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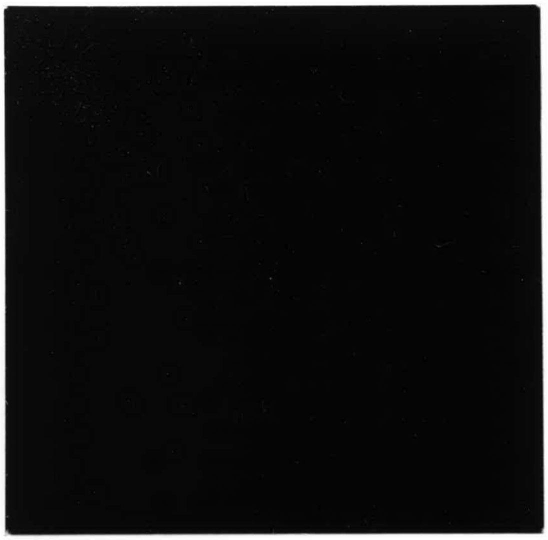

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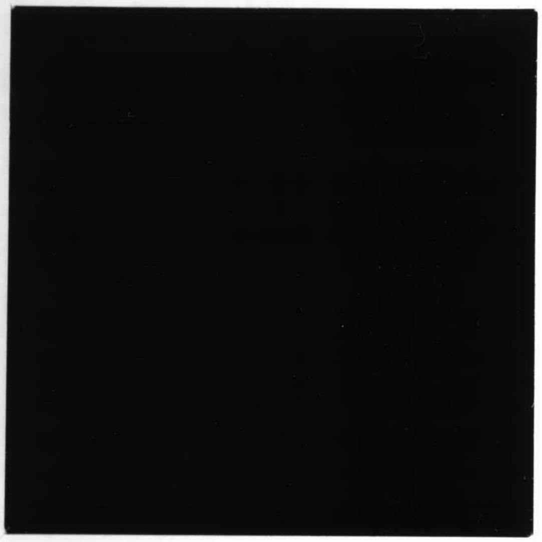

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J. N. Pease Associates

Narrative and Data for
Planning Study for
Exchange and Community
Center
Project N 518
New River Marine Corps
Air Station (H)
Camp Lejeune
Jacksonville, North Carolina

May 12, 1977

Comm. No. 4668

INDEX | PAGE

MASTER PLAN REPORT

Exchange and Community Center, Project N518 New River Marine Corps Air Station (Helicopter), Camp Lejeune, Jacksonville, North Carolina

01.00 INTRODUCTION

01.01 The architectural, engineering, planning firm of J.N. Pease Associates was selected in May of 1976 to prepare a master plan for development of a shopping and recreational complex for the military communities of Camp Geiger and the New River Marine Corps Air Station (Helicopter).

01.02 The project involved the preparation of a topographic survey of a site selected by the Navy for use as an exchange and community center complex. This site was selected by the Navy due to the favorable building characteristics and accessibility from adjacent facilities and military personnel. The close proximity to electrical power, water and sewer service as well as steam lines were very important considerations in the selection process. More specific information concerning the selection of the site can be found in the Master Plan for the Camp Lejeune Complex.

01.03 The community center complex is expected to be completed over a number of years and the exchange and auto service station are the only two buildings currently funded for construction. Therefore, phasing of construction in the first stage was of great importance in the design of the total development.

02.00 PROGRAM

02.01 The community center is to contain nineteen structures ranging in size from 1,900 square feet to 42,000 square feet. The range of structures is shown in the following table with approximate space requirements as previously determined by the Navy:

	Facility	Square Feet
1.	Chapel and Religious Education	10,710
2.	Child Care Center	2,475
3.	Commissary	18,500
4.	Cafeteria	9,300
5.	Credit Union	2,800
6.	Bank	1,900
7.	Thrift Shop	2,500
8.	Theatre	10,900
9.	Post Office	6,325
10.	Bowling Alley	15,200
11.	Art and Craft (Hobby Shop)	4,600
12.	Youth Center	9,250
13.	Library	7,875
14.	Exchange	30,282
15.	NCO Club	22,000
16.	Enlisted Men's Club	12,800
17.	Gymnasium	42,000
18.	Automotive Hobby Shop	8,000
19.	Service Station and Car Wash	4,390
		221,807

02.02 Additional recreational facilities such as tennis courts and ballfields have been incorporated into the master plan in order to supplement the gymnasium facilities.

03.00 THE SITE

03.01 The proposed site consists of a triangular piece of timber land surrounded by Curtis Road to the north and a dirt road to the south near the Bachelor Enlisted Quarters. Seaboard Coast Lines Railroad creates the third boundary on the eastern edge of the property. The Delalio School is located adjacent within the triangular piece of property in the northeast quadrant.

03.02 The land is relatively flat with the exception of several manmade mounds near the dirt road. The site is mostly wooded with a mixture of pine and hardwood vegetation with most trees under 12" caliper in size. The site has a high water table which is common throughout the base and will require special consideration for design of foundations and other underground structures.

03.03 An environmental impact assessment has been prepared for the project and is included with this narrative in Appendix 01.

04.00 CONCEPT NARRATIVE

04.01 The master plan has been designed to solve problems relating to the existing traffic flow, utilities, the future surrounding elements, and the immediate need of the new Exchange facility. These have been done in the most economical and effective way.

04.02 The plan has two distinctive areas which are created by the extension of "A" Street from Curtis Road to the existing "dirt road". The area between the "A" Street extension and the Seaboard Coast Line Railroad has been developed as a recreational complex. This area was selected for such purpose due to the close proximity to the Bachelor Enlisted Quarters.

04.03 The shopping complex occupies the second area of development along the "dirt road", "A" Street extension and Curtis Road. This area is easily "phased" so that gradual development of the land can take place without interfering with existing structures or phases. It is assumed that after the Exchange is completed that development would occur from the "A" Street extension to the west and south and thus allow minimum interruption to those facilities in operation at that time.

04.04 The concept after all buildings are completed would be an arrangement of facilities that would provide a neighborhood shopping center and circulation between buildings within the complex would be via covered pedestrian walkways. The concept would reduce the total number of parking spaces required as compared to individual construction of each facility with separate parking areas. A more detailed analysis of the parking facilities and vehicular circulation is shown in Sections 5 & 6.

Additional advantages of improved service to the two military communities are obvious and this convenience would also create larger sales for the various commercial buildings.

04.05 Service access to the building is hidden from public view and is separate from the public entrances and pedestrian areas. These areas are also easily accessible by service vehicles and do not require truck traffic to flow through parking areas in order to reach the service areas.

04.06 Natural buffer areas and undisturbed areas have been provided in the master plan to allow for expansion of the facilities as well as to provide a high degree of aesthetic appeal to the users of the recreation/shopping complex. The existing manmade "mounds" have been maintained in order to screen the adjacent service area as well as to provide some interest and relief to the otherwise flat surroundings. The buffer areas will also be valuable as a sound absorber and an animal habitat for existing animals presently located on the site.

04.07 Landscaped areas will also provide a large amount of visual and aesthetic interest in those areas not preserved in their natural state. These areas would be concentrated primarily next to the buildings and along the pedestrian walkways. Trees in islands throughout the parking areas would provide desirable shade and help break up the vast areas of asphalt paving required for the project.

04.08 Contiguous buildings, or those attached by covered walks in the complex, will be required to be of fire resistive or noncombustible construction, as defined in NAVFAC DM-8. In areas that require the construction of adjacent buildings within the specified limits of separation of buildings, appropriate measures will need to be taken in the design of fire walls.

05.00 TRAFFIC ANALYSIS

05.01 The effect of traffic flow after construction of the Curtis Road Support Complex will undoubtedly create congestion along Curtis Road if additional roads extending "A" Street and Campbell Street are not constructed. It is, therefore, recommended that these extensions, particularly the former, be executed in the near future. These two street extensions will help relieve existing congestion and will provide for a smooth flow around the proposed support facilities complex.

05.02 The most reasonable solution is to direct traffic during the morning rush hour (0645-0745) along the Campbell Street extension and along Curtis Road during the evening rush hour. This in effect will create a counterclockwise circulation around the triangular support facilities complex property, thus allowing an uninterrupted flow around the site. Parking for the operations center and other civilian oriented functions should, therefore, be considered in the area of the existing BEQ's along Bancroft Street. This would allow Bancroft Street to be one-way from the south to the north and thus force a counterclockwise circulation.

05.03 According to the Camp Lejeune Complex Master Plan, 1325 cars enter the Main Gate between 0645 and 0745 and 204 cars exit the base during the same period. We can assume that the design capacity for Curtis Road is approximately 1,500 for both lanes as discussed in AASHO A Policy on Geometric Design of Rural Highways. This design capacity of 1,500 is for uninterrupted flow and is based on an average running speed of 30-35 mph. Since there are already interruptions in Traffic flow along Curtis Road and since there are already more than 1,500 cars during the peak hour, it is evident that the existing road is not sufficient for the present, much less for the future.

05.04 It would appear that the addition of a two-lane road extending to Campbell Street would solve the problem, but analysis of the capacity of this new two-lane road indicates that the total capacity of both roads entering the base would actually be reduced from the present due to the requirement of a traffic signal at the "A" Street and Curtis Road intersection and at the intersection of Curtis Road and Campbell Street Extension. See Appendix 02, Exhibit "A".

05.05 According to AASHO A Policy on Geometric Design of Rural Highways, a three-lane highway will increase the capacity of a two lane highway by a factor of 1.7. By increasing the inbound lane along the Campbell Street Extension from two to three lanes, the capacity changes from 750 VPH to 1,250 VPH for the inbound traffic. The addition of the capacity of Curtis Road to this figure therefore gives a total inbound capacity of 1,750 VPH. See Exhibit "B". This should adequately serve the inbound traffic at peak hours and allow an additional capacity over the existing traffic count of 425 vehicles per hour.

05.06 Similar problems during the afternoon rush hour occur and similar solutions would be required to alleviate congestion and provide smooth flow out of the base. If we assume a capacity of 500 VPH along the Campbell Street Extension and 500 VPH along Curtis Road, the total capacity near the Main Gate would only be around 1,000 VPH. See Appendix 02, Exhibit "C".

05.07 The addition of a third lane to Curtis Road would increase the outbound capacity to 850 VPH and thus provide a total capacity of 1,350 VPH. Some traffic might turn right along "A" Street and go through Camp Geiger and thus reduce the total number of vehicles that would go through the Main Gate. See Appendix 02, Exhibit "E".

05.08 In conclusion, it is recommended that Campbell Street be extended to Curtis Road near the Main Gate in order to facilitate two inbound lanes to serve the Operations Center. A third lane for outbound traffic should also be provided. This road would also serve the Bachelor Enlisted Quarters adjacent to Seaboard Coast Line Railroad. Each lane should be approximately 12 feet wide in order to provide maximum flow of traffic. The widening of Campbell Street will require an easement from Seaboard Coastline Railroad, and a railroad crossing signal should be installed.

05.09 It is also recommended that Curtis Road be widened to accommodate a dual lane for exit from the base. This lane should be such that the paved width is 36 feet and thus giving each lane a width of 12 feet. Twelve-foot medians are also recommended between the thoroughfare. Turning lanes are recommended along Curtis Road at "A" Street. These would accommodate right turns for the Community Center Complex for persons traveling east and left turns for westbound traffic. See Appendix 02, Exhibit "E".

05.10 The "A" Street extension should provide smooth flow from Camp Geiger to the proposed Vehicular Maintenance Facility as well as traffic between Campbell Street and Curtis Road. A center turn lane is recommended for left turns along the extension, thus a road width of 36' is the desired dimension (including a 12' landscaped median). Significant traffic congestion along "A" Street is not expected along the support facilities development since entrances and exits have been provided along Curtis Road and Campbell Street. Nevertheless, as long as civilian work hours and the hours at the Support Facilities Complex terminate at different hours, no problem is anticipated with traffic congestion.

05.11 The outbound traffic from the Support Facilities would need to be double the number of planned parking spaces in order to exceed the capacity of Curtis Road and Campbell Street; therefore, the Support Facilities will be more than adequately served by those main roads.

05.12 Access for service to the various buildings has been separated from the public entrances for convenience and safety. These separate service areas provide access to groups of buildings and thus the service area is a shared space. Dumpster pads would also be placed within the service area and are shown on Sheet A-2 of the drawings.

06.00 PARKING FACILITIES

06.01 Parking for the Support Facilities has been arranged so that adequate internal circulation is provided and convenience to the various shops or functions is within easy walking distance of the parking space. Safety for the pedestrians has also been provided so that thru streets are not in conflict with the pedestrian circulation.

06.02 Parking has been divided into four major areas. The recreational area, club area, exchange/library area, and the commissary/theatre area. These four areas allow for phased construction and also distribute the parking throughout the site. The shopping facilities parking lots also serve as a dual purpose lot for the chapel and theatre.

06.03 The total number of spaces for each lot relates both to the number required if the structure was built separately and the number required based on total base population. A total figure of 1,583 spaces would be required (according to U.S. Navy standards) if each structure was built individually. Since many people will make visits to several of the shops with one visit, a more streamlined formula was used to calculate the required spaces. The Navy often determines the required number of spaces by multiplying the total population to be served by the facility (18,432) by 4%. This formula renders a requirement of 737 spaces. This figure was adjusted upward by 50% to reflect the separation of such areas as mentioned above in Paragraph 06.02. The total figures for each lot are listed in the table below, and shown on Sheet A-2.

06.04 Parking Tabulation

Lot Location	Number of Spaces
Large lot adjacent to Curtis Road	383 spaces
EM & NCO Club	80 spaces
Large lot to south of Shopping Area	361 spaces
Gas Station	18+spaces
Hobby Shop (Auto)	27+spaces
Recreation Complex	184 spaces
Youth Center	95 spaces
	1,148+Total Spaces

07.00 UTILITIES

07.01 Storm Sewers will be employed throughout the proposed development to provide adequate drainage from the paved roadways, parking areas, and building sites. Generally, curb and gutter will not be employed on roadways, so a crowned roadway and shoulder with side ditching will be utilized on roadways and drives. Outfall of the proposed storm sewer system is proposed under the Campbell Street extension and will run south into the swamp adjacent to Southwest Creek.

This route was selected over alternative routes along Curtis Road and Delalio School because many of the pipes in that area are already at or near full capacity.

07.03 Sanitary Sewers will be extended to the site, with principal main to be laid in the "A" Street extension right of way. The outfall of the sewer system will be extended to existing Manhole No. 1 to the north of Delalio School, and there connected to the existing 8" main. See Appendix 04.

07.04 Water will be extended to the site from the existing main now terminating to the north of Delalio school. The main will be laid in the right of way for the "A" Street extension, in the shoulder construction. A fire protection loop will be extended from the main to encircle the proposed support complex and connect into the existing system at the BEQ's along Demarco Street. The line will be sized for a fire flow of 1,750 GPM.

07.05 Steam will be extended to the site under the conditions outlined in Section 08.00 - Energy Study.

07.06 Electrical distribution will be extended from the existing 15 MVA, 12470/7200 volts Carolina Power and Lighting substation at the corners of Curtis Road and "A" Street. This substation is of enough capacity to serve the estimated loads. Distribution lines will be run overhead on poles to building service transformers. Existing overhead distribution line on "A" Street extension R/W will be retained to extent feasible, with adjustments to pole locations, etc., executed as necessary to avoid new construction. The existing overhead line, 4-336.4 mcm EC conductors, is of sufficient size to serve the electrical loads in the new complex. Transformers will be pole mounted for loads up to 150 kva. For larger loads and when overhead lines would be impractical, pad mounted transformers will be provided. Pad mounted transformers located within twenty-five feet of any building will be dry type. Secondary service to buildings will be underground as follows:

- 120/240 volts, 1-phase, 3-wire grounded neutral up to $37\frac{1}{2}$ kva services

- 208Y/120 volts, 3-phase, 4-wire, grounded neutral for all other services except for the Mechanical Building under mechanical scheme "C".

- 480Y/277 volts, 3-phase, 4-wire, grounded neutral for service to the Mechanical Building - Scheme "C"

07.07 Underground telephone service will be provided to all buildings.

07.08 The existing coded Fire Alarm System will be extended to the major buildings. Connection to buildings will be underground. Fire Alarm cables will be run overhead on power poles to a point where connection or transmission to Fire House Building 701, at Camp Geiger Area, is feasible. A new signal circuit will be added to the existing Gamewell positive noninterfering type Fire Alarm System.

08.00 ENERGY STUDY

08.10 INTRODUCTION

The Curtis Road Support Complex consists of a new Exchange Building and eighteen other facilities forming a neighborhood shopping recreational center. Construction is expected to begin with the Exchange (Project N-518), with the remainder of the facilities being constructed over a relatively long period. This study, however, considers all the structures to be constructed.

This energy utilization study is undertaken to analyze the energy and cost impact of alternative mechanical systems. The intent of this study is to determine the relative costs associated with each alternative system so that sound design decisions can be made. It must be emphasized that the analysis is based on early design decisions and there are a number of parameters that are, at this time, unknown. In these cases, assumptions based on experienced engineering judgment have been made. The results, then, are valid for comparison of the alternatives, but should not be utilized for predicting final costs associated with the facility. They should be accurate within ± 10 % if the project is constructed as assumed.

08.20 SUMMARY OF RESULTS AND RECOMMENDATIONS

08.21 OBJECT OF STUDY

This energy utilization study is undertaken to determine, analyze, and cost alternatives that affect the energy utilization of the Curtis Road Support Complex, MCAS(H), New River. All cost factors are presented; i.e., capital requirements, utility costs, and maintenance costs. From this data, plus estimates of economic life, total life-cycle cost are determined.

08.22 RESULTS OF ANALYSIS

This study evaluates five alternatives, designated as "schemes". The following tables summarize the results of the analysis for each scheme.

SUMMARY OF ANALYSIS

SCHEME	A	B	C
DESCRIPTION	Cooling provided by individual air-conditioning system for each building. Heating provided by individual boiler systems fired with #2 fuel oil.	Cooling provided by individual air-conditioning systems. Heating provided by existing central steam system extended to each building. Steam to water converter will provide hot water for heating within each building.	Cooling provided by a new district chilled water system. Heating provided by existing central steam system extended to each building. A separate steam line will be run to each building. A converter will provide hot water for heating within each building.
UTILITY CONSUMPTION (First Year)			
Electricity KWH	3,951,819	3,951,819	3,982,665
Gas			
Oil (#2) Gal.	12,664		
Other (Steam) MLB		930	930
ECONOMIC ANALYSIS			
Investment	$746,210	$1,040,246	$1,333,382
Utility	100,146	97,608	98,353
Maintenance	40,308	33,442	21,164
Economic Life-Years	25	25	25
Life-Cycle Cost	$2,698,588	$2,864,895	$3,039,473

SUMMARY OF ANALYSIS

SCHEME	D	E	
DESCRIPTION	Individual air-to-air heat pump systems provide both cooling and heating. Supplemental heating is provided by electric resistance coils	Individual water-to-air heat pump units provide both cooling and heating. A district water loop is provided with central heat rejection and supplemental heating from an oil fired boiler in the central mechanical building.	
UTILITY CONSUMPTION (First Year)			
Electricity KWH	4,048,662	4,111,255	
Gas			
Oil (#2) Gal.		9,148	
Other Steam MLB			
ECONOMIC ANALYSIS			
Investment	$768,200	$960,241	
Utility	97,799	102,696	
Maintenance	35,902	40,652	
Economic Life-Years	25	25	
Life-Cycle Cost	$2,577,158	$2,942,144	

08.23 RECOMMENDATIONS

The scheme producing the predicted lowest discounted life-cycle cost is Scheme D:

Individual air-to-air heat pump systems with electric resistance supplemental heating.

The relatively low first cost is attractive. In addition, this system is incremental in nature. Thus, if (as planned) construction is "phased", system expansion can be accommodated.

It is recommended that Scheme D be selected.

08.24 IMPACT OF DESIGN ASSUMPTIONS ON RESULTS OF STUDY

The many assumptions made in a study of this type will affect the results to varying degrees. A general discussion of the effect of some of the major assumptions (based on the complete initial construction of the project) is as follows:

1. Initial Investment Cost.

   If the project is assumed to be totally completed initially, the estimated initial investment has a greater effect on the outcome of the study than some of the other factors. This is because it receives the benefit of 10% discount factor for only one year. The other items are discounted at 10% for 25 years while being inflated at only 6% to 8% over the period. This point may be illustrated by the fact that the initial investment for Scheme A is only 10.2% of the total annual cost but is 27.6% of the discounted annual cost (for Scheme C this figure is 43.9%). The high initial cost thus accounts for the fact that Scheme C has the highest life cycle cost of the five schemes studied even though it has the lowest operating cost.

2. Utilization of Fossil Fuels for Heating.

   For all schemes studied, the consumption of fuel oil or steam for heating purposes is so small, when compared with the consumption of electricity for lighting and cooling,

that the assumed efficiency of the heating system and the assumed fuel rate have little effect on the life-cycle cost of the system. The steam cost, for example Scheme B, is 1.6% of the operating cost for the first year and is 3.1% of the operating cost for the 25th year.

3. Efficiency of Utilization of Incidental (Base Loads) Electrical Load for Heating the Buildings.

The base load annual consumption of electricity (primarily for lighting) is 2,771,001 KWH while the total usage for all schemes is approximately 4,000,000 KWH. This means that 69% of the power usage will exist regardless of the type of mechanical system. The ability of the mechanical system, therefore, to utilize a portion of this incidental heat source for useful comfort heating will reduce the life cycle cost of the system.

4. Efficiency of Utilization of Electricity for Cooling.

Even though the base load accounts for the majority of the electric power consumption, the cooling load is the next largest single cost factor. The cooling efficiency or KW/ton assumed for each scheme and the part load efficiency curves will have an impact on the life cycle operating costs.

5. Power Rate.

The annual power consumption for each of the five schemes studied was nearly equal. Since the existing demand was as high as 9,396 KWD and the usage as high as 4,822,000 KWH/month, the impact of this project (1201 KWD, 389,000 KWH)was not large enough to appreciably affect the power rate and a uniform cost/KWH was used for all schemes. As long as this is done, the rate, while affecting the life cycle cost of each scheme, will not affect the relationship between schemes (scheme selection). If theproject were separately metered and one scheme had a lower demand than the others, this could affect the rate and life-cycle cost. Scheme C actually has the lowest peak demand (1,060 KWH) in this case, while Scheme D has the highest demand (1,211).

08.25 IMPACT OF CONSTRUCTION PHASING ON RESULTS OF STUDY

Even though the study considered the entire complex to be built initially, the actual construction may be phased over a long period of time. The effects that building in phases will have on the study are, therefore, outlined in the following discussion. The phases considered are as follows:

Phase I - Building 14 constructed initially.

Phase II - Buildings 6, 10, 11, 12, 15, 17, 18, and 19 constructed 5 years after Phase I.

Phase III - Buildings 1, 2, 3, 4, 5, 7, 8, 9, 13 constructed 10 years after Phase I.

1. Investment Costs.

Scheme C (Central Chiller Plant) is probably the least attractive of the five schemes for a phased project since it will require that the major portion of the central plant (the building and one chiller) and at least a portion of the chilled water piping system be constructed initially to serve Building 14. A large portion of the steam distribution system must also be extended to the site initially to serve this building.

Scheme B will also require a rather large initial outlay for the steam distribution system.

Scheme E will either require that the central water loop be constructed initially or that Building 14 be initially equipped with a small local water loop system with a cooling tower and supplementary heater designed for connection to the larger loop system during Phase II or Phase III.

Schemes A and D are truly incremental in nature and require no initial outlay for the future buildings. They, therefore, are the most attractive systems for a phased project as far an initial investment is concerned. It should be noted that any scheme which defers the

investment cost to a point late in the life cycle will appear attractive under the discounted present-worth analysis since the discount rate 10% is greater than the construction cost inflation rate 6% to 8%.

2. Maintenance and Replacement Costs.

The annual maintenance and replacement cost for Scheme C is less than that of the other schemes. Maintenance on the central refrigeration plant must, however, begin with the first year which means a larger percentage of the maximum cost will be incurred over the entire 25-year period than for the other systems. The figure is nevertheless so low that the life-cycle maintenance and replacement cost for this scheme will be less than for any of the other schemes. Maintenance on the steam line for Scheme B and the water loop and boiler for Scheme E must also begin with Phase I while Schemes A and D are self-contained within each building and require no maintenance for future phases.

3. Utility Costs.

The utility costs for all schemes are nearly the same. If the project were separately metered, Scheme C would have an adverse effect on the demand charge in the power rate structure during the early phases, since a 250-ton chiller must be started to serve one building. The chiller would also operate at a partially loaded condition during the first 5 years of the life cycle. It would, therefore, appear that Scheme C is the least desirable system in the category of utility costs.

Phasing would have a nearly identical effect on the utility costs for Schemes A, B, D, and E since they are all essentially incremental in nature. Scheme E would require the operation of the main loop pumps and one of the 30 HP rejectors during all phases which is a "phasing liability for the system". A small local water loop for Building 14 during Phase I would reduce this liability.

Systems B and D seem to be the most desirable system with respect to utility costs when the unpredictability of oil prices (affecting Scheme A) and the possible partial

loading situation phasing could impose on Schemes C and E are considered.

4. Summary of Effects of Phasing.

Category	Least Desirable Scheme	Most Desirable Scheme
Investment Costs	C	A or D
Maintenance Costs	A or E	C
Utility Costs	E	B or D

5. Conclusion.

System D would appear to be the most attractive scheme to use if the stated phasing schedule is used (or another presently unknown schedule) since it rates high in the two most costly categories of investment and utilities.

08.26 CONSIDERATIONS OTHER THAN LIFE CYCLE COST

An examination of the life cycle cost for each scheme indicates that there is no clear cut choice of mechanical system based on this parameter. A discussion of the other factors, some of which may defy cost analysis, is as follows:

1. Availability of Fuel.

The present trends indicate that oil may become too scarce to use for comfort heating before the 25-year life cycle of this system is completed. If this occurs, Scheme A would require a major unforeseen conversion to electricity or steam at some point in the life cycle which would completely invalidate the cost predictions made at the present time.

Scheme E also uses oil (see supplement for boiler size) for supplemental heat, but this boiler could be easily converted to electricity or the system could receive heat from an existing central plant, since only one or two boilers are involved and they are at a single location. The reduction of oil availability would not, therefore, drastically affect the viability of this system.

The existing steam plant presently burns oil. This means that Schemes B and C are also sensitive to oil availability. The plants can, however, be converted to coal in the event of an oil scarcity.

A "fuel flexibility" ranking from the most flexible to the least flexible would be as follows:

Scheme D
Scheme E
Scheme C
Scheme B
Scheme A

A general statement could also be made that Schemes D and E consume less of our most critical form of energy (oil) than the other schemes.

2. Flexibility of Operation.

Schemes C and E require the operation of central pumping and/or cooling equipment during the times in which any of the air conditioned buildings are occupied. This means that if any building must go on an unusual (24 hours/day for example) operating schedule, the central plant must operate for the single building. This is an undesirable feature of these schemes.

3. Vulnerability to Plant Breakdown.

Schemes B, C, and E are obviously more vulnerable to a central plant breakdown or pipe failure than are Schemes A or D.

4. Effects of Local Conditions on Underground Piping Systems.

It will be very difficult to run all of the chilled water and steam lines above ground in a complex of this type. The local water table is very high, however, so that underground distribution systems will deteriorate more rapidly than they would if located on "higher ground". This situation tends to make Schemes B, C, and E less

favorable since they involve underground lines. The water loop for Scheme E operates at a relatively "neutral" temperature and can be constructed of PVC pipe which may be more resistant to corrosion than the metal pipes.

6. Benefits of the Storage Capability of Scheme E.

Of the five schemes considered, the one which lends itself the most readily to the thermal storage of both excess heating and cooling capacity is Scheme E. Although the CPUMP Program requires that a storage tank size (a 25,000-gallon tank was assumed in this case) be input for the calculation of the loop temperature at the end of each hour, no in-depth analysis of the possible life cycle cost benefits of various storage tank sizes was included in this study. A partial listing and discussion of the possible benefits to be derived from the total utilization of this storage capability is as follows:

a. If the power company should find it necessary to change to "off peak pricing" in their rate structure, a large storage tank could prove to be very beneficial. If the tank were large enough, it could conceivably eliminate the daytime operation of the heat rejector (cooling tower) or the supplemental heating boiler. This would be accomplished by running the rejector all night (during the period of low power rates and maximum tower efficiency) to store sufficient cool water to receive the heat rejected by the heat pump units during the following day.

   A similar method of operation during cold weather would entail the night-time operation of the boilers to store a large supply of 90 degree water which would be used as a heat source for the heat pumps during the following day. If it becomes necessary to convert the boilers to electricity in the future, the storage tank would, therefore, allow the boiler to use only off-peak power at the lower end of the rate scale.

b. The storage tank would reduce the size of both the cooling tower and boiler required since it would permit continuous full-load operation of the equipment during the night hours.

c. As solar energy becomes more widely used, the collectors will become more efficient and less costly. Many projects are, therefore, being designed with provision being made for the future addition of solar collectors. One of the factors to be considered in any solar system is the storage of surplus heat on a clear day for later use on a cloudy day. The storage system is, in fact, one of the major cost components of a solar heating system. If a storage tank were installed, however, in conjunction with Scheme E for the purpose of providing thermal storage and reducing the size of the boiler and cooling tower, the future addition of solar collectors to the system would be more feasible since the storage capability would already be present. The solar field could be located in the low lying areas adjacent to the complex.

08.30 DESCRIPTION OF STUDY

08.31 GENERAL

The Curtis Road Support Complex consists of nineteen structures ranging in size from 1, 900 square feet to 42, 000 square feet.

Bldg. No.	Facility	Square Feet
1	Chapel and Religious Education	10, 710
2	Child Care Center	2, 475
3	Commissary	18, 500
4	Cafeteria	9, 300
5	Credit Union	2, 800
6	Bank	1, 900
7	Thrift Shop	2, 500
8	Theatre	10, 900
9	Post Office	6, 325
10	Bowling Alley	15, 200
11	Art and Craft (Hobby Shop)	4, 600
12	Youth Center	9, 250

13	Library	7,875
14	Exchange	30,282
15	NCO Club	22,000
16	Enlisted Men's Club	12,800
17	Gymnasium	42,000
18	Automotive Hobby Shop	8,000
19	Service Station and Car Wash	4,390

With the exceptions of the Gymnasium, Automotive Hobby Shop, and Service Stations, all facilities are assumed to be both cooled and heated.

MCAS (H), New River, has approximately 2,300 annual heating degree days. Therefore, from Chapter 1 of Technical Guidelines for Energy Conservation in New Buildings, the wall and roof overall U-factors required are:

U_{wall} = 0.10   Uo wall (max.) = .36

U_{roof} = 0.05

Utilizing this information and the design conditions for New River (25°F winter, 90° F DB/78° F WB summer), the following heating and cooling factors were developed:

Heat Loss Factors (BTUH/SF)

Roof   .05 x (70 - 25) = 2.25

Walls

5% Glass   (.05 x 1.13 x 45) + (.95 x .1 x 45) = 6.8
(Uo = .15)

10% Glass   (.10 x 1.13 x 45) + (.90 x .1 x 45) = 9.1
(Uo = .20)

20% Glass   (.20 x 1.13 x 45) + (.80 x .1 x 45) = 13.8
(Uo = .31)

Floor   1.0 BTUH/SF

Heat Gain Factors (BTUH/SF)

Roof .05 x 61 = 3.0
(61° Equivalent Temperature Difference for medium constructed roof assumed)

Walls - The ASHRAE Standard 90 - 75 criteria is identical to the criteria in Technical Guidelines (U_{WO} = .36, U_W = .10) for walls with 20% glass. Based on this Standard, computer calculations were made on several orientations, aspect ratios, and glass percentages. The results were used for the wall cooling gains in the study. They are as follows (single glazing):

5% Glass	=	6.2
10% Glass	=	9.4
20% Glass	=	15.5

To determine the gross wall area, Figure 1 was utilized assuming an aspect ratio of 1.5:1.

Estimates of lighting levels (in watts/SF), population and glass percentages were made and the peak heating and cooling loads calculated. Outside air quantities for ventilation purposes were established based on criteria in Chapter 1 of Technical Guidelines. The results are tabulated in Table 1. All calculations were done as follows:

Building	-	Credit Union
Gross Area	-	2,800 SF
Wall Ratio	-	.95
Gross Wall Area	-	2,660 SF
Number of Stories	-	1
Roof Area	-	2,800 SF

Sample Heat Loss Calculation

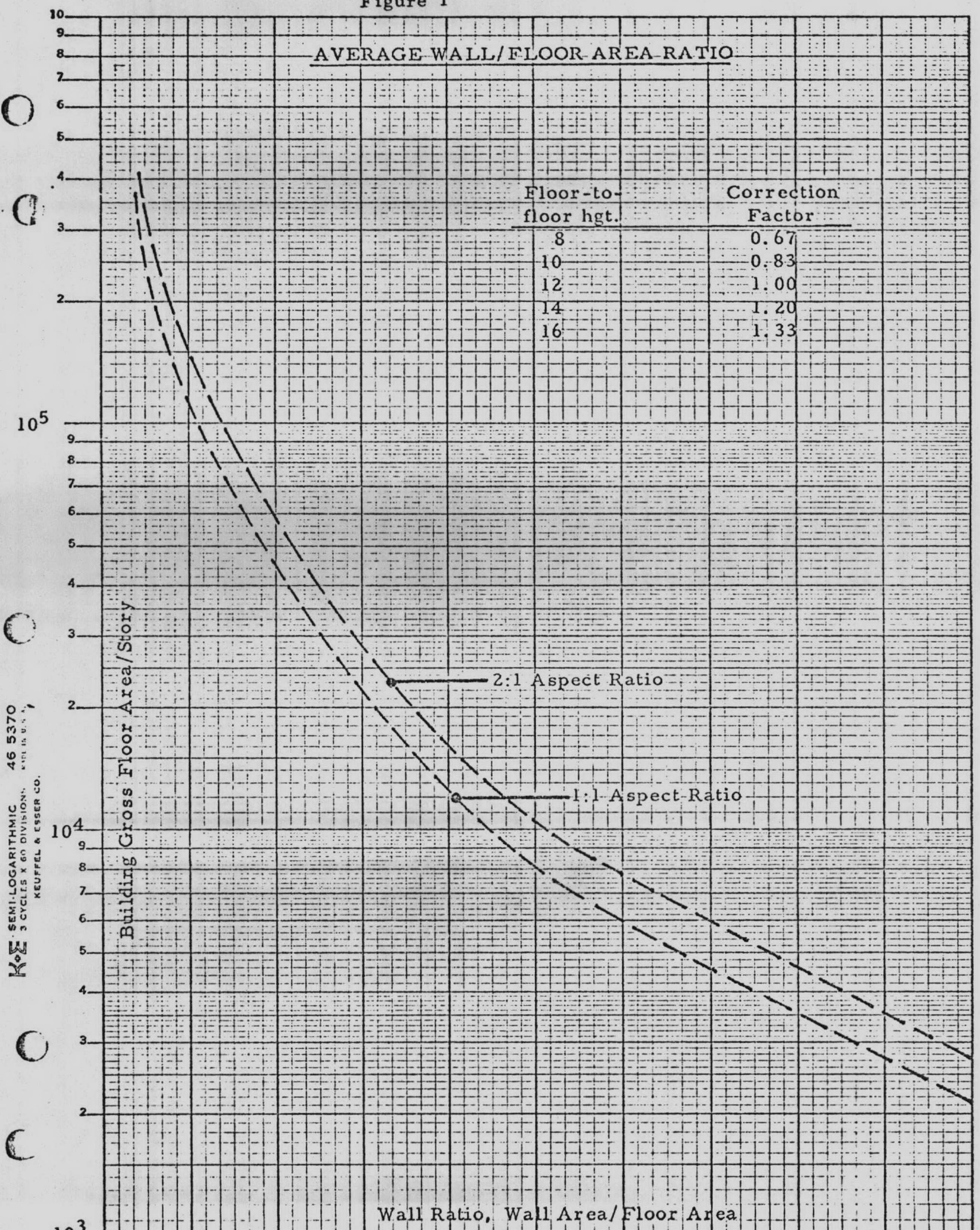
Gross Wall	2,660 x 13.8	=	36,700
Floor	2,800 x 1.0	=	2,800
Roof	2,800 x 2.25	=	6,300
Outside Air	350 CFM x 1.08 (70° - 25°)	=	17,000
		Total	62,800 BTUH

Sample Heat Gain Calculations

Gross Wall	2,660 x 15.5	=	41,200
Roof	2,800 x 3.0	=	8,400
People - Sensible	20 x 250	=	5,000
Lights	3.5 W/SF x 2,800 x 3.413	=	33,450
	Total Room Sensible		88,050
People - Latent	20 x 200	=	4,000
	Room Total		92,050
Outside Air	350 CFM x 4.45 x 13.37 (ΔH)	=	20,800
	Total Cooling		112,850

The energy usage of a structure is dependent on both the energy levels (loads) and the operating schedule for the facility. For this analysis the following operating schedules were established:

Figure 1



AVERAGE WALL/FLOOR AREA RATIO
Floor-to-floor hgt.
Correction Factor
8 0.67
10 0.83
12 1.00
14 1.20
16 1.33
2:1 Aspect Ratio
1:1 Aspect Ratio
Building Gross Floor Area/Story
Wall Ratio, Wall Area/Floor Area
10^5
10^4
10^3
0 0.1 0.2 0.3 0.4 0.5 0.6 0.7 0.8 0.9 1.0
K&E SEMI-LOGARITHMIC 46 5370
3 CYCLES X 60 DIVISIONS
KEUFFEL & ESSER CO.

TABLE 1
SUMMARY OF PEAK HEATING & COOLING LOADS

Facility	Bldg. No.	Sched-ule	% of Glass	Lights W/SF	People	CFM O.A.	Peak* Cool (MBH)	Peak* Heat (MBH)	Cool SF/Ton	Heat BTU/SF
Chapel & Relig. Ed.	1	E	20	2.0	107	1400	316	174	407	16.2
Child Care Center	2	C	20	3.0	25	310	100	57	298	23.0
Commissary	3	D	20	4.0	185	2300	628	261	354	14.1
Cafeteria***	4	B	20	3.0	250	1250	382****	155****	292	16.7
Credit Union	5	C	20	3.5	20	350	113	63	298	22.5
Bank	6	C	20	3.5	15	240	78	44	292	23.1
Thrift Shop	7	D	20	4.0	30	310	111	58	269	23.2
Theatre	8	A	5	2.0	250	1360	332	137	393	12.6
Post Office	9	C	5	4.0	25	790	189	86	403	13.6
Bowling Alley	10	A	10	2.0	100	1900	362	195	503	12.8
Hobby Shop	11	A	20	3.5	25	575	167	91	330	19.8
Youth Center	12	A	20	3.0	100	1150	307	150	361	16.2
Library	13	C	20	4.0	75	1000	320	137	295	17.4
Exchange	14	D	10	4.0	200	3800	898	361	405	11.9
NCO Club	15	A	10	3.0	250	2750	632	270	417	12.3
EM Club	16	A	10	3.0	150	1600	381	169	404	13.2
Gymnasium	17	A	5	3.0	500	2500	**	321	**	7.6
Auto Hobby Shop	18	A	10	1.0	50	1000	**	115	**	14.4
Service Station	19	D	20	0.5	10	550	**	87	**	19.8

* Includes outside air.
** Heated only.
*** Requires 10,000 CFM make-up to hood (heated only).
**** Does not include make-up air. Make-up air may be preheated by exhaust air heat recovery unit to reduce energy consumption. Recovery unit must, however, be readily cleanable due to grease laden exhaust air.

Notes:
1. All buildings were assumed to have one story.
2. All windows have single glazing.

TABLE 2
FACILITIES OPERATING SCHEDULES
(Occupied Hours)

Schedule	Sun	Mon-Fri	Sat
A	1300-2400	1100-2400	1100-2400
B	0900-2000	0700-2000	0900-2000
C		0800-1700	
D	1300-1800	0800-2000	0800-2000
E	0800-2000	1000-2000	1000-2000

Each Building is assumed to operate under one of the schedules, as indiciated in Table 1.

08.32 DESCRIPTION OF ALTERNATIVES

Five alternative mechanical systems are analyzed:

Scheme A: For each individual building, a cooling system is provided. Heating is provided by #2 oil-fired equipment.

Scheme B: For each individual building, a cooling system is provided. Heating is provided by the existing central steam distribution system which would be extended to the site. Steam to water converters will provide hot water for heating within each building.

Scheme C: A central chiller system and chilled water distribution network provides the cooling for all buildings. Heating is provided by the existing central steam distribution system extended to the site. A separate steam line will be run to each building. A converter will provide hot water for heating within each building. See supplement for selection data on major equipment in central plant. The central plant building would contain approximately 750 square feet of floor area.

Scheme D: For each building, an air-to-air heat pump system provides both heating and cooling. Any supplementary heating is provided by electric resistance coils.

Scheme E: Air-to-water heat pump units provide heating and cooling to each building. A water loop interconnects all the heat pumps and heat rejection or supplemental heating is done centrally. Supplemental heat is provided by an oil-fired boiler. See supplement for selection data on major equipment in central plant. The central plant building would contain approximately 300 square feet of floor area.

08.33 ENGINEERING DATA AND ASSUMPTIONS

The equipment and systems for the alternative mechanical schemes have been assumed to have the following performance characteristics:

1. Individual Cooling Systems

The individual cooling systems range in size from 7.5 tons to 75 tons. Therefore, the analysis is based on air-cooled DX Systems. The average system for the 16 air-conditioned buildings is 32 tons, and the equipment performance data is based on this size system:

Unit Capacity: 384MBH @70° EWB, 95° AMB
Compressor KW: 34.5; 1.08 KW/Ton
Condensing Fans KW: 5.6; 0.18 KW/Ton
Evaporator Fans KW: 7.5; 0.23 KW/Ton

Part Load Performance Curve
(Used in ECAL Program)

% of Max. Input Energy	% of Max. Output Energy
19	10
22	20
27	30
34	40
42	50
53	60
64	70
75	80
87	90
100	100

2. Individual Air-to-Air Heat Pumps

Based on the average 32 ton system, the equipment performance is:

Unit Capacity:	384 MBH @ 70° EWB, 95° AMB
Compressor KW:	39.0; 1.15 KW/Ton, cooling
Compressor KW:	11.5 MBH/KW, heating
Condensing Fans KW:	4.5; 0.13 KW/Ton
Evaporator Fans KW:	7.5; 0.23 KW/Ton

Part Load Performance Curves
(Used in ECAL Program)

Cooling - Same as individual cooling systems.

Heating -

O.A. Temp.	% of Max. Input Energy	% of Max. Output Energy
0	52	30
10	60	40
20	66	50
30	72	60
40	82	70
50	92	80
60	99	90
70	100	100

3. Individual Oil-fired Heating

Where individual oil-fired heating is utilized, either packaged boilers or oil-fired unit heaters (heated only buildings) are assumed. Maximum firing efficiency for equipment of this type is approximately 75%.

Part Load Performance Curve
(Used in ECAL Program)

% of Max. Input Energy	% of Max. Output Energy
14	10
23	20
33	30
43	40
52	50
61	60
70	70
80	80
90	90
100	100

4. Individual Air-to-Water Heat Pumps

Based on American Air Filters "Enercon" units, the average performance of the heat pump units, at rated temperatures and recommended flow (2.2 GPM/10 MBH evaporator capacity) is as follows:

* Cooling:	Energy Input (Includes Evap. Fans)	0.115 KW/MBH
	Heat Rejection Factor (to loop)	1.4
* Heating:	Energy Input	0.107 KW/MBH
	Heat Extraction Factor (from loop)	0.65

However, the units' capacity, energy requirement, and heat rejection/extraction vary with the loop temperature. The following tables show the percentage of design values as a function of temperature (the values are used in the CPUMP Program):

Cooling:

-Percent of Design-

Loop-Temp.	Capacity	Input Energy	Heat Rejection
90	96	104	98
85	98	102	99
80	100	100	100
75	102	98	101
70	104	95	102

* These values are valid for all building sizes since multiples of the small units must be used for the larger tonnages.

Heating:

-Percent of Design-

Loop-Temp.	Capacity	Input Energy	Heat Extraction
90	143	136	90
85	135	131	91
80	128	125	93
75	122	119	95
70	115	113	97
65	108	108	98
60	100	100	100

For a central loop system, the recommended flow rate is 1,170 GPM. See the supplement to this study for the selection data on the heat rejectors, circulation pumps and boiler.

5. Central Steam System

Steam is provided from an existing overhead system which is extended to the site. 15% line losses are assumed (based on rough estimate since exact percentage of underground lines is not known).

6. District Chilled Water System

The maximum cooling requirement for the entire site is 421* tons. Two 225-ton machines are assumed due to (1) incremental growth of the site and (2) the desire to have some standby capacity in the event of equipment failure. Based on the 450-ton capacity, the following equipment performance is estimated:

Refrigeration Machines:	0.825 KW/Ton
Cond. Water Pumps:	0.045 KW/Ton
CH. Water Pumps:	0.045 KW/Ton
Cooling Towers:	0.030 KW/Ton
Evaporator Fans:	0.230 KW/Ton

In addition, 5% line losses are assumed.

* 443 Tons x .95 diversity for use and orientation.

Part Load Performance Curve
(Used in ECAL Program)

% of Max. Input Energy	% of Max. Output Energy
0	0
23	20
30	30
37	40
44	50
52	60
62	70
72	80
85	90
100	100

08.40 METHOD OF STUDY

08.41 LIFE-CYCLE COSTING

Life-cycle costing is an analysis of the total cost of a system, building, etc. over its anticipated useful life. It consists of identifying all the costs associated with item under study. These costs include initial in-place costs, operating costs, maintenance costs, and the interest on the investment. In addition, the cost of inflation must be included.

To put a once-incurred cost and annual recurring costs on an equivalent basis, all costs are compared at a single point in time. Normally, costs are compared at the start of the accounting period. This technique is known as "discounted present worth analysis". This analysis answers the question: "What single sum, deposited today, at x% interest compounded annually, would enable you to withdraw funds at the end of each year to meet the operating costs incurred during that year?" "Discounting" is simply "compounding" in reverse; thus, the interest rate is referred to as the discount rate.

Basically, the procedure for determining the Life-Cycle cost is as follows:

1. The economic life is set. Economic Life is a matter of judgment, depending on the alternative under consideration and the Owner's normal depreciation schedule. Normally,

building components (insulation, windows, etc.) have an economic life of 40+ years. Mechanical equipment, however, has a normal economic life of 15-25 years depending on whether the system is of the incremental type (small individual units) or the central type (centrifugal refrigeration machines). For the purposes of this study, an economic life of 25 years was assumed in accordance with NAVFAC P-442. The difference in actual life between the incremental and central equipment has been allowed for in the annual maintenance and replacement costs.

2. The discount rate is established. The discount rate is the interest rate applied to the present worth calculation, and is normally the average rate of return available from alternative investments, i.e., bonds, certificates of deposit, etc.

3. For each year of the economic life, the project cash flow is determined. Annual cash flow is made up of the following:

   a. Investment Costs. Investment costs consist of the total capital expenditure required to implement an alternative. This included the cost of equipment, space to house equipment, installation costs, and any other directly associated costs.

   b. Annual Recurring Costs

   Utilities - Energy Costs

   Maintenance - Inspections and preventative maintenance, emergency repairs and filter replacements, including parts and labor (includes replacement of units which last less than 25 years).

4. The annual cash flow is then multiplied by the year factor. This year factor is the annual discount factor at a given discount rate (10% used for this study).

5. Over the economic life of the project, annual recurring costs are escalated at their expected individual rates:

	**
Electricity	6%
Fuel Oil	8%
Natural Gas & LPG	10%
Coal	5%
Maintenance	0%

6. The discounted annual costs are then summed over the economic life. The total discount project cost is the "life-cycle cost."

08.42 ENERGY UTILIZATION

The first step in the determination of an alternative's life-cycle cost is the calculation of the annual utility costs associated with it. This study utilizes the "ECAL System" of computer programs for this analysis.

The ECAL System consists of separate computer programs that are designed to aid in the analysis of a project's energy usage. A complete "system of programs", ECAL can be utilized to compare alternative architectral features, HVAC systems or system changes, HVAC equipment, operating schedules, etc. The goal of ECAL is an economic comparison.

The ECAL programs used for this study are:

<u>California Heat Pump System Analysis (CPUMP)</u> - This program analyzes the energy utilization of a system of air-to-water reverse cycle air-conditioners (heat pumps). This is a special case of an internal source heat recovery system which utilizes a piping loop and tank to provide thermal storage. The program calculates the monthly energy usage of the system by applying the temperature bin method to NAVFAC P-89 weather data. It also uses part-load efficiency tables based on a calculated varying water loop temperature. It was used to arrive at the annual energy usage for Scheme E.

**Based on NAVFAC Long Term Estimates

Energy Analysis and Calculation (ECAL) - A highly flexible energy program, ECAL accepts input describing the usual base utility loads (lights, elevators, etc.) profiles of operation, terminal systems, heating/cooling requirements, and primary system performance criteria. This data, along with the hours of occurrence weather data, is utilized to determine the energy demands and usage for each month, based on the temperature bin method and the part-load curves previously listed. This program was used to calculate the annual energy used for Schemes A, B, C, and D. The interior temperature of the building was assumed to be reset downward to 60°F. during the unoccupied hours. The outside air dampers were also assumed to be tightly closed during these hours.

Financial Analysis (ADOD) - This program, which applies escalation factors to the investment, replacement and utility costs, sums them up for each year, applies the discount factor to them for each year and then sums up the discounted figures, was used to arrive at the life-cycle cost for all schemes. The printout for each scheme is included in this report. NAVFAC discount factors were manually applied to the escalated annual operating cost figures, since they differed from the "textbook" discount factors normally used in the program.

The ECAL program is not a "black box" program. The derivation of every answer can be traced through the output so that the validity of the results can be checked by the user.

The results of the energy analysis utilizing ECAL are summarized in the following tables;

TABLE 3
SCHEME A ENERGY UTILIZATION

ELECTRICITY MONTH	KWH	KW DEMAND	OIL GAL.	OIL DEMAND GAL. /HR.
January	287,246	873	2,102	16
February	283,402	873	1,730	19
March	294,250	876	1,619	12
April	319,060	1,016	994	9
May	349,618	1,198	640	6
June	369,949	1,201	300*	3
July	389,533	1,201	126*	3
August	384,405	1,201	177*	3
September	358,092	1,120	430	3
October	330,753	1,118	914	9
November	299,093	944	1,498	15
December	286,418	873	2,134	18
Total	3,951,819		12,664	

TABLE 4
SCHEME B ENERGY UTILIZATION

ELECTRICITY MONTH	KWH	KW DEMAND	STEAM MLB	STEAM DEMAND LB. /HR.
January	287,246	873	182	1,496
February	283,402	873	145	1,496
March	294,450	876	129	915
April	319,060	1,016	63	579
May	349,618	1,198	29	455
June	369,949	1,201	10*	166
July	389,533	1,201	3*	112
August	384,405	1,201	5*	112
September	358,092	1,120	15	222
October	330,753	1,118	50	579
November	299,093	944	114	1,212
December	286,418	873	185	1,496
Total	3,951,819		930	

* Heating energy consumed during summer months was used to temper make-up air for hoods in Building No. 4 on cool mornings.

TABLE 5
SCHEME C ENERGY UTILIZATION

MONTH	ELECTRICITY KWH	KW DEMAND	STEAM MLB	STEAM DEMAND LB./HR.
January	298,703	820	182	1,496
February	293,452	820	145	1,496
March	305,759	820	129	915
April	325,339	932	63	579
May	349,416	1,060	29	455
June	362,269	1,060	10*	166
July	376,961	1,060	3*	112
August	373,241	1,060	5*	112
September	354,500	993	15	222
October	335,954	993	50	579
November	309,412	859	114	1,212
December	297,659	820	185	1,496
Total	3,982,665		930	

TABLE 6
SCHEME D ENERGY UTILIZATION

MONTH	ELECTRICITY KWH	KW DEMAND
January	305,642	941
February	298,108	1,004
March	306,693	905
April	325,059	1,045
May	352,739	1,211
June	371,814	1,211
July	391,341	1,211
August	386,176	1,211
September	360,082	1,127
October	335,471	1,127
November	310,296	985
December	305,241	964
Total	4,048,662	

TABLE 7
SCHEME E ENERGY UTILIZATION

ELECTRICITY MONTH	KWH	KW DEMAND	OIL GAL.	OIL DEMAND GAL./HR.
January	302,588	878	2,721	27
February	291,591	724	2,290	21
March	285,991	657	1,119	21
April	329,299	934	0	0
May	366,420	1,011	0	0
June	396,667	1,088	0	0
July	420,260	1,088	0	0
August	410,305	1,088	0	0
September	384,446	1,088	0	0
October	336,600	934	0	0
November	296,638	663	907	21
December	290,450	724	2,111	21
Total	4,111,255		9,148	

08.50 COST ANALYSIS

08.51 INVESTMENT COSTS

Investment costs are calculated on the basis of current budget estimates as follows:

Scheme A:	AC Systems	$ 651,210
	Oil-Fired Heating Systems	95,000
	Total	$ 746,210
Scheme B:	AC Systems	$ 651,210
	Below Ground Steam Distribution	289,785
	* Above Ground Steam Distribution	99,251
	Total	$1,040,246
Scheme C:	Air Handling Systems	$ 521,854
	Chilled Water Distribution	234,904
	Below Ground Steam Distribution	289,785
	* Above Ground Steam Distribution	99,251
	Central Plant Equipment	168,838
	Central Plant Building	18,750
	Total	$1,333,382
Scheme D:	Air-to-Air Heat Pumps	$ 170,500
	Sheet Metal	412,500
	Grilles & Diffusers	55,000
	Insulation	45,000
	Controls	30,000
	Check Test & Start	5,700
	Total	$ 718,700
Scheme E:	Air-to-Water Heat Pumps	$ 181,250
	Sheet Metal	412,500
	Grilles & Diffusers	55,000
	Insulation	45,000
	Controls	50,000
	Water Loop Piping	79,231
	Central Plant Equipment	121,760
	Central Plant Building	7,500
	Check Test & Start	8,000
	Total	$ 960,241

*Extent of above ground steam distribution estimated to site study perimeter, pending decision of extention of system by other contracts.

08.52 ANNUAL RECURRING COSTS

1. Utility Costs

The utility/fuel usage tabulated in Tables 3-7 were priced on the basis of :

Electricity	2.4156¢/KWH
Steam	$2.31/MLB
#2 Oil	$0.37/Gal.

The cost of electricity was determined by adding the usage and demand projected by the ECAL program for this project (Schemes A & B used) to the present usage was then computed based on Carolina Power & Light Company Rate G2 and the present fuel charge.

The cost of steam was determined based on the annual cost of fuel and energy input for the New River Plant adjusted for a plant efficiency of 80%.

The cost of oil was based on the actual price paid for #2 oil at Camp Lejeune during the most recent heating season.

TABLE
SUMMARY OF UTILITY COSTS

SCHEME	TOTAL COST
A	$100,146
B	97,608
C	98,353
D	97,799
E	102,696

2. Maintenance and Replacement

The total cost of maintenance and replacement was calculated on the basis of contract pricing by a National Mechanical Service Company (Honeywell). Included is

inspecting all equipment at 2-month intervals, preventative maintenance, temperature controls calibration, filter replacement, water treatment, and emergency service. Costs include all parts and labor. The cost differences between systems having different economic lives are included.

SCHEME A

Packaged AC Units	$21,700
H & V Units	400
Boilers	8,700
Motors	575
Unit Heaters (Oil)	1,200
Boiler Water Treatment	1,176
Filters	2,000
Controls	4,557
	$40,308

SCHEME B

Steam Distribution & Cond. Return	$ 3,890
Packaged AC Units	21,700
H & V Units	400
Motors	575
Unit Heaters (Steam)	320
Filters	2,000
Controls	4,557
	$33,442

SCHEME C

Steam Distribution	$ 3,890
Air-Handling Units & Chiller	7,163
H & V Units	400
Motors	800
Unit Heaters (Steam)	320
Cond. Water Treatment (Chemicals)	885
Filters	2,000
Controls	3,357
Chilled Water Loop	2,349
	$21,164

SCHEME D

Air-to-Air Heat Pumps	$28,210
H & V Units	400
Motors	575
Unit Heaters (Electric)	160
Filters	2,000
Controls	4,557
	$35,902

SCHEME E

Water Loop	$ 792
Supplemental Heating Boiler	1,025
Air-to-Water Heat Pumps	27,000
H & V Units	400
Motors	575
Unit Heaters (Electric)	160
Closed Circuit Cooler	1,760
Filters	2,000
Controls	7,425
	$40,652

08.53 LIFE-CYCLE COSTS

Total life-cycle costs are calculated utilizing the ADOD economics program of the ECAL System. The results are as follows:

TABLE
SUMMARY OF LIFE-CYCLE COSTS

SCHEME	TOTAL COST
A	$ 2,698,588
B	2,864,895
C	3,039,473
D	2,577,158
E	2,942,144

09.00 Cost Estimate
Energy Study

PROJECT NUMBER 4668.0000
PROJECT NAME CURTIS ROAD SUPPORT COMPLEX,MCAS(H),NEW RIVER,N.C.SCHEME A
DATE 9/22/77

ECONOMIC LIFE 25 YEARS
DISCOUNT RATE 10. PERCENT

INVESTMENT COSTS

COST	YEAR
746000.	1
0.	0
0.	0
0.	0
0.	0

ANNUAL RECURRING COSTS

	COST	ESCALATION
UTILITY (Electricity)	95460.	6 PCT
MAINTENANCE	40308.	0 PCT
REPLACEMENT	0.	0 PCT
PERSONNEL	0.	0 PCT
OTHER (Oil)	4686.	8 PCT

CURTIS ROAD SUPPORT COMPLEX,MCAS(H),NEW RIVER,N.C.SCHEME A

SUMMARY OF OPERATING COSTS

YEAR	UTILITY	MAINTENANCE	REPLACEMENT	PERSONNEL	OTHER**	TOTAL OPERATING
	ANNUAL COSTS					
1	95460.	40308.	0.	0.	4686.	140454.
2	101187.	40308.	0.	0.	5060.	146556.
3	107258.	40308.	0.	0.	5465.	153032.
4	113694.	40308.	0.	0.	5903.	159905.
5	120516.	40308.	0.	0.	6375.	167199.
6	127746.	40308.	0.	0.	6885.	174940.
7	135411.	40308.	0.	0.	7436.	183155.
8	143536.	40308.	0.	0.	8030.	191875.
9	152148.	40308.	0.	0.	8673.	201130.
10	161277.	40308.	0.	0.	9367.	210952.
11	170954.	40308.	0.	0.	10116.	221378.
12	181211.	40308.	0.	0.	10926.	232445.
13	192083.	40308.	0.	0.	11800.	244192.
14	203608.	40308.	0.	0.	12744.	256661.
15	215825.	40308.	0.	0.	13763.	269897.
16	228774.	40308.	0.	0.	14864.	283947.
17	242501.	40308.	0.	0.	16053.	298863.
18	257051.	40308.	0.	0.	17338.	314697.
19	272474.	40308.	0.	0.	18725.	331507.
20	288823.	40308.	0.	0.	20223.	349354.
21	306152.	40308.	0.	0.	21841.	368301.
22	324521.	40308.	0.	0.	23588.	388417.
23	343992.	40308.	0.	0.	25475.	409776.
24	364632.	40308.	0.	0.	27513.	432453.
25	386510.	40308.	0.	0.	29714.	456532.

** Oil.

CURTIS ROAD SUPPORT COMPLEX,MCAS(H),NEW RIVER,N.C.SCHEME A

ANALYSIS OF COST FACTORS

YEAR	INVESTMENT COST	OPERATING COST	TOTAL ANNUAL COST	DISCOUNT* FACTOR	DISCOUNTED ANNUAL COST
1	746000.	140454.	886454.	0.954	845677.
2	0.	146556.	146556.	0.867	127064.
3	0.	153032.	153032.	0.788	120589.
4	0.	159905.	159905.	0.717	114652.
5	0.	167199.	167199.	0.652	109014.
6	0.	174940.	174940.	0.592	103564.
7	0.	183155.	183155.	0.538	98537.
8	0.	191875.	191875.	0.489	93827.
9	0.	201130.	201130.	0.445	89503.
10	0.	210952.	210952.	0.405	85436.
11	0.	221378.	221378.	0.368	81467.
12	0.	232445.	232445.	0.334	77637.
13	0.	244192.	244192.	0.304	74234.
14	0.	256661.	256661.	0.276	70838.
15	0.	269897.	269897.	0.251	67744.
16	0.	283947.	283947.	0.228	64740.
17	0.	298863.	298863.	0.208	62164.
18	0.	314697.	314697.	0.189	59478.
19	0.	331507.	331507.	0.172	57019.
20	0.	349354.	349354.	0.156	54499.
21	0.	368301.	368301.	0.142	52299.
22	0.	388417.	388417.	0.129	50106.
23	0.	409776.	409776.	0.117	47944.
24	0.	432453.	432453.	0.107	46272.
25	0.	456532.	456532.	0.097	44284.
TOTAL	746000.	6587624.	7333622.		2698588.

UNIFORM ANNUAL COST 107944. (DISCOUNTED)
// XEQ ADOD

* Navy discount factors for a 10% discount rate and a 0% differential inflation factor have been inserted in this column for all schemes.

PROJECT NUMBER 4668.0000
PROJECT NAME CURTIS ROAD SUPPORT COMPLEX,MCAS(H),NEW RIVER,N.C.SCHEME B
DATE 9/22/77

ECONOMIC LIFE 25 YEARS
DISCOUNT RATE 10. PERCENT

INVESTMENT COSTS

COST	YEAR
1040246.	1
0.	0
0.	0
0.	0
0.	0

ANNUAL RECURRING COSTS

	COST	ESCALATION
UTILITY(Electricity)	95460.	6 PCT
MAINTENANCE	33442.	0 PCT
REPLACEMENT	0.	0 PCT
PERSONNEL	0.	0 PCT
OTHER (Steam)	2148.	8 PCT

CURTIS ROAD SUPPORT COMPLEX,MCAS(H),NEW RIVER,N.C.SCHEME B

SUMMARY OF OPERATING COSTS

YEAR	UTILITY	MAINTENANCE	REPLACEMENT	PERSONNEL	OTHER**	TOTAL OPERATING
	ANNUAL COSTS					
1	95460.	33442.	0.	0.	2148.	131050.
2	101187.	33442.	0.	0.	2319.	136949.
3	107258.	33442.	0.	0.	2505.	143206.
4	113694.	33442.	0.	0.	2705.	149842.
5	120516.	33442.	0.	0.	2922.	156880.
6	127746.	33442.	0.	0.	3156.	164345.
7	135411.	33442.	0.	0.	3408.	172262.
8	143536.	33442.	0.	0.	3681.	180659.
9	152148.	33442.	0.	0.	3975.	189566.
10	161277.	33442.	0.	0.	4293.	199013.
11	170954.	33442.	0.	0.	4637.	209033.
12	181211.	33442.	0.	0.	5008.	219661.
13	192083.	33442.	0.	0.	5409.	230934.
14	203608.	33442.	0.	0.	5841.	242892.
15	215825.	33442.	0.	0.	6309.	255576.
16	228774.	33442.	0.	0.	6813.	269030.
17	242501.	33442.	0.	0.	7358.	283302.
18	257051.	33442.	0.	0.	7947.	298441.
19	272474.	33442.	0.	0.	8583.	314499.
20	288823.	33442.	0.	0.	9270.	331535.
21	306152.	33442.	0.	0.	10011.	349606.
22	324521.	33442.	0.	0.	10812.	368776.
23	343992.	33442.	0.	0.	11677.	389112.
24	364632.	33442.	0.	0.	12611.	410685.
25	386510.	33442.	0.	0.	13620.	433572.

** Steam

CURTIS ROAD SUPPORT COMPLEX,MCAS(H),NEW RIVER,N.C.SCHEME B

ANALYSIS OF COST FACTORS

YEAR	INVESTMENT COST	OPERATING COST	TOTAL ANNUAL COST	DISCOUNT FACTOR	DISCOUNTED ANNUAL COST
1	1040246.	131050.	1171296.	0.954	1117416.
2	0.	136949.	136949.	0.867	118734.
3	0.	143206.	143206.	0.788	112846.
4	0.	149842.	149842.	0.717	107437.
5	0.	156880.	156880.	0.652	102286.
6	0.	164345.	164345.	0.592	97292.
7	0.	172262.	172262.	0.538	92677.
8	0.	180659.	180659.	0.489	88342.
9	0.	189566.	189566.	0.445	84357.
10	0.	199013.	199013.	0.405	80600.
11	0.	209033.	209033.	0.368	76924.
12	0.	219661.	219661.	0.334	73367.
13	0.	230934.	230934.	0.304	70204.
14	0.	242892.	242892.	0.276	67038.
15	0.	255576.	255576.	0.251	64150.
16	0.	269030.	269030.	0.228	61339.
17	0.	283302.	283302.	0.208	58927.
18	0.	298441.	298441.	0.189	56405.
19	0.	314499.	314499.	0.172	54094.
20	0.	331535.	331535.	0.156	51719.
21	0.	349606.	349606.	0.142	49644.
22	0.	368776.	368776.	0.129	47572.
23	0.	389112.	389112.	0.117	45526.
24	0.	410685.	410685.	0.107	43943
25	0.	433572.	433572.	0.097	42056
TOTAL	1040246.	6230430.	7270675.		2864895.

UNIFORM ANNUAL COST 114596. (DISCOUNTED)

PROJECT NUMBER 4668.0000
PROJECT NAME CURTIS ROAD SUPPORT COMPLEX,MCAS(H),NEW RIVER,N.C.SCHEME C
DATE 9/22/77

ECONOMIC LIFE 25 YEARS
DISCOUNT RATE 10. PERCENT

INVESTMENT COSTS

COST	YEAR
1333382.	1
0.	0
0.	0
0.	0
0.	0

ANNUAL RECURRING COSTS

	COST	ESCALATION
UTILITY (Electricity)	96205.	6 PCT
MAINTENANCE	21164.	0 PCT
REPLACEMENT	0.	0 PCT
PERSONNEL	0.	0 PCT
OTHER (Steam)	2148.	8 PCT

CURTIS ROAD SUPPORT COMPLEX,MCAS(H),NEW RIVER,N.C.SCHEME C

SUMMARY OF OPERATING COSTS

YEAR	ANNUAL COSTS UTILITY	MAINTENANCE	REPLACEMENT	PERSONNEL	OTHER**	TOTAL OPERATING
1	96205.	21164.	0.	0.	2148.	119517.
2	101977.	21164.	0.	0.	2319.	125461.
3	108095.	21164.	0.	0.	2505.	131765.
4	114581.	21164.	0.	0.	2705.	138451.
5	121456.	21164.	0.	0.	2922.	145542.
6	128743.	21164.	0.	0.	3156.	153064.
7	136468.	21164.	0.	0.	3408.	161041.
8	144656.	21164.	0.	0.	3681.	169501.
9	153336.	21164.	0.	0.	3975.	178475.
10	162536.	21164.	0.	0.	4293.	187994.
11	172288.	21164.	0.	0.	4637.	198089.
12	182625.	21164.	0.	0.	5008.	208797.
13	193583.	21164.	0.	0.	5409.	220156.
14	205198.	21164.	0.	0.	5841.	232203.
15	217509.	21164.	0.	0.	6309.	244982.
16	230560.	21164.	0.	0.	6813.	258538.
17	244394.	21164.	0.	0.	7358.	272917.
18	259057.	21164.	0.	0.	7947.	288169.
19	274601.	21164.	0.	0.	8583.	304348.
20	291077.	21164.	0.	0.	9270.	321511.
21	308541.	21164.	0.	0.	10011.	339717.
22	327054.	21164.	0.	0.	10812.	359030.
23	346677.	21164.	0.	0.	11677.	379518.
24	367477.	21164.	0.	0.	12611.	401253.
25	389526.	21164.	0.	0.	13620.	424311.

** Steam

CURTIS ROAD SUPPORT COMPLEX,MCAS(H),NEW RIVER,N.C.SCHEME C

ANALYSIS OF COST FACTORS

YEAR	INVESTMENT COST	OPERATING COST	TOTAL ANNUAL COST	DISCOUNT FACTOR	DISCOUNTED ANNUAL COST
1	1333382.	119517.	1452899.	0.954	1386065.
2	0.	125461.	125461.	0.867	108775.
3	0.	131765.	131765.	0.788	103831.
4	0.	138451.	138451.	0.717	99269.
5	0.	145542.	145542.	0.652	94893.
6	0.	153064.	153064.	0.592	90614.
7	0.	161041.	161041.	0.538	86640.
8	0.	169501.	169501.	0.489	82886.
9	0.	178475.	178475.	0.445	79421.
10	0.	187994.	187994.	0.405	76138.
11	0.	198089.	198089.	0.368	72897.
12	0.	208797.	208797.	0.334	69738.
13	0.	220156.	220156.	0.304	66927.
14	0.	232203.	232203.	0.276	64088.
15	0.	244982.	244982.	0.251	61490.
16	0.	258538.	258538.	0.228	59015.
17	0.	272917.	272917.	0.208	56767.
18	0.	288169.	288169.	0.189	54464.
19	0.	304348.	304348.	0.172	52348.
20	0.	321511.	321511.	0.156	50156.
21	0.	339717.	339717.	0.142	48240.
22	0.	359030.	359030.	0.129	46315.
23	0.	379518.	379518.	0.117	44404.
24	0.	401253.	401253.	0.107	42934.
25	0.	424311.	424311.	0.097	41158.
TOTAL	1333382.	5964355.	7297736.		3039473.

UNIFORM ANNUAL COST 121579. (DISCOUNTED)
// XEQ ADOD

PROJECT NUMBER 4668.0000
PROJECT NAME CURTIS ROAD SUPPORT COMPLEX,MCAS(H),NEW RIVER,N.C.SCHEME D
DATE 9/22/77

ECONOMIC LIFE 25 YEARS
DISCOUNT RATE 10. PERCENT

INVESTMENT COSTS

COST	YEAR
718700.	1
0.	0
0.	0
0.	0
0.	0

ANNUAL RECURRING COSTS

	COST	ESCALATION
UTILITY(Electricity)	97799.	6 PCT
MAINTENANCE	35902.	0 PCT
REPLACEMENT	0.	0 PCT
PERSONNEL	0.	0 PCT
OTHER	0.	0 PCT

CURTIS ROAD SUPPORT COMPLEX,MCAS(H),NEW RIVER,N.C.SCHEME D

SUMMARY OF OPERATING COSTS

YEAR	ANNUAL COSTS: UTILITY	MAINTENANCE	REPLACEMENT	PERSONNEL	OTHER	TOTAL OPERATING
1	97799.	35902.	0.	0.	0.	133701.
2	103666.	35902.	0.	0.	0.	139568.
3	109886.	35902.	0.	0.	0.	145788.
4	116480.	35902.	0.	0.	0.	152382.
5	123468.	35902.	0.	0.	0.	159370.
6	130877.	35902.	0.	0.	0.	166779.
7	138729.	35902.	0.	0.	0.	174631.
8	147053.	35902.	0.	0.	0.	182955.
9	155876.	35902.	0.	0.	0.	191778.
10	165229.	35902.	0.	0.	0.	201131.
11	175142.	35902.	0.	0.	0.	211044.
12	185651.	35902.	0.	0.	0.	221553.
13	196790.	35902.	0.	0.	0.	232692.
14	208597.	35902.	0.	0.	0.	244499.
15	221113.	35902.	0.	0.	0.	257015.
16	234380.	35902.	0.	0.	0.	270282.
17	248443.	35902.	0.	0.	0.	284345.
18	263349.	35902.	0.	0.	0.	299251.
19	279150.	35902.	0.	0.	0.	315052.
20	295899.	35902.	0.	0.	0.	331801.
21	313653.	35902.	0.	0.	0.	349555.
22	332473.	35902.	0.	0.	0.	368375.
23	352421.	35902.	0.	0.	0.	388323.
24	373566.	35902.	0.	0.	0.	409468.
25	395980.	35902.	0.	0.	0.	431882.

CURTIS ROAD SUPPORT COMPLEX,MCAS(H),NEW RIVER,N.C.SCHEME D

ANALYSIS OF COST FACTORS

YEAR	INVESTMENT COST	OPERATING COST	TOTAL ANNUAL COST	DISCOUNT FACTOR	DISCOUNTED ANNUAL COST
1	718700.	133701.	852401.	0.954	813191.
2	0.	139568.	139568.	0.867	121005.
3	0.	145788.	145788.	0.788	114881.
4	0.	152382.	152382.	0.717	109258.
5	0.	159370.	159370.	0.652	103909.
6	0.	166779.	166779.	0.592	98733.
7	0.	174631.	174631.	0.538	93951.
8	0.	182955.	182955.	0.489	89465.
9	0.	191778.	191778.	0.445	85341.
10	0.	201131.	201131.	0.405	81458.
11	0.	211044.	211044.	0.368	77664.
12	0.	221553.	221553.	0.334	73999.
13	0.	232692.	232692.	0.304	70738.
14	0.	244499.	244499.	0.276	67482.
15	0.	257015.	257015.	0.251	64511.
16	0.	270282.	270282.	0.228	61624.
17	0.	284345.	284345.	0.208	59144.
18	0.	299251.	299251.	0.189	56558.
19	0.	315052.	315052.	0.172	54189.
20	0.	331801.	331801.	0.156	51761.
21	0.	349555.	349555.	0.142	49637.
22	0.	368375.	368375.	0.129	47520.
23	0.	388323.	388323.	0.117	45434.
24	0.	409468.	409468.	0.107	43813.
25	0.	431882.	431882.	0.097	41892.
TOTAL	718700.	6263228.	6981926.		2577158.

UNIFORM ANNUAL COST 103086. (DISCOUNTED)

PROJECT NUMBER 4668.0000
PROJECT NAME CURTIS ROAD SUPPORT COMPLEX,MCAS(H),NEW RIVER,N.C.SCHEME E
DATE 9/22/77

ECONOMIC LIFE 25 YEARS
DISCOUNT RATE 10. PERCENT

INVESTMENT COSTS

COST	YEAR
960241.	1
0.	0
0.	0
0.	0
0.	0

ANNUAL RECURRING COSTS

	COST	ESCALATION
UTILITY(Electricity)	99312.	6 PCT
MAINTENANCE	40652.	0 PCT
REPLACEMENT	0.	0 PCT
PERSONNEL	0.	0 PCT
OTHER(Oil)	3384.	8 PCT

CURTIS ROAD SUPPORT COMPLEX, MCAS(H), NEW RIVER, N.C. SCHEME E

SUMMARY OF OPERATING COSTS

YEAR	----ANNUAL COSTS---- UTILITY	MAINTENANCE	REPLACEMENT	PERSONNEL	OTHER**	TOTAL OPERATING
1	99312.	40652.	0.	0.	3384.	143348.
2	105270.	40652.	0.	0.	3654.	149577.
3	111586.	40652.	0.	0.	3947.	156186.
4	118282.	40652.	0.	0.	4262.	163197.
5	125379.	40652.	0.	0.	4603.	170634.
6	132901.	40652.	0.	0.	4972.	178526.
7	140875.	40652.	0.	0.	5369.	186897.
8	149328.	40652.	0.	0.	5799.	195780.
9	158288.	40652.	0.	0.	6263.	205203.
10	167785.	40652.	0.	0.	6764.	215201.
11	177852.	40652.	0.	0.	7305.	225810.
12	188523.	40652.	0.	0.	7890.	237065.
13	199834.	40652.	0.	0.	8521.	249008.
14	211825.	40652.	0.	0.	9203.	261680.
15	224534.	40652.	0.	0.	9939.	275125.
16	238006.	40652.	0.	0.	10734.	289393.
17	252286.	40652.	0.	0.	11593.	304532.
18	267424.	40652.	0.	0.	12520.	320596.
19	283469.	40652.	0.	0.	13522.	337643.
20	300477.	40652.	0.	0.	14604.	355733.
21	318506.	40652.	0.	0.	15772.	374930.
22	337616.	40652.	0.	0.	17034.	395303.
23	357873.	40652.	0.	0.	18397.	416922.
24	379345.	40652.	0.	0.	19868.	439866.
25	402106.	40652.	0.	0.	21458.	464217.

**Oil

CURTIS ROAD SUPPORT COMPLEX,MCAS(H),NEW RIVER,N.C.SCHEME E

ANALYSIS OF COST FACTORS

YEAR	INVESTMENT COST	OPERATING COST	TOTAL ANNUAL COST	DISCOUNT FACTOR	DISCOUNTED ANNUAL COST
1	960241.	143348.	1103589.	0.954	1052824.
2	0.	149577.	149577.	0.867	129683.
3	0.	156186.	156186.	0.788	123075.
4	0.	163197.	163197.	0.717	117012.
5	0.	170634.	170634.	0.652	111253.
6	0.	178526.	178526.	0.592	105687.
7	0.	186897.	186897.	0.538	100551.
8	0.	195780.	195780.	0.489	95736.
9	0.	205203.	205203.	0.445	91315.
10	0.	215201.	215201.	0.405	87156.
11	0.	225810.	225810.	0.368	83098.
12	0.	237065.	237065.	0.334	79180.
13	0.	249008.	249008.	0.304	75698.
14	0.	261680.	261680.	0.276	72224.
15	0.	275125.	275125.	0.251	69056.
16	0.	289393.	289393.	0.228	65982.
17	0.	304532.	304532.	0.208	63343.
18	0.	320596.	320596.	0.189	60593.
19	0.	337643.	337643.	0.172	58075.
20	0.	355733.	355733.	0.156	55494.
21	0.	374930.	374930.	0.142	53240.
22	0.	395303.	395303.	0.129	50994.
23	0.	416922.	416922.	0.117	48780.
24	0.	439866.	439866.	0.107	47066.
25	0.	464217.	464217.	0.097	45029.
TOTAL	960241.	6712376.	7672615.		2942144.

UNIFORM ANNUAL COST 117686. (DISCOUNTED)

APPENDIXES

APPENDIX 01
ENVIRONMENTAL IMPACT ASSESSMENT

APPENDIX 01

ENVIRONMENTAL IMPACT ASSESMENT

Submitting DOD Component: Department of the Navy

Installation: New River Marine Corps Air Station (Helicopter)
Camp Lejeune, Jacksonville, North Carolina

Project Title: Exchange and Community Center, Project N518

Date of Submission: November 23, 1976

Assessment Authority: Prepared by J. N. Pease Associates Charlotte, North Carolina for the Department of the Navy in accordance with OPNAVINST 6240.3D in compliance with Section 102(2)(c) of the National Environmental Policy Act of 1969

1. INTRODUCTION

a. Project Description. The proposed project is a support facilities complex in which a range of functions will be incorporated into a centralized shopping/recreation complex. The project will be staged and completed over several years with the first two facilities being an exchange and service station/car wash. The new facilities will serve the personnel at both the New River Marine Corps Air Station and Camp Geiger. The total number of persons this facility will serve is estimated to be 18,432 as shown in appendix 1-a. A map which shows the scope of the proposed project is shown as appendix 1-b.

b. Existing Environment of Proposed Site. The existing environment of the proposed site consists of a triangular piece of timber land surrounded by roads on two edges and a main line of Seaboard Coast Line Railroad on the third edge of the proposed site. The total size is approximately 89 acres.

The site is generally wooded with a mixture of pine and hardwood vegetation. The sizes of these trees generally range from scrub growth to 10-12" caliper trees. Some evidence of selective timber

removal is evident and therefore many of the trees are poorly shaped and damaged as a result of such operations.

The site was selected by the Navy due to the favorable building characteristics of the soil; the accessibility from base personnel at Camp Geiger and the Marine Corps Air Station (Helicopter) at New River; the relative close proximity to electrical power, water, sewer and steam service; and the advantage of being located at a heavily traveled intersection between the two bases as mentioned above. Other nearby Federal projects are usually related to the activities on the New River base and the Camp Geiger base.

The project is expected to ultimately add population to the site in terms of shoppers and tenants, but will basicly serve the two bases as a support facility. It is expected that 18,432 persons will use the facility, some occasionally and others daily. The rate of growth for the area will be dependent on the future populations of the two bases. Otherwise, the population growth should remain fairly stable with the present population. See appendix 1-a for analysis of population figures.

2. RELATIONSHIP OF PROPOSED ACTION TO LAND USE PLANS, POLICIES AND CONTROLS FOR THE AFFECTED AREA

This project is a part of the Camp Lejeune Complex Master Plan (MARCORB CAMLEJ) for the West Base and is an important part of the plan. The plan states that the existing support facilities have many problems due to the eighteen separate structures and the parking and service problems associated with the separated buildings. This problem coupled with the limited expansion possibilities of the existing facilities clearly indicate the tremendous need for the new support complex. The existing buildings are basicly wood frame construction with wood siding, and are in violation of DOD criteria for location of personnel support facilities. This is because the present location is within 4,500 feet of the center of the north-south runway. The buildings are also in Noise Zone 2, which is not recommended for support facilities.

It is the recommendation of the master plan that the site mentioned above be used to relocate or replace the existing personnel support facilities at the air station and Camp Geiger. This project will not conflict with the Clean Air Act or the Federal Pollution Control Act Amendments of 1972.

3. PROBABLE IMPACT OF THE PROPOSED ACTION ON THE ENVIRONMENT

a. The construction of the Exchange and Community Center Complex with accompanying parking lots and recreational facilities will require eventual clearing and grading of approximately 60% of the site (53 ac.), The remaining 40% of the land will be used as vegatation buffers, future areas reserved for expansion of the support facility and natural areas for trails and recreational areas.

Any merchantable timber on the site could be sold for market value. With proper clearing and grading techniques employed, there should be little or no soil erosion or stream siltation. The added storm water resulting from the paved areas will be diverted into an existing canal parallel to the Seaboard Coastline Railroad. Much of this drainage system is expected to be contained in underground culverts.

Existing wildlife on the site consists of squirrels, rabbits, song-birds, and rodents. These animals will relocate to adjacent forest areas and many will return to the site after proper landscaping, or continue to reside in the buffer areas which are to be preserved.

b. Secondary consequences for the environment will be the social and economic changes associated with the persons which will use the facility. Personnel totaling 1,826 residing in the Bachelor Enlisted Quarters will greatly benefit by these facilities. They will be less than 1,000 feet from the recreational facilities and will be within walking distance of both the recreational and shopping facilities. The facility will also be convenient to the remainder of the base as well as Camp Geiger.

The population patterns might slightly change for the two bases and future facilities might find advantage in being located close to the recreational or shopping area. This might be an even greater possibility since utilities to this part of the base will be extended to the site, thus providing amenities which have been otherwise absent from the immediate area. At present this population change is not a part of the Camp Lejeune Master Plan, but the possibility exists for growth in the area.

4. ALTERNATIVES

No alternative sites are available that would fit into the MARCORB CAMLEJ's Master Plan for the Exchange and Community Center Complex. Alternative sites would not function properly with the proposed vehicular circulation, and the only other alternative is to not build the new complex. This would mean that the existing inadequate, dysfunctional facilities would remain located within 4,500 feet of the center of the north-south runway, thus in violation of DOD criteria for location of personnel support facilities.

The proposed plan will provide for wildlife losses in the form of landscaping and buffer areas.

5. ANY PROBABLE ADVERSE ENVIRONMENTAL EFFECTS WHICH CANNOT BE AVOIDED SHOULD PROPOSAL BE IMPLEMENTED

The three major elements which will result from the project are: (1) loss of growing timber, (2) relocation of associated wildlife to adjacent areas or buffer zones planned for the project, and (3) an increase in storm water runoff due to the paving and construction of buildings. Storm water will be diverted to an existing swampy area west of Seaboard Coast Line Railroad and south of the proposed development.

6. RELATIONSHIP BETWEEN LOCAL SHORT-TERM USE OF MAN'S ENVIRONMENT AND MAINTENANCE AND ENHANCEMENT OF LONG TERM PRODUCTIVITY

The proposed project will have short-term environmental losses due to the removal of timber, relocation of wildlife, and increase in storm water runoff. The long-term gain as a result of implementing the proposed project will completely out-weigh the short-term losses. This is due to the increase in landscape materials suitable for attracting birds and small animals as well as the convenience and safety created for the personnel which will use the complex. The number of people which will use the complex is estimated to be 18,432 and this social aspect of the development will be well worth the sacrifice of several acres of timber towards the development.

7. ANY IRREVERSIBLE AND IRRETRIEVABLE COMMITMENTS OF RESOURCES THAT WOULD BE INVOLVED IN THE PROPOSED ACTION IF IMPLEMENTED

The loss of tree growth and relocation of wildlife on approximately 60% (53 acres) of the site would be irretrievable. The percolation of storm water into the soil would be reduced due to the increase in pavement and building area, however this storm water will empty into an existing canal. The action will curtail the use of approximately 60% of the site for use as a wildlife habitat or growing of timber.

The energy impact, the alternatives and the analysis of several systems to provide energy to the site are analyzed and are shown in appendix 7-a.

8. CONSIDERATIONS THAT OFFSET ADVERSE ENVIRONMENTAL EFFECTS

The proposed Exchange and Community Center Complex is located at an optimum location for use by the personnel at Camp Geiger and the New River Air Station. The personnel housed in the BEQ's at New River are within walking distance of the proposed recreational facilities. This in itself will save energy and reduce polution. With proper landscaping and planning of buffer areas, the developed site will enhance the appearance of the base. The complex will be functionally more suitable for shopping than the existing structures, and will bring the various support facilities into one complex.

SUMMARY

It is concluded that the project will not have a significant effect upon the environment or be controversial. Preparation of a more detailed impact statement is therefore not considered necessary.

J. Gary Morgan, ASLA
Landscape Architect
J.N. Pease Associates
Architect, Engineers, Planners
Post Office Box 12725
Charlotte, North Carolina 28205

APPENDIX 01-A

UNITED STATES MARINE CORPS
Marine Corps Air Station
(Helicopter)
New River, Jacksonville
North Carolina 28540

October 14, 1976

Mr. J. Gary Morgan
J. N. Pease Associates
Post Office Box 12725
Charlotte, North Carolina 28205

Dear Gary:

The base loading personnel figures as per our additional input for the Exchange Complex/Service Station Projects are as follows:

a. Active Duty Military Population:			
MCAS(H)	5087		
Camp Geiger	3834	Total:	8921
b. Active Duty Dependent Population:			
MCAS(H)	4140		
Camp Geiger	3122	Total:	7262
c. Retired Population:			
MCAS(H) Percentage	421		
Camp Geiger Percentage	318	Total:	739
d. Retired Dependent Population:			
MCAS(H) Percentage	861		
Camp Geiger Percentage	649	Total:	1510.

If any additional information is required, please let me know.

Sincerely,

F. M. MORGAN
MAJOR, USMC
Facilities Officer

BJB:cbm

APPENDIX 02
TRAFFIC STUDY DRAWINGS

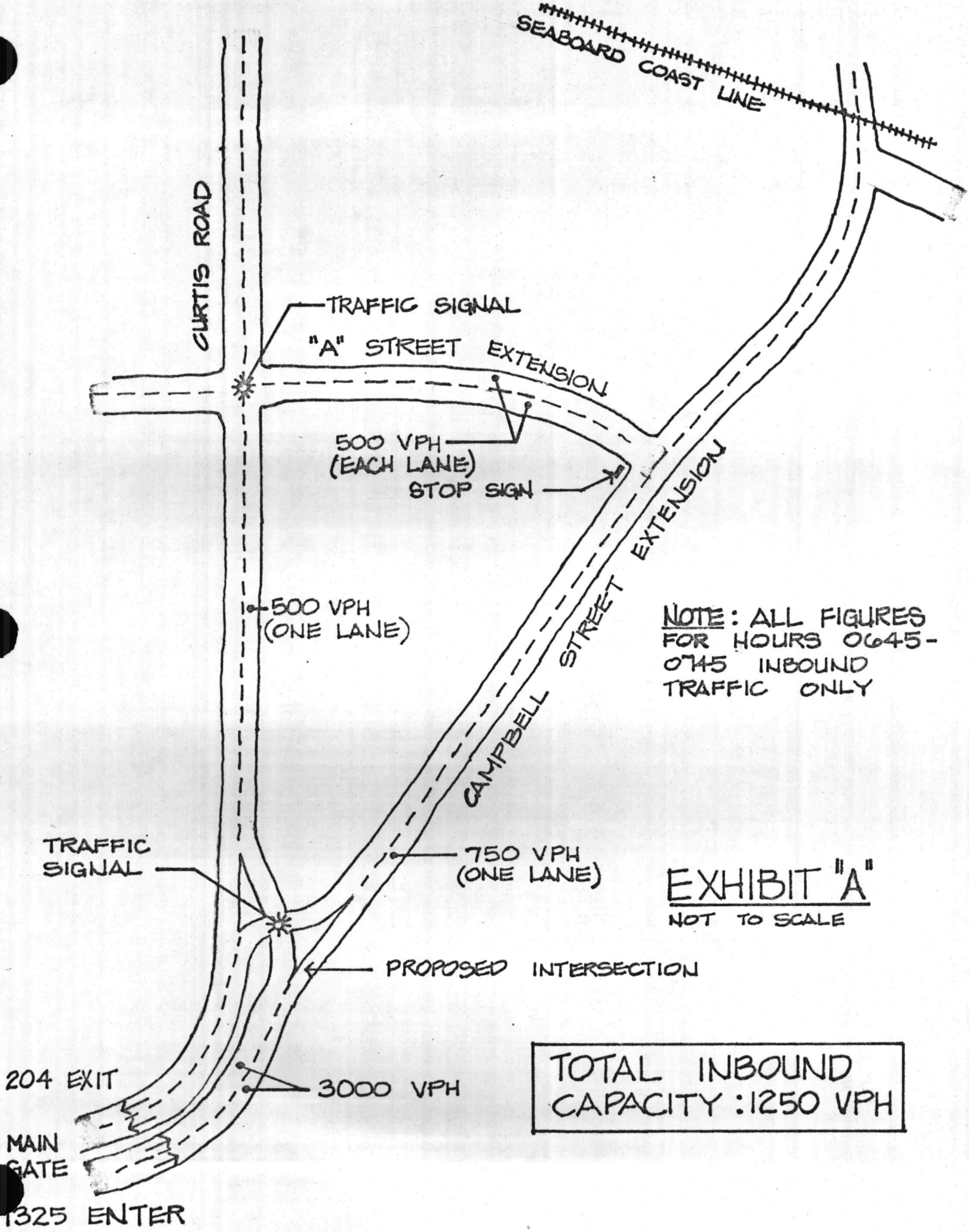
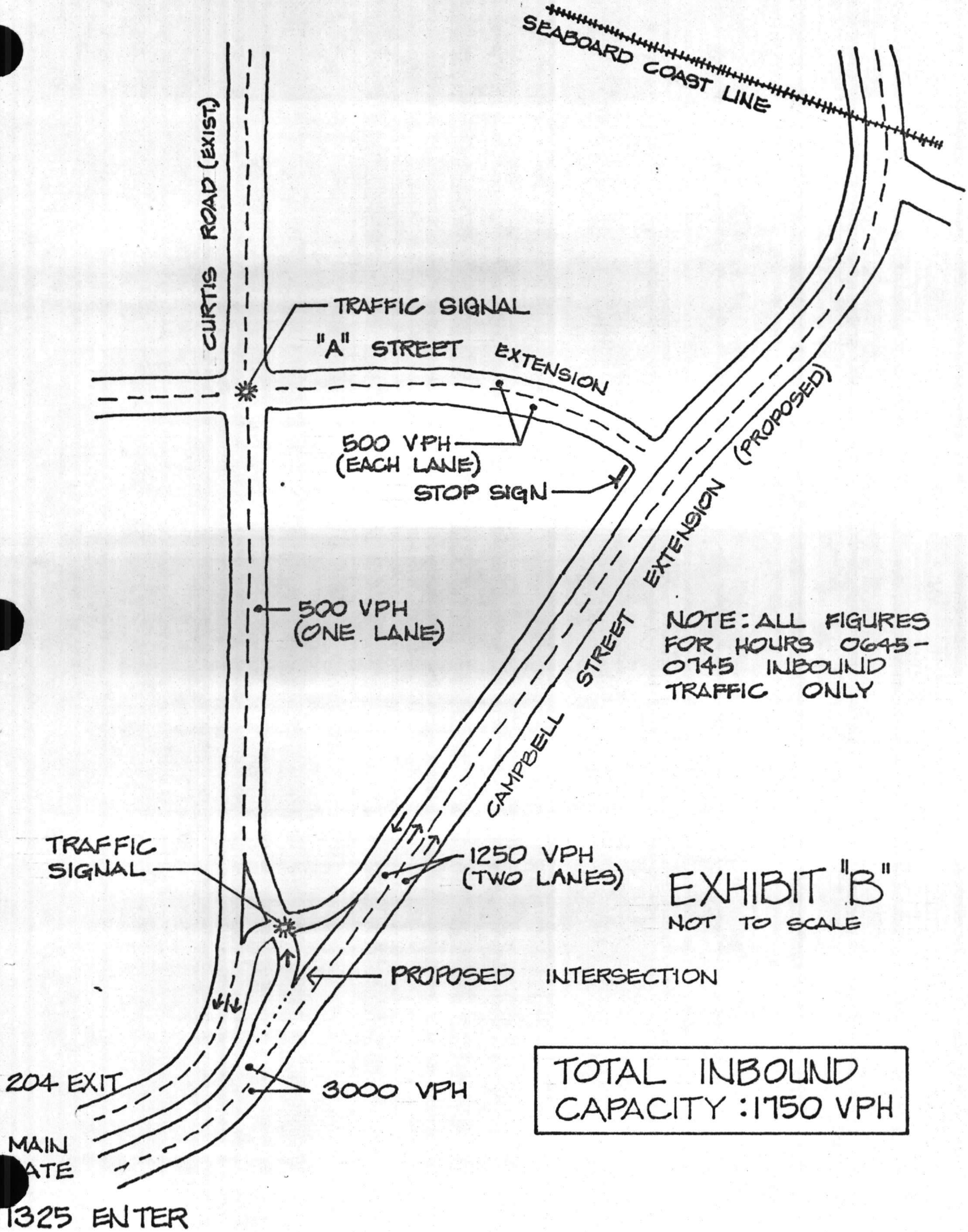
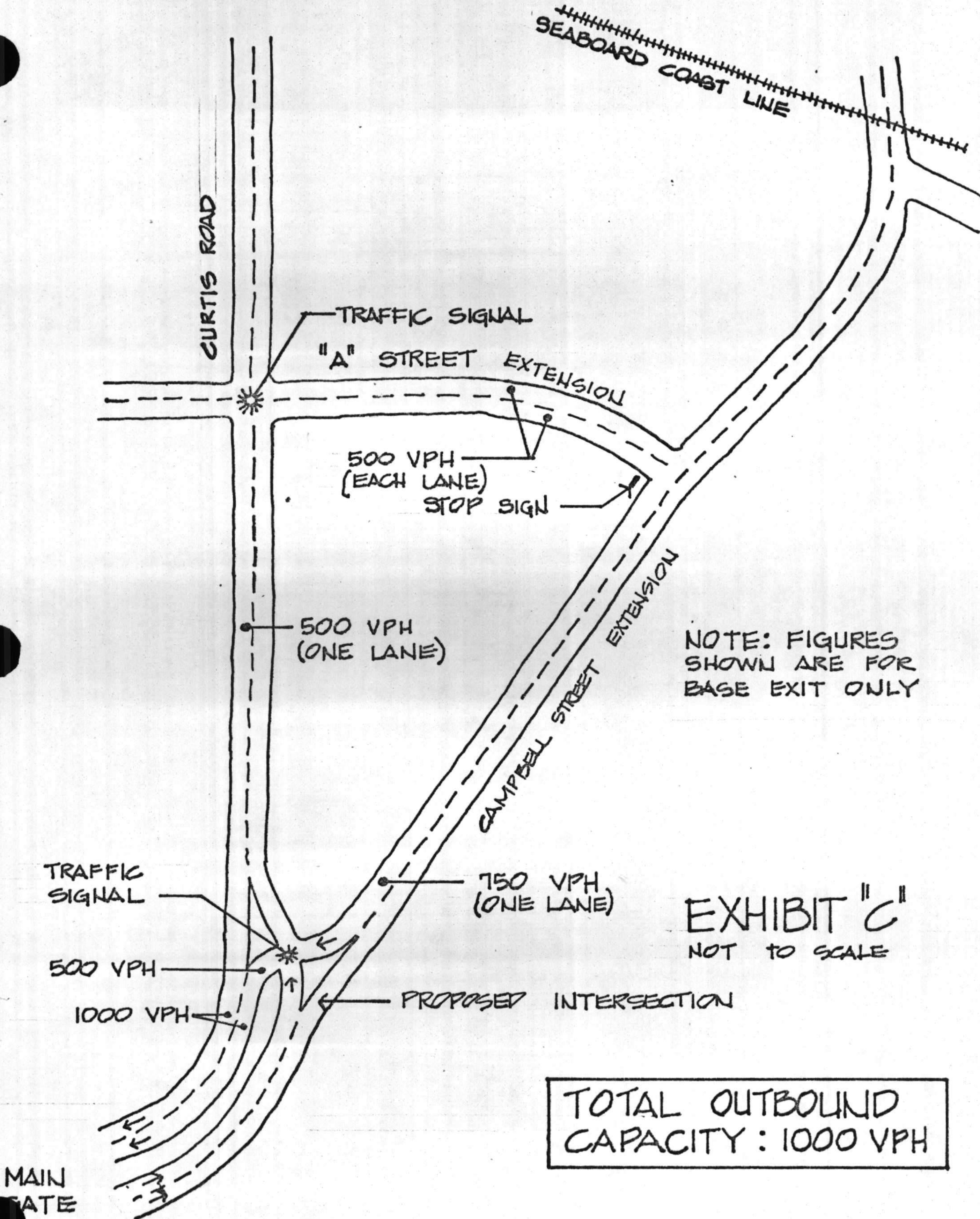


EXHIBIT "A"
NOT TO SCALE


SEABOARD COAST LINE
CURTIS ROAD (EXIST.)
TRAFFIC SIGNAL
"A" STREET EXTENSION
500 VPH
(EACH LANE)
STOP SIGN
CAMPBELL STREET EXTENSION (PROPOSED)
500 VPH
(ONE LANE)
NOTE: ALL FIGURES FOR HOURS 0645-0745 INBOUND TRAFFIC ONLY
TRAFFIC
SIGNAL
1250 VPH
(TWO LANES)
EXHIBIT "B"
NOT TO SCALE
PROPOSED INTERSECTION
204 EXIT
3000 VPH
TOTAL INBOUND
CAPACITY :1750 VPH
MAIN
ATE
1325 ENTER


SEABOARD COAST LINE
CURTIS ROAD
TRAFFIC SIGNAL
"A" STREET EXTENSION
500 VPH
(EACH LANE)
STOP SIGN
500 VPH
(ONE LANE)
CAMPBELL STREET EXTENSION
NOTE: FIGURES SHOWN ARE FOR BASE EXIT ONLY
TRAFFIC SIGNAL
750 VPH
(ONE LANE)
EXHIBIT "C"
NOT TO SCALE
500 VPH
1000 VPH
PROPOSED INTERSECTION
TOTAL OUTBOUND CAPACITY : 1000 VPH
MAIN GATE

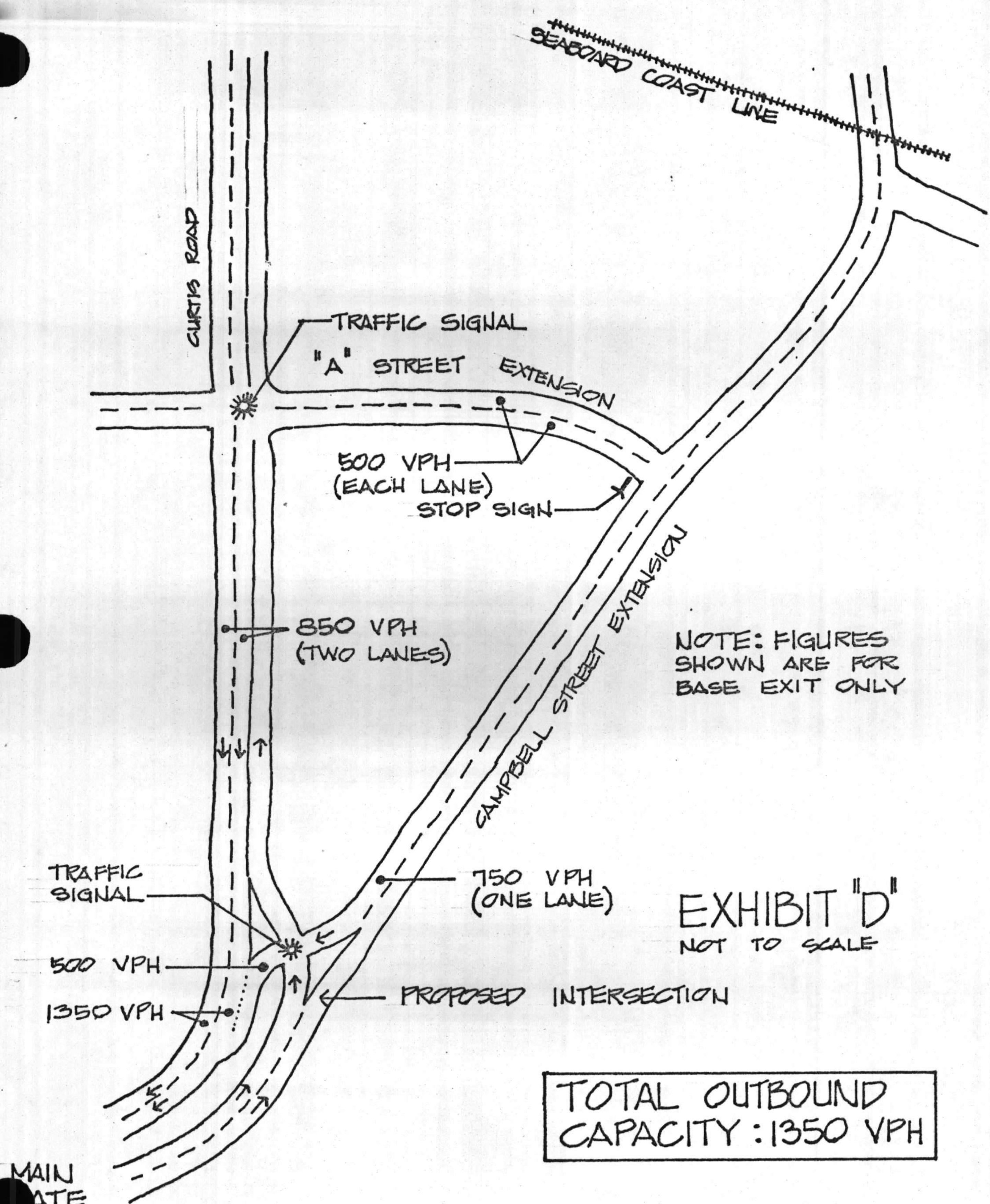
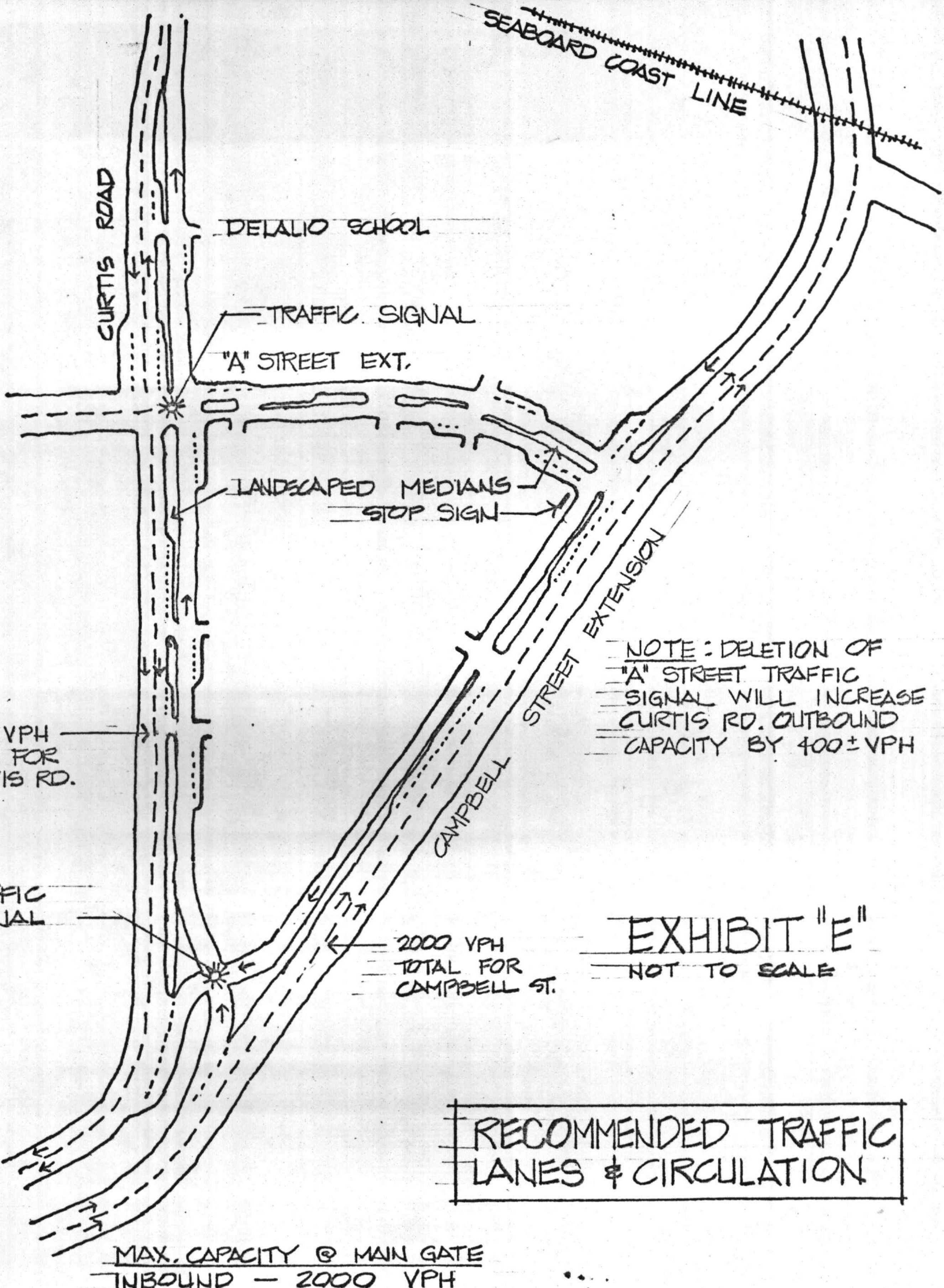


EXHIBIT "D"

NOT TO SCALE


SEABOARD COAST LINE
CURTIS ROAD
DELALIO SCHOOL
TRAFFIC SIGNAL
"A" STREET EXT.
LANDSCAPED MEDIANS
STOP SIGN
CAMPBELL STREET EXTENSION
NOTE: DELETION OF "A" STREET TRAFFIC SIGNAL WILL INCREASE CURTIS RD. OUTBOUND CAPACITY BY 400± VPH
1350 VPH TOTAL FOR CURTIS RD.
TRAFFIC SIGNAL
2000 VPH TOTAL FOR CAMPBELL ST.
EXHIBIT "E"
NOT TO SCALE
RECOMMENDED TRAFFIC LANES & CIRCULATION
MAIN GATE
MAX. CAPACITY @ MAIN GATE
INBOUND – 2000 VPH
OUTBOUND – 1350 VPH (SEE NOTE)

APPENDIX 03
ELECTRICAL CALCULATIONS

ELECTRICAL LOAD CALCULATIONS

ELECTRICAL LOAD CALCULATIONS

1. Two different calculations have been made:

   a. Using mechanical scheme "C". This calculation is based on the use of a central chiller facility. (Building No. 20)

   b. Using mechanical scheme "D". This calculation is based on the use of individual air-to-air heat pumps for each building. Calculations using mechanical schemes "A", "B", and "E" were not performed since loads are basically identical to the scheme "D" case.

2. Load factors and coincidence factor were based on NAVFAC DM-4 dated March 1974, updated October 1976.

ELECTRICAL CALCULATIONS

MECHANICAL SCHEME "C"

COMM. NO. 4668 | J. N. PEASE ASSOCIATES | DESIGN FOR..

ARCHITECTS ENGINEERS PLANNERS

CHARLOTTE, N. C.

PROJECT. CURTIS RD - SUPPORT COMPLEX

PREPARED BY DL

FILE UNDER. CALCULATIONS.

DATE JAN 17, 1977 †

COINCIDENT PEAK DEMAND - MECH. SCHEME "C"

NO.	FACILITY	AREA SQ.FT	MAX. DEMAND (KW)	LOAD FACTOR (%)	COINCIDENCE FACTOR (TABLE 1-8) (%)	ADJUSTED COINCIDENCE FACTOR * (%)	COINCIDENCE PEAK (KW)	
1	CHAPEL	10,710	25.3	20	59	61	15.4	
2	CHILD CARE CENTER	2,475	11.65	30	59	61	7.1	
3	COMMISSARY	18,800	74.9	30	59	61	45.7	
4	CAFETERIA	9,300	45.5	20	48	51	23.2	
5	CREDIT UNION	2,800	13.7	35	71	72	9.9	
6	BANK	1,900	10	25	64	66	6.6	
7	THRIFT SHOP	2,500	17.3	30	69	71	12.3	
8	THEATRE	10,900	24.5	12	44	47	11.5	
9	POST OFFICE	6,325	34.3	25	64	66	22.6	
10	BOWLING ALLEY	15,200	67.8	15	38	41	27.8	
11	HOBBY SHOP	4,600	25.5	30	59	61	15.6	
12	YOUTH CENTER	9,250	28.8	25	55	57	16.4	
13	LIBRARY	7,875	43.92	35	64	66	29.0	
14	EXCHANGE	30,282	116.8	25	55	57	66.6	
15	NCO-CLUB	22,000	106.6	23	62	64	68.2	
16	EM-CLUB	12,800	62	23	62	64	39.7	
17	GYMNASIUM	42,000	133.6	35	64	66	88.2	
18	AUTO HOBBY SHOP	8,000	23.4	30	59	61	14.3	
19	SERVICE STATION	4,390	11.2	20	48	51	5.7	
20	MECHANICAL BLDG.	1,200	426.2	30	N/A	100	426.2	
	SPORTS LIGHTING		25	12	44	47	11.8	

TOTAL	963.8
LOSSES	57.8
SPARE	144.6
GRAND TOTAL	1166.2

* ADJUSTED COINCIDENCE FACTOR COMPUTED USING FORMULA : $E_n = E_t + (1 - E_t)^{1/n}$ SEE U.S. NAVY DESIGN MANUAL NAVFAC DM-4. PAGE 4-1-17.

† - REVISED 6 MAY 77.

COMM. NO. 4668

PROJECT CURTIS RD. SUPPORT COMPLEX

FILE UNDER CALCULATIONS

J. N. PEASE ASSOCIATES
ARCHITECTS ENGINEERS PLANNERS
CHARLOTTE, N. C.

DESIGN FOR LOAD CALCULATIONS

PREPARED BY D.L.

DATE JAN. 11, 1977
REVISED 6 MAY 77

LOAD TABULATION

BUILDING: #1 - CHAPEL & RELIGIOUS EDUCATION CODE: 74010

MECH. SCHEME: C

AREA - 10,710 Sq. Ft.

DEMAND FACTORS						
ITEM	GENERAL PURPOSE MOTORS	RECPT. & SMALL APPLIAN.	LIGHTING	SPECIAL APPLIAN.	AIR CONDIT.	TOTAL
1. CONNECTED WATTS/SQ.FT.	—	1.0	2.0	-	.75	3.75
2. CONNECTED LOAD - KW	—	10.7	21.4	-	6.0	38.1
3. DEMAND FACTOR - %	—	10	85	-	100	
4. KW - MAX. COINCIDENT DEMAND	—	1.1	18.2	-	6.0	25.3
5.						
6.						

DEMAND FACTOR = $\frac{25.3}{38.1}$ = 66 %

PRELIMINARY LOAD FACTOR = 20

MINIMUM TRANSFORMER SIZE = 30 KVA

CHOSEN TRANSFORMER SIZE = 3@15 KVA

SPARE CAPACITY = 15 KVA

NOTE:

COMM. NO. 4668 | J. N. PEASE ASSOCIATES | DESIGN FOR LOAD CALCULATIONS

ARCHITECTS ENGINEERS PLANNERS

CHARLOTTE, N. C.

PROJECT CURTIS RD. - SUPPORT COMPLEX

PREPARED BY D.L.

FILE UNDER CALCULATIONS

DATE JAN. 11, 1977
REVISED 6 MAY 77

LOAD TABULATION

BUILDING: #2 CHILD CARE CENTER

CODE: —

MECH. SCHEME: C

AREA: 2,475 SQ. FT.

DEMAND FACTORS						
ITEM	GENERAL PURPOSE MOTORS	RECPT. & SMALL APPLIAN.	LIGHTING	SPECIAL APPLIAN.	AIR CONDIT.	TOTAL
1. CONNECTED WATTS/SQ.FT.	—	1.0	3.0	—	1.2	5.2
2. CONNECTED LOAD - KW	—	2.5	7.4	—	4.0	13.9
3. DEMAND FACTOR - %	—	10	100	—	100	—
4. KW.-MAX. COINCIDENT DEMAND	—	0.25	7.4	—	4.0	11.65
5.						
6.						

DEMAND FACTOR = $\frac{11.65}{13.9}$ = 84 %

PRELIMINARY LOAD FACTOR = 30

MINIMUM TRANSFORMER SIZE = 14 KVA

CHOSEN TRANSFORMER SIZE = 15 KVA

SPARE CAPACITY = 1 KVA

NOTE:

COMM. NO. 4668 | J. N. PEASE ASSOCIATES | DESIGN FOR LOAD CALCULATIONS

PROJECT CURTIS RD. SUPPORT COMPLEX | ARCHITECTS ENGINEERS PLANNERS | PREPARED BY D.L.

CHARLOTTE, N. C.

FILE UNDER CALCULATIONS | DATE JAN. 11, 1977

REVISED 6 MAY 77

LOAD TABULATION

BUILDING: #3 COMMISSARY | CODE: 74023

MECH. SCHEME: C

AREA = 18,500 SQ. FT.

DEMAND FACTORS						
ITEM	GENERAL PURPOSE MOTORS	RECPT. & SMALL APPLIAN.	LIGHTING	SPECIAL APPLIAN.	AIR CONDIT.	TOTAL
1. CONNECTED WATTS/SQ.FT.	—	2.0	4.0	—	.96	6.96
2. CONNECTED LOAD - KW	—	37.0	74.0	—	12.0	123.0
3. DEMAND FACTOR - %	—	10	80	—	100	—
4. KW. - MAX. COINCIDENT DEMAND	—	3.7	59.2	—	12.0	74.9
5.						
6.						

DEMAND FACTOR = $\frac{74.9}{123}$ = 61 %

PRELIMINARY LOAD FACTOR = 30

MINIMUM TRANSFORMER SIZE = 88 KVA

CHOSEN TRANSFORMER SIZE = 150 KVA PAD MT'D.

SPARE CAPACITY = 8 KVA

NOTE: TRANSFORMER TO SERVE ALSO BLDG. #4.

COMM. NO. 4668 | J. N. PEASE ASSOCIATES | DESIGN FOR LOAD CALCULATIONS

PROJECT CURTIS RD. SUPPORT COMPLEX | ARCHITECTS ENGINEERS PLANNERS | PREPARED BY D.L.

FILE UNDER CALCULATIONS | CHARLOTTE, N. C. | DATE JAN. 11, 1977

REVISED 6 MAY 77

LOAD TABULATION

BUILDING: #4 CAFETERIA CODE: —

MECH. SCHEME: C

AREA: 9,800 SQ. FT.

DEMAND FACTORS						
ITEM	GENERAL PURPOSE MOTORS	RECPT. & SMALL APPLIAN.	LIGHTING	SPECIAL APPLIAN.	AIR CONDIT.	TOTAL
1. CONNECTED WATTS/SQ.FT.	—	1.5	3.0	5.0	1.1	10.6
2. CONNECTED LOAD - KW	—	14.0	28.0	46.5	7	95.5
3. DEMAND FACTOR - %	—	25	75	30	100	—
4. KW.-MAX. COINCIDENT DEMAND	—	3.5	21.0	13.95	7	45.5
5.						
6.						

DEMAND FACTOR = $\frac{45.5}{95.5}$ = 48 %

PRELIMINARY LOAD FACTOR: 20

MINIMUM TRANSFORMER SIZE: 54 KVA

CHOSEN TRANSFORMER SIZE = — KVA

SPARE CAPACITY = — KVA

NOTE: SEE BUILDING #3 FOR TRANSFORMER.

COMM. NO. 4668 | J. N. PEASE ASSOCIATES | DESIGN FOR LOAD CALCULATIONS

PROJECT CURTIS RD. SUPPORT COMPLEX | ARCHITECTS ENGINEERS PLANNERS | PREPARED BY D.L.

CHARLOTTE, N. C.

FILE UNDER CALCULATIONS | DATE JAN. 11, 1977

REVISED 6 MAY 77

LOAD TABULATION

BUILDING: #5 CREDIT UNION   CODE: —

MECH. SCHEME: C

AREA: 2,800 SQ. FT.

DEMAND FACTORS						
ITEM	GENERAL PURPOSE MOTORS	RECPT. & SMALL APPLIAN.	LIGHTING	SPECIAL APPLIAN.	AIR CONDIT.	TOTAL
1. CONNECTED WATTS/SQ.FT.	—	2.0	4.0	—	1.1	7.1
2. CONNECTED LOAD - KW	—	5.6	11.2	—	2	18.8
3. DEMAND FACTOR - %	—	10	100	—	100	—
4. KW. - MAX. COINCIDENT DEMAND	—	.5	11.2	—	2	13.7
5.						
6.						

DEMAND FACTOR $= \frac{13.7}{18.8} = 73\ \%$

PRELIMINARY LOAD FACTOR = 35

MINIMUM TRANSFORMER SIZE = 16 KVA

CHOSEN TRANSFORMER SIZE = — KVA

SPARE CAPACITY = — KVA

NOTE: SEE BUILDING # 9 FOR TRANSFORMER USED.

COMM. NO. 4668 | J. N. PEASE ASSOCIATES | DESIGN FOR LOAD CALCULATIONS

ARCHITECTS ENGINEERS PLANNERS

CHARLOTTE, N. C.

PROJECT CURTIS RD. - SUPPORT COMPLEX

PREPARED BY D.L.

FILE UNDER CALCULATIONS

DATE JAN. 11, 1977
REVISED 6 MAY 77

LOAD TABULATION

BUILDING: #6 BANK   CODE: 74018

MECH. SCHEME: C

AREA: 1,900 SQ. FT.

DEMAND FACTORS						
ITEM	GENERAL PURPOSE MOTORS	RECPT. & SMALL APPLIAN.	LIGHTING	SPECIAL APPLIAN.	AIR CONDIT.	TOTAL
1. CONNECTED WATTS/SQ.FT.	–	2.0	4.0	–	1.1	7.1
2. CONNECTED LOAD - KW	–	3.8	7.6	–	2	13.4
3. DEMAND FACTOR - %	–	10	100	–	100	–
4. KW.-MAX. COINCIDENT DEMAND	–	.40	7.6	–	2	10
5.						
6.						

DEMAND FACTOR = $\frac{10}{13.4}$ = 75 %

PRELIMINARY LOAD FACTOR = 25

MINIMUM TRANSFORMER SIZE = 12 KVA

CHOSEN TRANSFORMER SIZE = 15 KVA

SPARE CAPACITY = 3 KVA

NOTE:

COMM. NO. 4668

PROJECT CURTIS RD. SUPPORT COMPLEX

FILE UNDER CALCULATIONS

J. N. PEASE ASSOCIATES
ARCHITECTS ENGINEERS PLANNERS
CHARLOTTE, N. C.

DESIGN FOR LOAD CALCULATIONS

PREPARED BY D.L.

DATE JAN. 11, 1977
REVISED 6 MAY 77

LOAD TABULATION

BUILDING: #7 THRIFT SHOP CODE: —

MECH. SCHEME: C

AREA: 2,500 SQ.FT.

ITEM	GENERAL PURPOSE MOTORS	RECPT. & SMALL APPLIAN.	LIGHTING	SPECIAL APPLIAN.	AIR CONDIT.	TOTAL
DEMAND FACTORS						
1. CONNECTED WATTS/SQ.FT.	—	1.0	6.0	—	1.6	8.6
2. CONNECTED LOAD - KW	—	2.5	15.0	—	2	19.5
3. DEMAND FACTOR - %	—	10	100	—	100	—
4. KW. - MAX. COINCIDENT DEMAND	—	.3	15.0	—	2	17.3
5.						
6.						

DEMAND FACTOR = $\frac{17.3}{19.5}$ = 89 %

PRELIMINARY LOAD FACTOR = 30

MINIMUM TRANSFORMER SIZE = 20 KVA

CHOSEN TRANSFORMER SIZE = — KVA

SPARE CAPACITY = — KVA

NOTE: SEE BUILDING #9 FOR TRANSFORMER USED

COMM. NO. 4668 | J. N. PEASE ASSOCIATES | DESIGN FOR LOAD CALCULATIONS

PROJECT CURTIS RD. SUPPORT COMPLEX

ARCHITECTS ENGINEERS PLANNERS

CHARLOTTE, N. C.

PREPARED BY D.L.

FILE UNDER CALCULATIONS

DATE JAN. 11, 1977
REVISED 6 MAY 77

LOAD TABULATION

BUILDING: #8 THEATRE

CODE: 74056

MECH. SCHEME: C

AREA: 10,900 SQ. FT.

DEMAND FACTORS						
ITEM	GENERAL PURPOSE MOTORS	RECPT. & SMALL APPLIAN.	LIGHTING	SPECIAL APPLIAN.	AIR CONDIT.	TOTAL
1. CONNECTED WATTS/SQ.FT.	—	1.0	2.0	1.0	.83	4.83
2. CONNECTED LOAD - KW	—	10.9	21.8	10.9	6	49.6
3. DEMAND FACTOR - %	—	10	75	10	100	—
4. KW.-MAX. COINCIDENT DEMAND	—	1.1	16.3	1.1	6	24.5
5.						
6.						

DEMAND FACTOR = $\frac{24.5}{49.6}$ = 49 %

PRELIMINARY LOAD FACTOR = 12

MINIMUM TRANSFORMER SIZE = 29 KVA

CHOSEN TRANSFORMER SIZE = — KVA

SPARE CAPACITY = — KVA

NOTE: SEE BUILDING NO. 9 FOR TRANSFORMER USED

COMM. NO. 4668

J. N. PEASE ASSOCIATES
ARCHITECTS ENGINEERS PLANNERS
CHARLOTTE, N. C.

DESIGN FOR LOAD CALCULATIONS

PROJECT CURTIS RD. - SUPPORT COMPLEX

PREPARED BY D.L.

FILE UNDER CALCULATIONS

DATE JAN. 11, 1977
REVISED 6 MAY 77

LOAD TABULATION

BUILDING: #9 - POST OFFICE CODE: 74033

MECH. SCHEME: C

AREA: 6,325 SQ FT.

ITEM	GENERAL PURPOSE MOTORS	RECPT. & SMALL APPLIAN.	LIGHTING	SPECIAL APPLIAN.	AIR CONDIT.	TOTAL
DEMAND FACTORS						
1. CONNECTED WATTS/SQ.FT.	—	1.0	4.0	1.0	.79	6.79
2. CONNECTED LOAD - KW	—	6.3	25.3	6.3	4	41.9
3. DEMAND FACTOR - %	—	30	100	50	100	—
4. KW.-MAX. COINCIDENT DEMAND	—	1.9	25.3	3.1	4	34.3
5.						
6.						

DEMAND FACTOR = $\frac{34.3}{41.9}$ = 82 %

PRELIMINARY LOAD FACTOR = 25

MINIMUM TRANSFORMER SIZE = 40 KVA

CHOSEN TRANSFORMER SIZE = 112½ KVA PAD MT'D

SPARE CAPACITY = 75 KVA

NOTE: TRANSFORMER TO SERVE ALSO BLDGS # 5, 7, & 8.

COMM. NO. 4668 | J. N. PEASE ASSOCIATES | DESIGN FOR LOAD CALCULATIONS

PROJECT CURTIS RD. - SUPPORT COMPLEX | ARCHITECTS ENGINEERS PLANNERS | PREPARED BY D.L.

CHARLOTTE, N. C.

FILE UNDER CALCULATIONS | DATE JAN. 11, 1977

REVISED 6 MAY 77

LOAD TABULATION

BUILDING: #10 - BOWLING ALLEY | CODE: 74040

MECH. SCHEME: C

AREA: 15,200 SQ. FT.

DEMAND FACTORS						
ITEM	GENERAL PURPOSE MOTORS	RECPT. & SMALL APPLIAN.	LIGHTING	SPECIAL APPLIAN.	AIR CONDIT.	TOTAL
1. CONNECTED WATTS/SQ.FT.	—	1.0	2.0	3.0	.59	6.59
2. CONNECTED LOAD - KW	—	15.2	30.4	45.6	7	98.2
3. DEMAND FACTOR - %	—	10	75	80	100	—
4. KW. - MAX. COINCIDENT DEMAND	—	1.5	22.8	36.5	7	67.8
5.						
6.						

DEMAND FACTOR $= \frac{67.8}{98.2} = 69\%$

PRELIMINARY LOAD FACTOR = 15

MINIMUM TRANSFORMER SIZE = 80 KVA

CHOSEN TRANSFORMER SIZE = 3@37½ KVA

SPARE CAPACITY = 32.5 KVA

NOTE:

COMM. NO. 4668

J. N. PEASE ASSOCIATES
ARCHITECTS ENGINEERS PLANNERS
CHARLOTTE, N. C.

DESIGN FOR LOAD CALCULATIONS

PROJECT CURTIS RD. - SUPPORT COMPLEX

PREPARED BY D.L.

FILE UNDER CALCULATIONS

DATE JAN. 11, 1977
REVISED 6 MAY 77

LOAD TABULATION

BUILDING: #11 - HOBBY SHOP

CODE: 74036

MECH. SCHEME: C

AREA: 4,600 SQ. FT.

DEMAND FACTORS						
ITEM	GENERAL PURPOSE MOTORS	RECPT. & SMALL APPLIAN.	LIGHTING	SPECIAL APPLIAN.	AIR CONDIT.	TOTAL
1. CONNECTED WATTS/SQ.FT.	1.0	1.0	3.5	2.0	.87	8.37
2. CONNECTED LOAD - KW	4.6	4.6	16.1	9.2	3	37.5
3. DEMAND FACTOR - %	10	10	100	10	100	—
4. KW. - MAX. COINCIDENT DEMAND	5	.5	16.1	.9	3	25.5
5.						
6.						

DEMAND FACTOR = $\frac{25.5}{37.5}$ = 68 %

PRELIMINARY LOAD FACTOR = 30

MINIMUM TRANSFORMER SIZE = 30 KVA

CHOSEN TRANSFORMER SIZE = 37½ KVA

SPARE CAPACITY = 7½ KVA

NOTE:

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CHARLOTTE, N. C.

FILE UNDER CALCULATIONS | DATE JAN. 12, 1977

Revised 6 May 77

LOAD TABULATION

BUILDING: #12 YOUTH CENTER CODE: —

MECH. SCHEME: C

AREA: 9,250 SQ. FT.

DEMAND FACTORS						
ITEM	GENERAL PURPOSE MOTORS	RECPT. & SMALL APPLIAN.	LIGHTING	SPECIAL APPLIAN.	AIR CONDIT.	TOTAL
1. CONNECTED WATTS/SQ.FT.	—	1.0	3.0	0.5	.86	5.36
2. CONNECTED LOAD - KW	—	9.2	27.7	4.6	6	47.5
3. DEMAND FACTOR - %	—	10	75	25	100	—
4. KW. - MAX. COINCIDENT DEMAND	—	.9	20.7	1.2	6	28.8
5.						
6.						

DEMAND FACTOR = $\frac{28.8}{47.5}$ = 61 %

PRELIMINARY LOAD FACTOR = 25

MINIMUM TRANSFORMER SIZE = 34 KVA

CHOSEN TRANSFORMER SIZE = 37½ KVA

SPARE CAPACITY = 3½ KVA

NOTE:

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FILE UNDER CALCULATIONS | CHARLOTTE, N. C. | DATE JAN. 12, 1977

Revised 6 May 77

LOAD TABULATION

BUILDING: #13 LIBRARY CODE: 74076

MECH. SCHEME: C

AREA: 7,875 SQ. FT.

DEMAND FACTORS						
ITEM	GENERAL PURPOSE MOTORS	RECPT. & SMALL APPLIAN.	LIGHTING	SPECIAL APPLIAN.	AIR CONDIT.	TOTAL
1. CONNECTED WATTS/SQ.FT.	—	1.0	4.0	—	1.1	6.1
2. CONNECTED LOAD - KW	—	9.2	37	—	6	52.2
3. DEMAND FACTOR - %	—	10	100	—	100	—
4. KW.-MAX. COINCIDENT DEMAND	—	.92	37	—	6	43.92
5.						
6.						

DEMAND FACTOR = $\frac{43.92}{52.2}$ = 84 %

PRELIMINARY LOAD FACTOR = 35

MINIMUM TRANSFORMER SIZE = 52 KVA

CHOSEN TRANSFORMER SIZE = 3@25 KVA

SPARE CAPACITY = 23 KVA

NOTE:

COMM. NO. 4668

PROJECT CURTIS RD. - SUPPORT COMPLEX

FILE UNDER CALCULATIONS

J. N. PEASE ASSOCIATES

ARCHITECTS ENGINEERS PLANNERS

CHARLOTTE, N. C.

DESIGN FOR LOAD CALCULATIONS

PREPARED BY D.L.

DATE JAN. 12, 1977

REVISED 6 MAY 77

LOAD TABULATION

BUILDING: #14 EXCHANGE

CODE: 74030

MECH. SCHEME: C

AREA: 30,282 SQ. FT.

DEMAND FACTORS						
ITEM	GENERAL PURPOSE MOTORS	RECPT. & SMALL APPLIAN.	LIGHTING	SPECIAL APPLIAN.	AIR CONDIT.	TOTAL
1. CONNECTED WATTS/SQ.FT.	—	1.0	4.0	—	.85	5.85
2. CONNECTED LOAD - KW	—	30.2	121.1	—	17.0	168.3
3. DEMAND FACTOR - %	—	10	80	—	100	—
4. KW. - MAX. COINCIDENT DEMAND	—	3.0	96.8	—	17	116.8
5.						
6.						

DEMAND FACTOR = $\frac{116.8}{168.3}$ = 69 %

PRELIMINARY LOAD FACTOR = 25

MINIMUM TRANSFORMER SIZE = 137 KVA

CHOSEN TRANSFORMER SIZE = 150 KVA PAD MT'D

SPARE CAPACITY = 13 KVA

NOTE:

COMM. NO. 4668

PROJECT CURTIS RD. - SUPPORT COMPLEX

FILE UNDER CALCULATIONS

J. N. PEASE ASSOCIATES
ARCHITECTS ENGINEERS PLANNERS
CHARLOTTE, N. C.

DESIGN FOR LOAD CALCULATIONS

PREPARED BY D.L.

DATE JAN. 12, 1977
REVISED 6 MAY 77

LOAD TABULATION

BUILDING: #15 - NCO CLUB

CODE: 74066

MECH. SCHEME: C

AREA: 22,000 SQ. FT.

DEMAND FACTORS						
ITEM	GENERAL PURPOSE MOTORS	RECPT. & SMALL APPLIAN.	LIGHTING	SPECIAL APPLIAN.	AIR CONDIT.	TOTAL
1. CONNECTED WATTS/SQ.FT.	—	1.0	3.0	5.0	.73	9.73
2. CONNECTED LOAD - KW	—	22.0	66	110.0	12	210
3. DEMAND FACTOR - %	—	25	85	30	100	—
4. KW.-MAX. COINCIDENT DEMAND	—	5.5	56.1	33	12	106.6
5.						
6.						

DEMAND FACTOR = $\frac{106.6}{210}$ = 51 %

PRELIMINARY LOAD FACTOR = 23

MINIMUM TRANSFORMER SIZE = 125 KVA

CHOSEN TRANSFORMER SIZE = 3@50 KVA

SPARE CAPACITY = 25 KVA

NOTE:

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CHARLOTTE, N. C.

PROJECT CURTIS RD. - SUPPORT COMPLEX

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FILE UNDER CALCULATIONS

DATE JAN. 12, 1977
REVISED 6 MAY 77

LOAD TABULATION

BUILDING: #16 EM CLUB | CODE: 74063

MECH. SCHEME: C

AREA: 12,800 SQ. FT.

DEMAND FACTORS						
ITEM	GENERAL PURPOSE MOTORS	RECPT. & SMALL APPLIAN.	LIGHTING	SPECIAL APPLIAN.	AIR CONDIT.	TOTAL
1. CONNECTED WATTS/SQ.FT.	—	1.0	3.0	5.0	.78	9.78
2. CONNECTED LOAD - KW	—	12.8	38.4	64.0	7	122.2
3. DEMAND FACTOR - %	—	25	85	30	100	—
4. KW.-MAX. COINCIDENT DEMAND	—	3.2	32.6	19.2	7	62
5.						
6.						

DEMAND FACTOR = $\frac{62}{122.2}$ = 51 %

PRELIMINARY LOAD FACTOR = 23

MINIMUM TRANSFORMER SIZE = 73 KVA

CHOSEN TRANSFORMER SIZE = 3@25 KVA

SPARE CAPACITY = 2 KVA

NOTE:

COMM. NO. 4668

PROJECT CURTIS RD. - SUPPORT COMPLEX

FILE UNDER CALCULATIONS

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CHARLOTTE, N. C.

DESIGN FOR LOAD CALCULATIONS

PREPARED BY D.L.

DATE JAN. 12, 1977
REVISED 6 MAY 77

LOAD TABULATION

BUILDING: #17 GYMNASIUM CODE: 74043

MECH. SCHEME: C

AREA: 42,000 SQ. FT.

DEMAND FACTORS						
ITEM	GENERAL PURPOSE MOTORS	RECPT. & SMALL APPLIAN.	LIGHTING	SPECIAL APPLIAN.	AIR CONDIT.	TOTAL
1. CONNECTED WATTS/SQ.FT.	—	1.0	3.0	—	.38	4.38
2. CONNECTED LOAD - KW	—	42.0	126.0	—	16	184
3. DEMAND FACTOR - %	—	10	90	—	100	—
4. KW. - MAX. COINCIDENT DEMAND	—	4.2	113.4	—	16	133.6
5.						
6.						

DEMAND FACTOR = $\frac{133.6}{184}$ = 73 %

PRELIMINARY LOAD FACTOR = 35

MINIMUM TRANSFORMER SIZE = 157 KVA

CHOSEN TRANSFORMER SIZE = 225 KVA PAD MT'D

SPARE CAPACITY = 68 KVA

NOTE:

COMM. NO. 4668

PROJECT CURTIS RD. - SUPPORT COMPLEX

FILE UNDER CALCULATIONS

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DESIGN FOR LOAD CALCULATIONS

PREPARED BY D.L.

DATE JAN. 12, 1977
REVISED 6 MAY 77

LOAD TABULATION

BUILDING: #18 AUTO HOBBY SHOP CODE: 74036

MECH. SCHEME: C

AREA: 8,000 SQ. FT.

DEMAND FACTORS						
ITEM	GENERAL PURPOSE MOTORS	RECPT. & SMALL APPLIAN.	LIGHTING	SPECIAL APPLIAN.	AIR CONDIT.	TOTAL
1. CONNECTED WATTS/SQ.FT.	1.0	1.0	2.0	1.0	.63	5.63
2. CONNECTED LOAD - KW	8.0	8.0	16	8.0	5	45
3. DEMAND FACTOR - %	10	10	100	10	100	—
4. KW. - MAX. COINCIDENT DEMAND	.8	.8	16	.8	5	23.4
5.						
6.						

DEMAND FACTOR = $\frac{23.4}{45}$ = 52 %

PRELIMINARY LOAD FACTOR = 30

MINIMUM TRANSFORMER SIZE = 28 KVA

CHOSEN TRANSFORMER SIZE = 37½ KVA

SPARE CAPACITY = 9.5 KVA

NOTE:

COMM. NO. 466B

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CHARLOTTE, N. C.

DESIGN FOR LOAD CALCULATIONS

PROJECT CURTIS RD. SUPPORT COMPLEX

PREPARED BY D.L.

FILE UNDER CALCULATIONS

DATE JAN. 12, 1977
REVISED 6 MAY 77

LOAD TABULATION

BUILDING: #19 SERVICE STATION CODE: 74030

MECH. SCHEME: C

AREA: 4,390 SQ. FT.

DEMAND FACTORS						
ITEM	GENERAL PURPOSE MOTORS	RECPT. & SMALL APPLIAN.	LIGHTING	SPECIAL APPLIAN.	AIR CONDIT.	TOTAL
1. CONNECTED WATTS/SQ.FT.	1.0	1.0	1.0	–	1.1	4.1
2. CONNECTED LOAD - KW	4.4	4.4	4.4	–	5	18.2
3. DEMAND FACTOR - %	20	20	100	–	100	–
4. KW.- MAX. COINCIDENT DEMAND	.9	.9	4.4	–	5	11.2
5.						
6.						

DEMAND FACTOR = $\frac{11.2}{18.2}$ = 62 %

PRELIMINARY LOAD FACTOR = 20

MINIMUM TRANSFORMER SIZE = 13 KVA

CHOSEN TRANSFORMER SIZE = 15 KVA

SPARE CAPACITY = 2 KVA

NOTE:

COMM. NO. 4668

PROJECT CURTIS RD. - SUPPORT COMPLEX

FILE UNDER CALCULATIONS

J. N. PEASE ASSOCIATES
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DATE JAN. 12, 1977
REVISED 6 MAY 77

LOAD TABULATION

BUILDING: #20 - MECHANICAL BLDG. CODE: 82720

MECH. SCHEME: C

AREA = 1,200 SQ.FT.

DEMAND FACTORS						
ITEM	GENERAL PURPOSE MOTORS	RECPT. & SMALL APPLIAN.	LIGHTING	SPECIAL APPLIAN.	AIR CONDIT.	TOTAL
1. CONNECTED WATTS/SQ.FT.	20	.5	.5	—	560	581
2. CONNECTED LOAD - KW	25	.6	.6	—	405	431.2
3. DEMAND FACTOR - %	80	100	100	—	100	—
4. KW. - MAX. COINCIDENT DEMAND	20	.6	.6	—	405	426.2
5.						
6.						

DEMAND FACTOR = $\frac{426.2}{431.2}$ = 99 %

PRELIMINARY LOAD FACTOR = 30

MINIMUM TRANSFORMER SIZE = 501 KVA

CHOSEN TRANSFORMER SIZE = 750 KVA

SPARE CAPACITY = 249 KVA

NOTE:

ELECTRICAL CALCULATIONS

MECHANICAL SCHEME "D"

COMM. NO. 4668 J. N. PEASE ASSOCIATES DESIGN FOR

ARCHITECTS ENGINEERS PLANNERS

CHARLOTTE, N. C.

PROJECT. CURTIS RD - SUPPORT COMPLEX

PREPARED BY DL

FILE UNDER. CALCULATIONS.

DATE JAN 17, 1977+

COINCIDENT PEAK DEMAND - MECH. SCHEME "D"

NO.	FACILITY	AREA SQ.FT	MAX. DEMAND (KW)	LOAD FACTOR (%)	COINCIDENCE FACTOR (TABLE 1-8) (%)	ADJUSTED COINCIDENCE FACTOR * (%)	COINCIDENCE PEAK (KW)	
1	CHAPEL	10,710	59.3	20	59	61	36.4	
2	CHILD CARE CENTER	2,475	32.7	30	59	61	19.9	
3	COMMISSARY	18,800	142.9	30	59	61	87.2	
4	CAFETERIA	9,300	86.45	20	48	51	44.1	
5	CREDIT UNION	2,800	25.7	35	71	73	18.8	
6	BANK	1,900	18	25	64	66	11.9	
7	THRIFT SHOP	2,500	29.3	30	69	71	20.8	
8	THEATRE	10,900	60.5	12	44	47	28.4	
9	POST OFFICE	6,325	54.3	25	64	66	35.8	
10	BOWLING ALLEY	15,200	106.8	15	38	41	43.8	
11	HOBBY SHOP	4,600	39	30	59	61	23.8	
12	YOUTH CENTER	9,250	61.8	25	55	57	35.2	
13	LIBRARY	7,875	78.92	35	64	66	52.1	
14	EXCHANGE	30,282	212.8	25	55	57	121.3	
15	NCO-CLUB	22,000	174.6	23	62	64	111.7	
16	EM-CLUB	12,800	104	23	62	64	66.6	
17	GYMNASIUM	42,000	133.6	35	64	66	88.2	
18	AUTO HOBBY SHOP	8,000	23.4	30	59	61	14.3	
19	SERVICE STATION	4,390	11.2	20	48	51	5.7	

*: ADJUSTED COINCIDENCE FACTOR COMPUTED USING FORMULA: $E_n = E_t + (1 - E_t)\frac{1}{n}$ SEE U.S. NAVY DESIGN MANUAL NAVFAC DM.4. PAGE 4-1-17

TOTAL	866
LOSSES	52.0
SPARE	129.9
GRAND TOTAL	1047.9

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CHARLOTTE, N. C.

PROJECT CURTIS RD. SUPPORT COMPLEX

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FILE UNDER CALCULATIONS

DATE JAN. 13, 1977
REVISED 6 MAY 77

LOAD TABULATION

BUILDING: #1 CHAPEL & RELIGIOUS EDUCATION; CODE: 74010

MECH. SCHEME: "D"

AREA: 10,710 SQ. FT.

DEMAND FACTORS						
ITEM	GENERAL PURPOSE MOTORS	RECPT. & SMALL APPLIAN.	LIGHTING	SPECIAL APPLIAN.	AIR CONDIT.	TOTAL
1. CONNECTED WATTS/SQ.FT.	—	1.0	2.0	—	5.7	8.7
2. CONNECTED LOAD - KW	—	10.7	21.4	—	40	72.1
3. DEMAND FACTOR - %	—	10	85	—	100	—
4. KW.-MAX. COINCIDENT DEMAND	—	1.1	18.2	—	40	59.3
5.						
6.						

DEMAND FACTOR = $\frac{59.3}{72.1}$ = 82 %

PRELIMINARY LOAD FACTOR = 20

MINIMUM TRANSFORMER SIZE = 70 KVA

CHOSEN TRANSFORMER SIZE = 3@25 KVA

SPARE CAPACITY = 5 KVA

NOTE:

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FILE UNDER CALCULATIONS | CHARLOTTE, N. C. | DATE JAN. 13, 1977
REVISED 6 MAY 77

LOAD TABULATION

BUILDING: #2 CHILD CARE CENTER CODE: —

MECH. SCHEME: D

AREA: 2,475 SQ. FT

DEMAND FACTORS						
ITEM	GENERAL PURPOSE MOTORS	RECPT. & SMALL APPLIAN.	LIGHTING	SPECIAL APPLIAN.	AIR CONDIT.	TOTAL
1. CONNECTED WATTS/SQ.FT.	—	1.0	3.0	—	7.2	11.2
2. CONNECTED LOAD - KW	—	2.5	7.4	—	25	34.9
3. DEMAND FACTOR - %	—	10	100	—	100	—
4. KW.-MAX. COINCIDENT DEMAND	—	0.25	7.4	—	25	32.7
5.						
6.						

DEMAND FACTOR = $\frac{32.7}{34.9}$ = 94 %

PRELIMINARY LOAD FACTOR: 30

MINIMUM TRANSFORMER SIZE: 38 KVA

CHOSEN TRANSFORMER SIZE = KVA

SPARE CAPACITY = KVA

NOTE:

COMM. NO. 4668

PROJECT CURTIS RD. - SUPPORT COMPLEX

FILE UNDER CALCULATIONS

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CHARLOTTE, N. C.

DESIGN FOR LOAD CALCULATIONS

PREPARED BY D.L.

DATE JAN. 13, 1977
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LOAD TABULATION

BUILDING: #3- COMMISSARY CODE: 74023

MECH. SCHEME: D

AREA: 18,500 SQ. FT.

DEMAND FACTORS						
ITEM	GENERAL PURPOSE MOTORS	RECPT. & SMALL APPLIAN.	LIGHTING	SPECIAL APPLIAN.	AIR CONDIT.	TOTAL
1. CONNECTED WATTS/SQ.FT.	—	2.0	4.0	—	6.75	12.75
2. CONNECTED LOAD · KW	—	37.0	74.0	—	80	191
3. DEMAND FACTOR - %	—	10	80	—	100	—
4. KW.- MAX. COINCIDENT DEMAND	—	3.7	59.2	—	80	142.9
5.						
6.						

DEMAND FACTOR = $\frac{142.9}{191}$ = 75 %

PRELIMINARY LOAD FACTOR: 30

MINIMUM TRANSFORMER SIZE = 168 KVA

CHOSEN TRANSFORMER SIZE = 300 KVA PAD MT'D

SPARE CAPACITY = 30 KVA

NOTE: TRANSFORMER TO SERVE ALSO BLDG #4

COMM. NO. 466B

PROJECT CURTIS RD. - SUPPORT COMPLEX

FILE UNDER CALCULATIONS

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DATE JAN. 13, 1977
REVISED 6 MAY 77

LOAD TABULATION

BUILDING: #4 - CAFETERIA   CODE: —

MECH. SCHEME: D

AREA: 9,300 SQ. FT.

DEMAND FACTORS						
ITEM	GENERAL PURPOSE MOTORS	RECPT. & SMALL APPLIAN.	LIGHTING	SPECIAL APPLIAN.	AIR CONDIT.	TOTAL
1. CONNECTED WATTS/SQ.FT.	—	1.5	3.0	5.0	8.3	17.8
2. CONNECTED LOAD - KW	—	14.0	28.0	46.5	48	136.5
3. DEMAND FACTOR - %	—	25	75	30	100	—
4. KW.-MAX. COINCIDENT DEMAND	—	3.5	21.0	13.95	48	86.45
5.						
6.						

DEMAND FACTOR = $\frac{86.45}{136.5}$ = 63 %

PRELIMINARY LOAD FACTOR: 20

MINIMUM TRANSFORMER SIZE: 102 KVA

CHOSEN TRANSFORMER SIZE = — KVA

SPARE CAPACITY = — KVA

NOTE: SEE BLDG. # 3 FOR TRANSFORMER USED

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FILE UNDER CALCULATIONS | CHARLOTTE, N. C. | DATE JAN. 13, 1977

REVISED 6 MAY 77

LOAD TABULATION

BUILDING: #5 CREDIT UNION CODE: —

MECH. SCHEME: D

AREA: 2,800 SQ. FT.

DEMAND FACTORS						
ITEM	GENERAL PURPOSE MOTORS	RECPT. & SMALL APPLIAN.	LIGHTING	SPECIAL APPLIAN.	AIR CONDIT.	TOTAL
1. CONNECTED WATTS/SQ.FT.	—	2.0	4.0	—	7.1	13.1
2. CONNECTED LOAD - KW	—	5.6	11.2	—	14	30.8
3. DEMAND FACTOR - %	—	10	100	—	100	—
4. KW.-MAX. COINCIDENT DEMAND	—	.5	11.2	—	14	25.7
5.						
6.						

DEMAND FACTOR = $\frac{25.7}{30.8}$ = 83 %

PRELIMINARY LOAD FACTOR = 35

MINIMUM TRANSFORMER SIZE = 30 KVA

CHOSEN TRANSFORMER SIZE = — KVA

SPARE CAPACITY = — KVA

NOTE: SEE BLDG. #9 FOR TRANSFORMER USED.

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FILE UNDER CALCULATIONS — CHARLOTTE, N. C. — DATE JAN. 13, 1977 REVISED 6 MAY 77

LOAD TABULATION

BUILDING: #6 BANK — CODE: 74018

MECH. SCHEME: D

AREA: 1,900 SQ.FT.

DEMAND FACTORS						
ITEM	GENERAL PURPOSE MOTORS	RECPT. & SMALL APPLIAN.	LIGHTING	SPECIAL APPLIAN.	AIR CONDIT.	TOTAL
1. CONNECTED WATTS/SQ.FT.	—	2.0	4.0	—	7.6	13.6
2. CONNECTED LOAD - KW	—	3.8	7.6	—	10	21.4
3. DEMAND FACTOR - %	—	10	100	—	100	—
4. KW.-MAX. COINCIDENT DEMAND	—	.40	7.6	—	10	18
5.						
6.						

DEMAND FACTOR = $\frac{18}{21.4}$ = 84 %

PRELIMINARY LOAD FACTOR = 25

MINIMUM TRANSFORMER SIZE = 21 KVA

CHOSEN TRANSFORMER SIZE = 25 KVA

SPARE CAPACITY = 4 KVA

NOTE:

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CHARLOTTE, N. C.

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DATE JAN. 13, 1977
REVISED 6 MAY 77

LOAD TABULATION

BUILDING: #7 - THRIFT SHOP   CODE: —

MECH. SCHEME: D

AREA: 2,500 SQ. FT.

DEMAND FACTORS						
ITEM	GENERAL PURPOSE MOTORS	RECPT. & SMALL APPLIAN.	LIGHTING	SPECIAL APPLIAN.	AIR CONDIT.	TOTAL
1. CONNECTED WATTS/SQ.FT.	—	1.0	6.0	—	9.3	16.3
2. CONNECTED LOAD - KW	—	2.5	15.0	—	14	31.5
3. DEMAND FACTOR - %	—	10	100	—	100	—
4. KW. - MAX. COINCIDENT DEMAND	—	.3	15.0	—	14	29.3
5.						
6.						

DEMAND FACTOR = $\frac{29.3}{31.5}$ = 93 %

PRELIMINARY LOAD FACTOR = 30

MINIMUM TRANSFORMER SIZE = 34 KVA

CHOSEN TRANSFORMER SIZE = — KVA

SPARE CAPACITY = — KVA

NOTE: SEE BUILDING NO. 9 FOR TRANSFORMER USED

COMM. NO. 466B

J. N. PEASE ASSOCIATES

ARCHITECTS ENGINEERS PLANNERS

CHARLOTTE, N. C.

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PROJECT CURTIS RD. SUPPORT COMPLEX

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FILE UNDER CALCULATIONS

DATE JAN. 13, 1977

REVISED 6 MAY 77

LOAD TABULATION

BUILDING: #8. [redacted] THEATRE

CODE: 74056

MECH. SCHEME: D

AREA = 10,900 SQ.FT.

DEMAND FACTORS						
ITEM	GENERAL PURPOSE MOTORS	RECPT. & SMALL APPLIAN.	LIGHTING	SPECIAL APPLIAN.	AIR CONDIT.	TOTAL
1. CONNECTED WATTS/SQ.FT.	—	1.0	2.0	1.0	6.0	10.0
2. CONNECTED LOAD - KW	—	10.9	21.8	10.9	42	85.6
3. DEMAND FACTOR - %	—	10	75	10	100	—
4. KW. - MAX. COINCIDENT DEMAND	—	1.1	16.3	1.1	42	60.5
5.						
6.						

DEMAND FACTOR = $\frac{60.5}{85.6}$ = 71 %

PRELIMINARY LOAD FACTOR: 12

MINIMUM TRANSFORMER SIZE: 71 KVA

CHOSEN TRANSFORMER SIZE = — KVA

SPARE CAPACITY: — KVA

NOTE: SEE BLDG. #9 FOR TRANSFORMER USED.

COMM. NO. 4668

PROJECT CURTIS RD. SUPPORT COMPLEX

FILE UNDER CALCULATIONS

J. N. PEASE ASSOCIATES
ARCHITECTS ENGINEERS PLANNERS
CHARLOTTE, N. C.

DESIGN FOR LOAD CALCULATIONS

PREPARED BY D.L.

DATE JAN. 13, 1977
REVISED 6 MAY 77

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BUILDING: #9 - POST OFFICE CODE: 74033

MECH. SCHEME: D

AREA: 6,325 SQ.FT.

DEMAND FACTORS						
ITEM	GENERAL PURPOSE MOTORS	RECPT. & SMALL APPLIAN.	LIGHTING	SPECIAL APPLIAN.	AIR CONDIT.	TOTAL
1. CONNECTED WATTS/SQ.FT.	—	1.0	4.0	1.0	5.9	11.9
2. CONNECTED LOAD - KW	—	6.3	25.3	6.3	24	61.9
3. DEMAND FACTOR - %	—	30	100	50	100	—
4. KW.-MAX. COINCIDENT DEMAND	—	1.9	25.3	3.1	24	54.3
5.						
6.						

DEMAND FACTOR = $\frac{54.3}{61.9}$ = 88 %

PRELIMINARY LOAD FACTOR = 25

MINIMUM TRANSFORMER SIZE = 64 KVA

CHOSEN TRANSFORMER SIZE = 225 KVA PAD MT'D

SPARE CAPACITY = 26 KVA

NOTE: TRANSFORMER TO SERVE ALSO BLDGS # 5, 7, & 8.

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DATE JAN. 13, 1977
REVISED 6 MAY 77

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BUILDING: 10 - BOWLING ALLEY   CODE: 74040

MECH. SCHEME: D

AREA: 15,200 SQ. FT.

DEMAND FACTORS						
ITEM	GENERAL PURPOSE MOTORS	RECPT. & SMALL APPLIAN.	LIGHTING	SPECIAL APPLIAN.	AIR CONDIT.	TOTAL
1. CONNECTED WATTS/SQ.FT.	—	1.0	2.0	3.0	4.5	10.5
2. CONNECTED LOAD - KW	—	15.2	30.4	45.6	46	137.2
3. DEMAND FACTOR - %	—	10	75	80	100	—
4. KW. - MAX. COINCIDENT DEMAND	—	1.5	22.8	36.5	46	106.8
5.						
6.						

DEMAND FACTOR = $\frac{106.8}{137.2}$ = 78 %

PRELIMINARY LOAD FACTOR = 15

MINIMUM TRANSFORMER SIZE = 126 KVA

CHOSEN TRANSFORMER SIZE = 3@50 KVA

SPARE CAPACITY = 24 KVA

NOTE:

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FILE UNDER CALCULATIONS | CHARLOTTE, N. C. | DATE JAN. 14, 1977

Revised 6 May 77

LOAD TABULATION

BUILDING: 11 - HOBBY SHOP CODE: 74036

MECH. SCHEME: D

AREA: 4,600 SQ. FT.

DEMAND FACTORS						
ITEM	GENERAL PURPOSE MOTORS	RECPT. & SMALL APPLIAN.	LIGHTING	SPECIAL APPLIAN.	AIR CONDIT.	TOTAL
1. CONNECTED WATTS/SQ.FT.	1.0	1.0	3.5	2.0	7.4	14.9
2. CONNECTED LOAD - KW	4.6	4.6	16.1	9.2	21	55.5
3. DEMAND FACTOR - %	10	10	100	10	100	—
4. KW. - MAX. COINCIDENT DEMAND	.5	.5	16.1	.9	21	39
5.						
6.						

DEMAND FACTOR = $\frac{39}{55.5}$ = 70 %

PRELIMINARY LOAD FACTOR = 30

MINIMUM TRANSFORMER SIZE = 46 KVA

CHOSEN TRANSFORMER SIZE = 3@25 KVA

SPARE CAPACITY = 29 KVA

NOTE:

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BUILDING: #12 YOUTH CENTER CODE: —

MECH. SCHEME: D

AREA: 9,250 SQ.FT

DEMAND FACTORS						
ITEM	GENERAL PURPOSE MOTORS	RECPT. & SMALL APPLIAN.	LIGHTING	SPECIAL APPLIAN.	AIR CONDIT.	TOTAL
1. CONNECTED WATTS/SQ.FT.	—	1.0	3.0	0.5	6.6	11.1
2. CONNECTED LOAD - KW	—	9.2	27.7	4.6	39	80.5
3. DEMAND FACTOR - %	—	10	75	25	100	—
4. KW. - MAX. COINCIDENT DEMAND	—	.9	20.7	1.2	39	61.8
5.						
6.						

DEMAND FACTOR = $\frac{61.8}{80.5}$ = 77 %

PRELIMINARY LOAD FACTOR: 25

MINIMUM TRANSFORMER SIZE: 73 KVA

CHOSEN TRANSFORMER SIZE = 3@25 KVA

SPARE CAPACITY = 2 KVA

NOTE:

COMM. NO. 4668
PROJECT CURTIS RD. - SUPPORT COMPLEX
FILE UNDER CALCULATIONS

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DATE JAN. 14, 1977
REVISED 6 MAY 77

LOAD TABULATION

BUILDING: #13 LIBRARY CODE: 74076

MECH. SCHEME: D

AREA = 7,875 SQ. FT.

DEMAND FACTORS						
ITEM	GENERAL PURPOSE MOTORS	RECPT. & SMALL APPLIAN.	LIGHTING	SPECIAL APPLIAN.	AIR CONDIT.	TOTAL
1. CONNECTED WATTS/SQ. FT.	—	1.0	4.0	—	8.25	13.25
2. CONNECTED LOAD - KW	—	9.2	37	—	41	87.2
3. DEMAND FACTOR - %	—	10	100	—	100	—
4. KW. - MAX. COINCIDENT DEMAND	—	.92	37	—	41	78.92
5.						
6.						

DEMAND FACTOR = $\frac{78.92}{87.2}$ = 91 %

PRELIMINARY LOAD FACTOR = 35

MINIMUM TRANSFORMER SIZE = 93 KVA

CHOSEN TRANSFORMER SIZE = 3@ 37½ KVA

SPARE CAPACITY = 19.5 KVA

NOTE:

COMM. NO. 4668

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DATE JAN. 14, 1977

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LOAD TABULATION

BUILDING: #14 EXCHANGE CODE: 74030

MECH. SCHEME: D

AREA 30,282 SQ.FT.

DEMAND FACTORS						
ITEM	GENERAL PURPOSE MOTORS	RECPT. & SMALL APPLIAN.	LIGHTING	SPECIAL APPLIAN.	AIR CONDIT.	TOTAL
1. CONNECTED WATTS/SQ.FT.	—	1.0	4.0	—	5.9	10.9
2. CONNECTED LOAD - KW	—	30.2	121.1	—	113	264.3
3. DEMAND FACTOR - %	—	10	80	—	100	—
4. KW. - MAX. COINCIDENT DEMAND	—	3.0	96.8	—	113	212.8
5.						
6.						

DEMAND FACTOR = $\frac{212.8}{264.3}$ = 81 %

PRELIMINARY LOAD FACTOR = 25

MINIMUM TRANSFORMER SIZE = 250 KVA

CHOSEN TRANSFORMER SIZE = 300 KVA PAD MT'D

SPARE CAPACITY = 50 KVA

NOTE:

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PROJECT CURTIS RD. SUPPORT COMPLEX
FILE UNDER CALCULATIONS

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DESIGN FOR LOAD CALCULATIONS
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DATE JAN. 14, 1977
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LOAD TABULATION

BUILDING: #15 - NCO CLUB CODE: 74066

MECH. SCHEME: D

AREA = 22,000 SQ.FT.

DEMAND FACTORS						
ITEM	GENERAL PURPOSE MOTORS	RECPT. & SMALL APPLIAN.	LIGHTING	SPECIAL APPLIAN.	AIR CONDIT.	TOTAL
1. CONNECTED WATTS/SQ.FT.	—	1.0	3.0	5.0	5.6	14.6
2. CONNECTED LOAD - KW	—	22.0	66	110.0	80	278
3. DEMAND FACTOR - %	—	25	85	30	100	—
4. KW.-MAX. COINCIDENT DEMAND	—	5.5	56.1	33	80	174.6
5.						
6.						

DEMAND FACTOR = $\frac{174.6}{278}$ = 63 %

PRELIMINARY LOAD FACTOR = 23

MINIMUM TRANSFORMER SIZE = 205 KVA

CHOSEN TRANSFORMER SIZE = 225 KVA PAD MT'D

SPARE CAPACITY = 20 KVA

NOTE:

COMM. NO. 4668

PROJECT CURTIS RD. - SUPPORT COMPLEX

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LOAD TABULATION

BUILDING: #16 EM CLUB

CODE: 74063

MECH. SCHEME: D

AREA: 12,800 SQ. FT.

DEMAND FACTORS						
ITEM	GENERAL PURPOSE MOTORS	RECPT. & SMALL APPLIAN.	LIGHTING	SPECIAL APPLIAN.	AIR CONDIT.	TOTAL
1. CONNECTED WATTS/SQ.FT.	—	1.0	3.0	5.0	5.9	14.9
2. CONNECTED LOAD - KW	—	12.8	38.4	64.0	49	164.2
3. DEMAND FACTOR - %	—	25	85	30	100	—
4. KW.-MAX. COINCIDENT DEMAND	—	3.2	32.6	19.2	49	104
5.						
6.						

DEMAND FACTOR = $\frac{104}{164.2}$ = 63 %

PRELIMINARY LOAD FACTOR = 23

MINIMUM TRANSFORMER SIZE = 122 KVA

CHOSEN TRANSFORMER SIZE = 3@50 KVA

SPARE CAPACITY = 28 KVA

NOTE:

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PROJECT CURTIS RD. - SUPPORT COMPLEX

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DATE JAN. 14, 1977

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LOAD TABULATION

BUILDING: #17 - GYMNASIUM CODE: 74043

MECH. SCHEME: D

AREA: 42,000 SQ. FT.

DEMAND FACTORS						
ITEM	GENERAL PURPOSE MOTORS	RECPT. & SMALL APPLIAN.	LIGHTING	SPECIAL APPLIAN.	AIR CONDIT.	TOTAL
1. CONNECTED WATTS/SQ.FT.	—	1.0	3.0	—	0.42	4.5
2. CONNECTED LOAD - KW	—	42.0	126.0	—	16	184
3. DEMAND FACTOR - %	—	10	90	—	100	—
4. KW. - MAX. COINCIDENT DEMAND	—	4.2	113.4	—	16	133.6
5.						
6.						

DEMAND FACTOR = $\frac{133.6}{184}$ = 73 %

PRELIMINARY LOAD FACTOR = 35

MINIMUM TRANSFORMER SIZE = 157 KVA

CHOSEN TRANSFORMER SIZE = 225 KVA PAD MT'D.

SPARE CAPACITY = 68 KVA

NOTE:

COMM. NO. 4668

PROJECT CURTIS RD. SUPPORT COMPLEX

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LOAD TABULATION

BUILDING: #18 AUTO HOBBY SHOP CODE: 74036

MECH. SCHEME: D

AREA: 8000 SQ.FT

DEMAND FACTORS

ITEM	GENERAL PURPOSE MOTORS	RECPT. & SMALL APPLIAN.	LIGHTING	SPECIAL APPLIAN.	AIR CONDIT.	TOTAL
1. CONNECTED WATTS/SQ.FT.	1.0	1.0	2.0	1.0	0.62	5.62
2. CONNECTED LOAD - KW	8.0	8.0	16.0	8.0	5.0	45
3. DEMAND FACTOR - %	10	10	100	10	100	-
4. KW.- MAX. COINCIDENT DEMAND	.8	.8	16	.8	5.	23.4
5.						
6.						

DEMAND FACTOR = $\frac{23.4}{45}$ = 52 %

PRELIMINARY LOAD FACTOR = 30

MINIMUM TRANSFORMER SIZE = 27.5 KVA

CHOSEN TRANSFORMER SIZE = 37½ KVA

SPARE CAPACITY = 10 KVA

NOTE:

COMM. NO. 4668

PROJECT CURTIS RD. - SUPPORT COMPLEX

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DESIGN FOR LOAD CALCULATIONS

PREPARED BY D.L.

DATE JAN. 14, 1977
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LOAD TABULATION

BUILDING: #19 SERVICE STATION CODE: 74030

MECH. SCHEME: D

AREA: 4390 SQ. FT.

DEMAND FACTORS						
ITEM	GENERAL PURPOSE MOTORS	RECPT. & SMALL APPLIAN.	LIGHTING	SPECIAL APPLIAN.	AIR CONDIT.	TOTAL
1. CONNECTED WATTS/SQ.FT.	1.0	1.0	1.0	–	.62	9.2
2. CONNECTED LOAD - KW	4.4	4.4	4.4	–	5.0	18.2
3. DEMAND FACTOR - %	20	20	100	–	100	–
4. KW. - MAX. COINCIDENT DEMAND	.9	.9	4.4	–	5.0	11.2
5.						
6.						

DEMAND FACTOR = $\frac{11.2}{18.2}$ = 61 %

PRELIMINARY LOAD FACTOR = 20

MINIMUM TRANSFORMER SIZE = 13 KVA

CHOSEN TRANSFORMER SIZE = 15 KVA

SPARE CAPACITY = 2 KVA

NOTE:

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FILE UNDER CALCULATIONS | CHARLOTTE, N. C. | DATE JAN. 14, 1977

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BUILDING: #20 - MECHANICAL BLDG   CODE:

MECH. SCHEME: E

DEMAND FACTORS						
ITEM	GENERAL PURPOSE MOTORS	RECPT. & SMALL APPLIAN.	LIGHTING	SPECIAL APPLIAN.	AIR CONDIT.	TOTAL
1. CONNECTED WATTS/SQ.FT.	10	.5	.5	—	40	51
2. CONNECTED LOAD - KW	12	.6	.6	—	38	51.2
3. DEMAND FACTOR - %	8	100	100	—	100	—
4. KW. - MAX. COINCIDENT DEMAND	9.6	.6	.6	—	38	48.8
5.						
6.						

DEMAND FACTOR = $\frac{48.8}{51.2}$ = 95 %

PRELIMINARY LOAD FACTOR = 30

MINIMUM TRANSFORMER SIZE = 57 KVA

CHOSEN TRANSFORMER SIZE = 3@ 25 KVA

SPARE CAPACITY = 18 KVA

NOTE:

APPENDIX 04
SANITARY SEWER DEMAND

SANITARY SEWER DEMAND

The demand for sanitary sewer service to the Support Facilities Complex is expected to average approximately 98,720 gallons per day (GPD). Peak demand should be approximately three times the daily average rate or 296,160 GPD. This figure represents 60% of the minimum capacity in an 8" sewer laid at a minimum grade of .4%. Therefore if the maximum capacity of the existing 8" sanitary sewer adjacent to Curtis Road (in front of Delalio School) exceeds 40% of the capacity of the pipe, overloading of the sanitary sewer is likely and a larger pipe size might be necessary. The following table shows the approximate demand of each of the planned structures and the existing Delalio School. Demand requirements were taken from Wastewater Engineering by Metcalf & Eddy. Capacities of buildings were based on approximate square footage requirements and probable functions of each structure.

Facility	Capacity	x	Demand/Per Day	=	GPD
1. Chapel and Religious Education	2 employees	x	20 gallon/employee	=	40
2. Child Care Center	80 children	x	15 gallon/child	=	1,200
3. Commissary	20 employees	x	20 gallon/employee	=	400
4. Cafeteria	400 seats	x	150 gallon/seat	=	60,000
5. Credit Union	10 employees	x	20 gallon/employee	=	200
6. Bank	10 employees	x	20 gallon/employee	=	200
7. Thrift Shop	5 employees	x	20 gallon/day	=	100
8. Theatre	800 seats	x	5 gallon/seat	=	4,000
9. Post Office	10 employees	x	20 gallon/employee	=	200
10. Bowling Alley	16 Lanes	x	200 gallon/lane	=	3,200
11. Art and Craft (Hobby Shop)	2 employees	x	60 gallon/day	=	120
12. Youth Center	100 seats	x	30 gallon/seat	=	3,000
13. Library	8 employees	x	20 gallon/employee	=	160
14. Exchange	40 employees	x	20 gallon/employee	=	800
15. NCO Club	300 seats	x	20 gallon/seat		6,000
16. Enlisted Men's Club	100 seats	x	20 gallon/seat	=	2,000
17. Gymnasium	200 showers	x	30 gallon/shower	=	6,000
18. Automotive Hobby Shop	20 mechanics	x	20 gallon/mechanic	=	400
19. Service Station and Car Wash	1 station	x	5,000 gallon/station	=	5,000
Existing Delalio School	350 students	x	15 gallon/student	=	5,250
			Total average gallons per day	=	98,720

Total peak demand = 296,160 GPD

Supplement to Planning Study Cost Estimate
Exchange and Community Center
New River Marine Corps Air Station (H)
Camp Lejeune
Jacksonville, North Carolina

1. Reference Para. 08.32 DESCRIPTION OF ALTERNATIVES

a. Selection Data for Central Plant Equipment for Scheme C

Centrifugal Refrigeration Machines

Number Required	-	Two
Capacity	-	225 Tons
GPM	-	532
Ent. Chilled Water	-	52°
Lea. Chilled Water	-	42°
Based On	-	Trane CVHA 025

Chilled Water Pumps

Number Required	-	Two
Type	-	Horizontal Split Case
GPM	-	532
Head Loss	-	75 Feet
RPM	-	1,750
Based On	-	Weinman 4" L2
Motor HP	-	15

Condenser Water Pumps

Number Required	-	Two
Type	-	Horizontal Split Case
GPM	-	675
Head Loss	-	75 Feet
RPM	-	1,750
Based On	-	Weinman 5" L3
Motor HP	-	15

Cooling Towers

Number Required	-	Two
Type	-	Steel Forced Draft
Ambient Wet Bulb		
Temp	-	78°
GPM	-	675
Ent. Water	-	95°
Lea. Water	-	85°
Based On	-	Baltimore Air Coil Co. VLT 235B
Fan Motor HP	-	2 @ 15 ea.

b. Selection Data for Central Plant Equipment for Scheme E

Loop Circulating Pumps

Number Required	-	Two
Type	-	Horizontal Split Case
GPM	-	585
Head Loss	-	75 Feet
RPM	-	1,750
Based On	-	Weinman 4" L2
Motor HP	-	15

Heat Rejector

Number Required	-	Two
Type	-	Closed Circuit Evaporative Cooler
Ambient Wet Bulb		
Temp	-	78°
Heat Rejected (443 Tons x 12,000 x 1.4 x .95 (Diversity) = 7,070,280 BTUH		
GPM (2.2 GPM/10,000)		
BTU/2	-	585
Ent. Water	-	102°
Lea. Water	-	90°
Based On	-	Baltimore Air Coil Co. VI-100-3
Fan Motor HP	-	2 @ 15 each
Pump Motor HP	-	3

Supplementary Heating Boiler

January Peak Oil Demand	-	27 Gal./Hr.
BTUH Input (139,000 BTU/ Gal. x 27)	-	3,753,000
BTUH Output (.75 x 3,753,000)	-	2,814,750
Based On	-	Cleaver Brooks Model M4W 4,000
BTUH Input	-	4,000,000
BTUH Output	-	3,200,000
Boiler HP	-	95
Blower Motor HP	-	5

Storage Tank

Tons of Refrigeration	-	443
Gal. Tank Cap/Ton	-	50
Tank Size (443 x 50)	-	22,150 Gal.
Select (Standard Size)	-	25,000 Gal. Tank

2. Reference Para. 08.51 INVESTMENT COSTS

a. Cost Data for Scheme A

AC Systems 443 Tons x $1,470/Ton	=	$651,210
Oil-fired Heating System 19 Systems x $5,000.00 ea.	=	95,000
Total		$746,210

b. Cost Data for Scheme B

AC Systems 443 Tons x $1,470/Ton	=	$651,210
Below Ground Steam Dist. (See Est. Sheets)	=	289,785
Above Ground Steam Dist. (See Est. Sheets)	=	99,251
Total		$1,040,246

c. Cost Data for Scheme C

Air Handling System 443 Tons x $1,178/Ton	=	$521,854
Chilled W. Piping (See Est. Sheets)	=	234,904
Below Ground Steam Dist. (See Est. Sheets)	=	289,785
Above Ground Steam Dist. (See Est. Sheets)	=	99,251
Central Plant Equip. (See Est. Sheets)	=	168,838
Central Plant Building 750S.F. x $25/S.F.	=	18,750
Total		$1,333,382

d. Cost Data for Scheme D

Air to Air Heat Pump 31 units x 5,500/unit	=	$170,500
Sheet Metal 250,000 LBS x 1.65/LB	=	412,500
Grilles & Diffusers	=	55,000
Insulation	=	45,000
Controls	=	30,000
Check Test & Start 19 x $300.00	=	5,700
Total		$718,700

e. Cost Data for Scheme E

Air to Water Heat Pump 250 Units x 725/unit	=	$181,250
Sheet Metal 250,000 LBS x 1.65/LB	=	412,500
Grilles & Diffusers	=	55,000
Insulation	=	45,000
Controls	=	50,000
Check Test & Start	=	8,000
Sub Total		$751,750
Water Loop Piping (See Est. Sheet)		79,231
Central Plant Equipment (See Est. Sheet)		121,760
Central Plant Building 300 S.F. x $25/S.F.		7,500
Total		$960,241

3. Reference Para. 08.52 2 Maintenance and Replacement Costs

This data was developed using factors from Honeywell as follows:

a. Maintenance Costs for Scheme A

(1) Packaged AC Units

Annual Cost = $300 + $40 x (tons - 5)

Assumed Average Unit Size = $\frac{443 \text{ Tons}}{31}$ = 14.29 (say 15 tons)

Cost/Unit = 300 + 40 x (15-5)
= 300 + 400 = $700

Assumed No. of Units = 31

Total Annual Costs = 700 x 31 = $21,700

(2) Heating & Ventilating Units

Annual Unit Cost	=	$20.00/Horsepower
Assumed Horsepower	=	4 units @ 5 HP Ea. = 20 HP
Total Annual Cost	=	20 x $20 = $400

(3) Boilers

Annual Unit Cost	=	$550 + ($5 x HP)
	=	$550 + ($5 x 6 HP/unit) = $580
Total Annual Cost	=	15 Units x $580
		= $8,700

(4) Fan and Pump Motors

Annual Unit Cost	=	$5/HP
Total Annual Cost	=	115 HP x 5 = $575

(5) Unit Heaters (Oil)

Annual Unit Costs	=	$60
Total Annual Cost	=	20 x 60 = $1,200

(6) Boiler Water Treatment

Annual Unit Cost	=	$12/HP
Total Annual Cost	=	98 HP x 12 = $1,176

(7) Filter Service

Type Assumed	=	1" disposable
Annual Unit Cost	=	$0.01/CFM
Total CFM Assumed	=	200,000
Total Annual Cost	=	200,000 x .01 = $2,000.00

(8) Controls

Annual Unit Costs:

Single Zone AH Unit Control, Heating and Cooling	$51
Minimum O.A. Control	30
2 Step DX Refrig. Control	50
Room Thermostat	6
Misc.	10
Annual Avg. Cost/Unit	$147

Total Annual Cost = 31 Units x 147 = $4,557

b. Maintenance Costs for Scheme B

(1) Steam Distribution & Condensate Return

Annual Unit Cost = 1%/year
Total Annual Cost = $389,036 x .01 = $3,890

(2) Packaged AC Units

Same as for Scheme A = $21,700

(3) Heating and Ventilating Units

Same as for Scheme A = $400

(4) Fan and Pump Motors

Same as for Scheme A = $575

(5) Unit Heaters (Steam or HW)

Annual Unit Cost = $16
Total Annual Cost = 20 x $16 = $320

(6) Filter Service

Same as for Scheme A = $2,000

(7) Controls

Same as for Scheme A = $4,557

c. Maintenance Costs for Scheme C

(1) Steam Distribution & Condensate Return

Same as for Scheme B = $3,890

(2) Air Handling Units and Centrifugal Chiller System

Annual Cost = $3,500 + $11 x (Ton - 100)

= 3,500 + $11 x (443 - 100) = $7,163

(3) Heating and Ventilating Units

Same as for Scheme A = $400

(4) Fan and Pump Motors

Same as for Scheme A = $800

(5) Unit Heaters

Same as for Scheme B = $320

(6) Condenser Water Treatment (Chemicals, etc.)

Annual Unit Cost = $2/Ton
Total Annual Cost = $2 x 443 = $885

(7) Filter Service

Same as for Scheme A = $2, 000

(8) Controls

Annual Unit Costs

Single Zone AH Unit Control	
Heating and Cooling	$51
Minimum O. A. Control	30
Room Thermostat	6
Misc.	10
Annual Avg. Cost/Unit	97

Annual AH System Cost = 31 units x 97/Syst.	=	$3, 007
Cent. Refrig. = 2 units x $175/Unit	=	350
Total Annual Cost		$3, 357

(9) Chilled Water Loop

Annual Unit Cost = 1%/Year
Total Annual Cost = $234, 904 x .01 = $2, 349

d. Maintenance Costs for Scheme D

(1) Air to Air Heat Pumps

Cost = 1.3 x Cost of Packaged AC Units
= 1.3 x $21,700 $28,210

(2) Heating & Ventilating Units (Electric)

Same as for Scheme A = $400

(3) Motors

Same as for Scheme A = $575

(4) Unit Heaters (Electric)

Annual Unit Cost = $8/Unit
Total Annual Cost = 20 x 8 = 160

(5) Filter Service

Same as for Scheme A = $2,000

(6) Controls

Same as for Scheme A = $4,557

e. Maintenance Costs for Scheme E

(1) Water Loop

Annual Unit Cost = 1%/year
Total Annual Cost = $79,231 x .01 = $792

(2) Supplemental Heating Boiler

Annual Unit Cost = $550 x ($5 x HP)
= $550 x ($5 x 95) = $1,025

(3) Air to Water Heat Pumps

Annual Unit Cost = $108/Unit
Total Annual Cost = 250 Units x $108 = $27,000

(4) Heating and Ventilating Units (Electric)

Same as for Scheme A = $400

(5) Fan and Pump Motors

Same as for Scheme A = $575

(6) Unit Heaters (Electric)

Same as for Scheme D = $160

(7) Heat Rejector (Closed Circuit Cooler)

Maintenance & Replacement Cost

= 1.375 x Original Cost for 25 years

$$\text{Annual Cost} = \frac{1.375 \times 32,000}{25} = 1,760$$

(8) Filter Service

Same as for Scheme A = $2,000

(9) Controls

Incremental Water to Air Heat Pump Control	$23
Room Thermostat	6
Annual Avg. Cost/Unit	$29

Annual Heat Pump Control Cost	= 250 Units x $29	=	$7,250
Water loop System		=	175
Total Annual Cost			7,425

MATERIAL & LABOR COST ESTIMATE 5ND LANTDIV 4-11012/5 (REV. 10/74)

SHEET 1 of

PREPARED BY C.E. NICHOLS

ATLANTIC DIVISION NAVAL FACILITIES ENGINEERING COMMAND

NORFOLK, VIRGINIA

Const. Contr. No.

FUNDS AVAIL.

DATE 20 SEPT [illegible]7

PROJECT CURTIS ROAD SUPP[illegible]

LOCATION CAM[illegible] [illegible], N.C.

☐ PRELIM. ☐ FINAL

ITEMS	QUANTITY	UNIT	MATERIAL COST		LABOR COST		TOTAL COST	REMARKS
			UNIT	TOTAL	UNIT	TOTAL		
STEAM PIPING BELOW GROUND								
4" PIPE & FITTINGS	2290	L.F.	6.16	14,106.00	SEE CLASS "A" CONDUIT BELOW			
CONDENSATE RETURN PIPING								
1½" PIPE & FITTINGS	2290	L.F.	1.57	3595.00	SEE CLASS "A" CONDUIT BELOW			
TRENCHING & BACKFILL 4'W x 4'D	1357	C.Y.			2.00	2714.00		
CLASS "A" CONDUIT W/4" INSULATED								
STEAM SUPPLY & 1½" CONDENSATE								
RETURN (NOT INSULATED) 4 x 1½ x 18	2290	L.F.	45.00	103,050.00	30.00	68,700.00		
ELBOWS	10	EA	656.00	6560.00	100.00	1000.00		
ANCHORS	6	EA	204.00	1224.00	175.00	1050.00		
END SEALS	28	EA	336.00	9408.00	200.00	5600.00		
TRENCHING & BACKFILL	1357	C.Y.			2.00	2714.00		
STEAM MANHOLES 4' I.D. x 6'D 8" CONC								
BLK.	7	EA	300.00	2100.00	155.00	1085.00		
	TOTAL MATERIALS			139,843.00		81,778.00	TOTAL LABOR	

MATERIAL & LABOR COST ESTIMATE   5ND LANTDIV 4-11012/5 (REV. 10/74)   SHEET 2 of ____

PREPARED BY C.E. NICHOLS

ATLANTIC DIVISION NAVAL FACILITIES ENGINEERING COMMAND

Const. Contr. No. ____

NORFOLK, VIRGINIA

FUNDS AVAIL. ____   DATE 26 SEPT [illegible]

PROJECT CUR[illegible] [illegible]   LOCATION [illegible]   ☐ PRELIM. ☐ FINAL

ITEMS	QUANTITY	UNIT	MATERIAL COST UNIT	MATERIAL COST TOTAL	LABOR COST UNIT	LABOR COST TOTAL	TOTAL COST	REMARKS
BELOW GROUND STEAM PIPING								
TOTAL MATERIALS				139,843.00				
4% SALES TAX				5,594.00				
COST OF MATERIAL				145,437.00				
TOTAL LABOR						81,787.00		
INS. ON LABOR 15%						12,268.00		
COST OF LABOR						94055.00		
TOTAL COST OF MATERIALS & LABOR							239,492.00	
SUB-CONTRACTORS OVERHEAD 10%							23,949.00	
						SUB-TOTAL	263,441.00	
SUB-CONTRACTORS PROFIT 10%							26,344.00	
COST TO PRIME CONTRACTOR FOR BELOW GROUND STEAM PIPING							289,785.00	

MATERIAL & LABOR COST ESTIMATE 5ND LANTDIV 4-11012/5 (REV. 10/74)

SHEET 3 of

PREPARED BY C. E. NICHOLS

ATLANTIC DIVISION NAVAL FACILITIES ENGINEERING COMMAND

NORFOLK, VIRGINIA

Const. Contr. No.

FUNDS AVAIL.

DATE [illegible]

PROJECT [illegible]

LOCATION [illegible]

☐ PRELIM. ☐ FINAL

ITEMS	QUANTITY	UNIT	MATERIAL COST		LABOR COST		TOTAL COST	REMARKS
			UNIT	TOTAL	UNIT	TOTAL		
STEAM PIPING ABOVE GROUND								
4" PIPE & FITTINGS	2865	L.F.	6.16	17,648.00	6.20	17,763.00		
1½" CONDENSATE RETURN PIPE & FITTINGS	2865	L.F	1.57	4,498.00	2.20	6,303.00		
CONCRETE PIPE SUPPORTS	143	EA	100.00	14,300.00	100.00	14,300.00		
TOTAL MATERIALS				36,446.00				
4% SALES TAX				1458.00				
COST OF MATERIALS				37904.00				
TOTAL LABOR						38,366.00		
INS. ON LABOR 15%						5755.00		
COST OF LABOR						44,121.00		
TOTAL COST OF MATERIALS & LABOR						82,025.00		
SUB-CONTRACTORS OVERHEAD 10%						8202.00		
				SUB-TOTAL		90228.00		
SUB-CONTRACTOR PROFIT 10%						9023.00		
COST TO PRIME CONTRACTOR FOR ABOVE GROUND STM PIPING						99,251.00		

MATERIAL & LABOR COST ESTIMATE 5ND LANTDIV 4-11012/5 (REV. 10/74)

SHEET 4 of

PREPARED BY C.E. NICHOLS

ATLANTIC DIVISION NAVAL FACILITIES ENGINEERING COMMAND

NORFOLK, VIRGINIA

Const. Contr. No.

FUNDS AVAIL.

DATE 2[illegible] SEPT [illegible]

PROJECT [illegible]

LOCATION [illegible]

☐ PRELIM. ☐ FINAL

ITEMS	QUANTITY	UNIT	MATERIAL COST UNIT	MATERIAL COST TOTAL	LABOR COST UNIT	LABOR COST TOTAL	TOTAL COST	REMARKS
WATERLOOP PIPING BELOW GROUND								
4" PVC PIPE & FITTINGS	8870	L.F.	2.13	18,893.00	3.90	34,593.00		
TRENCHING & BACKFILL 4'W x 4'D	2630	C.Y.			2.00	5260.00		
TOTAL MATERIALS				18,893.00				
4% SALES TAX				756.00				
COST OF MATERIALS				19,649.00				
TOTAL LABOR						39,853.00		
INS. ON LABOR 15%						5978.00		
COST OF LABOR						45,831.00		
TOTAL COST OF MATERIALS & LABOR							65 480.00	
SUB-CONTRACTORS OVERHEAD 10%							6 548.00	
						SUB-TOTAL	72,028.00	
SUB-CONTRACTORS PROFIT 10%							7203.00	
COST TO PRIME CONTRACTOR FOR WATERLOOP PIPING							79,231.00	

MATERIAL & LABOR COST ESTIMATE 5ND LANTDIV 4-11012/5 (REV. 10/74) — SHEET 5 of ____

PREPARED BY C.E. NICHOLS — ATLANTIC DIVISION NAVAL FACILITIES ENGINEERING COMMAND — Const. Contr. No. ____

FUNDS AVAIL. ____ — NORFOLK, VIRGINIA — DATE [illegible] SEPT 1977

PROJECT CURTIS ROAD [illegible] — LOCATION [illegible] — ☐ PRELIM. ☐ FINAL

ITEMS	QUANTITY	UNIT	MATERIAL COST UNIT	MATERIAL COST TOTAL	LABOR COST UNIT	LABOR COST TOTAL	TOTAL COST	REMARKS
CHILLED WATER PIPING BELOW GROUND								
4" PIPE & FITTINGS	8570	L.F.	6.16	52,791.00	7.44	63,761.00		
2" TK FIBERGLASS INSULATION w/WATER-								
PROOF MASTIC (4" PIPE)	8570	L.F.	3.82	32,737.00	2.64	22,625.00		
TRENCHING & BACKFILL 4'W x 4'D	2540	C.Y.			2.00	5080.00		
TOTAL MATERIALS				85,528.00				
4% SALES TAX				3421.00				
COST OF MATERIALS				88,949.00				
TOTAL LABOR						91,466.00		
INS. ON LABOR 15%						13,720.00		
COST OF LABOR						105,186.00		
TOTAL MATERIALS & LABOR							194,135.00	
SUB-CONTRACTORS OVERHEAD 10%							19414.00	
						SUB-TOTAL	213,549.00	
SUB-CONTRACTORS PROFIT 10%							21355.00	
COST TO PRIME CONTRACTOR FOR CHILLED WATER PIPING BELOW GROUND							234,904.00	

MATERIAL & LABOR COST ESTIMATE 5ND LANTDIV 4-11012/5 (REV. 10/74)

SHEET 6 of

PREPARED BY W. A. SANDERS

ATLANTIC DIVISION NAVAL FACILITIES ENGINEERING COMMAND

NORFOLK, VIRGINIA

Const. Contr. No.

FUNDS AVAIL.

DATE 20 SEPT 1977

PROJECT CURTIS ROAD SUPPORT COMPLEX

LOCATION CAMP LE JEUNE, N.C.

☐ PRELIM. ☐ FINAL

ITEMS	QUANTITY	UNIT	MATERIAL COST UNIT	MATERIAL COST TOTAL	LABOR COST UNIT	LABOR COST TOTAL	TOTAL COST	REMARKS
CENTRAL PLANT EQUIP (SCHEME E)								
CIRCULATING PUMPS	2	EA	1500	3000.00	300	600.00		
HEAT REJECTORS	2	EA	16000	32,000.00	4000	8000.00		
BOILER	1	EA	10625	10,625.00	3765	3765.00		
STORAGE TANK (25000 GAL STEEL)	1	EA	7700	7700.00	1880	1880.00		
PIPING & VALVES WITHIN PLANT		LS		3000.00		5000.00		
LOOP WATER TREATMENT SYST.		LS		400.00		200.00		
BOILER FUEL SYSTEM		LS		4000.00		3000.00		
BOILER STACK		LS		1500.00		800.00		
CONTROLS		LS		3000.00		4000.00		
PAINTING		LS		300.00		600.00		
CHECK TEST & START-UP		LS				400.00		
TOTAL MATERIAL				65,525.00				
4% SALES TAX				2,621.00				
COST OF MATERIAL				68,146.00				
TOTAL LABOR						28245.00		
INS ON LABOR 15%						4237.00		
COST OF LABOR						32482.00		
TOTAL MATERIAL & LABOR							100,628.00	

MATERIAL & LABOR COST ESTIMATE 5ND LANTDIV 4-11012/5 (REV. 10/74)

SHEET 7 of

PREPARED BY W. A. SANDERS

ATLANTIC DIVISION NAVAL FACILITIES ENGINEERING COMMAND

NORFOLK, VIRGINIA

Const. Contr. No.

FUNDS AVAIL.

DATE 20 SEPT 1977

PROJECT CURTIS ROAD SUPPORT COMPLEX

LOCATION CAMP LE JEUNE, N.C

☐ PRELIM. ☐ FINAL

ITEMS	QUANTITY	UNIT	MATERIAL COST UNIT	MATERIAL COST TOTAL	LABOR COST UNIT	LABOR COST TOTAL	TOTAL COST	REMARKS
CENT PLANT EQUIP (SCH E) CONT'D								
TOTAL MATERIAL & LABOR							100,628.00	
SUB-CONTRACTORS OVERHEAD 10%							10,063.00	
					SUB-TOTAL		110,691.00	
SUB-CONTRACTORS PROFIT 10%							11069.00	
COST OF CENTRAL PLANT EQUIPMENT							121 760.00	

MATERIAL & LABOR COST ESTIMATE 5ND LANTDIV 4-11012/5 (REV. 10/74)

SHEET 8 of

PREPARED BY W. A. SANDERS

ATLANTIC DIVISION NAVAL FACILITIES ENGINEERING COMMAND

Const. Contr. No.

FUNDS AVAIL.

NORFOLK, VIRGINIA

DATE 20 SEPT 1977

PROJECT CURTIS ROAD SUPPORT COMPLEX LOCATION CAMP LE JEUNE, N.C. ☐ PRELIM. ☐ FINAL

ITEMS	QUANTITY	UNIT	MATERIAL COST		LABOR COST		TOTAL COST	REMARKS
			UNIT	TOTAL	UNIT	TOTAL		
CENTRAL PLANT EQUIP (SCHEME C)								
CENT. REFRIG. MACHINES (225 TONS)	2	EA	27000	54,000.00	6000	12000.00		
CHILLED WATER PUMPS	2	EA	1500	3 000.00	300	600.00		
CONDENSER WATER PUMPS	2	EA	1800	3 600.00	300	600.00		
COOLING TOWERS	2	EA	7200	14400.00	3000	6000.00		
CONDENSER WATER PIPING & VALVES		LS		4 000.00		8000.00		
CHILLED WATER PIPING & VALVES		LS		3 000.00		6000.00		
COND. WATER TREATMENT SYSTEM		LS		800.00		300.00		
PIPING INSULATION (CHILLED WATER)		LS		1200.00		1000.00		
CONTROLS		LS		4000.00		5000.00		
PAINTING		LS		500.00		1000.00		
CHECK TEST & START-UP		LS				800.00		
TOTAL MATERIAL				88,500.00				
4% SALES TAX				3540.00				
COST OF MATERIAL				92,040.00				
TOTAL LABOR						41,300.00		
INS ON LABOR 15%						6,195.00		
COST OF LABOR						47495.00		
TOTAL MATERIAL & LABOR							139,535.00	

MATERIAL & LABOR COST ESTIMATE 5ND LANTDIV 4-11012/5 (REV. 10/74)

SHEET 9 of

PREPARED BY W. A. SANDERS

ATLANTIC DIVISION NAVAL FACILITIES ENGINEERING COMMAND

Const. Contr. No.

FUNDS AVAIL.

NORFOLK, VIRGINIA

DATE 20 SEPT 1977

PROJECT CURTIS ROAD SUPPORT COMPLEX | LOCATION CAMP LE JEUNE, N.C | ☐ PRELIM. ☐ FINAL

ITEMS	QUANTITY	UNIT	MATERIAL COST UNIT	MATERIAL COST TOTAL	LABOR COST UNIT	LABOR COST TOTAL	TOTAL COST	REMARKS
CENT PLANT EQUIP (SCH C) CONTD								
TOTAL MATERIAL & LABOR							139,535.00	
SUB-CONTRACTORS OVERHEAD 10%							13954.00	
					SUB-TOTAL		153,489.00	
SUB-CONTRACTORS PROFIT 10%							15,349.00	
COST OF CENTRAL PLANT EQUIPMENT							168,838.00	