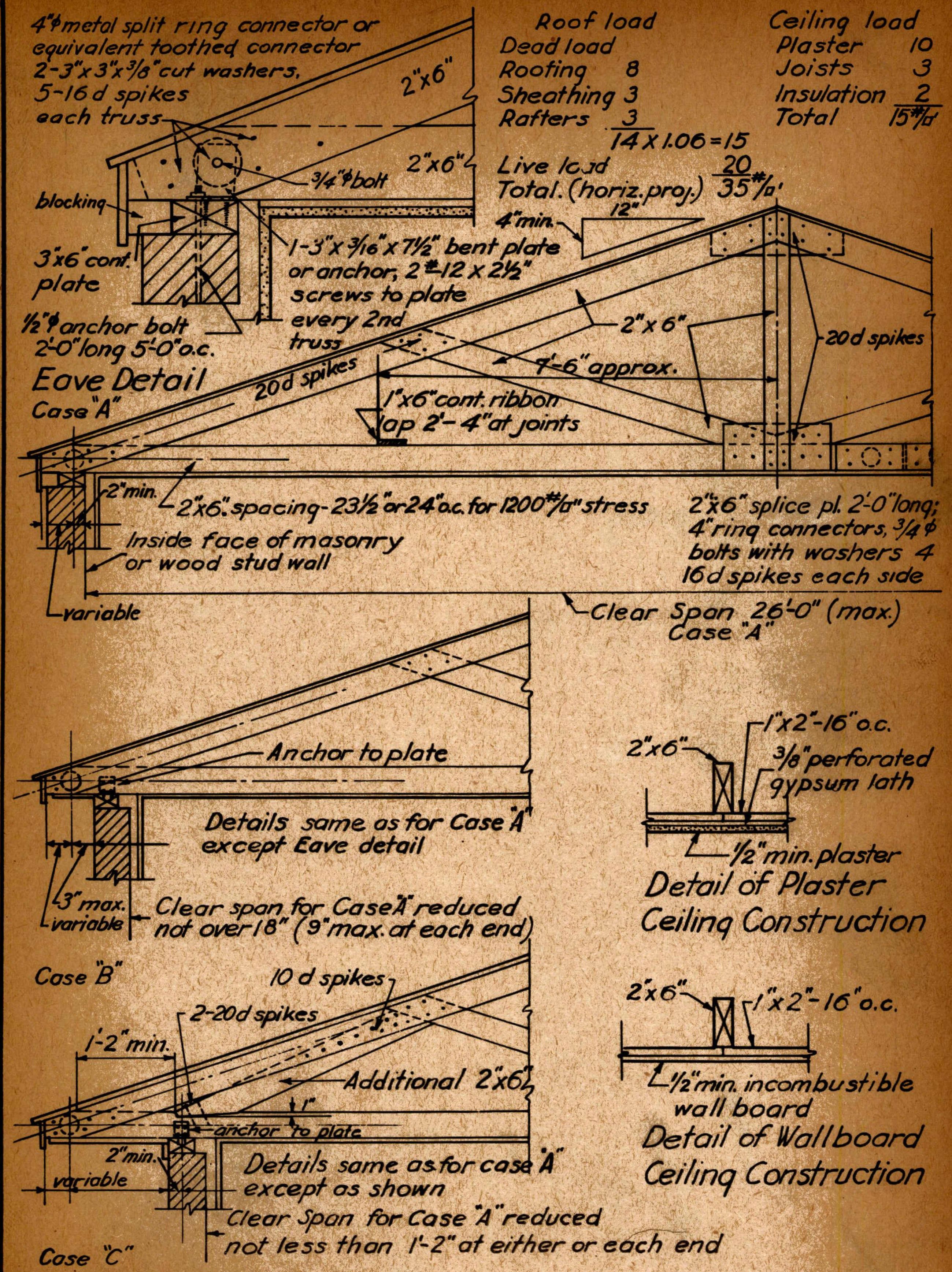

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DATE	PITCHED ROOF TRUSSED RAFTER	F.W.A.
FEB. '42	DEFENSE HOUSING • FEDERAL WORKS AGENCY • WASHINGTON D.C.	FIG. S-7

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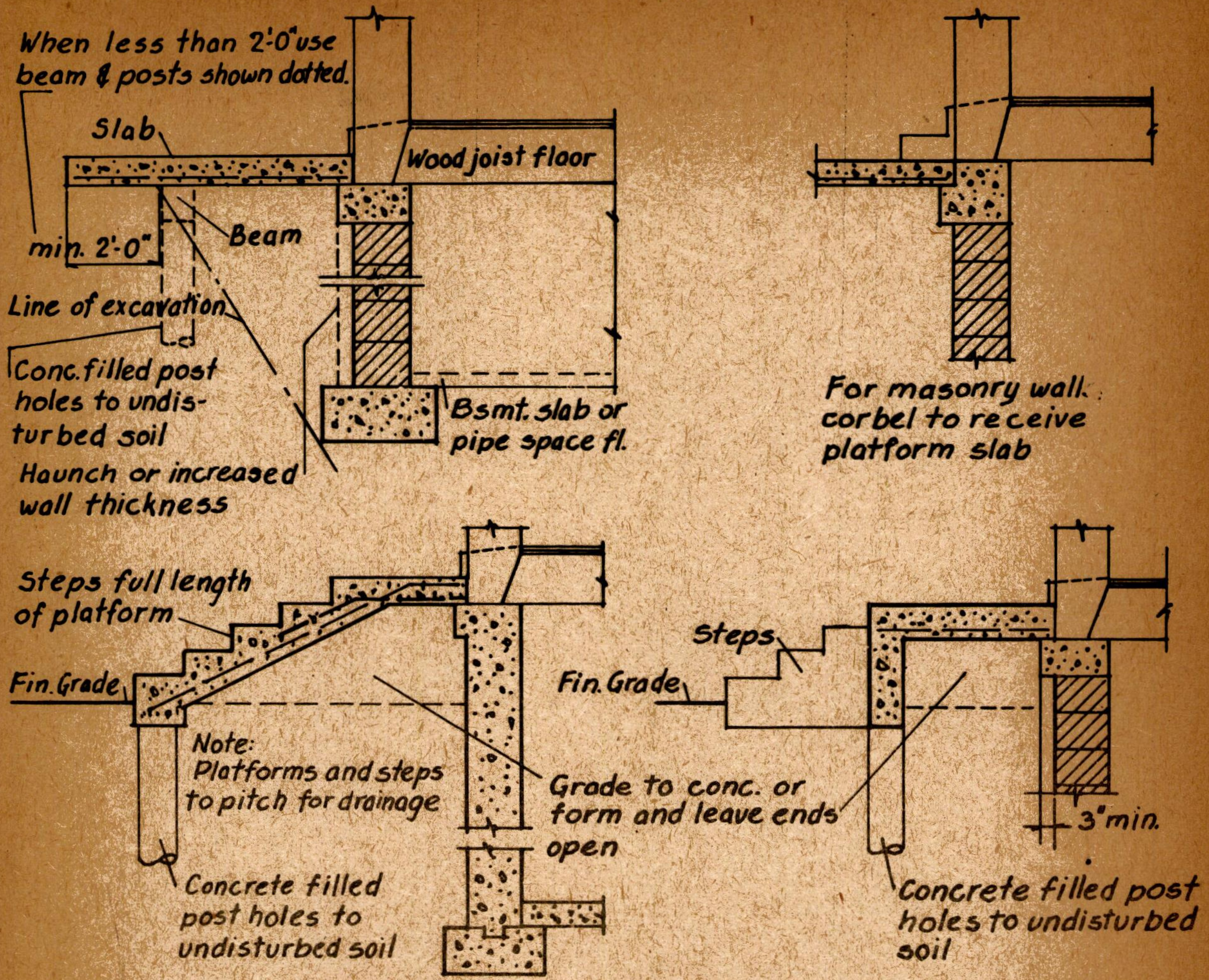
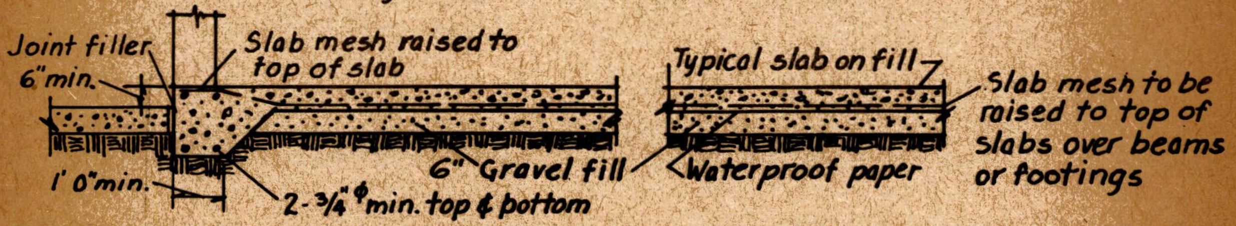


DETAILS of PORCH PLATFORMS

See Fig. S1 for "Termite Protection"



DETAIL of SHALLOW FOUNDATION & 1ST FLOOR on FILL

Shallow footings of this detail may be used where not subject to frost, and firm, undisturbed earth is within 1-0" of surface, or where fills are compacted in 6" layers with at least 4 passes over each layer with rollers of 5 tons minimum, and the load on the soil is uniformly distributed at suitably low values (generally suitable for wood framed buildings only). Where substantial undisturbed earth or rolled fill is not within 1'-0" of the slab bottom, the slab must have intermediate supports of concrete beams and concrete filled post holes 10" minimum diameter. Slab reinforcing should be adequate for beam span.

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DATE	PORCH PLATFORMS AND CONCRETE FLOOR ON FILL	F.W.A.
FEB. '42	DEFENSE HOUSING • FEDERAL WORKS AGENCY • WASHINGTON D.C.	FIG. S-8

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STANDARDS FOR WAR HOUSING

Excluding Temporary Housing

PLUMBING

Federal Public Housing Authority

May 15, 1942

General

The demand for metals for war use makes it imperative that the use of these metals for other than strictly military purposes be limited in every possible way. The application of the standards for plumbing installations set forth in this document will result in a considerable saving of metal and at the same time provide for installations which are sanitary in every respect and have the approval of public health officials.

These standards have been developed in collaboration with National Association of Master Plumbers of the United States, the United Association of Journeymen Plumbers and Steamfitters of the United States and Canada, and others, and have been issued by the Office of the Defense Housing Coordinator, Office of Emergency Management.

Some minor variations from these standards may be necessary to suit particular project requirements but only such necessary variations should be made. A priority preference rating may be refused if these instructions are not followed. Those concerned with code enforcement should be asked to cooperate in this important effort.

Where manufacturers have produced adequate products which reduce the amount of critical metal, such products must be given consideration. Advise contractor and direct him to submit such products for approval.

The drainage stacks, water and gas risers, run-outs and branches for two dwelling units should be combined where practical and economical.

The Defense Housing Critical List issued by War Production Board effective February 24, 1942, states that eligible materials and quantities are limited to those necessary to meet minimum requirements of the Emergency Standards for Defense Housing issued by Defense Housing Coordinator, dated February 1942. It is therefore necessary that the Critical List be followed in the design and preparation of plans and specifications of a defense housing project in order to procure materials.

Drainage Systems

Building (house) sewer (from 5' - 0" outside of building to lateral) to be vitrified clay pipe.

Building (house) drain (from 5' - 0" outside of building to soil and waste stacks) to be cast iron pipe.

Soil waste and vent stacks larger than 2" diameter to be standard weight cast iron pipe; 2" and smaller to be standard weight cast iron, galvanized steel, galvanized copper bearing steel, galvanized molybdenum, steel, galvanized wrought iron, lead waste pipe optional.

Branch waste and vents, standard weight cast iron pipe, galvanized steel, galvanized copper bearing steel, galvanized molybdenum, galvanized wrought iron, or leas waste pipe, optional.

Sizing of Soil and Waste Pipes

Base total loads, carried by a soil or waste pipe on Table of Fixture unit values.

Fixtures - Units for Fixture or Group	No. of Units
Lavatory - dwelling facilities	1
Lavatory - nondwelling facilities	2
Water closets - dwelling facilities	6
Water closets - nondwelling facilities	10
Bath tubs - dwelling facilities	2
Shower stall	2
Pedestal urinal	10
Wall urinal	5
Combination sink and tray	3
Kitchen sink	2
2 laundry trays	3
Bathroom group (W.C. bath tub & lavatory)	8

The following table shall determine the diameter of a soil or waste stack or horizontal branch.

Diameter of Pipe	Fixture units on horizontal branch	Fixture unit on stack
1-1/4"	1	2
1-1/2"	3	4
2"	6	12
3" waste only	32	48
3" soil	24	36
4"	160	240

The size of building (house) drains shall be in accordance with the following table.

Diameter of Pipe	Building Drain		
	1/8 inch fall/ft.	1/4 inch fall/ft.	1/2 inch fall/ft.
2"		21	26
3"	36	42	48
4"	180	216	240

Vent stacks or main vents should have a diameter of at least one-half that of the soil or waste stack, and shall be sized in accordance with the limits of length and number of fixture units as given in the following table.

Diameter of soil or waste stack	No Fixture Units on soil or waste stack	$1\frac{1}{4}$" Vent	$1\frac{1}{2}$" Vent	2" Vent	$2\frac{1}{2}$" Vent	3" Vent
$1\frac{1}{4}$	2	75				
$1\frac{1}{2}$	8	70				
2	24	28	70	300		
3	40		20	80	260	650
3	80		18	75	240	600
4	310			30	95	240
4	620			22	70	180

Distance of Trap from Vent: Except for water closets, pedestal urinals, trap standard service sinks and other fixtures which depend on siphon action for the proper functioning of the fixture, each fixture trap shall have a protecting vent located so that the total fall in the fixture drain from the trap weir to the vent fitting is not more than one pipe diameter, and the developed length of drain is not less than two pipe diameters nor more than 5'-0". A back vent or relief vent, preferably in the form of a continuous waste and vent, shall be installed within these limits.

Venting must follow the principles illustrated. See Figures No. P-1 to P-9. So far as possible, use the arrangements shown.

No vent terminal from the sanitary drainage system shall be within 12 feet of any door, window, or ventilating opening of the same or an adjacent building unless it is at least 3 feet higher than the top of such opening. Extensions of vent pipes through a roof shall terminate at least 1 foot above it and shall be properly flashed. Vent terminals extending through walls shall not terminate within 12 feet horizontally of any adjacent building line, shall be turned to provide a horizontal opening downward, shall be effectively screened, and shall be properly flashed, calked, or otherwise sealed.

Sizing of Vents (continued)

Roof area drained into a building storm sewer or any of its branches shall not exceed the values given in the following table.

Diameter of Pipe	Maximum square feet area 1/8" Fall	1/4" Fall	1/2" Fall
2		350	500
3	750	1050	1500
4	1550	2150	3100

Pipe Cleanouts

Provide accessible cleanout at or near the foot of each vertical waste or soil stack, and at each change of direction of the building drain greater than 45 degrees.

Cleanout to be of the same nominal size as the pipe up to 4-inches and not less than 4-inches for larger pipes.

Where cleanout is provided at the entrance to the building, cleanout at the base of the stack may be omitted.

Floor Drains and Sumps

Floor drains shall be provided in boiler rooms and where required in connection with heating work or where any accumulation of water may collect. Floors must slope towards floor drain.

Where subsoil drains are placed under the cellar floor or used to encircle the outer walls of a building, they shall be made of open-jointed drain tile or earthenware pipe, not less than 4-inches in diameter. When the building drain is subject to backwater, the subsoil drain shall be protected by an accessibly located automatic back pressure valve before entering the building sewer or drain. If such drains are connected with the sanitary sewer or with combined system, they must be properly trapped. They may discharge to an area drain.

Provide sump pump where it is not possible to drain fixtures by gravity, arranged generally in duplex. Provide means for automatic sequence operation from one pump to the other.

Provide cellar drainer where drainage requirements are limited.

Piping should be governed by analysis of water: Slightly and moderately corrosive waters, galvanized steel pipe, Type I, II, III, or wrought iron pipe, with galvanized malleable fittings. Corrosive waters, cement lined pipe and fittings or lead pipe with wiped joints. (Lead pipe must not be used in water supply until it has been determined that no poisonous lead salts are produced by contact of lead with the particular water supply).

Service main, from point of connection with lateral branch main, paralleling building to inside of building and connecting risers and branches.

Included in Utility Specifications "outside plumbing" is the provision in mains and laterals of the necessary fittings for connecting building service main.

Arrange piping to drain by gravity at low point. Provide drain cock or plug at low points.

Where practical, expose water piping in utility rooms or closets.

Outside piping must be installed below frost line.

Provide hose connections as follows: - In row houses, in front and back, one for every unit. Where front yards are not tenant maintained hose connection may be omitted.

Water Pipe Sizing

Size service main to meet peak demand.

Separate stop cocks or valves, always accessible, shall be placed at the foot of each riser line, and, in multiple dwellings, for each individual fixture or group of fixtures controlled by one tenant on one floor. On each family unit, one control valve must be provided, preferably located in kitchen or utility room, and accessible by the tenant occupying unit.

Minimum pressure to the furthermost fixture in the system should be 8 pounds per square inch; maximum velocities should be 15 feet per second.

Water pressure in excess of 70 pounds per square inch should be reduced to 50 pounds per square inch or mechanical compensating device provided.

The following table will assist in computing friction losses:

Diameter of Pipe	Discharge Gal./Min.	Velocity Ft./Sec.	Loss in feet/foot
3/8	3	5.02	0.49
3/8	5	8.37	1.26
1/2	3	3.16	0.16
1/2	5	5.26	0.41
1/2	8	8.42	0.98
1/2	10	10.52	1.47
3/4	3	1.80	0.04
3/4	5	3.01	0.11
3/4	8	4.81	0.25
3/4	10	6.02	0.38
3/4	15	9.02	0.80
3/4	20	12.03	1.36
1	3	1.12	0.013
1	5	1.86	0.03
1	8	2.98	0.08
1	10	3.72	0.12
1	12	4.46	0.16
1	16	5.95	0.28
1	20	7.44	0.42
1	25	9.30	0.64
1	30	11.15	0.89
1	40	14.88	1.53
1-1/4	5	1.07	0.009
1-1/4	10	2.14	0.03
1-1/4	16	3.43	0.07
1-1/4	20	4.29	0.11
1-1/4	25	5.36	0.17
1-1/4	35	7.51	0.31
1-1/4	50	10.72	0.60
1-1/4	70	15.01	1.13

Hot water supplied from individual tenant operated units: indicating piping at ceiling of first floor or two stories or concealed in attic where practical.

Hot water from central plant: indicate piping in crawl space or basement on side nearest the fixtures.

In buildings of more than four stories in height supplied with hot water and in all other buildings where the developed length of hot water piping from the source of hot water supply to the extreme fixture supplied exceeds 100 feet, a hot water return circulation system shall be installed. In no case may the circulation return be less than 1/2 inch in diameter.

For hot water installations underground, see section of "Heating - Underground Distribution."

Water storage equipment should be placed close to fixture in order to reduce line losses and over-drawing of tank storage.

RATE OF FLOW FOR FIXTURES (HOT AND COLD)

Water Closet with Tank...........	3	Gallons	Per	Minute
Lavatory.........................	4	"	"	"
Bath Tub.........................	10	"	"	"
Kitchen Sink (Small).............	5	"	"	"
Combination Sink & Tray..........	6	"	"	"
Shower per head..................	8	"	"	"
Slop Sink or Service Sink........	10	"	"	"
Hose Bibb........................	5	"	"	"

Hot Water Equipment

Specifications for equipment outlined below should be based on the determination of fuel to be used in a particular project.

Gas: Automatic storage type pilot operated tank completely insulated, no copper except for controls, and no interior jacket over insulation. Side arm type heater manually controlled with prefabricated insulated jacket for boiler. (No copper coils of burners permitted). Storage: 20 gals. nominal capacity for automatic and 30 gals. nominal capacity for manual control.

Electric: Automatic operation only should be considered, and controlled by two electrical elements. Tank should be completely insulated. Nominal storage capacity for above heater would be based on 15 gallons for one bedroom unit, 30 gallons for larger units.

Oil: Same requirements as given for gas water heating should be employed.

Coal: Cast iron sectional dome type heater. Integral steel water heater and storage tank.

Storage tanks: Galvanized iron for slightly and moderately corrosive water. Porcelain lined for corrosive water in connection with automatic type water heaters and procelain or cement lined for range boilers. 300 pounds per square inch hydrostatic, 127-1/2 pounds per square inch water working pressure.

Relief valves: Pressure type, spring or diaphragm actuated, self reseating. For automatic equipment outlet set towards wall and piped to crawl space or outside of building with 3/8" pipe.

Tanks for project operated plants should be of material suitable for the water available. With corrosive water, cement lining or other protective means should be provided. Tanks must conform with the rules for construction of Pressure Vessels, A.S.M.E. Construction Code. Heating element should be constructed of red brass, copper pipe or copper tubing and of sufficient area to raise the temperature of the water a minimum of 100 degrees F. over a period of two hours.

<u>Clearances</u>: Provide a minimum head room of 6 feet 3 inches to underside of lowest pipe, in traffic areas of basements or occupied spaces. Provide a minimum clearance of 30 inches in crawl space between underside of first floor and excavated area.

Replacement of piping should be considered in designing the system. Where utility rooms are provided between the kitchen and the bath, or adjacent to either, expose piping in the utility room, or so arranged otherwise that piping may be replaced or repaired with a minimum of cost.

<u>Expansion</u>: Piping must not be rigidly encased in masonry nor so supported that pipe may not move.

<u>Backfill</u>: Provide neutral backfill for soils into which metal piping is installed and which is contaminated with cinders, or any acid soils due to sulphur or other injurious chemical compounds.

<u>Insulation</u>: Cold water lines must be insulated where they are liable to sweat or freeze.

Hot water piping must be insulated when located in boiler rooms and in buildings below the first floor. Such piping should not be insulated above the first floor except where there is possibility of freezing.

Insulate hot water supply and return underground in presealed conduit, and hot water supply only where located in conduit or trench in grouping with other piping.

Insulate hot water risers in buildings over two stories, except where hot and cold water risers are more than 6 inches apart.

Insulate all exposed surfaces of generators.

Insulate range boilers (with precast jackets) except where they may be used for space heating.

Insulate traps and drainage piping exposed to freezing temperatures.

Piping should be shown to grade back towards the inlet, where this is not practical, drip pipes or pots of adequate capacity must be provided.

Drip pipes or pots should be located where they will be readily accessible at all times.

Underground piping or where exposed to sudden changes of temperatures should be protected from corrosion or insulated as the case may be.

Pipe sizes should be based on the following: (a) total connected load, (b) length of pipe and number of fittings, (c) allowable pressure loss, (d) specific gravity of gas, (e) consumption requirements of all equipment piped with allowance made for diversity factor.

Provision should be made during construction for the future installation of check gas meters for each individual unit. Check meters should be installed only when gas fuel is used for cooking, with water heating or space heating. Meter loops should be placed under kitchen sinks, except in the case where liquefied or bottled gas is used.

Where liquefied or bottled gas is used, equipment must be equipped with 100 percent safety pilot and approved AGA for operation with bottled or liquefied gases.

When any supply pipe is installed with a fixture in such a manner that an air gap is not provided, an approved back flow preventer must be installed in the supply connection on the outlet side of the valve.

The following fixtures are standard for Housing:

Water Closet: Wash down law tank water closet combination, each with flushing trimmings, flush pipe and seat.

Lavatory: Wall hung lavatory approximately 20" x 18", each with combination supply fitting chain and stopper; waste with plug tail piece P-trap and wall escutcheon.

Bath tubs: Recess pattern 60" tub, each with combination over rim supply fitting, 1/2" hot and cold water connections, and with a combined concealed waste and overflow provided with washers at tub and with chain and stopper. Outlet tee 1-1/2" threaded.

Shower Stalls: See Fig. P-10. Receptor may be precast concrete, or non-metallic, available from shower cabinet manufacturers. Sidewalls shall be of water repellent material and non-metallic panels. Each stall shall be equipped with a combination compression valve type similar to Fig. #34-WWP 541A except that materials shall conform to WPB Insulation orders. Shower fixture shall be located on side panel and readily accessible by user from outside of stall with head directed towards interior corner of stall. Provide non-metallic rod and curtain pins and 8 oz. white duck curtain of sufficient width and length to permit shrinkage and still remain inside of entire front opening.

Combination Sink and Tray: 42" long with supporting leg, each provided with wall hanger; drainboard; a combination hot and cold water supply faucet with swing spout, tray plug with stopper and 1-1/2" tail piece; sink strainer with 1-1/2" tail piece; 1-1/2" connected waste with P-trap having 1-1/2" threaded outlet.

Nondwelling building fixtures will be similar to those provided for the dwelling units.

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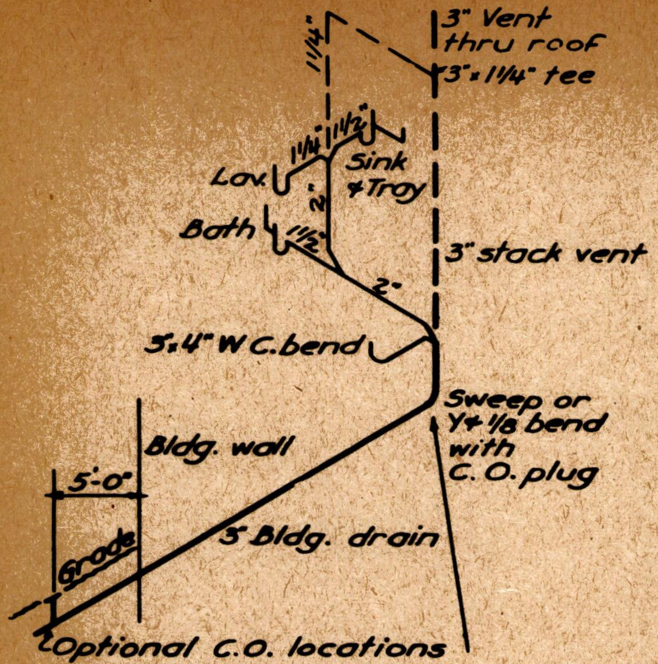
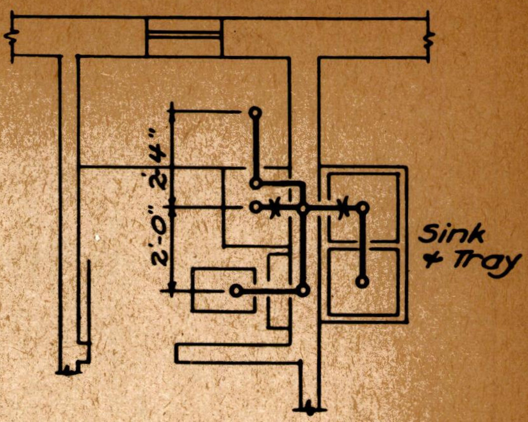
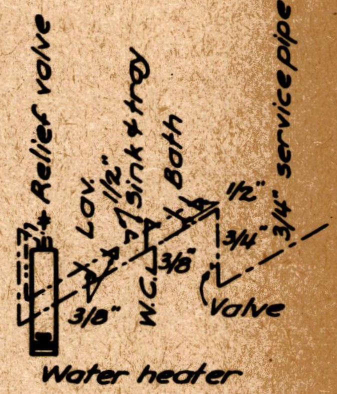
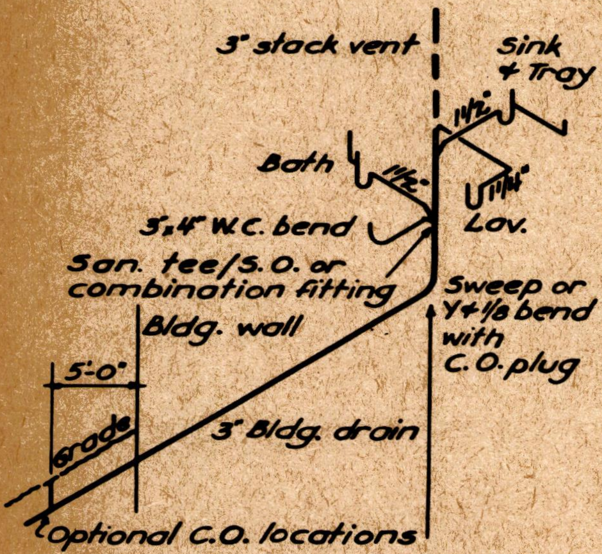


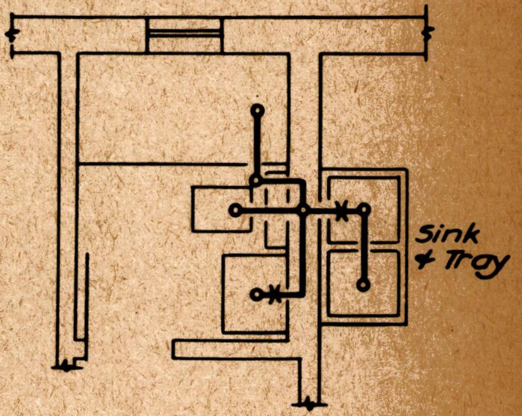


Standard Arrangement of Piping



Water





Optional Arrangement where Local Practice will Permit

REVISED ___ ___ ___ ___

DATE	ROUGHING-IN FOR 1 STORY, 1 FAMILY UNIT	F.W.A.
FEB. '42	DEFENSE HOUSING · FEDERAL WORKS AGENCY · WASHINGTON D.C.	FIG. P-1

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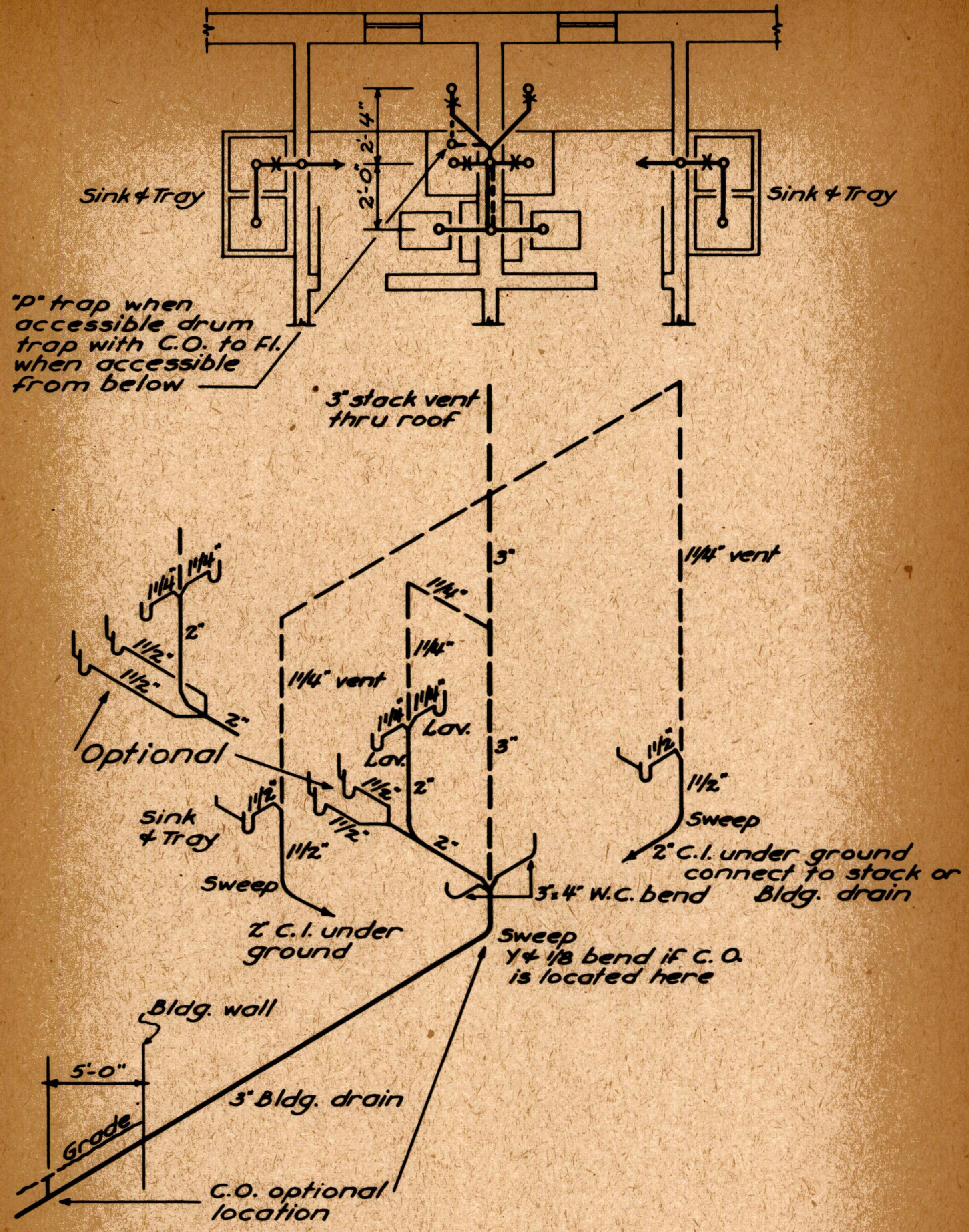

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DATE	ROUGHING-IN FOR 1 STORY, 2 FAMILY UNIT	F.W.A.
FEB. '42	DEFENSE HOUSING · FEDERAL WORKS AGENCY · WASHINGTON D.C.	FIG. P-2

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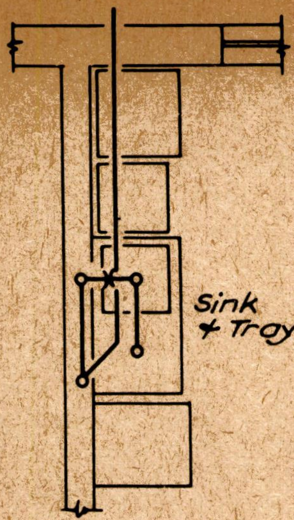
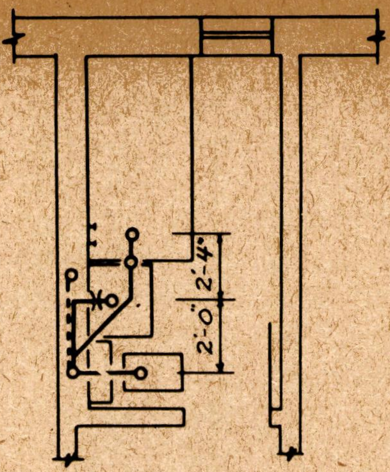
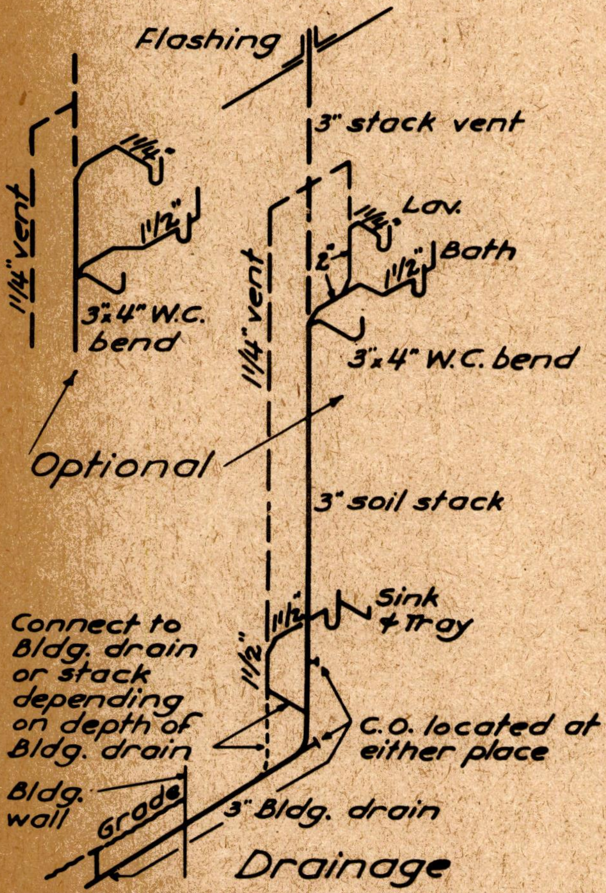


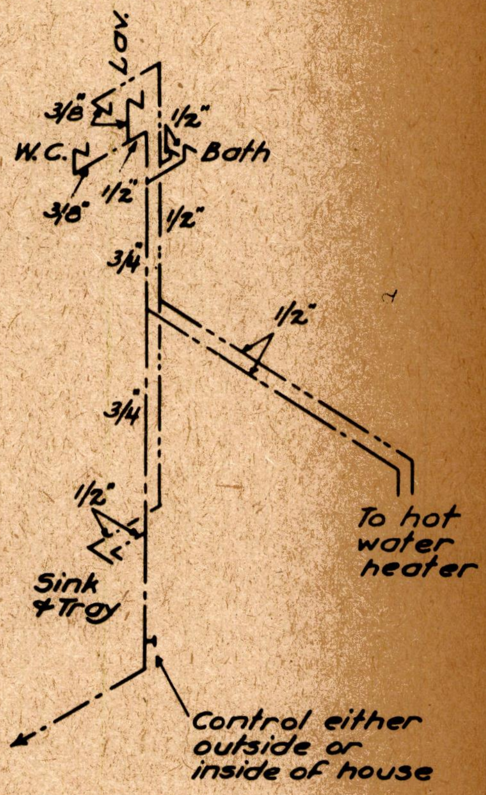
1ST Floor



2ND Floor



Drainage



Water

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DATE	ROUGHING-IN FOR 2 STORY, 1 FAMILY UNIT	F.W.A.
FEB. '42	DEFENSE HOUSING • FEDERAL WORKS AGENCY • WASHINGTON D.C.	FIG. P-3

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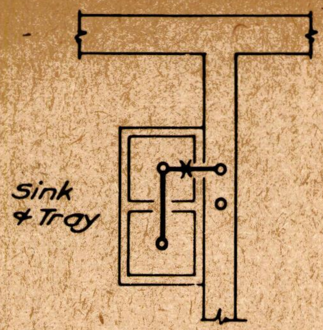
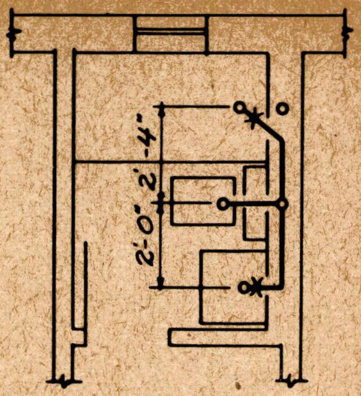
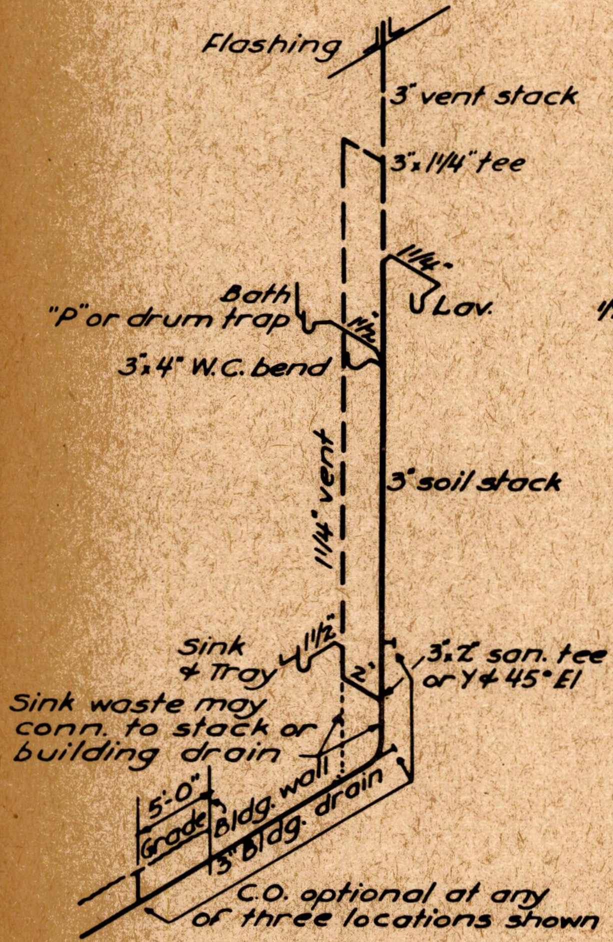


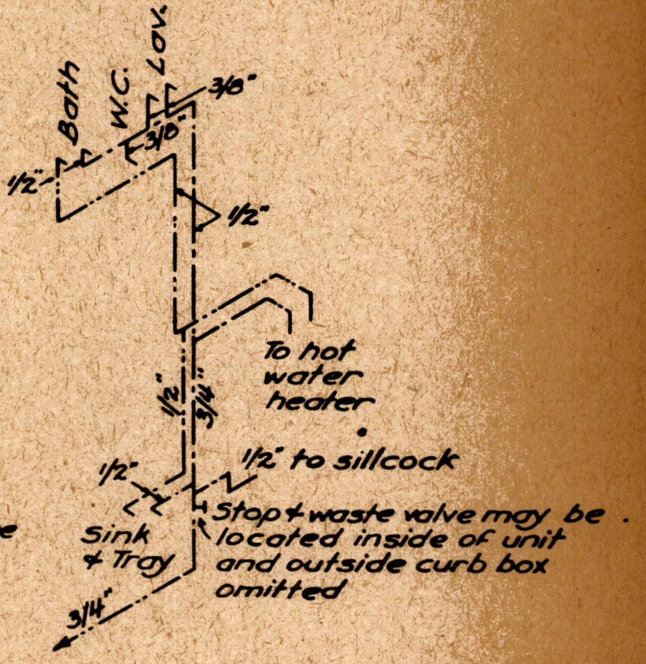
1st Floor



2nd Floor



Drainage



Water

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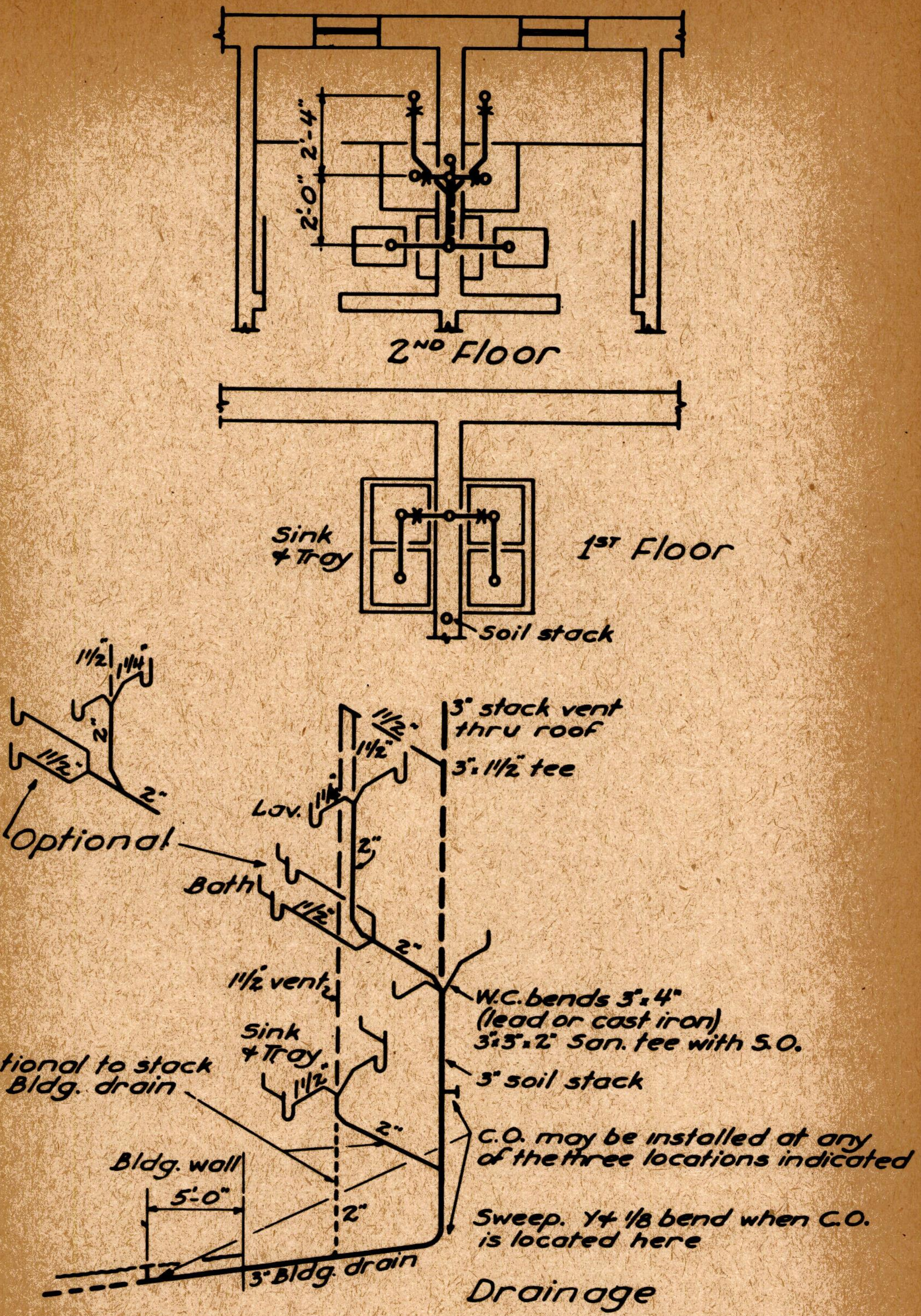
DATE	ROUGHING-IN FOR 2 STORY, 1 FAMILY UNIT	F.W.A.
FEB. '42	DEFENSE HOUSING • FEDERAL WORKS AGENCY • WASHINGTON D.C.	FIG. P-4

9781



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DATE	ROUGHING-IN FOR 2 STORY, 2 FAMILY UNIT	F.W.A.
FEB. '42	DEFENSE HOUSING • FEDERAL WORKS AGENCY • WASHINGTON D.C.	FIG. P-5

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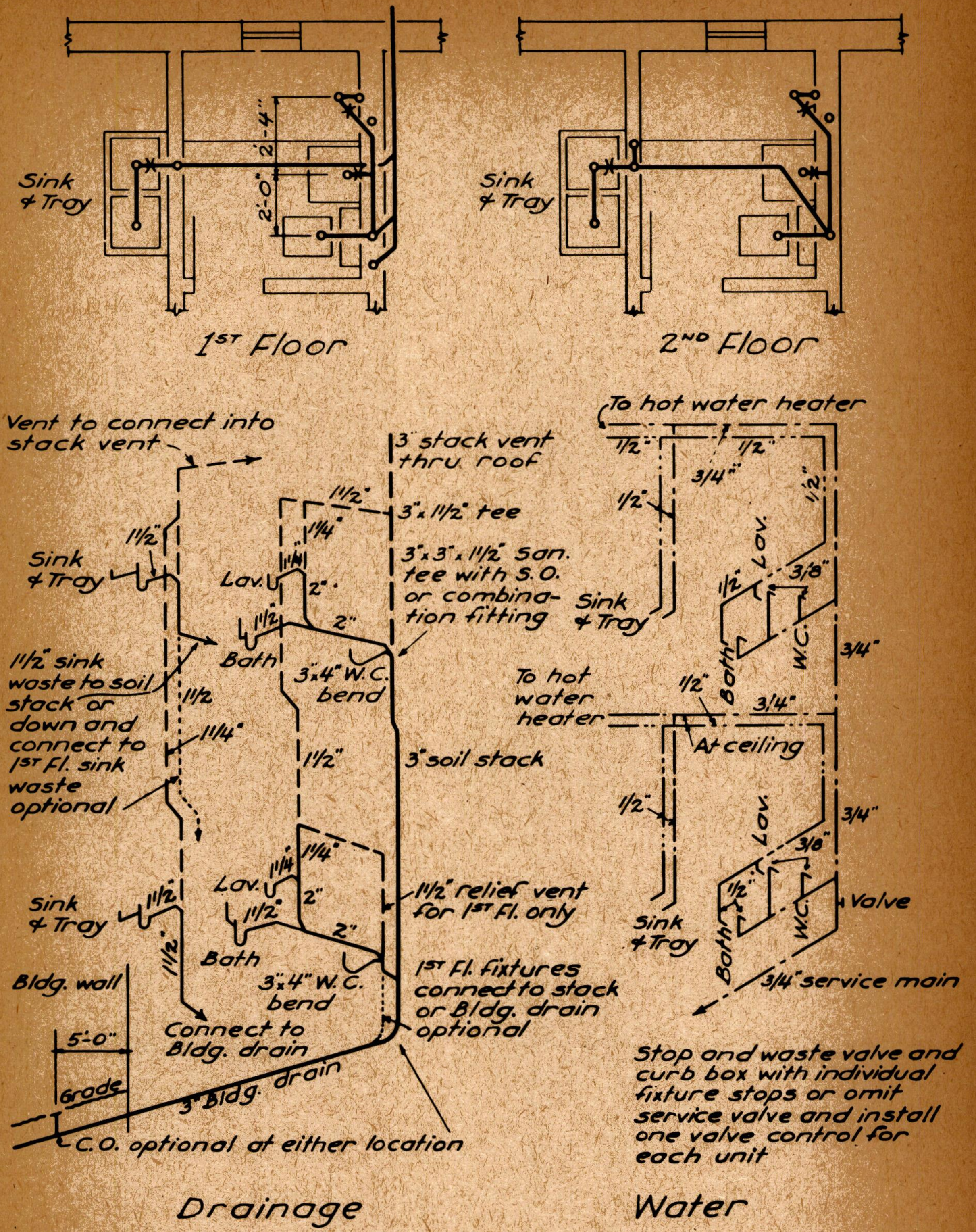

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DATE	ROUGHING-IN FOR 2 STORY, 2 FAMILY UNIT	F.W.A.
FEB. '42	DEFENSE HOUSING • FEDERAL WORKS AGENCY • WASHINGTON D.C.	FIG. P-6

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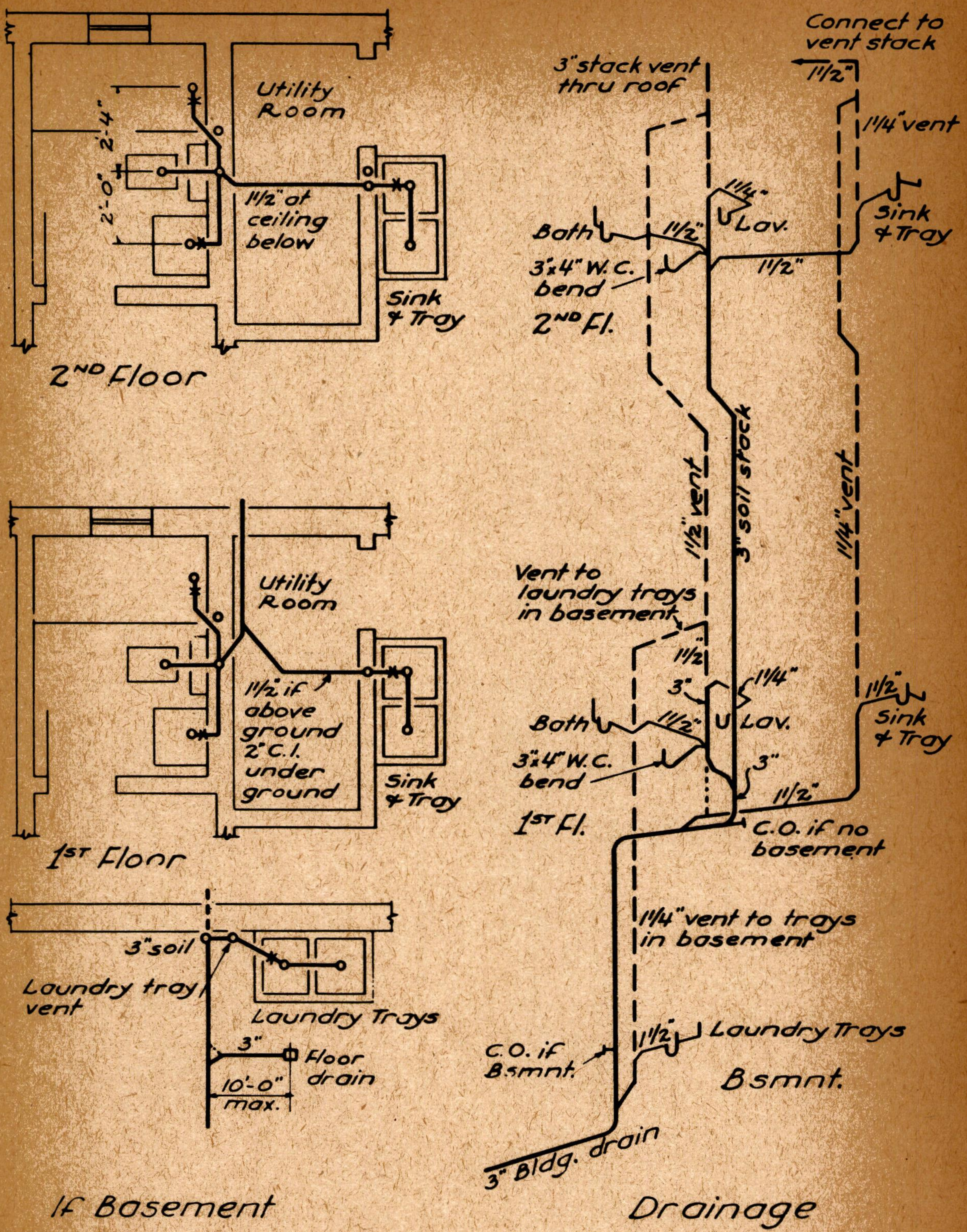

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REVISED

DATE	ROUGHING-IN FOR 2 STORY & BASEMENT, 2 FAMILY UNIT	F.W.A.
FEB. '42	DEFENSE HOUSING · FEDERAL WORKS AGENCY · WASHINGTON D.C.	FIG. P-7

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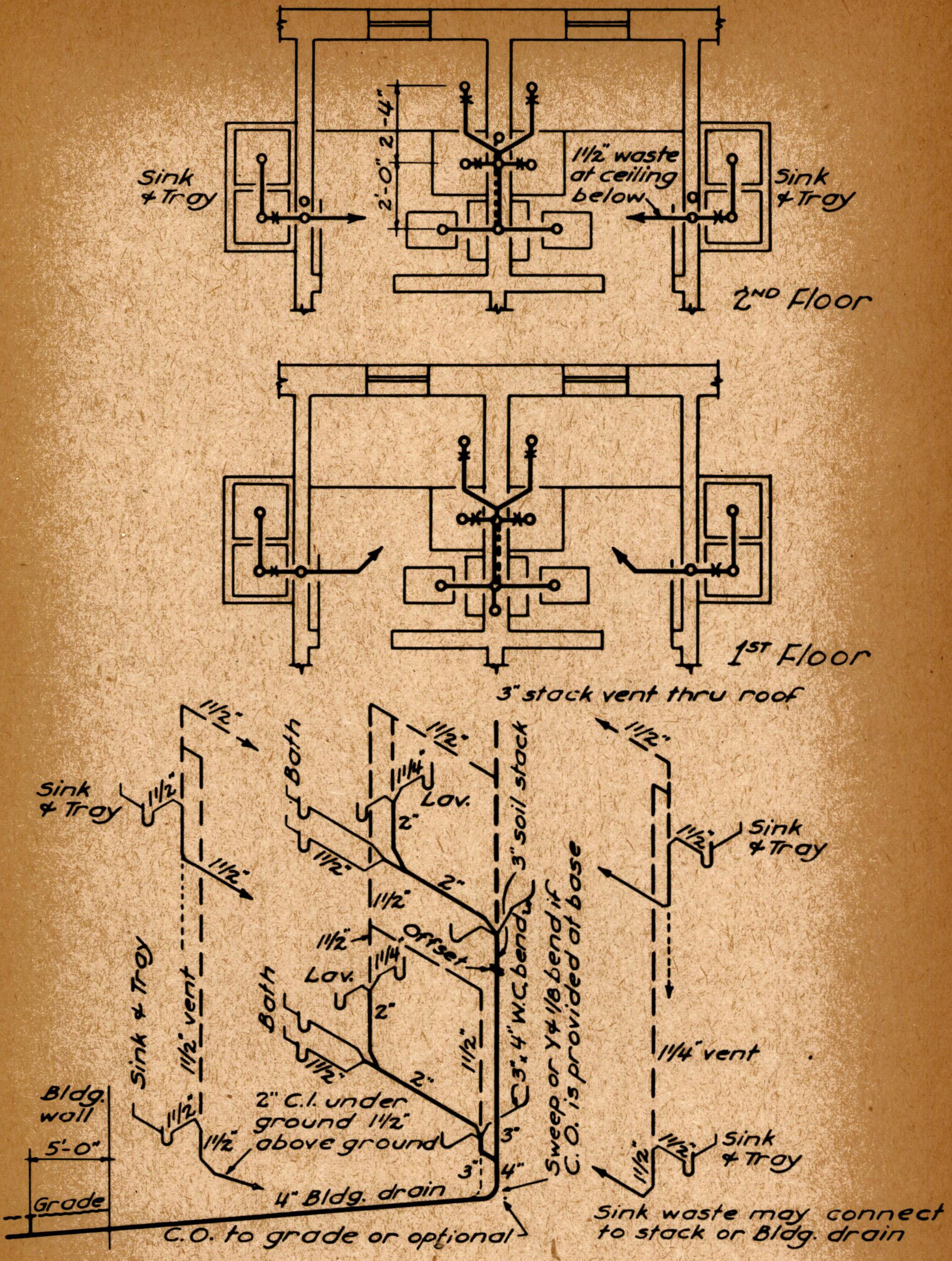

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DATE	ROUGHING-IN FOR 2 STORY, 4 FAMILY UNIT	F.W.A.
FEB. '42	DEFENSE HOUSING · FEDERAL WORKS AGENCY · WASHINGTON D.C.	FIG. P 8

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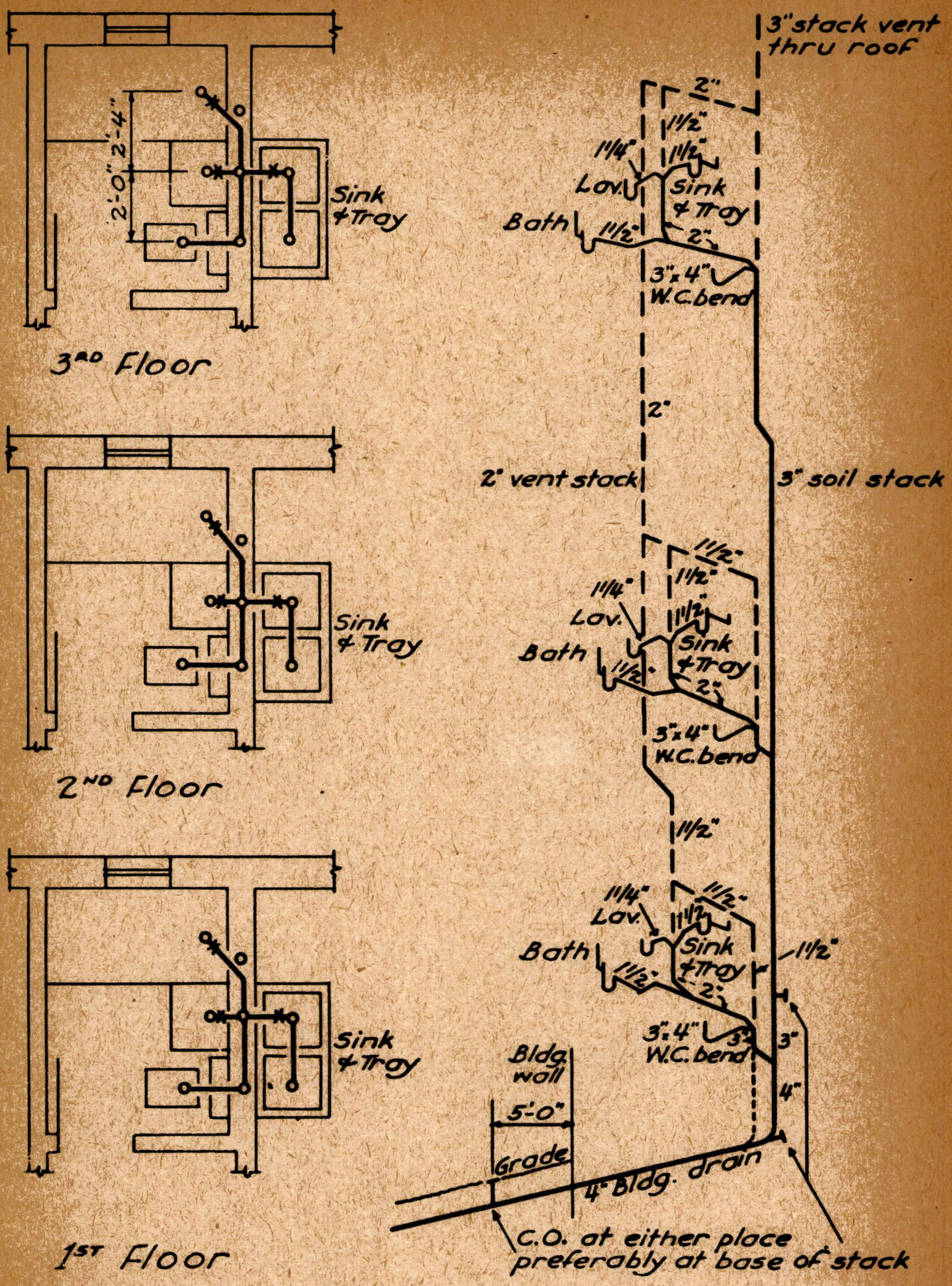

REVISED

DATE	ROUGHING-IN FOR MULTI-STORY UNITS	F.W.A.
FEB. '42	DEFENSE HOUSING • FEDERAL WORKS AGENCY • WASHINGTON D.C.	FIG. P-9

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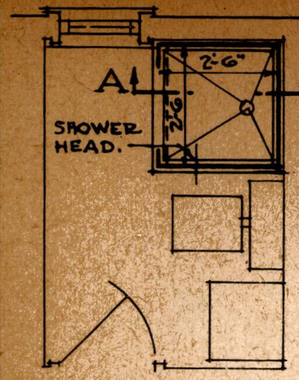
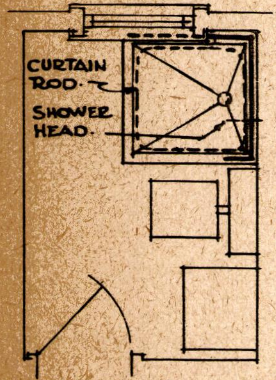
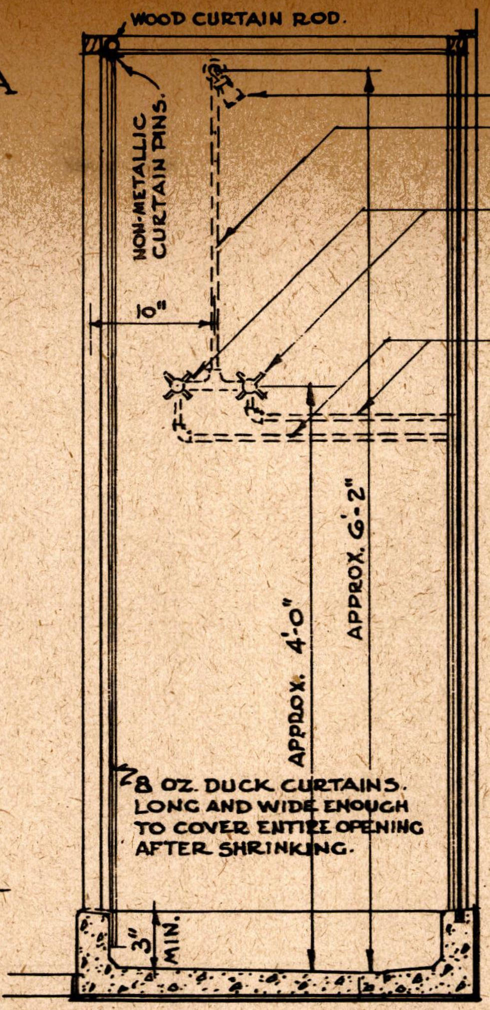


PLAN No. 1.

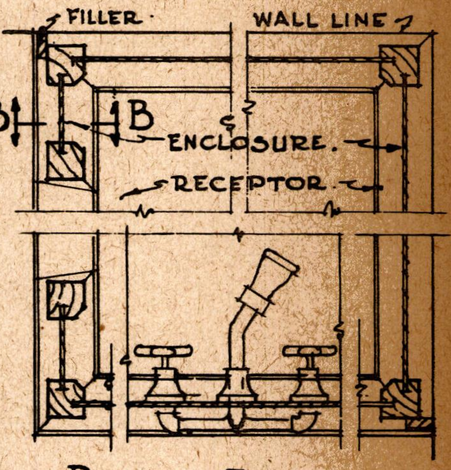


PLAN No. 2.

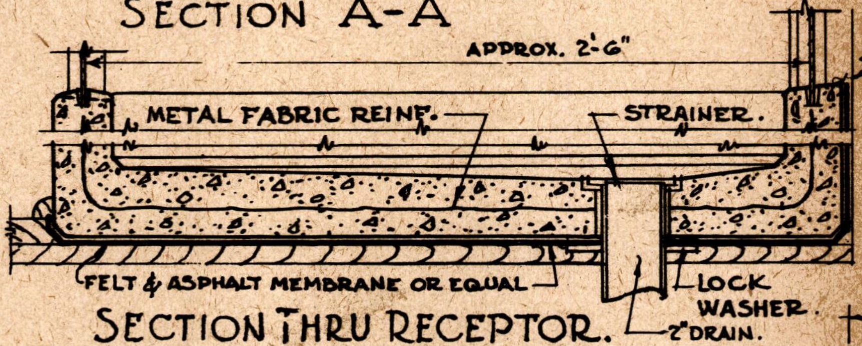
PLAN No. 3.



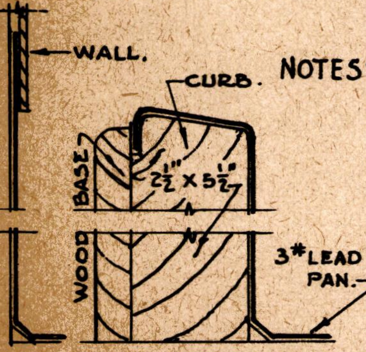
SECTION A-A



PLAN DETAILS.



SECTION THRU RECEPTOR.



LEAD PAN DETAILS.
PLAN No. 3.

NOTES:-
1. Materials shall conform to Limitation Orders and Material Lists issued by the War Production Board.
2. Shower wall panels-$\frac{3}{16}$" hard pressed fibre board all exposed surfaces smooth and baked-on water resistant enamel or other approved non-metallic material.
3. All edges of panels to be set in mastic and made waterproof.
4. Dimensions for shower are nominal. A slight variation will be permitted.

DETAIL B-B.

ACS-RKW.

G.M.

DATE.	SUGGESTED SHOWER DETAILS	F. P. H. A.
MAY 1942	DEFENSE HOUSING-NATIONAL HOUSING AGENCY - WASHINGTON D. C.	FIG. P-10

9781

STANDARDS FOR WAR HOUSING

Excluding Temporary Housing

HEATING

Federal Public Housing Authority

May 15, 1942

General

Use type of heating and fuel determined in accordance with utility selection procedure.

A complete set of heating calculations shall be prepared for record. Heating calculations shall be based on the practice and data of latest edition of the ASHVE Guide. System shall be designed for 70 degree inside room temperature.

Heat losses must conform to the requirements of the Defense Housing Critical List. (See Structural Design - Thermal Insulation).

See that ample space and suitable access is allowed around all equipment for servicing and replacement.

Heating shall be by means of warm air, using a furnace and duct system where conditions warrant such heating, or a space heater of the combined radiant and air circulating type where requirements are more moderate

Defense Housing Critical List limits the use of radiators to systems serving two or more dwelling units.

System must be forced circulation when furnace (not space heater) is on same floor as dwelling. Gravity warm air furnaces shall only be used in basements.

Gas or oil forced warm air furnace may be located in hall, kitchen or heater room.

Coal furnace shall be located only in heater room or basement.

When heater rooms are totally enclosed, they should have a window to the outside or other means must be provided to supply air from combustion and to relieve the heat from the room. Grilled openings at high and low point may be used.

Where heating equipment is furnished by the Government, plans and specifications must clearly indicate same and bidders must be fully advised of scope of work for assembly and installation of such equipment.

Preparation of Plans

Indicate complete layout of duct system for each separate type building unit. Layout must include the following:

Sizes of all ducts.

Preparation of Plans (Continued)

Sizes of all registers and grilles.
CFM to be handled at each supply grille or register.
Electric connection. Coordinate with electric drawing.
Damper for each supply outlet for balancing system.
Location of room thermostat when gas or oil fired systems are used.

Forced Warm Air

Warm air distribution system should be designed in manner to use minimum amount of duct work. Provide adequate returns from far side of living and bedrooms located under the windows for one-story units. For two-story units, a single return may be used, preferably located at the foot of the stairs. Provide living room, each bedroom, kitchen and bathroom with individual direct air supply through high or low grilles. No provision should be made for return of air from kitchen or bathroom.

System should be designed for a plenum temperature of not less than 140°, and not any higher than required.

Distribution systems should be designed so that total resistance of system including furnace loss will not exceed 0.25 inches static pressure.

Provide necessary electrical connections and switch for all forced warm air furnaces. To prevent tenant from attempting to control heat by disconnecting fan (which may result in burning out furnace) locate electrical connection so that it is not easily accessible.

In layout of duct system, provide clearance from combustible materials in accordance with regulations of National Board of Fire Underwriters' Pamphlet No. 90, titled "Air Conditioning, Warm Air Heating, Air Cooling and Ventilating Systems", for high temperature system when coal fired, and for low temperature system when oil or gas fired.

Ceiling outlets are not to be used. Top of high supply outlet to be set 6" below ceiling. Low supply outlet to be over base. Discharge velocities from high supply outlets should not exceed 800 FPM; from low supply outlet should not exceed 300 FPM.

Provide each supply register with adjustable horizontal and vertical air deflectors, set as required. Provide a shut-off valve at each supply outlet, except bathroom, operative from face of grille.

Ducts, registers and grilles shall be selected to use standard commercial sizes wherever possible.

Gravity Warm Air

Use only when basements are available.

Supply air to all rooms, by ducts.

Provide returns from living and bedrooms.

Design should conform to applicable codes of National Warm Air Heating Association.

Warm Air Furnace Controls

Units must include the following controls:

Gas

Pressure regulator.
Automatic gas valve.
Safety pilot.
Bonnet temperature limit controls.
Room thermostat.
With forced warm air; bonnet thermostat for blower control.

Oil (Caporizing Pot Type Burner and Mechanical Draft)

Constant level and control valve.
Bonnet temperature limit control.
Room thermostat.
With forced warm air; bonnet thermostat for blower control.

Coal

Damper regulator; including bonnet temperature limit control.
With forced warm air; bonnet thermostat for blower control.

Furnace Settings

Furnaces shall not be set directly on floors of combustible material. See Fig. H-1.

With combustible floors, set gas or oil furnaces on metal clad insulating board or equivalent material. Oil furnaces on cement should be set on metal to serve as drip pan.

Coal furnaces should only be set on non-combustible finished floor.

With non-combustible floor finish over wood joist, the coal burning furnace must be set a minimum of 3" over the floor to provide through ventilating space under furnace.

Circulating Space Heaters

Space heaters should be located in living room close to center of house.

Space heaters must be vented.

In two-story units, additional circulation benefits may be obtained through simple duct systems. See Fig. H-2.

Capacity of space heaters should be based on:

Heat losses.
Pick up.
Fuel correction (coal)

Floor furnaces shall only be used under conditions where the area under the furnace is properly drained or otherwise adequately safeguarded by means of a waterproof pit and curb so that no water can get within 3" of any part of the furnace.

Adequate provision shall be made for easy access to the furnace under the house by means of an opening in the foundation wall or through a trap door of at least 18 by 24 inches, located at some convenient point in the house, and a clear and unobstructed passageway to the furnace at least 24 inches high by 24 inches wide.

Only wall register models shall be used.

Gas fired floor furnace shall have the American Gas Association Label.

All gas floor furnaces shall be equipped with safety pilots which shall automatically shut off the gas supply to the main burner in the event of pilot or gas failure and which shall also prevent turning the gas into the main burner unless the pilot is lighted.

Units designed for use of heavier-than-air gases shall be equipped with safety pilots which shall automatically shut off the gas supply to both the main and the pilot in the event of pilot or gas failure and which shall also prevent turning the gas into the main burner unless the pilot is lighted.

Suitable baffles shall be installed or other means provided to prevent air currents from extinguishing the pilot or burner or both.

6 HEATING.
Chimneys or Flues

Chimneys for oil and coal burning equipment should be masonry type with an inside flue lining.

Assembled flues of porcelain enamel or clay which meet the following performance requirement may be proposed for consideration:

The construction of the flue below the roof shall be such as to limit the temperature on the outside surface to 375 degrees F. above room temperature when flue gas temperature is 1000 degrees F. Outside surface temperature to be measured under a felted asbestos pad, 6 in. x 6 in., 0.04 in. thick and weighing not less than 4 ounces nor more than 6 ounces.

With such assembled flues a barometric damper should be introduced in the smoke pipe and set to limit the flue temperature to about 1000° F. before it enters the flue.

Vent: all gas, oil or coal burning space and domestic water heating equipment; all ranges burning coal or No. 1 (or heavier) fuel oil. Unless the venting of gas ranges is a definite local requirement they need not be vented.

Smoke pipe connection from gas-burning domestic water heating equipment when vented into the same flue with pressure type oil or coal-burning equipment should be made above the smoke pipe of such equipment.

Gas-burning heating equipment may be vented by means of vent flues complying with National Board of Fire Underwriters' requirements. Such flues may be oval in shape and installed concealed in 3-5/8-inch stud space in partition; however, such flues should be arranged to clear combustible materials by one inch minimum. Drain must be provided in base of each flue from gas-burning heating equipment.

Chimneys and flues shall extend:

Not less than 2 ft. above a flat roof.
To height of adjacent parapet.
To height of adjacent ridge of sloping roof.
Not less than 1 ft. above ridge within 10 ft. of flues.

Note: See Flue Size chart, Fig. H-3.

Furnace casing or smoke pipes shall not be closer than 6" to combustible construction.

If furnace casing or smoke pipe is from 6" to 18" from a partition or ceiling of combustible construction, such construction shall be faced with 1/8" thick asbestos cement wall board over 3/8" gypsum wall board with staggered joints, or 3/4" gypsum plaster on incombustible lath.

For further details see Structural Design, Fire Resistive Standards.

Smoke pipe passing through a partition of combustible material should be avoided, but where necessary it must be insulated and clear combustible material by 6".

See Fig. H-1.

Fuel Storage

Fuel storage facilities must be provided.

Oil: Oil shall be stored in individual tanks.

For use with furnaces, tanks shall be 110 gallon capacity (approximately 27-1/2" diameter by 44" long) and piped to the burner. When used with a constant level valve, bottom of tank should be set at least 8" above such valve. Tank must be fitted with fill fitting, indicating gauge, and vent. If tank is within an enclosure, vent must be extended to outside. Other oil burning devices can be connected to the same tank.

With circulating space heaters, use a standard 55 gallon drum (approximately 24" diameter and 35" high) set vertically and fitted with a hand pump. If the same oil is used for cooking and domestic water heating in addition to space heating, it may be desirable to pipe these three units to the tank, in which case, tank should be set as described for the furnace.

Installation should conform to the following: National Board of Fire Underwriters' pamphlet No. 31 titled "Installation of Oil Burning Equipments" and National Board of Fire Underwriters' pamphlet No. 39 titled "Installation of Oil Burners in Stoves and Ranges Originally Designed for Solid Fuels and for the Storage and Use of Oil Fuels in Connection Therewith."

Coal: See architectural standards.

Liquefied Petroleum - (Bottled Gas): Installation shall conform for the present to the National Board of Fire Underwriters' pamphlet No. 58 titled "Liquefied Petroleum Gases", and when available to "Standards for Installation and Storage of Liquefied Petroleum" to be issued by the National Bureau of Standards.

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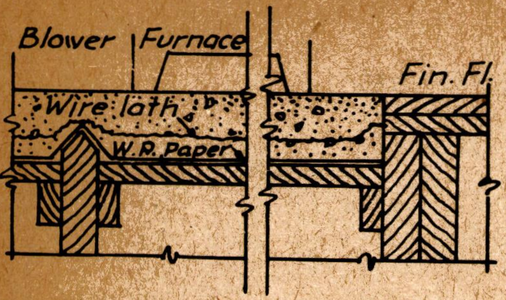
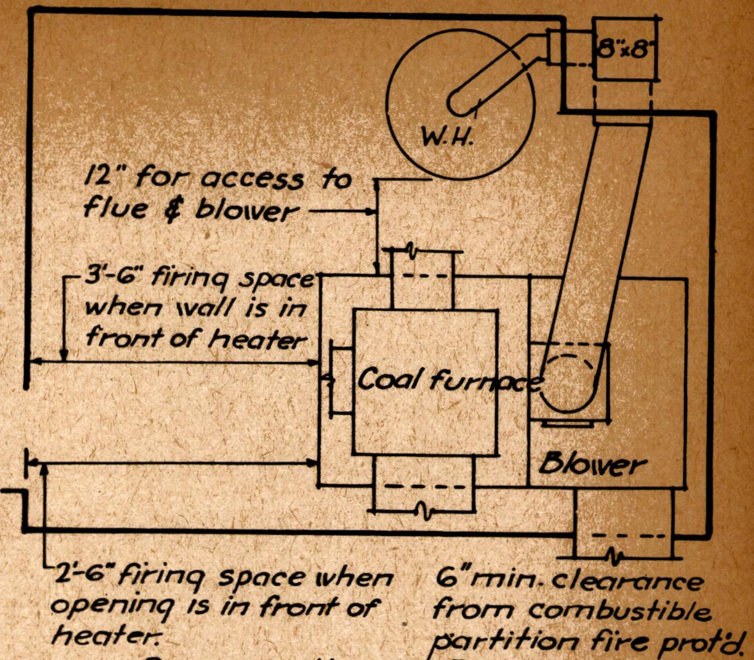
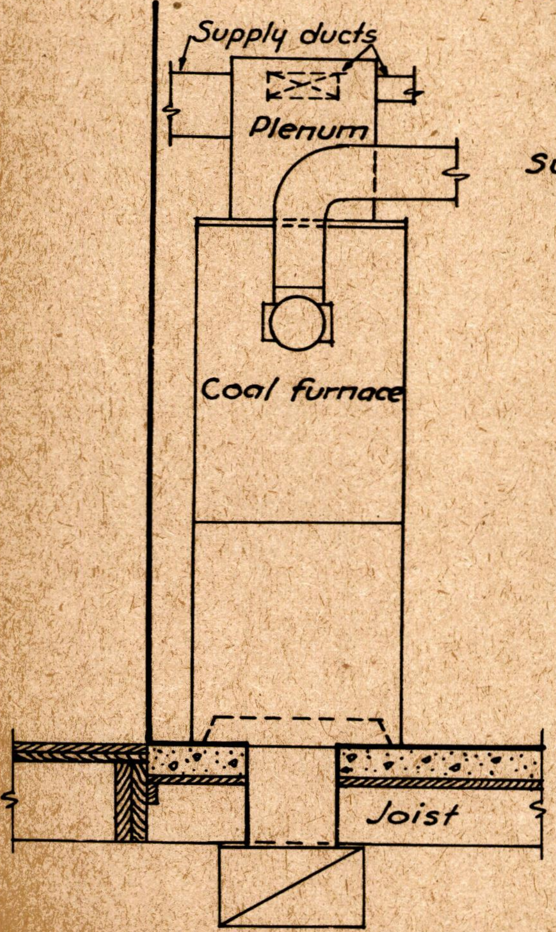


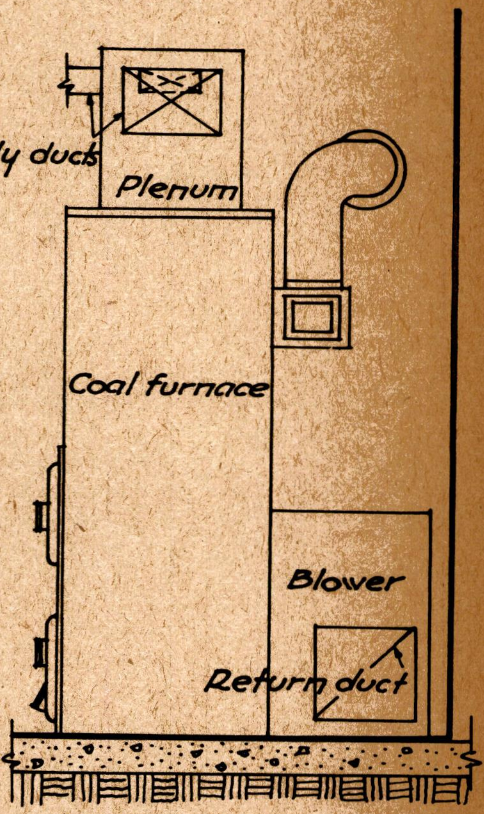
Concrete Over Joist
Scale 1½"=1'-0"



Plan of Heater Room



Rear Elevation of Furnace on Wood Floor over Crawl Space



Side Elevation of Furnace on Concrete Slab

Scale ½"=1'-0"

REVISED 5-42

DATE	FORCED WARM AIR DETAILS - COAL FURNACE	F.P.H.A.
FEB. '42	DEFENSE HOUSING - NATIONAL HOUSING AGENCY - WASHINGTON, D.C.	FIG. H-1

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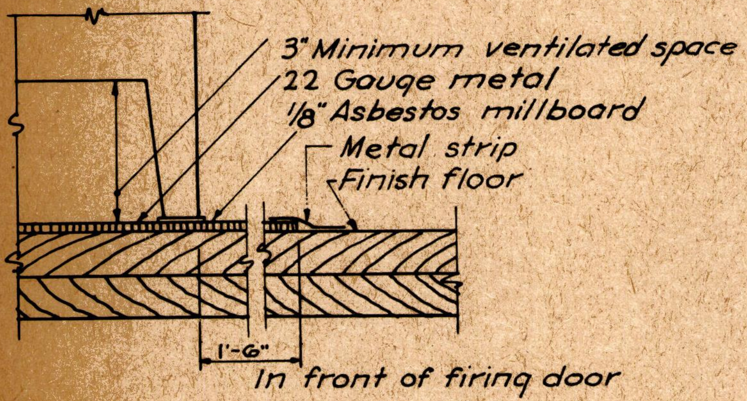
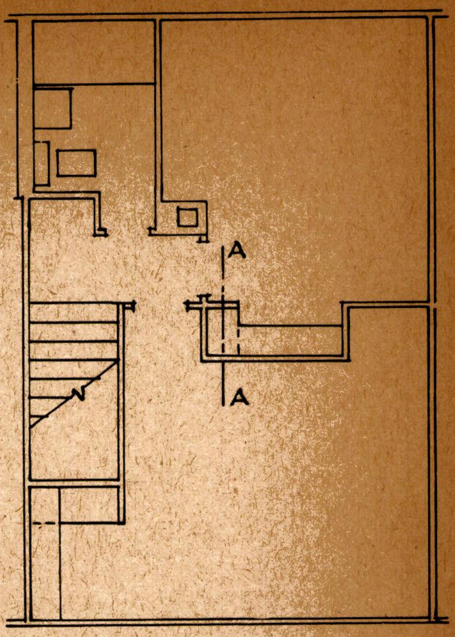
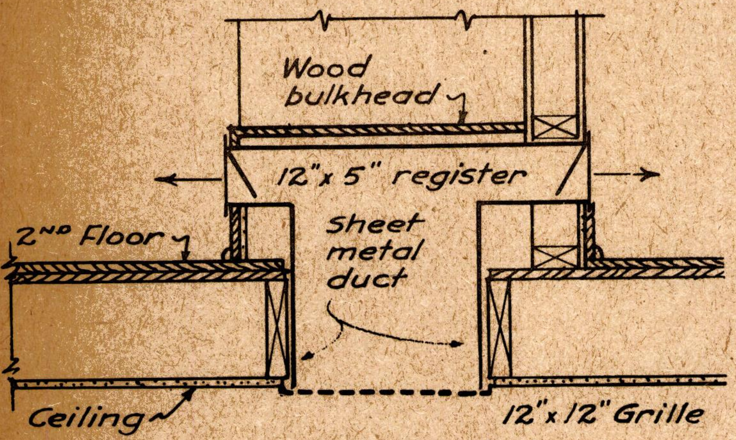


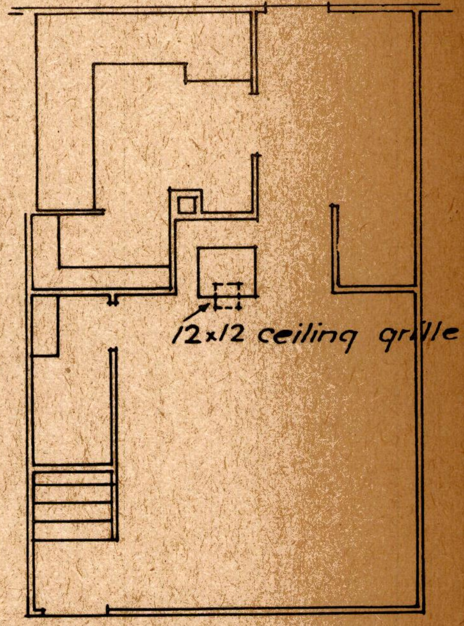
COAL SPACE HEATER



2ND Floor



SECTION A-A



1ST Floor
2 STORY UNIT

REVISED

DATE	SPACE HEATER DETAILS	F. W. A.
FEB. '42	DEFENSE HOUSING · FEDERAL WORKS AGENCY · WASHINGTON D.C.	FIG. H-2

2781

~ F L U E S ~

HEATING					WATER HEATER OR RANGE					HEATING COMBINED WITH WATER HEATER OR RANGE		
FUEL	TYPE OF EQUIPMENT	FLUE SIZE			FUEL	TYPE OF EQUIPMENT	FLUE SIZE			FLUE SIZE		
		MASONRY	PORCELAIN ENAMEL	CLAY			MASONRY	PORCELAIN ENAMEL	CLAY	MASONRY	PORCELAIN ENAMEL	CLAY
COAL	SPACE HEATER	8"×8"	7"	8"	COAL	WATER HEATER	8"×4"	5"	5"	8"×12"	8"	10"
					COAL	RANGE	8"×8"	7"	8"	8"×12"	8"	10"
					GAS	WATER HEATER	8"×4"	4" *		8"×8"	8"	10"
					OIL	" "	8"×4"	5"	5"			
					OIL	RANGE	8"×8"	7"	8"			
COAL	FURNACE	8"×8"	7"	8"	COAL	WATER HEATER	8"×4"	5"	5"	8"×12"	9"	10"
					COAL	RANGE	8"×8"	7"	8"	8"×12"	9"	10"
					GAS	WATER HEATER	8"×4"	4" *		8"×12"	9"	10"
					OIL	" "	8"×4"	5"	5"			
					OIL	RANGE	8"×8"	7"	8"			
OIL	SPACE HEATER	8"×8"	7"	8"		EACH FLUE TO BE INDEPENDENT. SEE ABOVE FOR SIZES.						
OIL	FURNACE	8"×8"	7"	8"		EACH FLUE TO BE INDEPENDENT. SEE ABOVE FOR SIZES.						
GAS	SPACE HEATER	8"×8"	5" *			OTHER GAS APPLIANCES				8"×8"	5" *	
GAS	FURNACE	8"×8"	5" *			OTHER GAS APPLIANCES				8"×8"	6" *	

* = TYPE 'B' FLUE AS APPROVED BY NATIONAL BOARD OF FIRE UNDERWRITERS.

MASONRY FLUES MUST HAVE THE FOLLOWING MINIMUM AREAS :-
8"×4" - 23 SQ.IN. 8"×8" - 50 SQ.IN. 8"×12" - 80 SQ.IN.

~ NOTES ~

1. OIL BURNING EQUIPMENT WITH VAPORIZING POT TYPE BURNER MUST HAVE AN INDEPENDENT FLUE.
2. COAL BURNING EQUIPMENT IN ONE STORY FLAT ROOF UNIT MUST HAVE AN INDEPENDENT FLUE.
3. TWO COAL BURNING UNITS OR A COAL AND GAS BURNING UNIT MAY BE COMBINED INTO A SINGLE FLUE PROVIDED THE STACK IS NOT LESS THAN 15 FEET HIGH MEASURED FROM THE FLOOR ON WHICH THE EQUIPMENT RESTS, AND THE COAL IS ANTHACITE OR A HIGH GRADE LOW VOLATILE BITUMINOUS COAL.
4. TWO GAS BURNING UNITS MAY BE COMBINED INTO A SINGLE FLUE.
5. KEROSENE RANGES NEED NOT BE VENTED.
6. GAS RANGES NEED NOT BE VENTED UNLESS SPECIFICALLY REQUIRED BY LOCAL CODE, IN WHICH CASE, SIZES SHOULD BE AS RECOMMENDED BY CODE.

REVISED____ ____ ____ ____

DATE	FLUE SIZES	F.P.H.A.
MAY '42	DEFENSE HOUSING - NATIONAL HOUSING AGENCY - WASHINGTON, D.C.	FIG H-3

9781

STANDARDS FOR WAR HOUSING

Excluding Temporary Housing

ELECTRICAL

\- - - - - -

Interior

Exterior

Federal Public Housing Authority

May 15, 1942

Electrical drawings should indicate by reasonably accurately locating and sizing (where required) all electrically operated equipment, controls, and disconnects, lighting fixture outlets and switch controls, receptacles, service equipment, metering locations, branch and feeder circuit control panels, and feeders and branch circuits (branch circuits should either be shown connecting outlets or outlets should be numbered to indicate circuit). Telephone, radio and call system should be indicated to the extent of rendering enough information to intelligently permit not only of estimating but of use as a working drawing.

The National Electrical Code and The National Electrical Safety Code, latest issue, shall govern design, except that orders issued by the Federal Agency Controlling Priorities affecting these codes shall take preference.

Adopt electrical symbols shown on Figure E-1.

Cable size shall be governed by National Bureau of Standards "Simplified Practice Recommendation R180-41" on subject of "Copper Conductors for Building Purposes".

The standard practice, with respect to arrangement of service equipment and the distribution of electrical energy on project site, promulgated by the local utility company shall be followed except where such practice is contrary to the national codes. Approval of layouts should be obtained wherever possible from utility company before issuing documents for bids.

Living Room: Provide ceiling fixture with wall switch control and three receptacles, one to be combined with wall switch.

Bedroom: Provide ceiling fixture with wall switch control and two receptacles, one to be combined withwall switch.

Kitchen: Provide ceiling fixture with wall switch control and two or three receptacles, one to be combined with wall switch (where practical). Regardless of the type of refrigeration locate one of the required receptacles at refrigerator, 1 foot 8 inches off center line of refrigerator, and between 3 feet 6 inches and 4 feet 4 inches above floor. One receptacle should be adjacent to work top, and another (or the same one) near dining table. In large kitchens locate ceiling outlets off-center; center outlets between exterior wall and inside partition, and 3 feet from the work space partition or wall. Connect receptacles in kitchen on one circuit.

Bathroom: Provide bracket fixture over medicine cabinet with combination wall switch and receptacle at entrance door.

Utility Room: Provide ceiling fixture, pull cord controlled.

Storage Room: Provide ceiling fixture, pull cord controlled.

Halls: Provide ceiling fixture, pull cord controlled.

Stairhall: Provide ceiling fixture with 3-way switch control. Locate switch away from top step.

Crawl Space: Provide receptacle near each crawl space entrance and such additional receptacles as to permit the whole crawl space being reached by a 100 foot extension cord.

Combine switch and plug receptacles devices in one box, where practical.

Dwellings

Wiring devices located on opposite side of same wall within one dwelling unit should be back to back, wherever practical, utilizing common box if of metal.

Branch circuits of one dwelling unit should not run through outlets serving other dwelling units.

Raceways, outlets and cables must not be located in partitions at end of bath tubs (or space for tubs) so that they will interfere with tub replacement.

Follow layouts of outlets and circuiting as per Fig. E-2 to E-5.

Nondwellings

Management and Maintenance Spaces: Follow general scheme of layouts of outlets and circuits as per Fig. E-6 and E-7.

Community Laundries: Where electric hot plates are used, one "double hot plat unit" (two 2000 watt enclosed heating elements) per laundry should be provided. Lighting and electrically operated equipment (excluding fans) must be controlled by means of an automatic cut-off with manual re-set. Locate control station near entrance door. Provide lighting outlet (small wattage) with lock switch control on constant circuit.

Community Spaces: Follow general scheme of layouts of outlets and circuiting as per Fig. E-8. Wall switches in public spaces should be of lock type.

Crawl Spaces: Provide receptacle near each crawl space entrance and such additional receptacles as to permit the whole crawl space being reached by a 100 foot extension cord.

Electrical appliances rated at more than 1650 watts, such as electric ranges, must have disconnecting means other than part of the appliances, and such disconnecting means must be readily accessible to the operator. In multi-family (more than two) dwellings, the switch must be within the dwelling unit proper or on the same floor as the dwelling unit in which the appliance is installed.

Branch circuit centers should be conveniently located for the restoration of circuit protection, preferably within dwelling units. Where common space is accessible to tenants served, circuit centers may be located in such space. Where branch circuit centers are used as distribution centers for buildings, locate near longitudinal center of row houses or near center of load of apartment type buildings. See Fig. E-9.

Feeder distribution centers must not be located within dwelling units or in crawl spaces.

Back-to-back combination metering and circuit protection centers are available for installation in exterior frame wall construction of thickness varying from 4-1/2" to 7". The meter socket faces on the exterior of the wall, with the protective devices accessible from inside the dwelling units.

Cables and Raceways: Use cable, without armor, in dry locations (concealed or exposed) except that knob and tube work may be used where it is standard practice and then only in hollow spaces of walls and ceilings. Do not imbed cables in masonry, concrete or fill; use metallic raceways.

Conductors in raceways should be lead covered, moisture resistant rubber covered or other type especially approved by Underwriters' for the conditions, where raceways are installed (a) underground, (b) in concrete slabs or other masonry in direct contact with earth, (c) in wet locations, and (d) where condensation within raceway is likely to occur.

Do not run service entrance conductors through hollow spaces of, or within, frame buildings for a distance greater than 5 feet, unless provided with overcurrent protection at their outer end.

Feeder Distribution: Follow generally the schemes shown on Figures E-10 and E-11.

Individual Meters: Provide for installation at a later date for individual tenant meters. Provide for metering facilities where energy used for project service is centralized, as for heating plants, or where it may be difficult for management to estimate energy consumption. Meter loops at distribution centers should generally suffice.

Design for voltage loss not to exceed 3% from point of building service connection to the last outlet, with all lamps and devices in operation and loadings based on code requirements (Articles 220, National Electrical Code - 1940).

Service Equipment

Locate service disconnects within building served and adjacent to, or part of, branch circuit or feeder distribution center. Do not locate service disconnects exposed on outside of buildings if other locations or concealment are economically feasible; where exposed, they must be weatherproof.

Where accessible to children, disconnect handles should be about 7 feet above floor or ground.

Metering

Do not include furnishing and installing of check meters: only facilities to accommodate meters should be provided in distribution system.

Provide metering facilities at feeder or branch circuit panels. See Figures E-12 and E-13. Metering panel should be arranged with space only for meter with (a) means for inserting meter tap in circuit or (b) sockets or receptacles to receive detachable type meter.

Do not install meters in crawl spaces.

Where practicable and where load permits, dwelling unit panels should have 2 or 3 wire single phase services so the 2 or 3 wire single element meters may be used. On a 3 phase, 4 wire system, a 3 wire 120/208 volt service to a dwelling unit panel necessitates a 2 element meter, the cost of which is 100% greater than that of the single element meter.

Fuses and circuit breakers are both suitable for overcurrent protection. The type of device which is most practical on basis of initial cost, comparative cost of maintenance, repair and replacement, and operating conditions peculiar to the immediate location, should be chosen.

The protective devices in the main service, feeder distribution center and branch circuit panel installation should be so planned that an overload on one or more of the dwelling unit circuits will not cause the protective devices ahead of the branch circuits to operate before the branch circuit devices open, resulting in a complete shutdown to the particular dwelling unit group.

Where thermal circuit breaker protection with inherent time lag is used for branch circuit, provide the protective devices ahead of the branch circuit with proper time lag protection.

Lighting fixture should be provided in every room of dwelling unit. They should be low in first cost, require little maintenance and repair expense, simple and sturdy in design, lasting finish, of standard types permitting ready interchangeability and replacement. (See Figure E.14).

Replacement of socket and switch (if any) should be possible without requiring replacement of canopy or fixture.

Illumination intensity in each occupied room of from 4 to 6 foot candles, measured in horizontal plane 30 inches above floor, should be provided over 25% of floor area. 15 foot candles should be provided for close work. On stairs and in passageways, 1 foot candle should be provided. In public vestibules, halls, stairways, provide approximately 1/3 watt per sq. ft., (control automatically through one time clock by relays.)

Recommended fixture types:

Living rooms - Ceiling fixtures with 12 inch translucent or opaque bowls fastened to lamp receptacle holder by chains. Opaque bowls to have louvered openings in bottoms to give sufficient intensity directly below fixture for close work.
Lamp size - 100 watt.
Control - - wall switch.

Bedrooms - Same as for living rooms except diameter of bowls approximately 9 inch. No louver in bottom of opaque bowl.
Lamp size - 75 watt.
Control - - wall switch.

Kitchens - Ceiling lamp receptacle with approximately 8 inch opal glass globe.
Lamp size - 40 - 60 watt.
Control - - wall switch.

Halls - Ceiling beam fixture with flared ring opening.
Lamp size - 25 watt.
Control - - pull cord.

Bathrooms - Bracket Fixture.
Lamp size - 25 watt.
Control - - wall switch.

Utility rooms - Ceiling lamp receptacle.
Lamp size - 25 watt.
Control - - pull cord.

Pull cord control on ceiling fixtures should be provided with snubber or stop at hole in canopy where chain emerges.

Provide means for preventing lamp theft on fixtures in accessible public spaces.

Fixtures subjected to moisture must be of the moisture-proof type. Fixtures subjected to explosive vapors (such as in paint shops) must be of the vapor-proof type.

Fixtures in community spaces, subject to use as play rooms, should have wire guards.

10 ELECTRICAL - Interior.
Signalling and Communication

Call Systems: Where required at dwelling unit entrances, provide mechanical device (not electrically operated). Do not provide automatic door openers.

Fire Alarm Systems: Provide only if local code regulations require. Where unnecessarily restrictive, waiver should be obtained.

Telephone Systems: Provide minimum adequate roughing-in for introduction of cables, cable terminals, protectors and wires with minimum cutting of structures.

Type Bldg.	Required Provisions
A	1. In masonry exterior walls, provide service sleeves through exterior wall for each dwelling unit. Terminate coupling flush with exterior wall; seal with slotted head plug.
B	1. Sleeve through floor of a closet in each dwelling unit.
	2. Service sleeve or sleeves through exterior wall.
C	1. First floor dwelling units - sleeve through floor of a closet in each dwelling unit.
	2. Dwelling units above first floor; a vertical raceway extending to the basement of crawl space.
	3. Service sleeve or sleeves through exterior wall. Engineers of telephone company should be consulted regarding the detail and location of service sleeves through exterior walls.

For the purpose of the preceding illustration, Type A Buildings are considered to be row houses and flats without basement or crawl space (space with headroom less than 3 feet 6 inches is not considered adequate for service operations by telephone company engineers). Type B Buildings are considered to be row houses with basement or crawl space - minimum headroom of 3 feet 6 inches. Type C Buildings are considered to be flat and apartment type buildings with basement or crawl space - minimum headroom of 3 feet 6 inches.

For buildings of 6 dwelling units or less (without basement and with crawl space headroom less than 3 feet 6 inches) design for telephone company No. 93A protector mounted on outside of buildings. Large buildings without basement or crawl space require closet (30 inches high, 20 inches wide, 10 inches deep) accessible from exterior.

Where project distribution is not overhead, design to provide for underground duct (or cable buried in trenches) between buildings.

Radio Systems: No radio facilities in buildings free from reinforced slabs and metal lath. Provide sleeves or raceways in fire-proof or simifire-proof buildings using steel reinforcing and metal lath.

12 ELECTRICAL - Exterior.
Load Characteristics
Electric Energy Source
Overhead vs. Underground

Load Characteristics

If rate classification under which project will be served carries a power factor penalty clause, the distribution system or the inductive appliances on the system, or both, should be disigned to correct the current lag so that power factor will range between 85% and 100%.

Electric Energy Source

Where utility company permits totalized readings (where more than one point of metering is provided on wholesale purchase) provide a pilot system to register demand impulses at one metering point.

Design system of distribution based on negotiated rate classification with particular regard to delivery voltage and concessions (if any) by utility company. Primary voltage should not exceed 4.5 KV, preferably using 4 wire, 'Y' connected, permitting use of nominal 2400 volt apparatus.

Overhead vs. Underground

Provide overhead system of distribution except where the underground distribution cost is equal to or less than an overhead system.

The simplest form of distribution is the radial type. For a schematic layout, see Fig. E.15.

The "ring" or "loop" type of system has greater flexibility than the radial system and is, therefore, often preferable. For a schematic layout, see Fig. E.16.

Allowable Copper

Due to the critical copper shortage, the on-site electrical distribution from point of utility company service contact to points of electrical contact at buildings, shall be designed to reflect the very minimum practical amount of copper. Depending on densities, types of buildings and functions served electrically, the amount of allowable copper per dwelling unit (probable WPB restriction) will vary between 6 and 15 pounds. These figures include all copper required for on-site distribution (building wiring excluded) such as conductors, transformers, disconnects, etc.

Distribution should be accomplished by stringing conductors on pole structures, extending service conductors to buildings (see Fig. E-17).

Pole - spans should not be greater than 150 feet, exact length of spans to be governed by location or service drops, and future yard and street lighting location. Avoid needless changes in direction of pole line.

Where apparatus requiring periodic servicing is installed on poles, means for pole climbing should be provided.

Place guys so as not to obstruct walkways, play areas, parking areas, etc.

Place transformer stations in center of loads; limit sizes to maximum of one $37\frac{1}{2}$ KVA or three 15 KVA per pole.

Conductor size shall not be less than No. 6 medium hard drawn copper. Sizes larger than 2/0 should not be used. Use bare primary conductors. Secondary runs from transformers to buildings should not exceed 400 feet. Do not slack span wires between poles.

One story buildings with flat or hip roofs of such height as not to gain required clearance for service loops must have support provided to obtain such clearance over roadways and walks in accordance with NESC (Article 232A).

Total bending moment (ft./lbs.) due to wind pressure on pole plus a safety factor of two (2Mp) and the moment (ft/lbs) due to wind pressure on conductors plus a safety factor of two (2Mc) should be equal to, or smaller than, the moment of resistance of the pole (Mr).

Formula 1: $2Mp + 2Mc = Mr$

For straight line construction, apply the following formulae in determining "bending moment."

Formula 2: (Heavy loading district)

$$2Mp = \frac{H_1^2 \ (D_1 + 2D_2)}{4.5}$$

$$2Mc = \frac{H_2 \ n \ (d + 1) \ S_1 + S_2)}{1.5}$$

Formula 3: (Medium loading district)

$$2Mp = \frac{H_1^2 \ (D_1 + 2D_2)}{4.5}$$

$$2Mc = \frac{H_2 \ n \ (d + 0.5) \ \ S_1 + S_2)}{1.5}$$

Formula 4: (Light loading district)

$$2Mp = \frac{H_1^2 \ (D_1 + 2D_2)}{3}$$

$$2Mc = H_2 \ n \ d \ (S_1 + S_2)$$

Wherein:

Mr = Resistance moment at ground lines (ft/lbs)

Mp = Bending moment at ground line (ft/lbs) due to wind pressure on pole

2Mp = Bending moment at ground line (ft/lbs) due to wind pressure on pole (safety factor 2)

Mc = Bending moment at ground line (ft/lbs) due to wind pressure on conductors

2Mc = Bending moment at ground line (ft/lbs) due to wind pressure on conductors (safety factor 2)

H_1 = Height of pole (ft) above ground line

H_2 = Height of conductors (ft) above ground line

D_1 = Diameter of pole (inches) at 6' - 0" from butt (see Table E-101)

D_2 = Diameter of pole (inches) at top (See Table E-101)

n = Number of conductors

d = Diameter of conductors (inches) (See Table 81, NESC)

S_1 = (Adjacent spans (ft)
S_2 = (

Apply the following formula in determining pole resistance:

Formula 5: $Mr = 0.000264\ f\ c^3$

Wherein:

Mr = Resistance moment of poles (ft/lbs)

f = Allowable fibre stress (lbs/sq.in.) (See Table E-102)

c = Circumference of pole 6 feet from butt (inches). See Table E-101. Multiply diameter given by 3.1416.

Tables E-101, Minimum Diameters of Wood Poles

Top Diameter	Class: (In.):	1 8.6	2 8.0	3 7.3	4 6.7	5 6.1	6 5.4	7 4.8
Ople Length (ft)	Ground from butt (ft)	Diameter 6 ft. from butt (in.)						
Southern yellow pine, creosoted								
25	5	10.9	10.3	9.5	8.9	8.3	7.6	7.0
30	5½	11.9	11.1	10.3	9.5	8.9	8.3	7.6
35	6	12.7	11.9	11.1	10.2	9.5	8.8	8.1
40	6	13.4	12.6	11.8	10.8	10.0	9.2	8.6
45	6½	14.0	13.2	12.2	11.5	10.5	9.7	9.1
Chestnut								
25	5	11.8	11.0	10.3	9.5	8.9	8.1	7.6
30	5½	12.7	12.1	11.1	10.3	9.5	8.9	8.3
35	6	13.5	12.7	11.9	10.9	10.2	9.5	8.8
40	6	14.3	13.5	12.6	11.6	10.8	10.0	9.4
45	6½	15.1	14.2	13.2	12.2	11.5	10.5	9.9
Western red cedar								
25	5	12.1	11.3	10.5	9.7	9.1	8.3	7.8
30	5½	13.0	12.2	11.3	10.5	9.7	9.1	8.4
35	6	13.8	13.0	12.1	11.3	10.3	9.7	8.9
40	6	14.6	13.8	12.9	11.9	11.0	10.1	---
45	6½	15.4	14.5	13.5	12.5	11.6	---	---
Northern white cedar								
25	5	13.8	13.0	12.1	11.3	10.3	9.5	8.9
30	5½	15.1	14.2	13.2	12.2	11.3	10.5	9.7
35	6	16.1	15.1	14.0	13.0	12.1	11.1	10.3
40	6	17.0	15.9	14.8	13.8	12.7	11.8	---
45	6½	17.8	16.7	15.6	14.5	13.4	---	---

Table E-102, Ultimate Allowable Fibre Stresses (Modulus of Rupture) of Wood Poles

Southern Yellow Pine - creosoted	7400 lb., sq. in.
Chestnut	6000 lb., sq. in.
Western red cedar	5600 lb., sq. in.
Northern white cedar	3600 lb., sq. in.

In straight line construction, only transverse loads generally need consideration; vertical and resultant loads should be determined in sizing transformer and unbalanced pole structures.

Where loads imposed on poles are greater than can safely be supported, additional strength should be provided by the use of guys. Wherever conductor stresses are unabalanced and at angle and dead ends, guys should be provided where pole strength is not sufficient.

Streeses due to line angles between 10 and 60 degrees should be supported by a single guy placed to split line angle or resultant load. Angles greater than 60 degrees should be guyed in both directions.

Figure E-18 indicates number and size of guys for varying conditions. To illustrate its use, the following example is given:

Conditions:

(a) 3 #4 primary and 4 #1/0 secondary
(b) Measured distance (d) - 20 feet
(c) Guy attachment height (H) - 36 feet
(d) Anchored lead (L) is 18 feet (a lead of 1/2 H or more is recommended)

Solution:

(a) $L = \frac{18}{36} = 0.5$ Therefore use column L = 1/2H

(b) Wire equivalent in #1/0

Sec. 4 #1/0	=	4.0
Pri. 3 #4 3 x .39*	=	1.17
		5.17

nearest whole number of #1/0 = 5 #1/0

(c) Referring to figures opposite 5 #1/0 under Col. "1/2H" a distance of 22 feet is the next larger figure to measured distance (d) or 20 feet.

(d) Therefore, one 3/8" guy with a 16" cone anchor should be used.

* Ratio of #/ft. of conductor used to #/ft. or #1/0 as base.

Estimated demands of various electrical loads for varying number of dwelling units are given in Tables E-103 and E-104. They are based on national averages and should be used with discretion in application to specific local conditions.

Voltage drop between transformer secondary and building service contact should not exceed 5% based on demands in Tables E-103 and E-104.

Standardize on transformer and cable sizes; limit number of sizes used.

Provide one-step transformation. Do not use open delta connections. Balance load on each of the primary phases.

Indicate a one-line diagram on site plan showing diagrammatically sizes of the primary and secondary feeders, transformer capacities, cutouts and disconnects. For schematic outline diagram, see Figure E-19.

Route raceways with relation to contour of finished site; indicate profiles on drawings to show elevations between vaults, manholes and buildings, and locations of service sleeves in buildings.

Raceways, vaults and manholes must not be subjected to accumulation of subsurface or surface water. Raceways must not be trapped.

Top of access covers should be raised above surrounding grade, where practical.

Avoid french or rock bed drains; use only where soil conditions permit absorption of water.

Single conductor primary feeders must be provided. If leaded, carry direct to wiping sleeves on oil-fused cutouts.

Use non-leaded secondary conductors up to 600 volt. Cable designed for laying directly in ground may be used, provided soil conditions will not attack it.

Transformers may be placed (a) in vaults within buildings, (b) in underground vaults independent of buildings, and (c) in vaults or kiosks above grade. If vaults are underground independent of buildings, subway-type transformers and equipment should be provided. Vaults within buildings and above grade should be provided with standard distribution equipment.

Primary service should not exceed 4.5 KV.

Following planning, clearances, and ventilation method as shown in Figure E-20.

Vault and Manhole Doors and openings must be large enough to permit removing or replacing equipment. Transformer vaults should be adequately ventilated in accordance with requirements of local utility company.

Foreign pipes and ducts must not come within line rooms and vaults.

Use oil-fused cutouts on each incoming primary phase line. Operate in gang and control by lever from outside vault.

Provide removable disconnecting links in underground distribution centers; do not use fuse protection.

Play Area Lighting

Local recreational authorities should be consulted on play area lighting. Where local recreational authorities will furnish cables, fixtures and controls, raceways only should be provided.

Equip lighting units with guards at play areas designed for ball playing.

Mount flood lights on wood poles or non-residential buildings, connecting to project circuit with provision for separate metering.

Control lighting from single time clock utilizing pilot wires to actuate contactors controlling power circuits. Single pole switch on load side of time switch for manual operation.

Air Traffic Lighting

Where a project located in the path of air traffic has a high chimney stack or other obstruction to aviation, illumination of such obstruction may be necessary. The Civil Aeronautics Authority, Commerce Building, Washington, D. C. should be consulted and approval obtained on the layout and equipment proposed.

Fire and Police Alarms: Appropriate city officials should be consulted with regard to municipal fire and police alarm systems. Local municipality should provide and maintain new stations, relocate existing stations and re-route or extend overhead or underground lines in connection therewith. Such of these systems as may be required should be installed in cooperation with contractor's work. Work to be done by city should be indicated on electrical site plan, calling contractor's attention to work which will be performed by others during the course of his contract.

If the project is remotely located and it is not feasible to connect to a municipal or Government reservation fire alarm system, the procedure shall be as follows:

The fire alarm stations shall be located so as to be no farther than 600 feet from any dwelling unit on the project.

Where three or more stations are needed, a local independent fire alarm system with coded siren shall be specified.

Where two stations are necessary, non-coded system with motor-driven siren actuated by fire boxes on the project shall be specified.

For very small projects of approximately 50 dwelling units, one motor-driven siren and a single pull box shall be specified.

Where fire-fighting equipment is not provided by the project, connection shall be made to the nearest city fire department by leased telephone wires.

Telephone System: Site facilities for a telephone system depend, to a large extent, on the means of electrical distribution for lighting and power. Where project owned overhead pole structures are planned, telephone lines generally can be brought from outside the property line to the various buildings on these poles.

Where no overhead distribution exists, provision must be made for underground distribution of telephone cables. This may consist of underground ducts (or trenches only for buried cables) connecting buildings.

Public Telephones: Pay telephone stations on project are desirable unless public telephone facilities are otherwise available immediately adjacent to project. Stations should be accessible at all times.

CEILING OUTLET

WALL BRACKET OUTLET

CONVENIENCE RECEPTACLE OUTLET (DUPLEX UNLESS OTHERWISE NOTED)

WALL SWITCH AND SINGLE RECEPTACLE OUTLET

PC PULL CORD OR PULL CHAIN CONTROL

S WALL SWITCH OUTLET (SINGLE POLE)

S_3 " " " (THREE WAY)

S_4 " " " (FOUR WAY)

HEATER BLOWER SWITCH OUTLET

TELEPHONE OUTLET

LIGHTING PANEL

METER OUTLET

RANGE CONNECTION

SPECIAL PURPOSE OUTLET

APPROVED

APPROVED

APPROVED

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DATE	ELECTRICAL SYMBOLS	F.W.A.
FEB. '42	DEFENSE HOUSING • FEDERAL WORKS AGENCY • WASHINGTON D.C.	FIG. E-1

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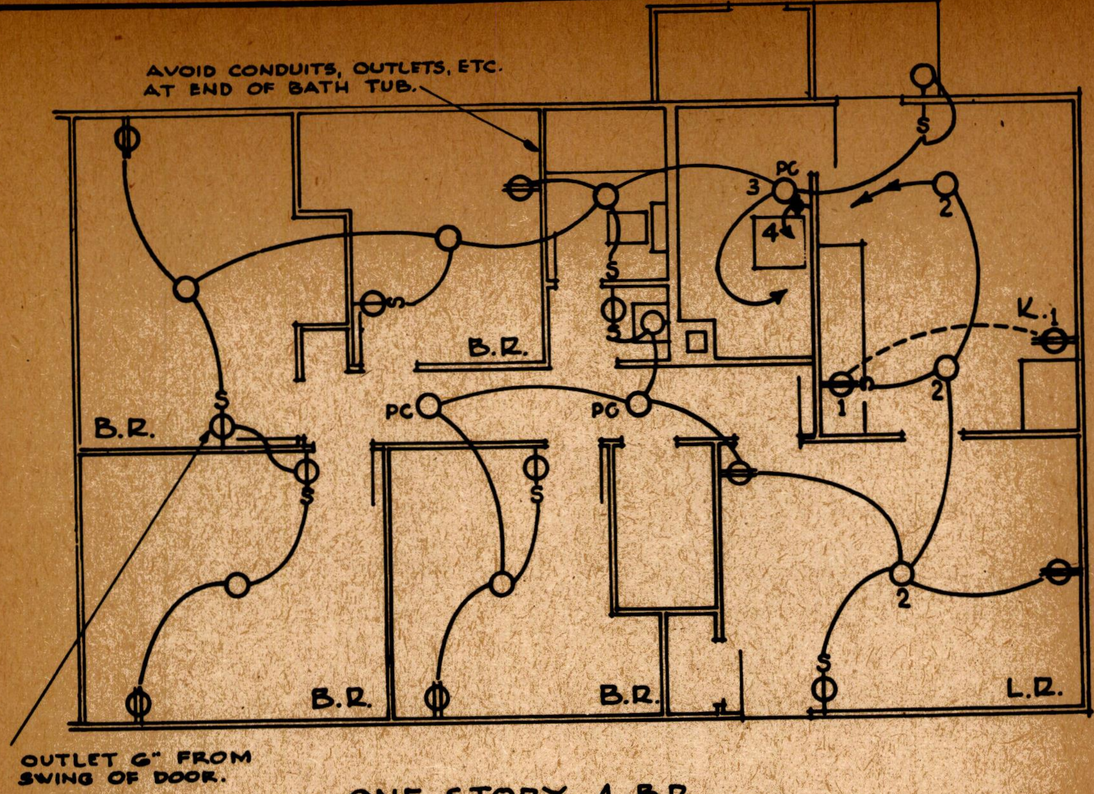
APPROVED

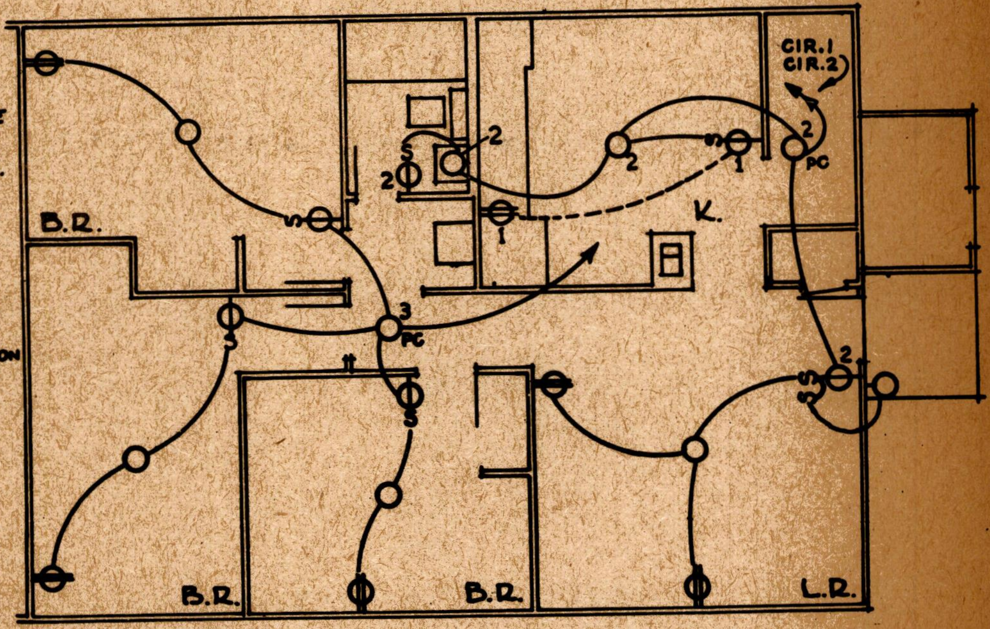


ONE STORY 4 B.R.

APPROVED

ROUTING OF HOME RUNS DEPENDENT ON PROTECTIVE CABINET LOCATION.

LOCATE CEILING KITCHEN FIXTURE OFF CENTER FOR BETTER ILLUMINATION OF WORK SPACE. CONTROL BY WALL SWITCH.



ONE STORY 3 B.R.

APPROVED

REVISED

DATE	TYPICAL WIRING LAYOUT	F. W. A.
FEB. '42	DEFENSE HOUSING • FEDERAL WORKS AGENCY • WASHINGTON D.C.	FIG. E-2

9781

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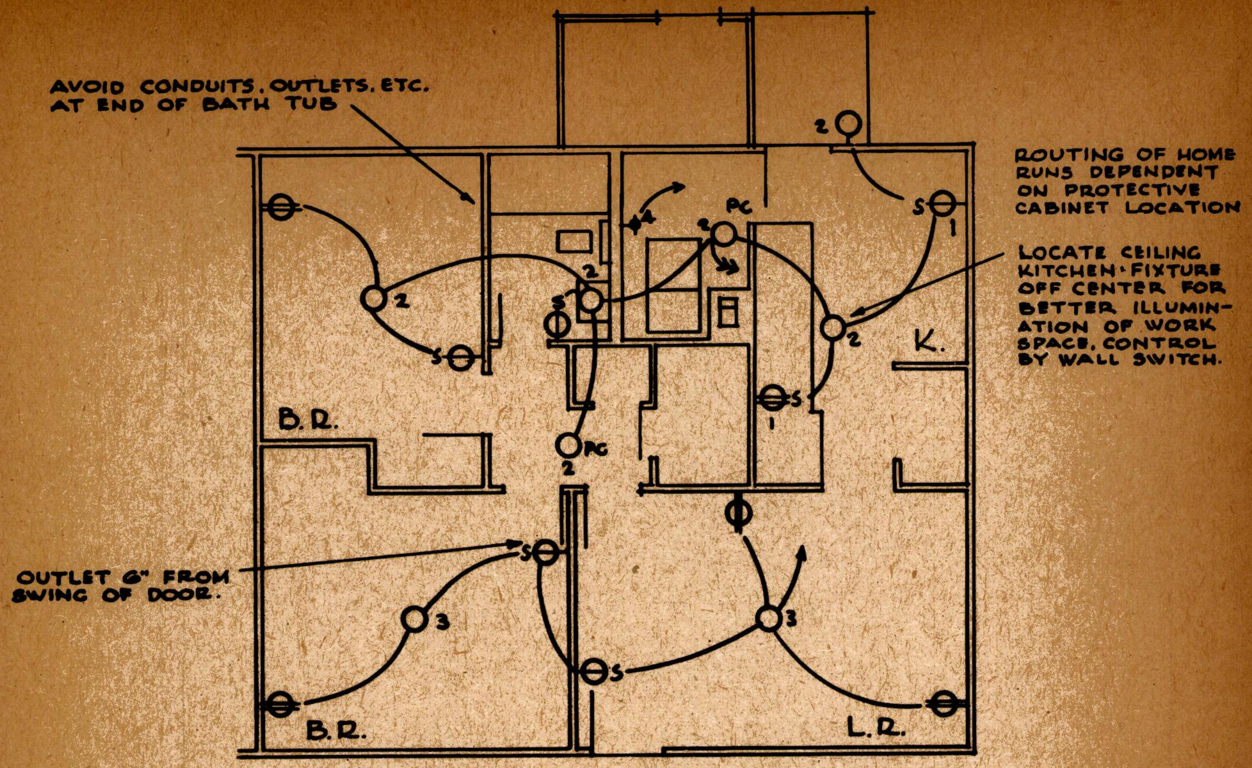

ONE STORY - 2 B.R. UNIT

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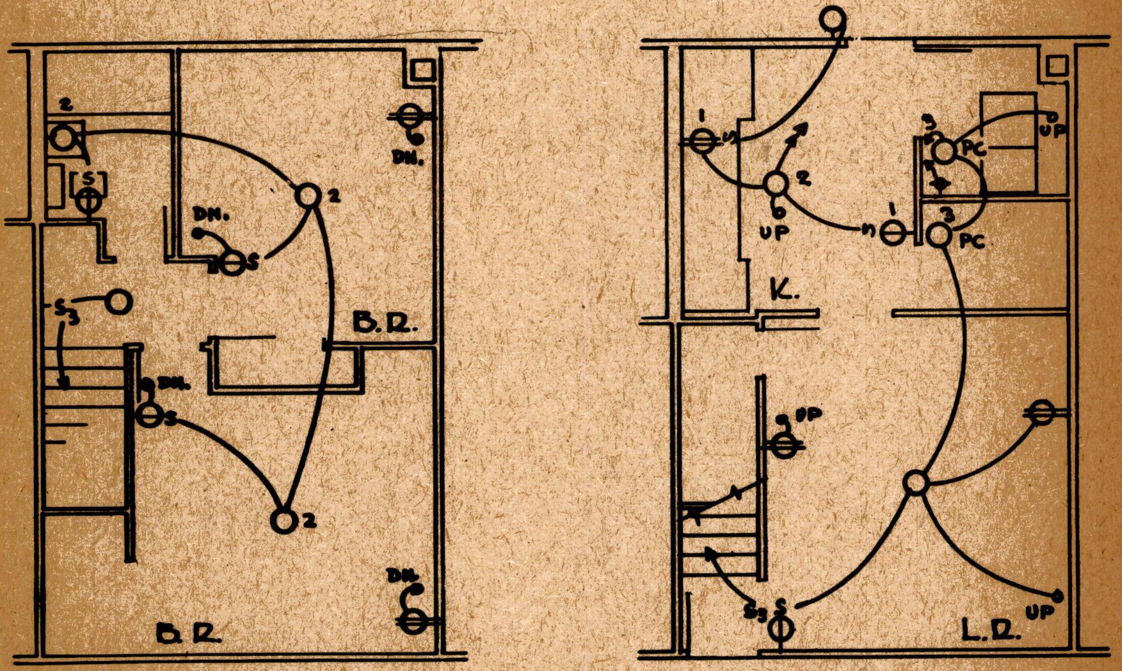


SECOND FLOOR FIRST FLOOR

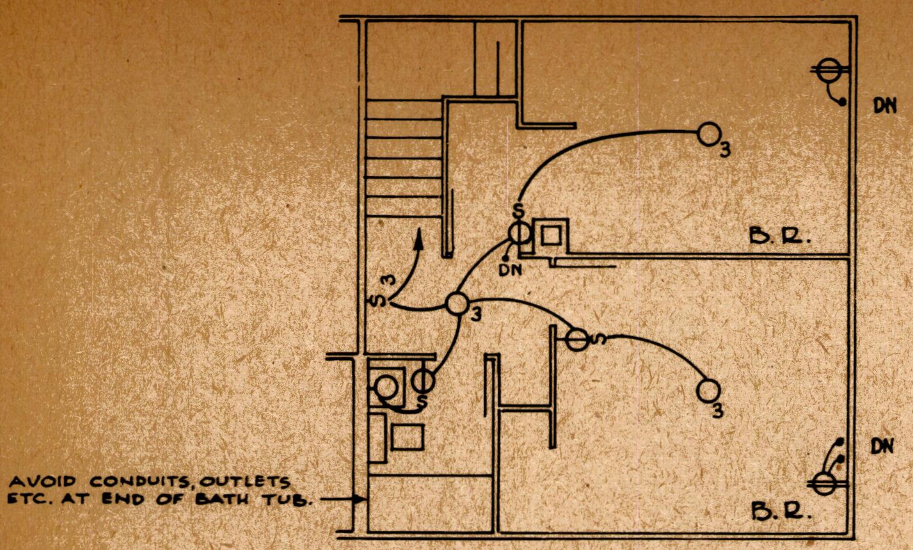
TWO STORY 2 B.R. UNIT

APPROVED

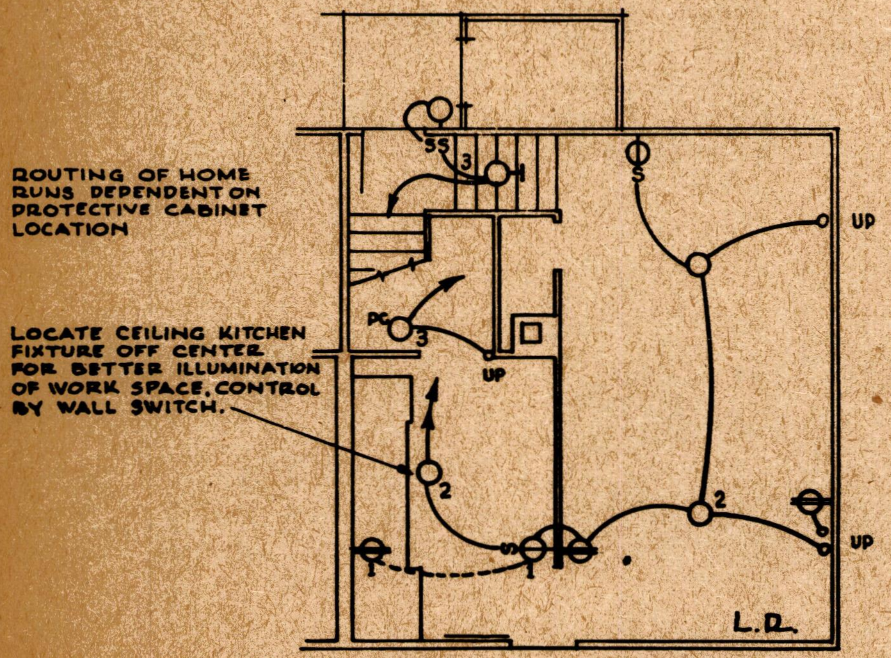
REVISED

DATE	TYPICAL WIRING LAYOUT	F. W. A.
FEB. '42	DEFENSE HOUSING • FEDERAL WORKS AGENCY • WASHINGTON D.C.	FIG. E-3

9782



SECOND FLOOR



FIRST FLOOR

TWO STORY 2 B.R. UNIT

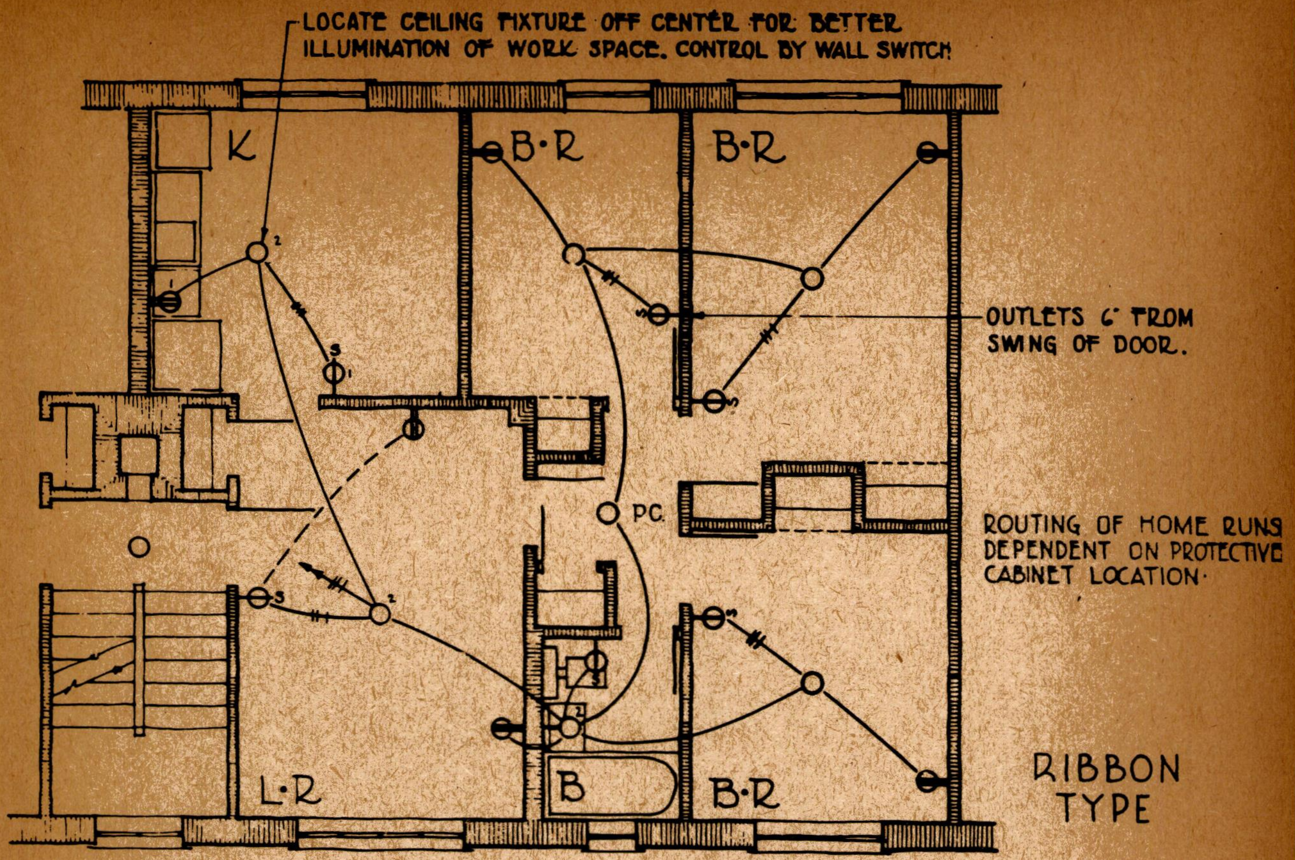
APPROVED

APPROVED

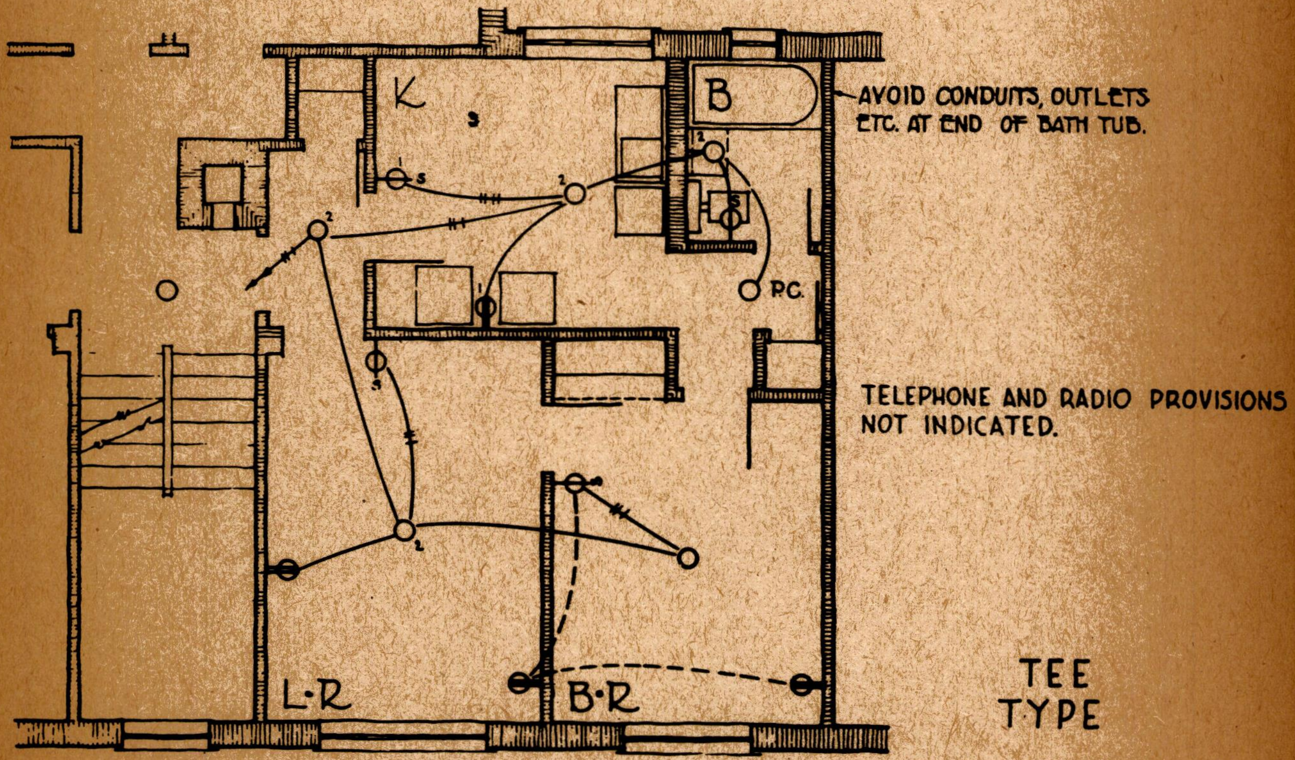
APPROVED

REVISED

DATE	TYPICAL WIRING LAYOUT	F. W. A.
FEB. '42	DEFENSE HOUSING • FEDERAL WORKS AGENCY • WASHINGTON D.C.	FIG. E-4



RIBBON TYPE



TEE TYPE

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DATE	WIRING PLAN FOR APARTMENTS	F.W.A.
FEB. '42	DEFENSE HOUSING • FEDERAL WORKS AGENCY • WASHINGTON D.C.	FIG. E-5

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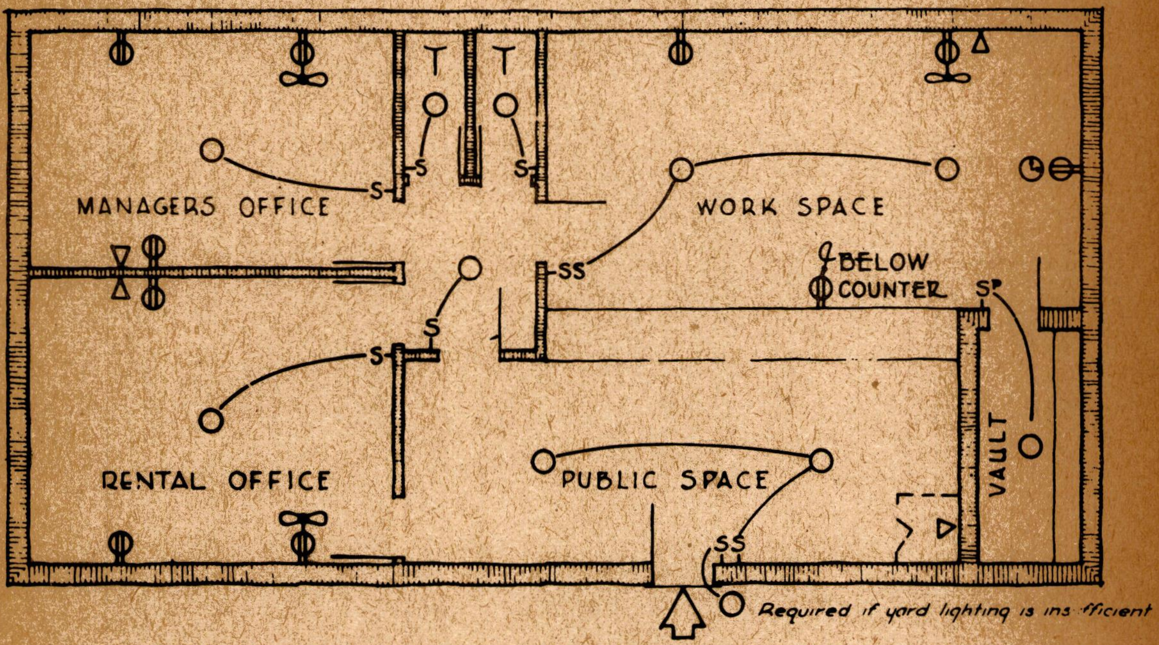

THIS LAYOUT IS TO INDICATE THE ARRANGEMENT OF ELECTRICAL WORK ONLY FOR THE VARIOUS SPACES THIS PLAN IS NOT NECESSARILY APPLICABLE FOR BUILDING DESIGN

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DATE	MANAGEMENT SPACE	F.W.A.
FEB. '42	DEFENSE HOUSING · FEDERAL WORKS AGENCY · WASHINGTON D.C.	FIG. E-6

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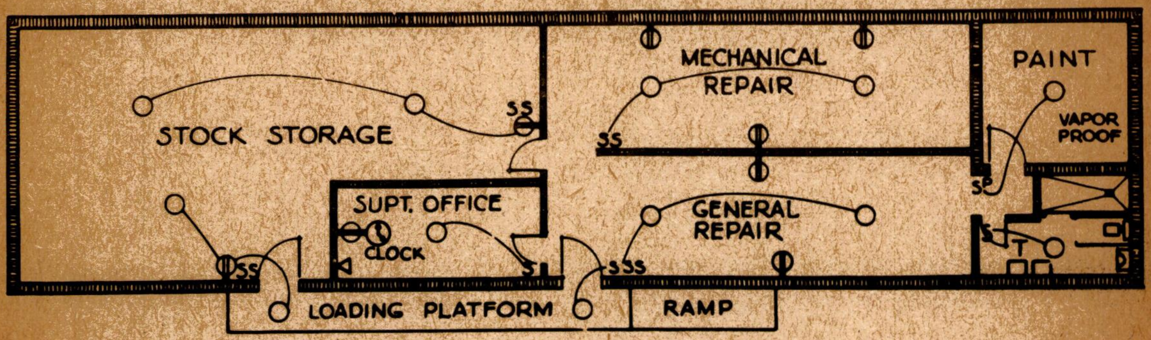

THIS LAYOUT IS TO INDICATE THE ARRANGEMENT OF ELECTRICAL WORK ONLY FOR THE VARIOUS SPACES THIS PLAN IS NOT NECESSARILY APPLICABLE FOR BUILDING DESIGN.

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DATE.	WIRING PLAN FOR MAINTENANCE AND WORK SPACES	F. W. A.
FEB. '42	DEFENSE HOUSING · FEDERAL WORKS AGENCY · WASHINGTON D.C.	FIG. E-7

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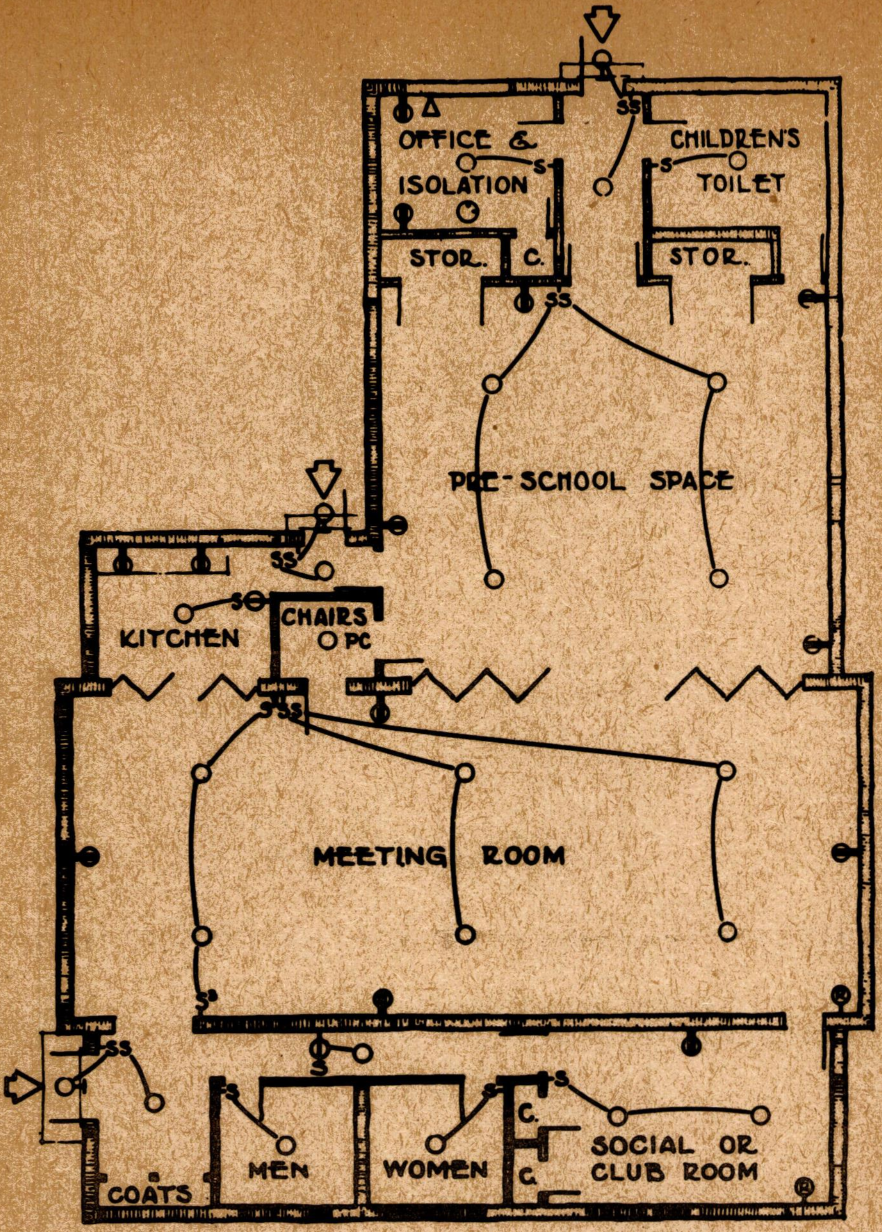

THIS LAYOUT IS TO INDICATE THE ARRANGEMENT OF ELECTRICAL WORK ONLY FOR THE VARIOUS SPACES. THIS PLAN IS NOT NECESSARILY APPLICABLE FOR BUILDING DESIGN.

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DATE	WIRING PLAN FOR SOCIAL & RECREATIONAL SPACES	F.W.A.
FEB. '42	DEFENSE HOUSING · FEDERAL WORKS AGENCY · WASHINGTON D.C.	FIG. E-8

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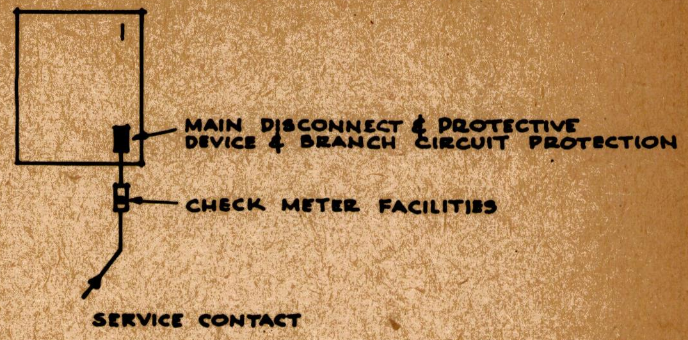

SINGLE

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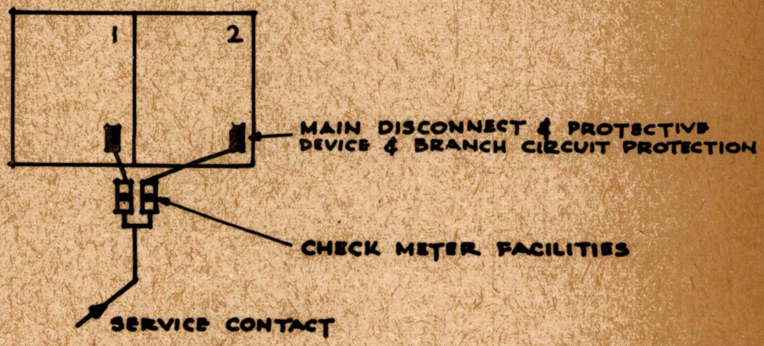

TWIN

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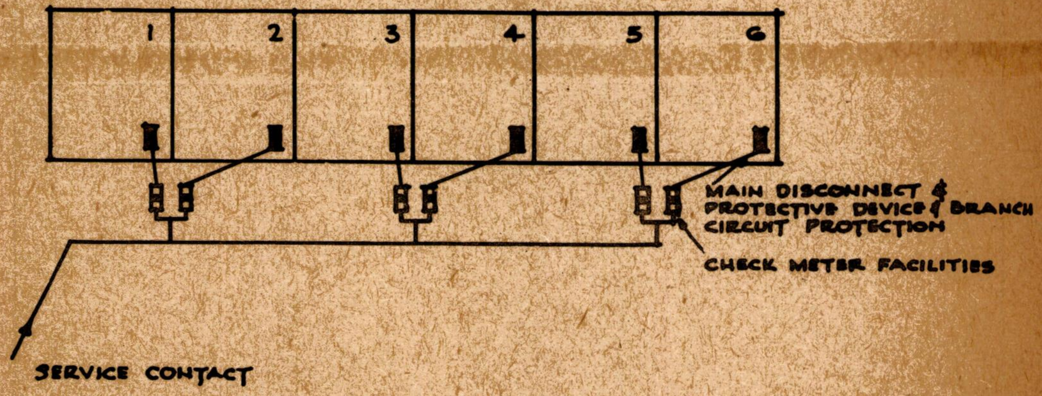

GROUP

REVISED

DATE	FEEDER AND BRANCH WIRING (SINGLE TWIN AND GROUP)	F. W. A.
FEB. '42	DEFENSE HOUSING • FEDERAL WORKS AGENCY • WASHINGTON D.C.	FIG. E-10

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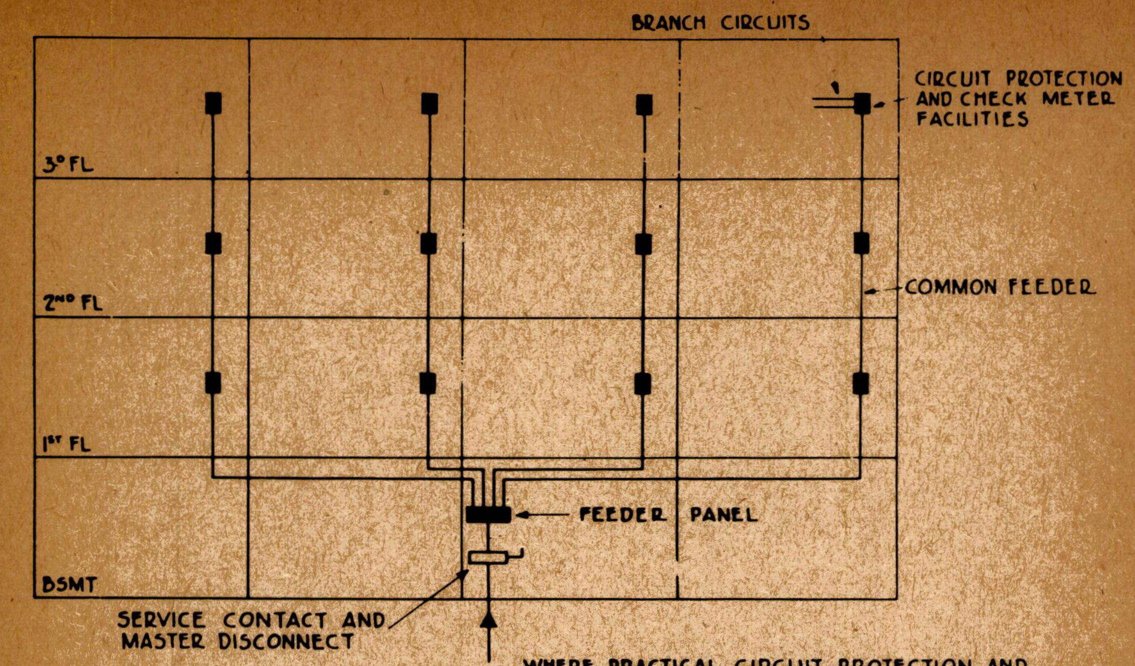
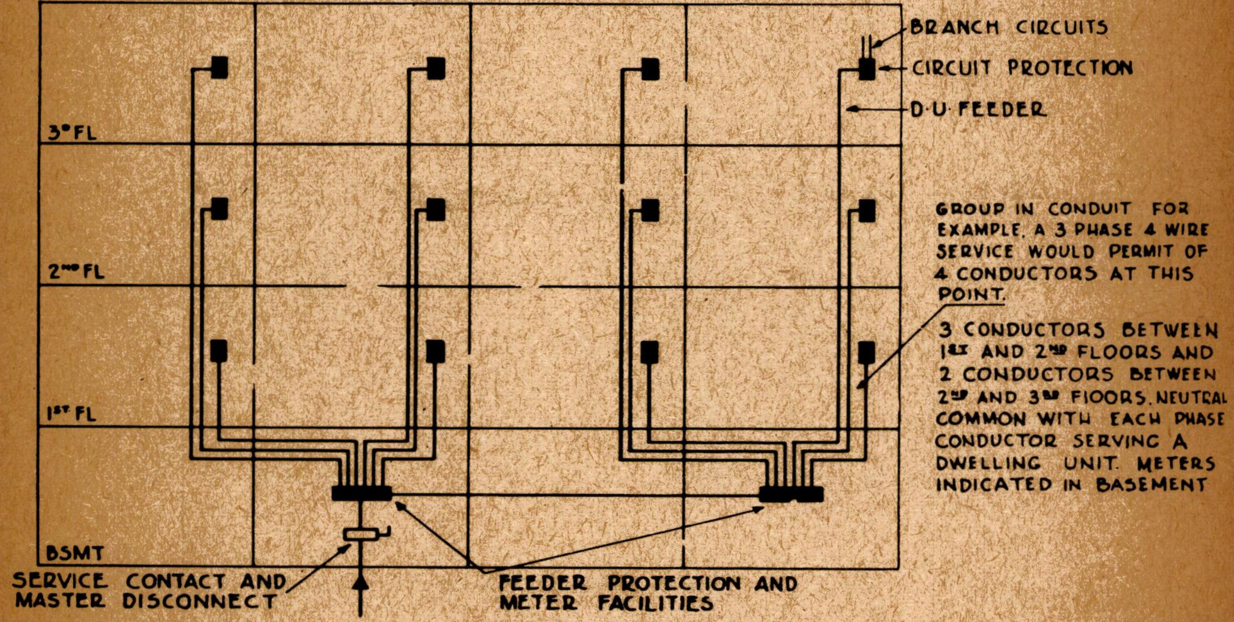


WHERE PRACTICAL, CIRCUIT PROTECTION AND METER FACILITIES MAY BE GROUPED ON EACH FLOOR OR EVERY OTHER FLOOR, SERVING THREE FLOORS; LOCATING IN PUBLIC STAIR HALL

INDIVIDUAL DISTRIBUTION CENTERS



WHERE PRACTICAL, CIRCUIT PROTECTION AND METER FACILITIES MAY BE GROUPED ON EACH FLOOR OR EVERY OTHER FLOOR, SERVING THREE FLOORS; LOCATING IN PUBLIC STAIR HALL

GROUP DISTRIBUTION CENTERS

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REVISED ____ ____ ____ ____

DATE	FEEDER & BRANCH WIRING (APARTMENT TYPE BLDGS.)	F.W.A.
FEB. '42	DEFENSE HOUSING · FEDERAL WORKS AGENCY · WASHINGTON D.C.	FIG. E-11

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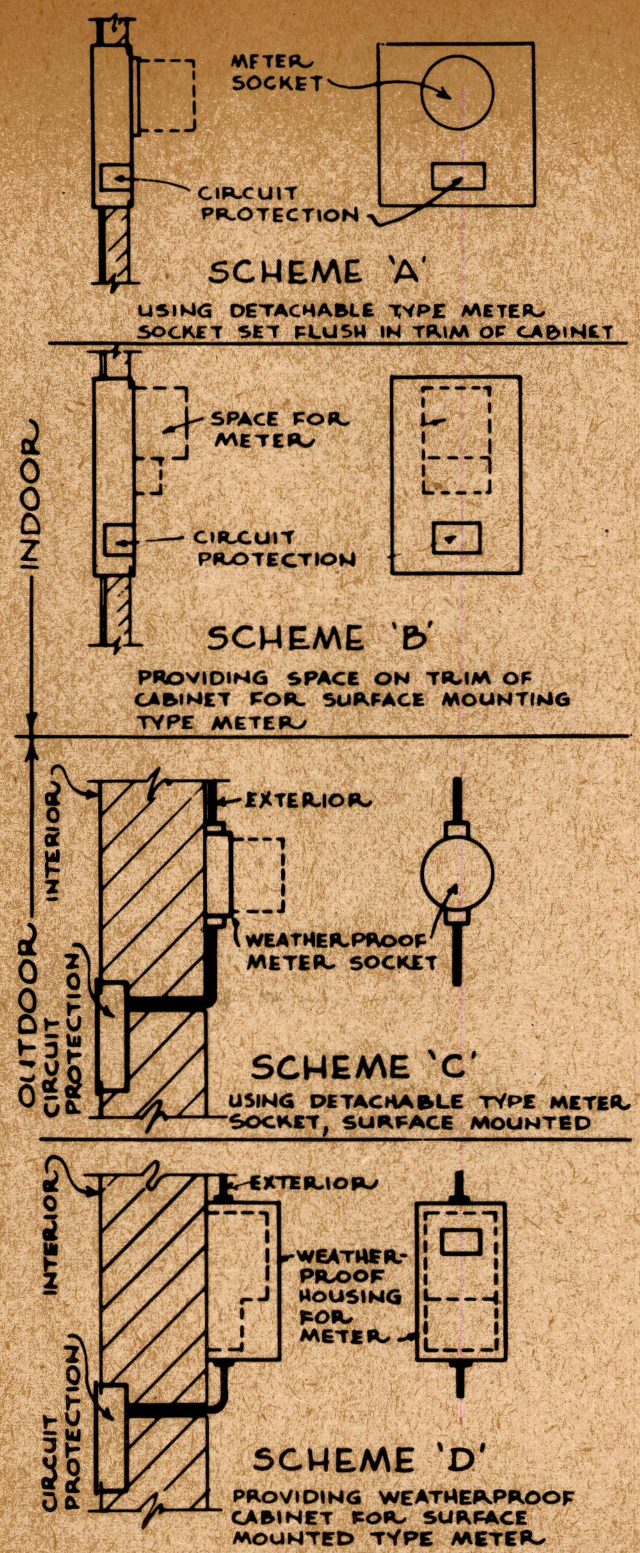

REVISED

DATE	INDIVIDUAL DISTRIBUTION AND METERING CENTERS	F. W. A.
FEB. '42	DEFENSE HOUSING • FEDERAL WORKS AGENCY • WASHINGTON D.C.	FIG. E-12

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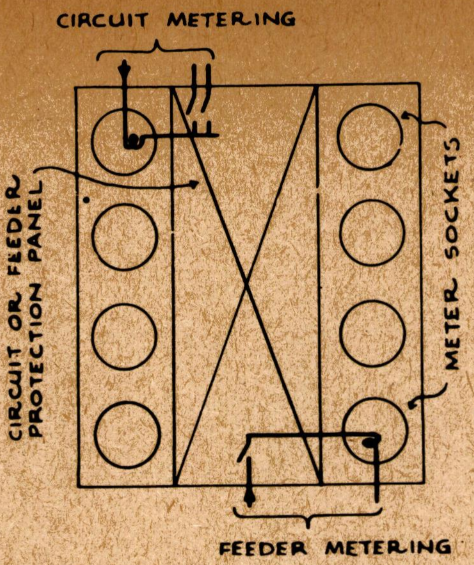
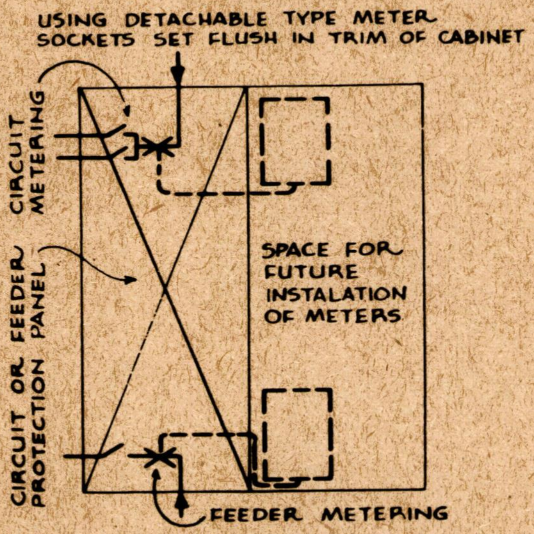
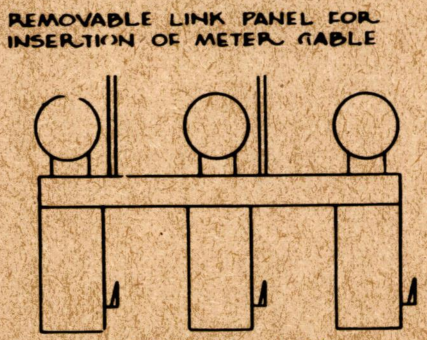


SCHEME 1'A'



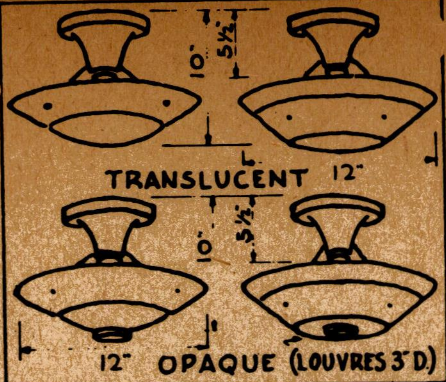
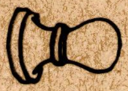
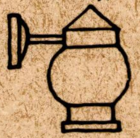
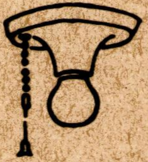
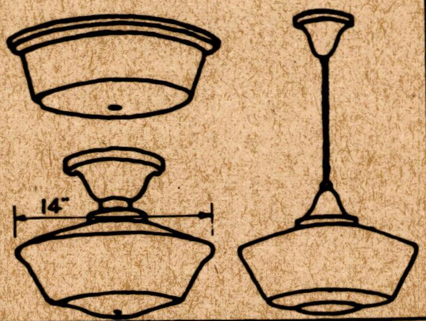
SCHEME 1'B'



SCHEME 1'C'

REVISED

DATE	GROUP DISTRIBUTION AND METERING CENTERS	F. W. A.
FEB. '42	DEFENSE HOUSING • FEDERAL WORKS AGENCY • WASHINGTON D.C.	FIG. E-13

LIVING ROOM	
BED ROOM	TRANS. SAME AS ABOVE, BUT 8½" MIN. D. OPAQUE " " " 9½" MIN. D. OVERALL HT. APPROX. 9½" (NO LOUVRE)
KITCHEN	
HALLS, PUBLIC STAIRS AND VESTIBULES	
BATH ROOM	
EXTERIOR BRACKET	
UTILITY ROOM	
SOCIAL ROOMS STORES OFFICES	

NOTE: THE DESIGNS INDICATED ABOVE ARE GIVEN ONLY TO CONVEY THE DESIRE FOR SIMPLICITY. FIXTURES SIMILAR IN DESIGN SHOULD BE CONSIDERED.

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DATE	INTERIOR LIGHTING FIXTURES	F. W. A.
FEB. '42	DEFENSE HOUSING · FEDERAL WORKS AGENCY · WASHINGTON D.C.	FIG. E-14

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This schedule is based on underground distribution system serving dwelling units with LIGHTING REFRIGERATION AND RANGES. Project lighting included, but not project power.

Number of D.U.	KW Per D.U.	Total KW	Amp. at 230 V. 3 wire 1 phase	Amp. at 208 V. 3 phase 4 wire
1	4	4	17.4	11.3
2	3.65	7.3	31.7	20.2
3	3.3	9.9	43.0	27.5
4	3.2	12.8	55.8	35.6
5	3.2	16.0	70.0	44.5
6	3.2	19.2	83.6	53.5
7	3	21.0	91.5	58.4
8	2.8	22.4	97.9	62.4
9	2.7	24.3	106.0	67.6
10	2.6	26.0	113.0	72.2
11	2.5	27.5	119.0	76.3
12	2.45	29.4	128.0	81.6
13	2.40	31.2	135.7	86.6
14	2.35	32.9	143.0	91.3
15	2.30	34.5	150.0	95.8
16	2.25	36.0	157.0	100
17	2.20	37.4	163.0	103.8
18	2.15	38.7	168.0	107.5
19	2.10	39.9	173.0	110.8
20	2.05	41.0	178.0	113.8
21	2	42.0	182.5	116.6
22	1.95	42.9	187.0	119.1
23	1.90	43.6	190.0	121.1
24	1.85	44.5	193.0	123.6
25	1.80	45.0	196.5	125.0
26	1.75	45.5	197.5	126.3
27	1.70	45.9	199.0	127.5
28	1.65	46.3	201.0	128.6
29	1.63	47.3	203.0	131.3
30	1.62	48.0	212.0	135.5
31	1.60	49.5	219.5	137.5
32	1.59	50.9	221.0	141.3
33	1.58	52.3	227.0	145.05
34	1.57	53.4	232.0	148.3
35	1.56	54.6	238.0	151.6
36	1.55	55.9	243.0	155.4
37	1.54	57.1	249.0	158.6
38	1.53	58.2	253.0	161.8
39	1.52	59.4	258.0	165
40	1.51	60.5	263	168.05
41	1.50	61.5	267.5	170.8
42	1.49	62.6	272.0	173.8
43	1.48	63.8	277.5	177.2
44	1.47	64.9	282.0	180.2
45	1.46	66.0	287.0	183.2
46	1.45	66.8	291.0	185.5
47	1.44	67.7	294.0	188.05
48	1.43	68.6	298.0	190.05
49	1.42	69.4	302.5	192.7
50	1.41	70.5	306.0	195.2
51	1.40	71.4	310.4	198.3
52	1.40	72.8	316.5	202.2
53	1.40	74.2	322.6	206
54	1.40	75.6	328.7	210
55	1.40	77	334.8	213.9
56	1.40	78.4	341	217.8
57	1.40	79.8	347	221.7
58	1.40	81.2	353	225.5
59	1.40	82.6	359	229.4
60	1.40	84	365	233.3

Number of D.U.	KW Per D.U.	Total KW	Amp. at 230 V 3 wire 1 phase	Amp. at 208 V 3 phase 4 wire
61	1.40	85.4	371.3	237.2
62	1.40	86.8	377	241.1
63	1.40	88.2	383.4	245
64	1.40	89.6	389.6	248.9
65	1.40	91	395.7	252.7
66	1.40	92.4	401.7	257
67	1.40	93.8	407.8	260.5
68	1.40	95.2	413.9	264.5
69	1.40	96.6	420	268.5
70	1.40	98	426	272.2
71	1.40	99.4	432	276
72	1.40	100.8	438	280
73	1.40	102.2	444.5	284.1
74	1.40	103.6	450.4	287.8
75	1.40	105	456.5	291.8
76	1.40	106.4	462.6	295.5
77	1.40	107.8	468.6	299.5
78	1.40	109.2	474.7	303.5
79	1.40	110.6	480.8	307.6
80	1.40	112	486.9	311
81	1.40	113.4	493	315
82	1.40	114.8	499	318.8
83	1.40	116.2	505	322.7
84	1.40	117.6	511	326.8
85	1.40	119	517	330.5
86	1.40	120.4	523.4	334.5
87	1.40	121.8	529.5	338.5
88	1.40	123.2	535.6	342.2
89	1.40	124.6	541.7	346
90	1.40	126	547.8	350
91	1.40	127.4	553.9	353.8
92	1.40	128.8	560	357.8
93	1.40	130.2	566	361.9
94	1.40	131.6	572	365.5
95	1.40	133	578	369.5
96	1.40	134.4	584	373.5
97	1.40	135.8	590.4	377.2
98	1.40	137.2	596.5	381
99	1.40	138.6	602.6	385.5
100	1.40	140	608.6	388.8
101 - 500	1.40	—	—	—
501 - 600	1.30	—	—	—
601 - 800	1.25	—	—	—
801 - 2000	1.20	—	—	—
2001 - 4000	1.10	—	—	—

Note:
1. The above figures are to be used for underground secondary distribution system and are based on the use of the conventional type transformer.
2. For an overhead secondary distribution system, reduce the figures by 30%.
3. For transformers in well ventilated vaults, reduce the figures by 20%.
4. For transformers on poles, reduce the figures by 30%.

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DATE	DEMANDS FOR SIZING FEEDERS & TRANSFORMERS-INCL. RANGES	F.W.A.
FEB. '42	DEFENSE HOUSING · FEDERAL WORKS AGENCY · WASHINGTON D.C.	FIG. E-103

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This schedule is based on underground distribution system serving dwelling units with LIGHTING ONLY or with LIGHTING AND REFRIGERATION. Project lighting included but not project power

	Lighting Only				Lighting and Refrigeration			
Number of D.U.	KW Per D.U.	Total KW	Amps. 230 V. Single Phase	Amps. 208 V. 3 phase 4 wire	KW Per D.U.	Total KW	Amps. 230 V. Single Phase	Amps. 208 V. 3 phase 4 wire
1	.805	.805	3.5	2.24	.955	.955	4.15	2.65
2	.775	1.55	6.74	4.18	.920	1.84	8.00	5.11
3	.745	2.24	9.74	6.22	.885	2.65	11.08	7.25
4	.270	2.88	12.51	8.00	.855	3.42	14.86	9.5
5	.708	3.54	15.40	9.84	.838	4.19	18.2	11.6
6	.698	4.19	18.20	11.63	.823	4.94	21.4	13.7
7	.688	4.81	20.90	13.37	.808	5.65	24.6	15.7
8	.659	5.35	23.22	14.87	.784	6.27	27.2	17.4
9	.660	5.94	25.80	16.50	.770	6.93	30.1	19.2
10	.652	6.52	28.35	18.11	.757	7.57	32.9	21.1
11	.646	7.11	30.95	19.75	.746	8.20	35.6	22.8
12	.638	7.65	33.11	21.21	.735	8.82	38.3	24.5
13	.630	8.20	35.62	22.78	.724	9.40	40.8	26.1
14	.625	8.75	38.00	24.30	.716	10.05	43.6	27.9
15	.620	9.30	40.40	25.80	.708	10.61	46.2	29.5
16	.615	9.85	42.80	27.38	.700	11.20	48.7	31.1
17	.610	10.40	45.20	28.90	.695	11.82	51.4	32.8
18	.605	10.90	47.40	30.25	.690	12.41	54.0	34.5
19	.600	11.40	49.50	31.65	.685	13.00	56.6	36.2
20	.595	11.90	51.70	33.00	.680	13.6	59.1	37.8
21	.590	12.40	53.90	34.40	.675	14.2	61.6	39.4
22	.585	12.90	56.10	35.80	.670	14.75	64.1	41.0
23	.580	13.40	58.20	37.20	.665	15.30	66.5	42.5
24	.575	13.80	60.00	38.15	.660	15.85	68.9	44.0
25	.570	14.25	61.90	39.60	.652	16.3	70.9	45.3
26	.565	14.70	63.90	40.80	.647	16.82	73.2	46.8
27	.560	15.10	65.60	41.90	.642	17.33	75.2	48.1
28	.555	15.50	67.4	43.0	.637	17.83	77.7	49.7
29	.550	15.95	69.4	44.3	.632	18.25	80.0	50.8
30	.545	16.35	71.1	45.4	.624	18.64	81.4	51.2
31	.540	16.75	72.8	46.6	.619	19.18	83.5	53.3
32	.535	17.10	74.3	47.5	.614	19.64	85.3	54.5
33	.530	17.50	76.1	48.6	.609	20.09	87.4	55.7
34	.525	17.85	77.6	49.6	.604	20.53	89.5	57.2
35	.520	18.20	79.1	50.6	.595	20.80	90.7	58.3
36	.515	18.55	80.6	51.5	.590	21.24	92.5	59.1
37	.510	13.90	92.2	52.5	.585	21.64	94.1	60.2
38	.505	19.20	83.4	53.4	.580	22.04	96.0	61.3
39	.500	19.50	84.8	54.2	.575	22.42	97.5	62.4
40	.495	19.80	86.1	55.0	.567	22.68	98.7	63.0
41	.490	20.10	87.4	55.8	.562	23.0	100.00	63.9
42	.485	20.40	88.7	56.6	.557	23.4	101.7	65.0
43	.480	20.60	89.5	57.2	.552	23.85	103.5	66.0
44	.475	20.90	90.8	58.0	.547	24.1	104.8	66.9
45	.470	21.20	92.2	58.9	.539	24.25	105.3	67.4
46	.465	21.40	93.0	59.5	.534	24.6	107.0	68.3
47	.460	21.60	93.9	60.0	.529	24.85	108.0	69.0
48	.455	21.80	94.8	60.5	.524	25.19	109.2	69.9
49	.450	22.10	96.1	61.4	.519	25.41	110.6	70.7
50-100	.435				.500			
101-200	.425				.488			
201-300	.400				.460			
301-600	.350				.408			
601-800	.300				.355			
801-1500	.250				.300			
1501-2000	.225				.270			
2001-4000	.200				.240			

Remarks:

1. The above figures are to be used for underground secondary distribution system and are based on the use of the conventional type transformer.
2. For overhead secondary distribution system and transformers on poles, reduce the figures by 25%
3. For transformers in well ventilated vaults, reduce the figures by 15%.

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DATE	DEMANDS FOR SIZING FEEDERS & TRANSFORMERS-EXCL. RANGES	F. W. A.
FEB. '42	DEFENSE HOUSING • FEDERAL WORKS AGENCY • WASHINGTON D.C.	FIG. E-104

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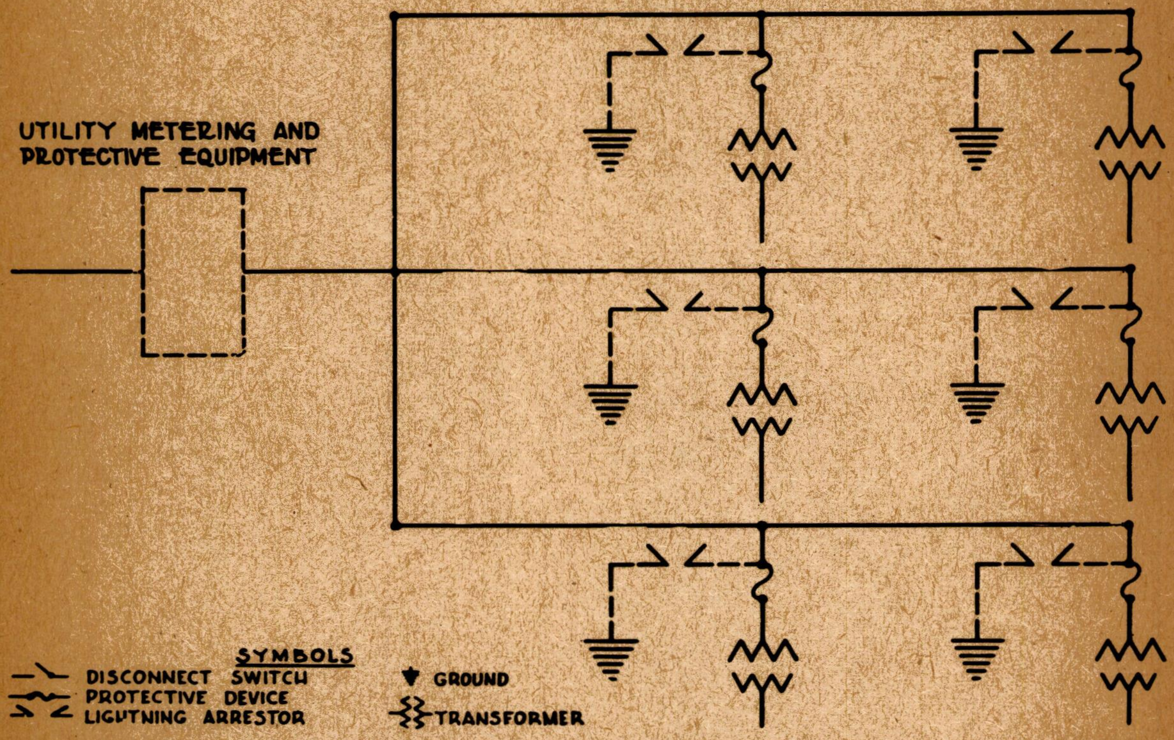

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DATE	RADIAL SYSTEM	F. W. A.
FEB. '42	DEFENSE HOUSING • FEDERAL WORKS AGENCY • WASHINGTON D.C.	FIG. E-15

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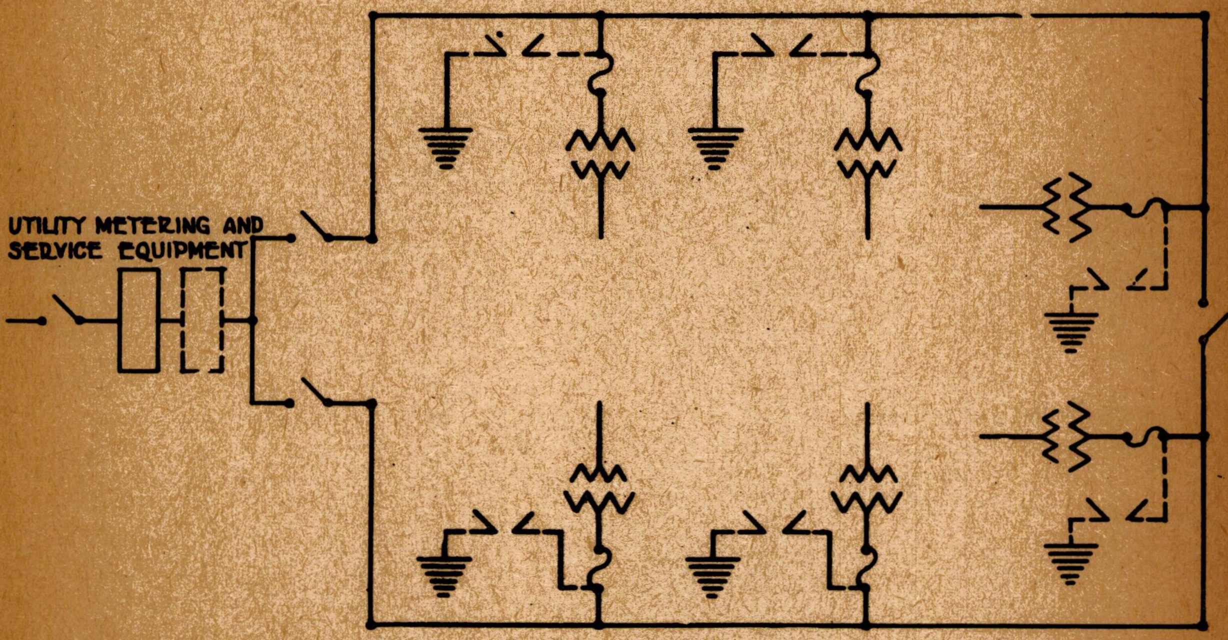

SYMBOLS

DISCONNECT SWITCH
PROTECTIVE DEVICE
LIGHTNING ARRESTOR
GROUND
TRANSFORMER

REVISED

DATE	LOOP SYSTEM	F. W. A.
FEB. '42	DEFENSE HOUSING • FEDERAL WORKS AGENCY • WASHINGTON D.C.	FIG. E-16

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Maximum "d" in feet — Lead "L" = 1/4 H

Number of #1/0's or Equivalent*	1 guy, Cone 8"	1 guy, Cone 16"	2 guys, Cone 23"	3 guys, Log	4 guys, Log
1	15	Dead End			
2	8	31	Dead End		
3	5	20	41	Dead End	
4	4	16	31	46	Dead End
5	3	12	24	37	49
6	3	10	20	31	41
7	2	9	17	26	35
8	2	8	15	23	31
9	2	7	14	20	27
10	2	6	12	18	24
11	1	6	11	17	22
12	1	5	10	15	20
13	1	5	9	14	19
14	1	4	9	14	17
15	1	4	8	12	16

Maximum "d" in feet — Lead "L" = 1/3 H

Number of #1/0's or Equivalent*	1 guy, Cone 8"	1 guy, Cone 16"	2 guys, Cone 23"	3 guys, Log	4 guys, Log
1	20	Dead End			
2	10	40	Dead End		
3	7	27	53	Dead End	
4	5	20	40	Dead End	
5	4	16	32	43	Dead End
6	3	13	27	40	53
7	3	11	23	34	46
8	2	10	20	30	40
9	2	9	18	27	35
10	2	8	16	24	32
11	2	7	14	22	29
12	2	7	13	20	27
13	2	6	12	18	25
14	1	6	11	17	23
15	1	5	11	16	21

Maximum "d" in feet — Lead "L" = 1/2 H

Number of #1/0's or Equivalent*	1 guy, Cone 8"	1 guy, Cone 16"	2 guys, Cone 23"	3 guys, Log	4 guys, Log
1	28	Dead End			
2	14	Dead End			
3	9	37	Dead End		
4	7	28	Dead End		
5	6	22	50	Dead End	
6	5	19	37	Dead End	
7	4	16	32	48	Dead End
8	4	14	28	42	Dead End
9	3	12	25	37	50
10	3	11	22	34	45
11	3	10	20	31	41
12	2	9	19	28	37
13	2	9	17	26	35
14	2	8	16	24	33
15	2	7	16	22	30

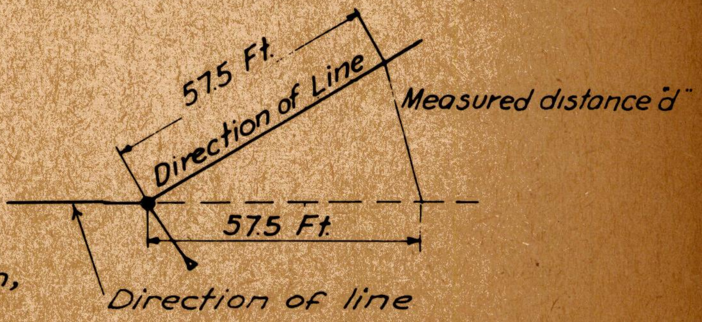
Maximum "d" in feet — Lead "L" = H

Number of #1/0's or Equivalent*	1 guy, Cone 8"	1 guy, Cone 16"	2 guys, Cone 23"	3 guys, Log	4 guys, Log
1	44	Dead End			
2	22	Dead End			
3	15	Dead End			
4	11	44	Dead End		
5	9	36	Dead End		
6	7	30	Dead End		
7	6	25	51	Dead End	
8	6	22	44	Dead End	
9	5	20	40	Dead End	
10	4	18	36	53	Dead End
11	4	16	32	49	Dead End
12	4	15	30	44	Dead End
13	3	14	27	41	54
14	3	13	25	38	51
15	3	12	24	36	47

Equivalents

#6 solid = 0.26 - #1/0's
#4 solid = 0.39 - #1/0's
#2 stranded = 0.64 - #1/0's
#1/0 stranded = 1.0 - #1/0's
#2/0 stranded = 1.23 - #1/0's
#3/0 stranded = 1.54 - #1/0's
#4/0 stranded = 2.0 - #1/0's

For straight line construction, use the "dead end" columns opposite equivalent loads to find anchor and guy sizes.



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DATE	GUYING OF POLE LINE	F.P.H.A.
FEB. '42	DEFENSE HOUSING - NATIONAL HOUSING AGENCY - WASHINGTON, D.C.	FIG. E-18

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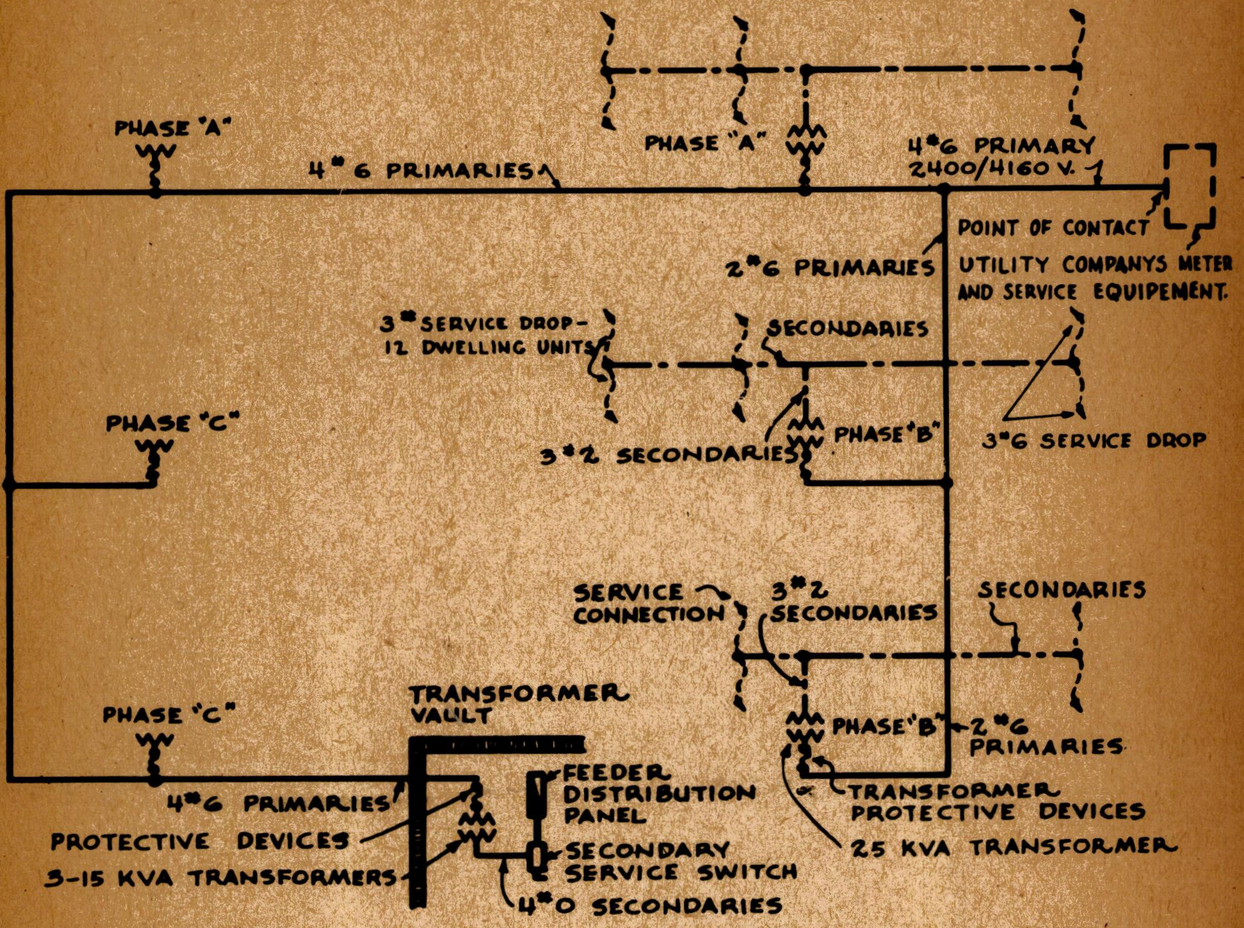

NOTE: THIS DRAWING IS FOR EXAMPLE ONLY. THE LAYOUT, WIRE SIZES, AND TRANSFORMER CAPACITIES INDICATED SHOULD BE CHANGED TO SUIT THE PARTICULAR PROJECT.

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DATE	SAMPLE ONE LINE DIAGRAM	F.W.A.
FEB. '42	DEFENSE HOUSING • FEDERAL WORKS AGENCY • WASHINGTON D.C.	FIG. E-19

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NOTES:

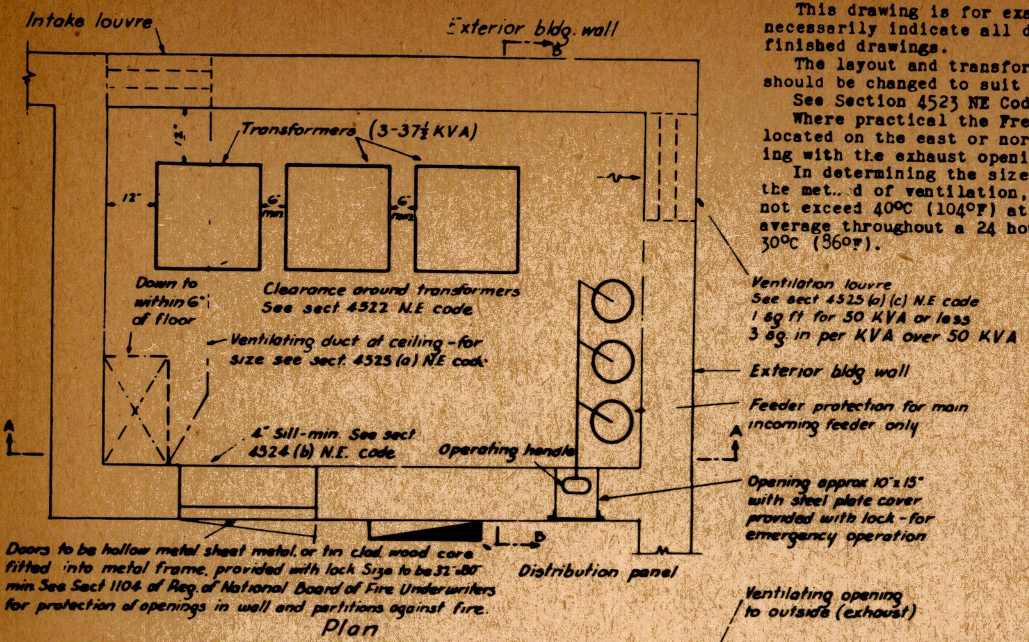
This drawing is for example only and does not necessarily indicate all data required for finished drawings.

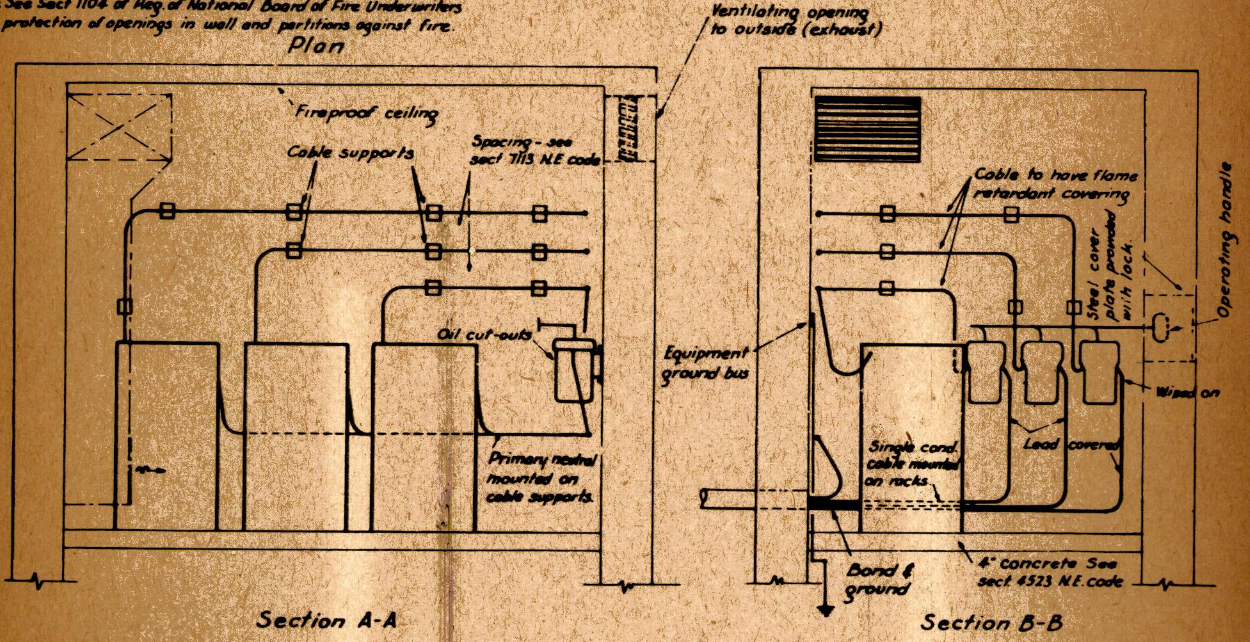
The layout and transformer capacities indicated should be changed to suit the particular project.

See Section 4523 NE Code for wall construction.

Where practical the Fresh Air Intake shall be located on the east or north exposure of the building with the exhaust opening diagonally opposite.

In determining the size of the transformers and the met..d of ventilation, room temperatures shall not exceed 40°C (104°F) at any period, or shall the average throughout a 24 hour period be greater than 30°C (86°F).





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DATE	SAMPLE LAYOUT OF TRANSFORMER VAULT EQUIP. (UNDERG'D DIS.)	F. W. A.
FEB. '42	DEFENSE HOUSING · FEDERAL WORKS AGENCY · WASHINGTON D.C.	FIG. E-20

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