

35

WILMINGTON,
NORTH CAROLINA

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April, 1958

File No. 35

REPORT

ON

WILMINGTON,
NORTH CAROLINA

NATIONAL BOARD OF FIRE UNDERWRITERS

COMMITTEE ON

FIRE PREVENTION AND ENGINEERING STANDARDS

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The survey of conditions in Wilmington, North Carolina was made during December, 1957 by Engineers James W. Roberts, Harold Goldwasser, John L. Jablonsky, and N. F. Odell.

Acknowledgment is made of the valuable assistance rendered by the Hon. J. E. L. Wade, Mayor; James R. Benson, City Manager; the officials and staffs of the various city departments concerned; the South-Eastern Underwriters Association; the North Carolina Fire Insurance Rating Bureau; and others.

WILMINGTON, NORTH CAROLINA

FILE NO. 35

CITY IN GENERAL

The city is administered by a council-manager form of government. The council is composed of 5 members, each elected for 4 years, who elect one of their number to be mayor for 2 years; they also appoint the city manager who serves at their pleasure. The Hon. J. E. L. Wade is Mayor; James R. Benson has been City Manager since 1946.

Population is estimated to be 50,000; the 1950 U. S. census showed a population of 45,043. The city is an important port and railroad center; its principal industries and products include fertilizers, creosoted lumber, textiles, wearing apparel, warehousing, and the storage and shipment of petroleum products.

The city is in the southeastern part of the state 30 miles up the Cape Fear River from the Atlantic Ocean. It covers an area of 10.4 square

miles of which about 80 per cent is built upon. Elevations range from 3 to 65 feet above mean sea level. Street grades are generally slight though there are a few short grades of about 20 per cent in the principal business district. Most streets in the principal business district are 66 feet wide, though the range is from 25 to 99 feet; elsewhere streets are mainly 66 feet wide. Of 122.6 miles of streets 101.7 are paved and in good condition; the unpaved streets vary in condition, some being passable all year.

Records of the United States Weather Bureau indicate that there is no snowfall or prolonged periods of cold weather and that high winds and tornadoes occur infrequently. However, the area does have periods of hot, dry weather and is subject to damage from hurricanes. For further information see Conflagration Hazard, page 19.

FIRE-FIGHTING FACILITIES

WATER SUPPLY

ORGANIZATION. — General. — The water system is municipally owned and operated and supplies all built-up sections in the city and numerous consumers outside.

The department is under the control of the city manager with direct supervision by the Superintendent of Water and Sewers, Colin F. Churchill, who was appointed in 1950. He is a professional engineer with considerable prior experience, and has capable assistants. There are 66 permanent employees. Appointments are made by the superintendent with the approval of the city manager; long tenure of service has been the rule for all employees.

Records.—These consist of construction drawings of the supply works; a general map at 600-foot scale of the distribution system showing mains, valves, and hydrants; large scale sectional sheets of the distribution system; street intersection drawings showing measurements to valves which were not entirely completed during this survey; and index card records for both

valves and hydrants showing available information and inspection data. The valve cards were also not complete since they are made up in conjunction with the street intersection sketches. The general map and sectional drawings are in duplicate, but the intersection drawings are not; the originals are kept in a bound book at the shop office. Consumption and operating records at the filter plant are complete.

Emergency Provisions.—Box alarms of fires are received on a punch register and tapper at the filter plant where someone is always on duty. Response to fires is not made by any water department employee as a part of his regular duties, but all such fires have been attended in recent years. Two foremen take turns being on call during week nights and both keep well equipped trucks at home; 4 men rotate for week ends. The department is well equipped with trucks, and special equipment including among others, a crane, payloader, compressors, pumps, and a valve operating attachment on one truck. Radio is not used for communication. A good supply of spare fittings is available. Emergency repair crews are quickly assembled when needed.

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WATER SUPPLY

OUTLINE OF SYSTEM. — Supply, taken from the Cape Fear River above a dam at Kings Bluff, about 23 miles northwest of the city, is pumped through supply lines to a plant near the northern city limits where it is filtered and re-pumped into a single service distribution system with 2 elevated tanks.

SUPPLY WORKS. — General. — The northwest branch of the Cape Fear River, with a drainage area of over 5000 square miles, furnishes an ample supply. The works comprise intakes, raw-water pumping equipment at 3 locations, filter plant, clear water storage, and main pumping station.

Kings Bluff Pumping Station.—This station, 23 miles northwest of the city, was placed in service in 1945 and forms the main source of supply. Equipment includes 3 centrifugal pumps, one rated 5.0 mgd at 43 psi with a spare 7.5-mgd impeller available, another rated 12.0 mgd at 95 psi, and the third rated 9.0 mgd at 82 psi; pumps are direct-connected to a 250-hp and 600-hp motors, and a 12 cylinder 495-hp gasoline engine, respectively. An overhead crane is provided for repairs. The 5.0- or 12.0-mgd pump is used depending on the consumption rate. The 9.0-mgd pump is held in reserve but is tested weekly for about 2 hours under load.

Each pump takes suction from a common suction well which is fed by a canal of ample size extending 680 feet from the river. The level of the river is maintained at about elevation 15.0 by a dam; highest river stage, elevation 28.0, occurred in 1945. A bar rack and a conveyor screen are provided to prevent leaves and debris from entering the intake. Pumps, in a pit 20 feet deep with bottom at elevation 8.29, discharge through rising connections to a 16-inch unvalved header with a connection to a 30-inch steel-cylinder-type reinforced concrete pipe.

Power is supplied at 33,000 volts over a single circuit to three 150-kva, 33,000/2200-volt transformers in a yard near the station. From the yard, power is carried in 2 underground conduits to the station. Gasoline is stored in a 6000-gallon underground tank about 100 feet from the station; ordinarily about 3 days supply is on hand. In 1955 a storm caused interruption of electric service to the station for 3 days.

The station is a small area brick building with concrete roof and floor, containing little combustible material; it is unexposed. Wiring is in conduit. The office section is electrically heated. A small sump pump sufficient to handle only leakage is installed. The flood of 1945 came within 1 foot of window sills and 2 feet of the door sill at elevation 29.0 and 30.0, respectively. A 230-volt gasoline-engine-driven generator is provided for standby power to the lights and

sump pump. A 15-pound and a 5-pound carbon dioxide extinguishers are provided at the standby pump and generator respectively; 25 feet of garden hose with connection is provided inside the station and 100 feet of 1½-inch hose with a connection to the discharge header is outside. There is no response of fire apparatus. Two operators live nearby.

Toomers Creek Pumping Station.—This station is now held in reserve and tested infrequently. Equipment consists of two electrically-driven 4.0-mgd centrifugal pumps. Suction is through a short 24-inch connection extending from 3 feet below low water in Toomers Creek, a cross-cut in a bend of the Cape Fear River. Discharge connects to the raw water conduits at the beginning of the 24-inch cast-iron sections.

A 12,000-volt circuit extends from a substation near the city. The pumps are in a concrete pit with a wood joisted roof on brick superstructure. No fire protection is provided. Manual operation is necessary by an engineer from the main pump station in event of use.

Hilton Pumping Station.—Originally the main pumping station, this facility has now been abandoned except for one 8.0-mgd raw-water pump driven by a 125-hp 2200-volt motor or an 8-cylinder 180-hp gasoline engine. Suction is through a 16-inch connection extending from the Cape Fear River. Discharge is to the old 24-inch cast-iron raw-water conduit.

Power is supplied from a bank of 2200-volt transformers, 200 feet away. Gasoline is supplied from a 500-gallon underground tank west of the station.

The pump is located in a small one-story concrete block building within the old brick station. Heat is provided by infra-red bulbs. A 15-pound carbon dioxide extinguisher is provided.

Raw Water Supply Lines.—From Kings Bluff Pumping Station a 30-inch steel-cylinder-type reinforced concrete pipe extends 20.97 miles to Toomers Creek, 1.07 miles of which is on pile bents. Two 24-inch cast-iron lines extend from this point 2.18 miles to the filter plant; these lines are on pile bents to the Cape Fear River which they cross in the stream bed. The older line is provided with a venturi meter at the plant and discharges into the mixing chamber; the newer line, which is cement lined, connects to the first line ahead of the venturi. A third line, which is normally closed, extends for a short distance from the older line at the Cape Fear River to a point in the first line between the venturi and the mixing chamber. The concrete line is gated at both ends and at 2 intermediate points. The cast-iron lines have 2 single-valved interconnections at Toomers Creek and one midway to the filter plant. Line valves are installed

at Hilton Pumping Station and the filter plant. Adequate blow-off and air valves are provided.

Sweeney Filter Plant and Pumping Station.— This plant, built in 1943, is located at 5th and Hilton Streets.

Raw water is received in the mixing chamber and passes through a flocculation basin into a common flume which supplies 10 sedimentation basins, then to a second common flume from which 10 rapid sand filters, rated at 1.0 mgd each, are supplied; 2 additional filters are under construction. From the filters flow is to an effluent flume and then through a 36-inch cast-iron pipe to two reservoirs so arranged that either may be bypassed; a sluice gate is provided to deliver water directly from the effluent flume to the clear well.

Both reservoirs are of reinforced concrete. One, placed in service in 1943, is rectangular in shape and holds 4.0 mg at 15 feet depth; the second is circular and with full depth of 12 feet holds 1.0 mg. Elevation of full line is 33.0 for both reservoirs; usual operation allows a draw-down of about 4 feet leaving an average minimum storage of 4.0 mg. A 30-inch cast-iron line extends from each reservoir to a single 30-inch line that supplies the clear well.

Pumping equipment includes a 7.0-mgd centrifugal unit driven by either a 350-hp motor or a 12-cylinder 495-hp gasoline engine, a 5.0-mgd two-stage centrifugal pump with a 300-hp motor, a 12.0-mgd centrifugal pump with a 600-hp motor, and a standby 4.0-mgd centrifugal pump direct-connected to a 240-hp gasoline engine. All pumps are rated at 86 psi. A 11.6-mgd wash water pump is also provided. All pumps can deliver slightly more than rated capacity.

Pumps take suction directly from the clear well with bottom elevation at 17.0; suction is within 18 inches of the bottom. The 7.0-mgd pump is in a pit and receives water under a positive head; the other pumps are located over the clear well with centerline elevation at 38.0. Each pump has a separate connection to a looped discharge header in which the repair of a valve in an interconnection could put the station out of service. Normal operation is to use one pump at a time depending upon the demand; 2 to 6 men are on three 8-hour shifts. An overhead crane is provided.

Electric power is supplied over two 22-kv and one 12-kv commercial circuits on wood poles to a sub-station on the plant grounds from which an overhead circuit carries 2200-volt power 200 feet to the pumping station. A 8-kw gasoline-engine-driven generator is provided to supply emergency power for lighting and auxiliary equipment and is provided with automatic starting in the event of power failure.

The plant is of fire-resistive construction, 3-stories in height. Wiring is in conduit; heat

is provided by a coal-fired boiler. There are no exposures. Internal fire protection is provided; the nearest fire company is one mile distant.

ELEVATED TANKS.— There are two elevated tanks on the distribution system. A 1.5-mg steel tank built in 1952 at 9th and Dawson Streets is 96 feet in diameter and has an effective depth of 30 feet. Overflow is at elevation 186 which is 125 feet above the ground level. A bypass is kept open around an altitude valve. A 0.5-mg tank, built in 1949, is at 17th and Grace Streets. It is 60 feet in diameter and has an effective depth of 28 feet with overflow at elevation 184 which is 157 feet above the ground level. An altitude valve is provided. Storage is normally maintained above the 20-foot level in both tanks.

CONSUMPTION.— Statistics are based on venturi meter readings at the filter plant. The average daily consumption during the 12-month period ending June 30, 1957 was 5.997 mg, and the maximum daily consumption occurred on July 9, 1957 when 11.0 mg were delivered; the next largest day of maximum daily consumption for 1957 was 9.55 mg. There were 11,925 metered services in the system on December 10, 1957. Fire services and city owned connections are not metered.

PRESSURES.— A pressure recording gauge at the pumping station at elevation 40 shows discharge pressures varying from a low of 56 psi with no pumps operating to a high of 80 psi. Charts from recording gauges at city hall, elevation 49, and the water department shop, elevation 42, show pressures of 60 to 65 and 63 to 69 psi, respectively. Pressures observed during fire flow tests throughout the city averaged 64 psi with a maximum of 74 and a minimum of 51; in the principal business district pressures at two locations were 69 and 66 psi.

DISTRIBUTION SYSTEM. — General.— As shown on the accompanying map, two 24-inch mains extend south about 2400 feet from Sweeney pumping station to a 20-inch interconnection, from which a 12-inch and two 16-inch branches continue to the distribution system, one of the latter passing directly through the principal business district and the other extending to the 1.5-mg tank. These three mains, with well spaced 12- and 10-inch intersecting mains and some 12-inch loops form a mainly complete system of arteries throughout the built-up portions of the city. Minor distributors are largely 6-inch with a moderate amount of 8-inch and a small amount of 4-inch. The gridironing is mainly good with an average length of 640 feet of 4- or 6-inch mains on the long side of blocks between intersecting mains. There are 3.26 miles of dead-end 4- and 6-inch pipe supplying hydrants.

WATER SUPPLY

Pipe.—See Table 1 which includes all pipe 4-inch and larger within the system. All pipe is tar-coated or cement-lined cast-iron. New taps indicate that most pipe is in fairly good condition; flows from hydrants indicated no sediment. Pipes are laid with about 3-foot cover; there have been no recent frozen mains. Except for a portion of the raw water supply lines and at some railroad and creek crossings, there are no exposed mains; special provisions are now made for installation of pipe under railroads. Little trouble has been experienced with breaks.

Newer installations are class 150, mechanical-joint cement-lined pipe; it is inspected on receipt and tested to 150 psi before back filling. No trouble is experienced from electrolysis.

Valves.—There were 1255 valves, 4-inch and larger, in service on June 30, 1957. All new valves open clockwise; a few older valves open counterclockwise, and this type is replaced rather than repaired, when necessary. Some 12-inch and all 16-inch and larger valves are geared; some of these have incased gears, and some are set in manholes. Other valves are direct acting in the usual iron extension box. Valves now being installed are of Mueller make; others are either of the Eddy, Chapman, or Pratt and Cady makes with several of the older and larger ones of Michigan make.

With few exceptions, valves are located on property lines at street intersections. The average length of main that would be affected by a break is 570 feet in the principal business district, and 780 feet elsewhere.

Valves are operated and inspected yearly. An inspection of 35 valves during this survey revealed them to be in fairly good condition. A card index system is being developed to keep a record of all valve inspections and other pertinent data.

Hydrants.—As of December 5, 1957 there were 987 hydrants in the city and the immediate surrounding areas including 104 private hydrants. All hydrants have two 2½-inch outlets, and all but 146, many of which are private, have a 4½-inch outlet. All have 6-inch laterals, even when on a 4-inch main; about 122 public and 89 private hydrants are not gated. Makes are mainly Mueller, and Columbian. Of 63 hydrants in and bordering the principal business district all have two 2½-inch outlets and all but 3 have a 4½-inch outlet; all but one have a gate valve in the lateral.

Hydrants are generally installed at street intersections with intermediate hydrants in very long blocks. The average area served per hydrant in the principal business district is 41,700 square feet. In representative residential districts, the average area served is 175,000 square feet.

Hydrants are inspected annually. Records of repairs and inspections are kept in a card index. During the survey 47 hydrants were operated and no major defects were encountered.

FIRE FLOW TESTS.—See Table A on the accompanying map. The tests were made December 5, 1957 between 8:45 A.M. and 12:25 P.M. During the tests in the principal business district pumping was at a 9.0-mgd rate. Consumption for the day amounted to 5.55 mg.

CHANGES AND IMPROVEMENTS.—Since the 1949 report of the National Board of Fire Underwriters, a number of improvements have been made. Raw water pumping capacity has been increased by 4.5 mgd. Three additional 1.0-mgd filters have been added and two are under construction; high lift pumping capacity has been increased by 9.0 mgd. Both elevated storage tanks have been added to the system, and 35.03 miles of additional pipe has been laid, much of which is 12- and 16-inch.

CONCLUSIONS.—Supervision is experienced and qualified. Records have been greatly improved.

Ample supply is available from the river with raw-water pumps of adequate capacity. Short single sections of piping around the filter plant make it possible for a break to interrupt supply; also the repair of a valve in the discharge header could interrupt pumping from the plant. The high-lift pumping capacity is adequate with fairly sufficient reserve. The unreliable feature of a single power line from the transformer yard to the high-lift station is mainly offset by the gasoline driven equipment. Filter capacity and clear water storage are adequate. Main raw-water and high-lift pump stations are of good construction.

Pressures are well maintained and are adequate for automatic sprinkler equipment. Fire

TABLE 1.—PIPE IN THE DISTRIBUTION SYSTEM, JUNE 30, 1957.

Diameter, Inches	P I P E		
	Length, Miles	Per Cent of Total	Inc. Since May 1, 1949
4	5.11	4.4	.....
6	60.19	51.5	22.56
8	21.39	18.3	5.00
10	1.61	1.4	.....
12	21.61	18.5	6.70
16	5.48	4.7	0.84
24	1.42	1.2	.....
Totals.....	116.81	100.0	35.10

flow tests indicate that the mains can deliver adequate quantities to the principal business district and mainly good quantities to other sections of the city.

The system of main arteries and secondary feeders is of good capacity and mainly well looped. Minor distributors are generally well gridironed, 4-inch pipe is small in amount, dead ends are infrequent, and pipe is in good condition.

Valve spacing is generally good and valves are in fairly good condition. Hydrant spacing is good in the principal business district and fairly good in other areas. Hydrants are in good condition and regularly inspected.

FIRE DEPARTMENT

ORGANIZATION.—General.—The fire department is full paid; members work an average of 72 hours a week under the general supervision of the City Manager, J. R. Benson. The chief is the executive head of the department and is responsible to the city manager for its efficient operation.

Officers.—Chief J. A. West, age 62, has been a member of the department since 1920 and was appointed to his present position in 1954. Assistant Chiefs, J. Q. Lewis, age 62, and D. E. Milliner, age 48 were appointed to the department in 1925 and 1939 and promoted to their present positions in 1956.

Membership.—Total membership of the department is 84 including a fire force of the chief, 2 assistant chiefs, 7 captains, 7 lieutenants and 62 firemen; other members are the master mechanic and his assistant, 2 fire prevention inspectors and the fire alarm superintendent.

Appointments and Promotions.—All appointments are made by the city manager from eligibility lists furnished by a local civil service board. Applicants for appointment must pass physical and mental examinations; and good age, weight and heights limits are prescribed. All appointments are for an indefinite term with removal only for just cause, after a one-year probationary period.

The chief is appointed by the city manager with approval of council. Promotions are made by the city manager from recommendations by the chief after consideration is given to seniority, service and ability, but no written examinations are given. Annual medical examinations are given to all members by the city physician.

Retirement and Pension.—A pension fund is supported by 4 per cent deductions of members' salaries; any deficiency occurring in the fund would be made up by the city. A member may retire at age 55 after 20 years service or after

25 years service at any age and receive benefits equal to one-half of his salary at the time of retirement; for each year of service above 25 years, small additional benefits are paid. Disability, widows and dependent children benefits are also provided. Retirement is compulsory at age 65. Thirty former members and 5 widows were receiving benefits at the time of this survey. One company member is over 55 years of age.

Companies.—See Table 2.—Five engine, an engine-ladder, a ladder and a fireboat companies are in service in 5 stations. A captain or a lieutenant is on duty with each engine and the engine-ladder company except during vacations, sick leaves and days off. A lieutenant is on duty for one shift with the fireboat and the drillmaster is on duty part of the year with the ladder company.

Members are divided into two platoons working 11 and 13-hour shifts with one day off each week for an average of 72 hours a week. Each member receives 2 weeks annual vacation and 9 holidays a year and is allowed one day per month sick leave accumulative to 120 days at full pay and 120 days at half pay. Vacation periods extend from April through September with about 4 men off on each platoon. Sick leave for 1956 averaged about one man per day. No substitutes are provided for vacancies due to vacations or sick leave. The response of off-shift members is reported to be good.

Four engine and one ladder companies are within ½ mile of the center of the principal business district. Most built-up residential areas are within 1½ miles of an engine company except some sections in the east and south which are up to 2 miles distant. Three pumpers are equipped with 35-foot and one with a 28-foot extension ladders.

APPARATUS AND EQUIPMENT.—See Tables 2 and 3.—**Pumpers.**—Five pumpers are in service. All are equipped with centrifugal pumps and carry 2 lengths of 4½-inch hard suction. A 1917 American LaFrance 750-gpm rotary gear pumper is in reserve at headquarters. It has a 100-gallon water tank and carries 2 lengths of 4½-inch hard suction, a 24- and a 14-foot ladders, and a small amount of minor equipment. Due to its old and questionable condition it is rated and tested by the department as a 500-gpm pumper.

Pumper-Ladder Truck.—One pumper-ladder truck equipped with a centrifugal pump and 2 lengths of 4½-inch hard suction, is in service. Included in the 9 ladders carried are three 30-foot extension ladders.

Pumper Tests.—Tests at draft of all pumpers and the pumper-ladder truck were witnessed

FIRE DEPARTMENT

TABLE 2.—FIRE COMPANIES—LOCATION AND EQUIPMENT.

Company	Location	Members on Duty	APPARATUS		HOSE			Ladders Carried	Water Tank, Gallons
			Make and Type	Put in Service	Size, Inches	Carried, Feet	Spare, Feet		
Eng. 1 ^{hv}	Headquarters: 4th and Dock Sts.	6	Am. LaFrance 1000-gpm Pumper	1950	2½ 1½ 1	1250 200 250	2700 250	1—35' 2—14'	150
Eng. 2 ^{hv}	With Engine 1	4	Mack 600-gpm Pumper	1936	2½ 1½ ¾	1000 300 200	..... ..... .....	1—24' 1—14' 1—12'	100
Eng. 3	With Engine 1	5	Oren 750-gpm Pumper	1952	2½ 1½ 1	1250 300 200	..... ..... .....	1—35' 2—14'	200
Eng. 4 ^{hv}	4th and Campbell Sts.	4	Oren 750-gpm Pumper	1952	2½ 1½ 1	1250 300 200	600 100	1—35' 2—14'	200
Eng.- Lad. 5	Dock and 17th Sts.	4	Seagrave 750-gpm Pumper-Lad. Tk.	1939	2½ 1½ ¾	1000 300 250	800 100	9; Total Length, 180'	100
Eng. 6	Willard and 3rd Sts.	4	Am. LaFrance 750-gpm Pumper	1942	2½ 1½ ¾	1000 300 200	1000 100	1—28' 2—14'	100
Lad. 1 ^{hv}	With Engine 1	3	Am. LaFrance 75' Aerial Lad. Tk.*	1914 1939	.....	.....	.....	10; Total Length, 278'	.....
Fire Boat	Foot of Grace St. and Cape Fear River	1-2	2500-gpm Fire Boat	1948	2½ 1½	500 300	..... .....	2—10'	.....

* Equipped with Ladder Pipe.

^{hv} Company located in or near High Value District.

during this survey to determine their condition and the ability of the operators. All apparatus in service delivered its rated capacity at adequate pump pressures and the reserve pumper operated satisfactorily as a 500-gpm pumper. Pump operators are experienced in operating pumps from draft but some additional training is needed in basic design, mechanics and maintenance of fire pumps. Pumps are tested at draft at least annually.

Fireboat.—The fireboat "Atlantic III," built in 1943 and acquired by the city in 1948, has a wooden hull 64 feet 11 inches long, with a beam of 14 feet 6 inches and a draft of 4 feet. It is powered by an 8-cylinder diesel engine of 230 horsepower at 1500 rpm. Two Mack pumping units, each consisting of a 6-cylinder 200-horsepower gasoline engine-driven 1250-gpm centrifugal pump, take suction through individual sea chests and discharge into 6-inch welded gated pipes delivering water to two fixed turrets on steel framework towers, one forward above the pilot house and one above the afterdeck; each have tips with a maximum diameter of 2 inches. Two pairs of 2½-inch gated outlets on each side of the engine housing are fed by 4-inch pipes connected to the 6-inch pipe. Valves and piping are so arranged that either unit may discharge

through either turret but the gated outlets are supplied only from the line leading to the after-turret. It is equipped with 3-way radio on the police department system.

Tests of the units were witnessed during this survey to determine their condition. When the units were installed in 1948 they delivered a combined capacity of 2500-gpm at 150 pounds pump pressure but at the time of this survey they delivered only 2255-gpm at the same pump pressure. Each unit is tested annually by the department to deliver 1000-gpm at 150 pounds pump pressure.

Ladder Truck.—A 1914 spring-raised aerial ladder truck, completely rebuilt in 1939, is in service; it carries, in addition to the aerial, 9 other ladders including a 45-foot extension.

Chiefs' Cars.—Miscellaneous Vehicles.—A 1956 Oldsmobile and a 1953 Chevrolet sedans are provided for the use of the chief and assistant chiefs, respectively; both are 3-way radio equipped on the police department system. A 1955 Chevrolet pick-up truck, assigned to the repair shop, would be used to carry wet hose and gasoline at large fires. A ¾-ton, 1952 Chevrolet truck stored at headquarters is used when called for; it is equipped with 3-way radio, a

TABLE 3.—SUMMARY OF APPARATUS.

	In Service	In Reserve
Pumpers:		
1000-gpm	1	0
750-gpm	3	1
600-gpm	1	0
Pumper-Ladder Truck:		
Service—750-gpm	1	0
Ladder Truck:		
Aerial	1	0
Fire Boat	1	0
Booster Truck	0	1
Foam Truck	0	1
Utility Truck	1	0
Chief Officer Automobiles	2	0
Hose, 1 and ¾-inch Booster ...	1,300'	400'
Hose, 1½-inch	2,550'	300'
Hose, 2½-inch	12,350'	1,400'
Ladders, Total Length	773'	74'
Ladders, Short, on		
Pumpers, Etc.	17	4
Portable Extinguishers	22	4
Large Water Tanks	6	2
Breathing Apparatus,		
Self-contained	13	0
Portable Turrets	4	0
Ladder Pipe	1	0
Cellar Pipes	3	0
Distributing Nozzles	3	0
Siamese Connections, 2½-inch ..	3	0
Foam Generators	0	4
Waterproof Covers	16	1
Smoke Ejectors	2	0
Portable Lighting Units	3	0
Special Couplings (For Pumpers from Other Cities)	12	0

booster pump and a 150-gallon water tank, 200 feet of ¾-inch hose and a few items of minor equipment. A ¾-ton 1940 Ford truck equipped as a foam truck, is kept in reserve at headquarters.

Hose.—All 2½- and 1½-inch hose is double jacketed cotton, rubber-lined, purchased under the usual trade guarantees. It is tested twice annually to 250 pounds. In addition to the hose on apparatus as listed in Table 2, the reserve pumper carries 1000 feet and the reserve foam truck 400 feet of 2½-inch hose. No hose drying facilities are provided in any stations; all hose being dried on apparatus floors or outside walks. Hose is not shifted on apparatus unless used at a fire or during tests and drills. About 40 per cent of the 2½-inch hose in the department is over 7 years old. Couplings are of the usual screw type; the outside diameter of the male thread is 3¼ inches with 6 threads per inch. The 2½-inch outlet on hydrants is 3 13/64 inches with 6 threads per inch on which the female hose coupling is a loose fit. All engine

and engine-ladder companies carry adapters to fit the different size couplings of other local communities.

Appliances.—Minor equipment carried on apparatus is generally uniform and fairly complete. Special and heavy stream appliances include a ladder pipe, 3 cellar pipes, 3 distributing nozzles, 3 siamese hose connections, a 2½-inch ungated wye and a fairly good supply of spray nozzles, all on apparatus in service; in reserve are four foam generators and about three tons of foam powder. Emergency equipment consists of 13 self-contained breathing apparatus, an oxyacetylene cutting unit, 2 smoke ejectors, 3 portable electric generators and 10 floodlights, all in service, and 2 asbestos suits in reserve. Salvage appliances include 1 to 4 waterproof covers for each company, a few mops and squeegees, brooms and buckets on apparatus in service and one waterproof cover on the reserve pumper. Additional equipment needed is listed under the Recommended Improvement Program.

Repairs.—The repair shop is under the general supervision of Assistant Chief D. E. Millinor; all repairs to apparatus being made by Captain C. C. Jordan and a helper who perform their duties on a full time basis. The shop is in a 1-story addition to the rear of fire headquarters; it is of sufficient width to house 2 pumpers but of inadequate depth to accommodate the ladder truck. It is equipped with an oxyacetylene cutting unit, an overhead block and fall, greasing pit, air compressor, 2 battery chargers, heavy duty jacks, drill press, sander and grinder and a fairly good supply of hand tools. A fair supply of small parts are on hand, larger parts being ordered from the manufacturers. A preventive maintenance program, including annual pumper tests, is in effect. Housekeeping was generally good.

Stations. — Fuel. — Five stations are in use. Headquarters, a 2-story building of noncombustible construction built in 1955 houses fire alarm headquarters on the first floor. The other 4 stations, 3 of which house apparatus, are of ordinary construction and were built between 1908 and 1942. Headquarters has 5 overhead doors at the front of the building and 3 in the rear; 3 other stations have single overhead doors and the fireboat station houses no apparatus. Heating facilities consist of oil-fired stoves on the apparatus floor at 3 stations and steam systems at the other two. Apparatus floors are either brick, tile or concrete, and electric wiring is in conduit and armored cable. All stations except the fireboat station are equipped with automatic light switches. Stations are in generally good condition, except the fireboat station which is in poor condition; housekeeping was generally good.

FIRE DEPARTMENT

Gasoline is of good grade and is stored in an underground tank at headquarters where all apparatus refuels from an outside electric pump. Gasoline is delivered to apparatus at large fires in ordinary 5-gallon cans. The fireboat is refueled directly from a tank truck.

OPERATION. — Discipline. — Printed rules and regulations, covering essential matters of operation and discipline, were adopted and issued to all members in 1954. Typewritten general and special orders are issued by the chief whenever necessary. The chief may enforce minor matters of discipline and suspend a member for a maximum of 30 days plus vacations and days off but serious charges must be referred to the city manager who has the authority to suspend a member indefinitely; the member has the right to appeal any decision to the civil service commission. Discipline is good.

Training and Instruction.—There is no drill tower or other department facilities provided for training. Lieutenant L. H. Wolfe is the drillmaster part of the year and assigned to the ladder company at all other times. During 1957 he conducted extended periods of training in pump operation, basic hose and ladder evolutions and the use of special appliances including turrets, spray nozzles and foam generators. Prior to this each company received about 2 days training in the spring and fall of the year. New men receive on-the-job training for the 1-year probationary period and are given a written examination just prior to permanent appointment. Company drills are held twice a week. A section of city owned property has been set aside as the site for a new training center.

Company members do not make inspections of buildings in their districts. Chief officers make random inspections of hospitals, schools and buildings in the principal business district but no records are kept.

Response to Alarms.—The numbers and locations of all fire alarm boxes are mounted on the wall near the watch desk at each station except the fireboat station and lists of boxes to which the respective companies respond on first alarms are at the watch desk; no second alarm assignment has been established.

The ladder and 3 engine companies respond to schools over 1-story high while in session, hospitals, and buildings in the principal business district. Elsewhere the assignment is 1 engine and the engine-ladder or 2 engine companies; this is increased to include the ladder company to all apartment houses. Telephone alarm response for building fires is the same as that to a box alarm from the same area. The nearest engine or engine-ladder company is dispatched to minor fires. The fireboat responds to waterfront fires when special called. Response to a

second or third fire is the 2 nearest engine companies and to a second alarm at the same fire additional apparatus would be dispatched as called for by the chief officer in charge.

A good percentage of the streets are paved and traffic and parking conditions are serious to moderate. Grade railroad crossings in the southern part of the city might retard response of apparatus. Overhead wiring in the principal business district offers moderate obstructions to fire fighting operations.

Fire Methods.—Most fires are extinguished by the use of portable extinguishers and small hand lines. Upon arrival at a building fire the usual procedure when no smoke or fire is visible is for the officers to investigate and then order lines to be laid as necessary; when some smoke is visible small hand lines are laid but when heavy smoke or fire is evident large lines are laid immediately. Hydrant hose gates are always used when 2½-inch lines are laid. Engine companies connect their pumper to the siamese connections on buildings equipped with sprinkler or stand-pipe systems upon orders from the officer in charge. Fires are fought from the inside whenever possible and good use is made of spray nozzles. Heavy and special stream appliances and emergency equipment are employed when the occasion demands. Salvage work is usually conducted by all members of the department.

Reports and Records. — Department records are maintained on a full-time basis by the chief's secretary. These include personnel and apparatus data, fire records, general and special orders, a correspondence file and others necessary for efficient operation. Company records include a house journal and records of personnel, roll calls, alarms and company drills. Hose records are maintained by an assistant chief and individual personnel training records by the drillmaster. Generally complete apparatus records including annual pumper tests are kept on file by the master mechanic. The chief makes an annual and monthly report to the city manager.

CHANGES AND IMPROVEMENTS.—Since the 1949 report by the National Board of Fire Underwriters 2 men have been added, a new headquarters, including a repair shop, has been constructed and the station at 5th and Castle Streets, has been abandoned. Three pumpers have been replaced, the drill tower has been torn down and a set of rules and regulations has been distributed to all members. Since this survey, 10 additional waterproof covers, 1000 feet of 2½-inch hose and 500 feet of 1½-inch hose have been purchased.

CONCLUSIONS. — The fire department is under the supervision of experienced and competent chief officers but is considerably under-

manned, especially during absences due to vacations and sick leaves. There is a need for additional pumper and ladder service and response distances to some sections of the city are excessive. Provisions for appointment are satisfactory but methods of promotion are inadequate. Rules and regulations are adequate and discipline is good. The supply of 2½- and 1½-inch hose is adequate but emergency equipment is somewhat incomplete. Shop facilities and the repair program are generally adequate. Pumping apparatus in service is in generally good condition but the reserve pumper and the ladder truck are of such an age that immediate replacement should be seriously considered. The new headquarters station is a commendable improvement. Training is seriously hampered by the lack of proper training facilities and inspections of buildings by company members is limited. Response to first alarms is fairly good but provisions for subsequent alarms are lacking and methods of dispatching could be improved. Fire methods are fairly good except that backup lines are not laid immediately at all building fires. Records are fairly good.

FIRE ALARM

ORGANIZATION.—The fire alarm system is under the same general supervision as the fire department and is maintained by City Electrician D. F. Sandlin, Jr. who also has charge of the police signaling and traffic control systems and supervises electrical installations. He was appointed in 1946 and has 4 assistants.

Fire alarm headquarters is in one room on the first floor of fire headquarters, a building of non-combustible construction erected in 1955. External exposures are slight and protected by wired-glass windows. The dispatcher's room across the hall has plain glass windows and wooden doors.

EQUIPMENT.—**Apparatus at Headquarters.**—Equipment of automatic type, manufactured and installed by the B. & B. Engineering Corporation in 1955, consists of two 10-circuit operating and charging units, each with supervisory, testing, repeating and automatic ground return facilities, and a punch register; the ground return feature is not in use. In addition, terminal and protector panels are mounted in metal cabinets in the wall.

Equipment in the dispatcher's room includes a 5-digit transmitter, a punch register with time and date stamp, telephone and voice amplification facilities, and switches for operating the apparatus doors and the siren on the roof.

Circuits extend from the operating units and equipment in conduit in the floor to the terminal and protector cabinet and then in conduit and

underground duct to a manhole in the street. Circuits in headquarters are of No. 14 rubber-covered copper wire.

Current Supply.—Current for normal operation of the system is furnished by individual circuit rectifiers connected to a branch circuit from the building power panel which is supplied by a commercial circuit. The secondary source of power is eight 6-volt batteries in each operating unit which, through a converter supply the rectifiers; individual circuits can also be supplied directly from the battery in case of emergency. The batteries are maintained in a fully charged condition by an automatic variable battery charger. Emergency power can also be supplied by a 10-kw gasoline engine driven generator which also supplies emergency lighting to the building.

Apparatus at Fire Stations and Elsewhere.—Headquarters has a gong and each station except the fireboat station has a punch register connected to a box circuit; an automatic light switch and 1 to 4 gongs are in each station except the fireboat station and 3 tappers in headquarters are connected to an alarm circuit. Sirens for civilian defense at 4 stations are used to call the off shift. A punch register and gong are located at the water department pumping station, a tapper in the chief's residence and a tapper and voice amplification facilities at police headquarters.

Boxes.—There are 205 boxes in service of Gamewell, Horni or SAFA make and succession type. Ten master boxes have auxiliary connections, 5 are inaccessible to the public and 15 are privately owned. Two boxes are on pedestals, 196 on poles and 7 either on or in buildings. All boxes are grounded and have either quick-action or key-guard type doors. Paint on boxes and identifying bands on poles ranged from fair to good; 11 boxes in the principal business district have identifying lights.

Tests of 2 boxes on each circuit were witnessed during this survey; all operated satisfactory and are timed to transmit blows at 1¼ second intervals.

Box distribution in the principal business district is good but elsewhere approximately 50 additional boxes are needed to provide proper protection.

Circuits.—Ten box and two alarm, normally closed, all-metallic circuits are in use, to which all boxes, punch registers, tappers and gongs are connected. Five box circuits serve excessive areas. As scaled from a map, box circuits total 63 miles of which 16 miles are in underground cable; one alarm circuit is within headquarters station and the other is entirely underground. Approximately 75 per cent of the aerial wire is

FIRE DEPARTMENT AUXILIARIES

No. 12 copper covered steel and 25 per cent is No. 10 hard-drawn copper both in triple braid weatherproof covering. Box leads are No. 14 rubber-covered wire in conduit with a weather cap; some conduits have an insulating joint. Wiring in stations is No. 14 rubber-covered copper in conduit. Circuits tested free of grounds.

Circuit protection at headquarters consists of ½- and 3-ampere fuses and inert-gas lightning arresters at the terminal board, 3-ampere fuses on the rectifiers, and 10-ampere fuses on the battery leads; 7-ampere fuses and lightning arresters at the junction of aerial and underground construction; and 5-ampere fuses and lightning arresters at fire stations.

Commercial Telephone Service.—Three trunk lines extend from the telephone company central office building to a private switchboard at fire headquarters and 4 additional lines are provided to various offices in the same building. Individual lines are provided to each fire station and various offices in fire headquarters. No trunk line is reserved exclusively for emergency calls and the department is not properly listed in the telephone directory.

Voice Amplification System.—A 2-way voice amplification system, with audio-amplifiers in 4 stations and police headquarters, is in service; each station has one to 5 speakers. The system receives current from the same commercial power circuit that serves each station. Individual aerial wire circuits, totaling 6 miles, extend to 3 outlying stations and police headquarters. The circuits are protected at headquarters by ½- and 3-ampere fuses and lightning arresters and at stations by 7-ampere fuses and lightning arresters. A local voice amplification system is in service at fire headquarters.

Radio.—The two chief officers automobiles, the fireboat and the booster truck are equipped with 3-way radio units on the police radio system. For details see Police Department, page 11.

OPERATION.—The fire alarm superintendent and his assistants work 5½ days a week and are subject to call at all other times. A 1948 Ford, a 1949 Chevrolet and a 1958 International trucks are provided for maintenance; the latter is equipped with a 23½-foot aerial ladder.

Test blows are sent over the system and circuits are tested for current, voltage and grounds twice each day. The amount of electrolyte in batteries is checked weekly but no tests are made for specific gravity. The emergency generator is tested daily. Boxes are tested about three times a year employing a silent test where boxes are so equipped. Maps of circuits and underground terminal points are on file and records are kept of daily tests and box tests but no daily log or records of trouble are maintained.

One company member is on duty in the dispatcher's room at fire headquarters at all times. Four rounds of box alarms are automatically transmitted over the system. Telephone alarms are received at fire headquarters and all companies except the fireboat are notified over the voice-amplification system; the fireboat is notified by telephone. Telephone alarms are not confirmed over the fire alarm system.

During the year 1956 there were 539 alarms of which 408 were received by telephone, 116 by box, 11 verbally and 4 from police headquarters over the voice amplification unit; 87 were recorded as false alarms and 200 were for other than building fires.

CHANGES AND IMPROVEMENTS.—Since the 1949 report by the National Board of Fire Underwriters fire alarm headquarters has been relocated to the new fire department headquarters building and all headquarters equipment has been replaced. One additional assistant has been appointed to the maintenance force, 10 boxes have been installed, wiring in stations has been improved and the alarm circuit and 25 per cent of the box circuits have been placed underground.

CONCLUSIONS.—The fire alarm system is under the supervision of experienced personnel and the new headquarters equipment has good provisions for normal expansion. The current supply is adequate and circuit construction is generally good; but all or part of each box circuit being of aerial wire construction could result in the interruption of service due to accidents, high winds and storms; 5 box circuits serve excessive areas. Box distribution is fairly good but conspicuousness, tests and records could be improved. Telephone facilities are adequate but no trunk lines are reserved exclusively for emergency calls. Good use is made of voice amplification facilities but dispatching operations are seriously affected by the lack of full time fire alarm dispatchers and adequate radio facilities. Tests and records are somewhat incomplete but were being improved at the time of the survey.

FIRE DEPARTMENT AUXILIARIES

FIRE MARSHAL.—Charles F. Gold is State Insurance Commissioner and ex officio State Fire Marshal; Sherman Pickard is the local deputy fire marshal. The fire marshal and his deputies have the powers of an examining court and the authority to investigate and make arrests of anyone suspected of arson. By state law the chief of the fire department is required to investigate the origin of each fire within three days of its occurrence and submit a written report to

the state fire marshal. This is usually done by the officer in charge of the responding company except that when fires are of suspicious origin investigation is made by the fire prevention bureau and the police department, the latter group providing the photographer. In recent years all suspicious fires were small in extent; no arrests were made but one case is still pending.

POLICE DEPARTMENT.—The department is under the direct supervision of Chief Jessie J. Padrick and has a membership of 74; in addition there are 13 school crossing guards, 3 parking meter men, 2 painters, a utility officer, 3 radio operators and 6 clerks or secretaries, all on civilian status. Five cruisers, 3 detectives cars, a chief's car, an accident investigation car, traffic survey car, 2 trucks and 6 motorcycles are in service; all but one truck are radio equipped.

The police signaling system, maintained by fire alarm maintenance personnel, consists of 11 call boxes, each equipped with a recall bell, operating over 3 circuits. The police radio system has a 250-watt output transmitter at city hall with the antenna on the roof, and 8- to 60-watt mobile units. The system is maintained on a part-time basis by V. G. Slatter, a local radio engineer.

Box alarms of fire are received on a gong and telephone alarms over the voice-amplification system. Foot patrolmen, a lieutenant, a sergeant and a cruiser with 2 men are dispatched to fires in the principal business district and one cruiser or a motorcycle responds to residential areas; additional help would be dispatched as needed. Stanchions and rope are available for use in establishing fire lines. Cooperation with the fire department is good. Police report unauthorized building construction to the building inspector.

PUBLIC TELEPHONE COMPANY.—The Southern Bell Telephone Company provides dial telephone service to almost all of New Hanover County through 2 central offices. There are approximately 16,200 subscribers on 1- to 8-party

lines with about 21,600 instruments in use. The central office building is a 2-story structure of fire-resistive construction at 4th and Princess Streets; exposures are slight and well protected. Interior protection consists of carbon dioxide and water type extinguishers and a standpipe system. Fifty-four per cent of the circuits are underground and 46 per cent are in aerial cable and wire. Three trunk lines extend from the central office building to the private switchboard in fire headquarters; none are reserved specifically for emergency calls. All emergency calls are logged and those deemed necessary are monitored by the telephone operator on duty.

PUBLIC UTILITIES.—The Carolina Power and Light Company is not normally notified of fires but does respond upon request or when a fire is made known to them. After hours designated men are on call and would be contacted by a telephone answering service; all vehicles are radio equipped. The Wilmington Gas Company is not normally notified of fires but does respond to all fires in the principal business district and upon request of the fire department. There is a man on duty all the time at the gas plant to receive emergency calls when the main office is closed; he would contact the emergency man on call at that time. Vehicles are not radio equipped.

PRIVATE FIRE PROTECTION.—The Atlantic Coast Line Railroad maintains a private fire brigade which makes regular inspections of buildings and hose on the grounds; a railroad tank car, containing water and equipped with a gasoline engine driven pump, is kept in reserve. A number of establishments are protected by automatic sprinkler systems, standpipes and have hose and a few have reservoirs with fire pumps.

OUTSIDE AID.—A small amount of outside aid is available from the small volunteer departments of a few neighboring communities. A few tugboats with fire pumps in the waterfront area would respond upon request.

STRUCTURAL CONDITIONS AND HAZARDS

BUILDING DEPARTMENT

ORGANIZATION AND CONTROL.—**Personnel.**—Authority and responsibility for supervision and control of building construction is vested in a building inspector who is appointed by the city manager with approval of the city council; the building inspector appoints his assistants. Duties of the inspector involve examining plans; issuing building, electrical, and heating permits; enforcing the local minimum

housing code, and state and local laws relative to the erection and repair of buildings and to zoning; making inspections, and keeping records. A zoning board of adjustments, consisting of 5 members and 2 alternates appointed by the city council, functions to grant variances from the zoning ordinance and to recommend rezoning to the city council.

S. Warren Sanders, Jr. has been Building Inspector since 1954 and in city employ since 1950. He is assisted by two combination building-elec-

BUILDING DEPARTMENT

trical inspectors, a minimum housing inspector and a clerk. A transportation allowance is provided.

Procedures.—All construction valued in excess of \$10 requires a permit. Application is made in duplicate, one copy being given to the inspector in whose district the building will be erected, and the other copy filed in the office. One set of plans is required on all new buildings and on some alterations and additions. Plans for institutional buildings, churches, hospitals, schools, and convalescent homes are required to be approved by the state. Buildings valued in excess of \$20,000 require that the architect and contractor be licensed by the state; a list of licensed contractors is made available to the building inspector. Issuance of the permit signifies approval of the plans; specifications are required on larger buildings at the discretion of the building inspector. The permit is issued in duplicate, one copy going to the applicant and one kept on file at the office; a card is issued for posting at the site.

The city is divided into two inspection districts with Market Street being the dividing line. There is no set number of inspections; dwellings are given at least two inspections and generally three, and larger buildings are inspected more frequently. Because the same inspectors make electrical as well as building inspections and because electrical contractors are required to request inspection at two stages, each building is assured of receiving at least two inspections though building contractors are not required to call for inspection. Contractors are notified of violations orally; correction has always been forthcoming. State and city codes make provision for gaining compliance through court action. After completion of a structure the inspector turns in to the office his copy of the application for permit on which he has noted his inspections; no certificate of occupancy is issued.

Heating installations require two permits, one for the wiring and the other for the plant. A copy of the application is sent to the fire prevention bureau which makes all the inspections, except electrical. For further details see Fire Prevention, page 14.

The local minimum housing code authorizes inspection of existing dwellings. If after an inspection a substandard condition is noted, as many of the following steps are taken as is needed to obtain correction: an unofficial 30-day notice, an official notice for a hearing, an official order to repair or demolish, and court action. The procedure and authority to condemn is covered in the city code; the actual order is issued by the city council. The building inspector has the authority to demolish or repair a structure and put a lien on the property for the cost.

Building records include duplicate typed index cards for each permit, filed by street and by owner's name, both copies of applications filed by month, copies of permits, a ledger in which is recorded all plan numbers assigned, copies of monthly reports to the state and city manager, and plans. All records are kept in metal cabinets in the office back to 1953; older records and plans are stored elsewhere. All records of the office are orderly, up to date, and mostly complete.

State Laws.—The North Carolina State Building Code adopted in 1953 and last amended in 1956 applies to all new buildings except dwellings used by less than 3 families. The code closely follows the 1949 edition of the National Building Code of the National Board of Fire Underwriters. It is compulsory in all cities in the state having a population exceeding 1000, except where local law is more restrictive. The state building code council, of which the local building inspector is a member, is composed of 9 members appointed by the governor; they are empowered to amend the code and adopt related ordinances. The present building code, as compared with the 1955 edition of the National Building Code, is slightly deficient in a few requirements only.

An act adopted April 5, 1947, with provisions for a three-year compliance period, requires a fire alarm system in all hotels or buildings of like occupancy and watchman service in hotels over 2 stories in height or containing over 20 rooms. Hotels, other than those of fire-resistive construction, when over three stories in height must have automatic sprinkler protection or a fire detection system; buildings less than three stories high but lacking adequate means of egress must be sprinklered. All hotel stairways must be enclosed, decorations flameproofed, and fire extinguishers provided.

Municipal Ordinances.—The municipal code contains some requirements relating to building construction, but most are less restrictive than the state code which is being enforced. However, it does provide for the appointment of a building inspector and prescribes his duties. It also describes the boundaries of the fire limits which are shown on the accompanying map. Restrictions on permissible construction in the fire limits are adequate; wooden shingle roofs are not permitted in the city and there are few left. The fire limits are quite extensive, fully protecting the principal business district and part of one minor business district, but do not protect other business and commercial areas. The zoning ordinance was adopted September 4, 1956; it designates eight use, height and area districts.

Enforcement.—Inspections of a substantial number of buildings under construction and re-

cently completed revealed few violations of the building code. Some provisions of the code have not been required and some enforcement shortcomings were noted. The police and fire departments report unauthorized construction.

BUILDING CONSTRUCTION AND PROTECTION.—General.—There was little new construction at the time of this survey; a 2-story office building, an armory and some single-family dwellings were being built. Recent construction includes a 6-story office building at the edge of the principal business district, a 3-story department store in the district, the 2-story fire department headquarters building, an addition to the high school, 3 warehouses, 2 housing developments, a number of schools and churches, and numerous small retail establishments. No major construction is planned for the near future.

See Table 4 for fire areas and heights of buildings in the principal business district. For further information on current structural conditions in the district see Conflagration Hazard, page 18.

TABLE 4.—FIRE AREAS AND HEIGHTS OF BUILDINGS IN PRINCIPAL BUSINESS DISTRICT.

FIRE AREAS				
Square Feet	Per Cent of Built-on Area			
	Fire-Resistive	Ordinary*	Wood Frame†	Total
5,000 and Under	1	36	2	39
5,001 to 10,000	2	27	1	30
10,001 to 20,000	2	21	0	23
20,001 to 40,000	2	2	0	4
Over 40,000	0	4	0	4
Total	7	90	3	100
Per Cent Sprinklered	1	8	0	9

HEIGHTS				
Number of Stories	Number of Buildings			
	0	1	2	Total
1	0	55	9	64
2	3	109	2	114
3	3	72	0	75
4	0	8	0	8
5	0	4	0	4
6-10	4	0	0	4
Total	10	248	11	269
Number of Sheds and Additions	0	2	8	10

* Includes protected noncombustible and heavy timber construction.

† Includes unprotected noncombustible construction.

Specific Occupancies.—The largest hotel occupies a 9-story building of fire-resistive construction in the principal business district. It has proper exit facilities except that one fire escape terminates at the fourth floor and continues from another point; accessibility to the fire escapes is through screened windows. Indicating lights are provided at elevators and exits but some are poorly located or not lighted. Sufficient extinguishers are provided. Each floor is equipped with a standpipe with 1½-inch hose, and an alarm bell. All corridors are equipped with automatic sprinklers. A communicating garage occupies a fully sprinklered building of fire-resistive construction. Another hotel, also in the principal business district, occupies a 7-story building of part ordinary and part fire-resistive construction. An open stairway serves all floors; two outside fire escapes are provided one of which ends on the roof of a 2-story section. Access to one of the escapes is through windows; lights indicate the exits. Extinguishers and an alarm bell are provided on each floor.

The hospital occupies five communicating buildings mostly three stories in height and of ordinary construction. Communicating openings are unprotected and many doors to enclosed stairways are blocked in the open position. The doors of the metal laundry chute are not self-closing. Most exits are not properly indicated; a set of exit doors, indicated to be used only in the event of fire, were found locked. Local alarm boxes are auxiliarized to a master box on the premises; many of the boxes are enclosed in wood jackets and not properly identified. A recently built 3-story corridor connecting two buildings contains the only automatic sprinkler installation. Standpipe and hose were available in one building; sufficient extinguishers were provided, however, some were in need of being serviced, and some were on the floor. A day nursery at a housing development occupies a 1-story building of ordinary construction. Exits were not indicated, one was locked, and another had a screen door that opened in. A third exit, from an adjoining room directly to the outside, was not accessible.

CONCLUSIONS. — State laws bearing on building construction and structural fire protection are mainly adequate and are being fairly well enforced. The municipal code contains few requirements relating to construction and is less restrictive than the state code. The fire limits protect the principal business district and most of a minor business district but do not protect other business and commercial areas. Building restrictions in the fire limits are adequate; wooden shingle roofs are prohibited throughout the city. Control over heating installations is shared with the fire prevention bureau. Enforce-

ment of the minimum housing code has brought about correction of many hazardous conditions. At the time of this survey there was little current construction. Records are orderly, up to date, and mostly complete.

FIRE PREVENTION

ORGANIZATION AND CONTROL.—**Personnel.**—State law places control of fire prevention matters with the building inspector and the chief of the fire department. Ordinances require that these officials inspect buildings, have defects remedied, submit all reports required by the insurance commissioner, and enforce the state fire prevention regulations. The powers and duties of the fire chief as regards fire prevention have been delegated to a fire prevention bureau of the fire department. The bureau is directly responsible to the fire chief. All personnel are under state civil service. Duties of the bureau include enforcing the municipal fire prevention code, controlling heating and cooling installations, making investigations of fires, inspecting public buildings at regular intervals, teaching and promoting fire prevention, making hazard inspections and keeping records.

Lt. Robert D. Shipp, Fire Inspector, has been in the bureau since 1950 and in charge since October, 1956; he was a fireman for 4 years before being assigned to the bureau. He is assisted by a fireman detailed to the bureau in May, 1957. A transportation allowance is provided.

Procedures.—Permits for heating installations are issued by the building inspector's office but inspections are made by the bureau which receives a copy of the application for permit. All tanks must be approved before being concealed; contractors call for inspection. The various stages of an installation are inspected as time permits. If the installation is unsatisfactory the home owner or contractor is notified to correct the poor condition. If compliance is difficult to obtain the fire chief is advised and if necessary he will resort to court action. Cooperation from installers of gas heat has not been good in the past; permits were not obtained but some did call for inspection. At the time of this survey the bureau was preparing to notify gas installers that they must have a permit and submit to inspection. The bureau is inspecting such installations at present and requiring compliance with the local ordinance.

On bulk storage of flammable liquids and gases the procedure is similar to that for heating installations except that the building inspector will not issue the permit until the plans have been checked by the fire inspector. To use, store,

sell or transport explosives application must be made to the fire prevention bureau; if approved the permit is issued by the building inspector.

Hazard inspections of schools and hospitals are made monthly; nurseries, nursing homes, hotels and all buildings in both fire districts, except 1- and 2-family dwellings, are done quarterly. Churches and business and industrial establishments outside the fire limits are inspected as time allows. After an inspection an oral report is made to the occupant or owner advising him of existing hazards; reinspection is made after a reasonable time. If after two or three inspections the faulty conditions have not been corrected a letter is sent and then the fire chief is asked to gain compliance. At present members of the fire companies do not make inspections but will when the apparatus become radio equipped. The bureau conducts fire prevention programs throughout the year.

Records of the bureau include a file of applications for heating permits and a file of index cards giving details of the installation. Inspections of heating installations are noted in an inspection book and transferred to a daily report form. Reports of school inspections are made in triplicate, one copy going to the principal of the school, one to the superintendent of schools, and one kept in the bureau office. Copies of monthly and annual reports which are made to the fire chief are available. A card is kept for each building within the fire limits; the floor plan and other information is shown on the card. Large detailed sketches of the hospitals are kept and it is planned to do the same for all nursing homes. Records of inspections are kept on either small slips filed by date, or on complete inspection forms put into use in July, 1957.

State Laws.—State laws properly safeguard the hazards resulting from the handling and disposition of combustible rubbish, ashes and matches; the handling and storage of flammable liquids; and from dry cleaning operations. Plans for theatre and motion picture booths must be approved and licenses must be obtained for handling dynamite, caps and similar explosives. Fire prevention must be taught in schools and colleges and public schools are required to be inspected monthly by the fire and electrical inspectors. The state building code refers to many standards of the National Fire Protection Association as acceptable good practice in connection with hazardous materials and processes.

Municipal Ordinances.—On February 11, 1953 the city adopted the 1947 edition of the fire prevention code of the National Board of Fire Underwriters. The city code of ordinances contains some requirements relating to explosives, junk dealers, flammable liquids, smoking, trash and combustibles.

LOCAL CONDITIONS.—No high explosives or pyrotechnics are manufactured in the city nor is there any large storage of dynamite or blasting caps though small quantities of both are stored at the many fertilizer plants in the city. Only at some of the plants are such items properly stored; the bureau was not aware of all such storage in the city. Storage of ammunition was fairly large and unsegregated at a wholesale distributor; at sporting goods stores it varied in quantity, being excessive at one, and was being stored at many locations in the open. At the latter occupancies many poor conditions were noted, the most hazardous potential being the large storage of gasoline in portable tanks for motor boat use. Other poor conditions noted were open cans of gasoline, an open tank of gasoline for cleaning outboard motor parts, discarded cigarettes and compressed gas torches in the vicinity of the gasoline, poor aisle widths, accessibility to the power panel blocked by storage, a substandard paint-spray chamber illuminated by an ordinary lamp suspended from an extension cord, an open wire-brush buffing machine and storage of flammables near the spray booth, a space heater supplied from an oil tank about 2 feet away by unprotected tubing lying on the floor, many flexible cords and other poor wiring. Of the few extinguishers provided most were of the wrong type for the hazard, of small size, or in need of servicing.

Most dry cleaning plants use a solvent having a flashpoint similar to kerosene; conditions varied from fair to good. Hazardous conditions noted include an unlocked solvent tank on gravity tap accessible to the public, tanks of compressed gas subject to damage from traffic in adjoining parking lots, unenclosed boilers, an unvented solvent storage tank, damaged tubing supplying a space heater, a washer in operation with the door open, an unvented indoor oil tank and much poor wiring, especially the extensive use of flexible cords to permanent equipment. Extinguishers were of small size, in need of servicing, of wrong type, and not conspicuous.

There is much storage of bulk flammables at 3 plants in the city; storage outside the city is considerably larger. Two of the three plants receive the products by boat and ship them by truck and rail; the third is the smallest and uses trucks only. Though the installations are mainly of good type some shortcomings were noted. Some horizontal tanks have unprotected steel supports and are set in a hollow resulting in only slight diking. Some tanks are not grounded, ordinary lights were in use at one loading rack, some grounding wires were lacking or not carried directly to ground, and at one loading rack a driver filling his truck had wired open the valve controlling the flow of gasoline. Overall conditions were mostly good especially at the two larger plants; one of the latter is exposed by a steel

fabricating plant. Fire protection ranges from extinguishers only at the smallest plant to a foam generating system that supplies 3 hose houses surrounding the loading racks of the largest plant. A fourth hose house is equipped with hose and fog nozzles. Extinguishers were of good type and size, were well distributed, and in good condition. No tanks are protected by fixed piping systems; no evidence of smoking was noted at any of the plants.

At a retailer of paints and related products in the principal business district conditions were only fair. On the third floor two 55-gallon drums of mineral spirits were on gravity tap and had no pan to keep drippings off the wood floor, wood chips and shavings were on the floor as were many full and partly full open bottles of thinner, carton storage was excessive, 11 carboys of muriatic and sulphuric acid were in one corner and an electric heater was being supplied by a flexible cord extension. On the floor below, two 55-gallon drums of thinner were also on gravity tap and not provided with drip pans; evidences of smoking were noted. No extinguisher was provided.

At a distributor of gases, cylinders of oxygen, acetylene and liquefied petroleum gas were stored close to each other; drums of calcium carbide were stored nearby. No extinguishers were available in the gas storage area. Generally good conditions were noted at plants that bottle and sell propane except that one was open to the public with no one in attendance and grounding clamps were not provided at a loading rack. The proper type extinguishers were provided.

The Wilmington Gas Company distributes manufactured gas to about 5000 customers in the county of which about half are in the city. Propane is received by tank car at the plant, at Kidder and Tenth Streets, and stored in six 30,000-gallon tanks. After processing the gas is stored in two 50,000-gallon tanks at about 70 psi. Gas leaves the tanks at about 40 psi to supply the high pressure distribution system and a 150,000-cubic foot gas holder located at Surry and Castle Streets; the latter stores the gas at about $\frac{1}{4}$ psi for the low pressure distribution system. About 1000 customers are served off the high pressure system through individual regulators located outside or just under the building; all are vented directly to roof level. All customers on the low-pressure distribution system, which includes the principal business district, are supplied directly from the gas holder. All services in the principal business district and on the high-pressure system are equipped with shutoffs at the curb and at the meter; other services have a shutoff at the meter only. It is expected that the company will be distributing natural gas sometime in 1958.

At a tire recapping establishment a 55-gallon drum of solvent was in the working area; con-

FIRE PREVENTION

tents are obtained by tipping the drum. Other conditions were good except that no extinguisher was available. Another tire recapping establishment communicates with a tire-storage and car service area. The buffing room is not properly enclosed and much buffings were on the floor. A 55-gallon drum of naphtha was on gravity tap with an improper type faucet; buffings are dumped on the floor of a small enclosure which is emptied every two weeks, and there was considerable storage of scrap plastic in cartons. Only one extinguisher was provided and it was in need of servicing.

At one garage and body shop conditions were mostly good; paint spraying is done in a special building equipped with a booth of good type. Paints were being stored on open wood shelves outside the booth but were very neat; two drums of thinner were on gravity tap. Extinguishers are of good type and were in good condition. At another garage and body shop, located in the principal business district, improvement of conditions was being made but many poor conditions still exist. Paint spraying operations were being moved to another building and a good type booth being installed. Many drums of solvents and thinner on gravity tap still remain however. Undercoating nozzles were soaking in an open can of kerosene, an open bucket of gasoline was being used to clean parts, evidences of smoking were noted in the area, trash is stored in open containers, open spraying of rebuilt motors is done in one section, there was combustible storage up against the outside of the building, and copper tubing supplying gas to a heater was unprotected on the floor. An old pot-bellied stove was being used to burn waste oil which was being fed to it by gravity; a compressed air line was run to the stove to aid combustion resulting in flame issuing out of all the openings in the stove. Some good type extinguishers were provided but many areas did not have any available.

Some poor conditions were noted at a combination junk dealer and steel fabricator. In a storage area were much loose combustibles in piles, batteries were undergoing charge next to a hot plate, an open can of gasoline was noted and there was no fire extinguishing equipment. Though the property is enclosed it borders a bulk gasoline storage area; one tank is near the property line. Car burning is done in the open as is paint spraying of steel assemblies; a home-made salamander that was burning kerosene had flames issuing from it and other salamanders were also in use. No fire protection was provided anywhere in the plant.

At a woodworking plant many poor conditions were noted. Because the collecting system does not extend to all machines there was much chips and dust throughout. Aisles were blocked with lumber, exits are inadequate in number and not

indicated, some gas-fired suspended heaters are not vented, discarded cigarettes were noted as was a hot plate, scrap wood is thrown out the window resulting in piles of wood up against the building, and though extinguishers were adequate in number most were of wrong type. In a second building were many cans of flammable bonding products and a 25-gallon drum of a resin on gravity tap; storage had eliminated most aisles.

A small manufacturer of mattresses does not reprocess old materials; storage of old mattresses and cotton batting was large and unprotected but orderly. Some flexible cords were in use; no extinguisher was available. Good conditions were observed at a feed and grain retail establishment except that flammables were kept near other storage. The building is fully sprinklered including exposed window openings; no extinguisher was available.

At a wholesale grocer storage of matches was fairly large and unsegregated though orderly; there were no open cases. Two drums of flammables, one to supply kerosene-fired heaters, had hand pumps. Flexible cords were supplying power to the heater fans. One pump type water can was provided on each floor of the building.

At fertilizing plants many hazardous or other substandard conditions were noted; among them were the storage of blasting caps in one building, poor structural conditions in a building of heavy timber construction, much exposed knob and tube wiring subject to damage, the storage of bagged ammonium nitrate, nitrate of soda, potash, and cyanamide in unsegregated areas of one building, the storage of other combustible ingredients—some of which generate heat if they become wet, wood chips used to absorb spills from drums of oil, smoking and welding in an area where batteries were being recharged, and evidences of smoking in other locations. At one location, in a building of heavy timber construction, frozen condensate in a dry pipe sprinkler system was being thawed by using a torch; no extinguisher was in the area nor were the wood surfaces covered. Extinguishers were inadequate in number and size.

In hospital operating rooms, electrical outlets are only 3 feet above the floor and there is no provision for exhausting the operating rooms. Drums of ether, alcohol and oils were on gravity tap and did not have self-closing spigots. House-keeping was fairly good throughout.

CONCLUSIONS.—State laws contain a few good features but are not sufficiently comprehensive to provide adequate control over special hazards which exist in various occupancies. However, local laws are complete. There is a fire prevention bureau consisting of two inspectors whose duties prevent them from visiting hazardous occupancies frequently enough. Though

inspections revealed the existence of many poor conditions it is evident that progress is being made and that the approach to gaining compliance with the local code is good. Though records were generally only fair at the time of this survey they were being improved.

ELECTRICITY

ORGANIZATION AND CONTROL.—Personnel and Procedures.—City ordinance provides for the appointment of a city electrician, by the city manager, whose duties shall be to maintain traffic signals, fire and police alarm systems and other municipal equipment in addition to making inspections of interior wiring installations. In actuality enforcement is by the building department.

D. F. Sandlin, Jr., an experienced electrician, has been city electrician since 1946. S. Warren Sanders, Jr., is the building inspector; electrical inspections are made by two combinations building-electrical inspectors. One clerical assistant is available; a transportation allowance is provided.

Permits are required for installation or alteration of any electrical wiring, device or appliance. The installer makes application for permit and on larger structures must submit plans which are usually reviewed by the inspectors, but when necessary are reviewed by the city electrician. The permit is issued in triplicate, one being filed, one given to the installer and one remaining in the book. The application is given to the inspector, in whose district the installation is to be made, who records on it the progress of the installation; upon completion he turns in the application approved and the utility is then authorized to provide service. Except for small installations which are given a final inspection only, the installer is required to request inspection at the rough-in and final stages. Temporary services are provided when desired and also require approval of the inspector. There is no regular program of reinspection, some being made on request. Where poor wiring is noted a report is sent to the utility which is expected to attempt to obtain correction. Once a service is interrupted, regardless of the reason, the utility requires inspection and approval before it will restore the service. Records are complete, orderly and up to date; plans are filed with those for building in a metal cabinet.

Laws and Ordinances.—By state law the 1956 edition of the National Electrical Code is in effect and is being enforced; in addition a local ordinance has some more restrictive provisions one of which requires that all installations in the fire limits be at least of armored cable type. Master electricians must be licensed by the state. A

municipal electrical examining board, consisting of the city electrician, an electrical contractor, and a representative of the local utility, qualify journeymen by written test. Apprentices are not required to pass a test; to wire his own home a man must pass a test. State law requires approval by the local inspector before a utility may provide service; it also prohibits an electrical inspector from being in the contracting business or doing electrical work.

Enforcement and Conditions.—Inspection of a number of electrical installations did not reveal any major shortcomings; new work is generally well installed and properly controlled. Old wiring ranges from good to poor; adverse conditions noted in existing wiring systems include the lack of grounding of some equipment, the use of substandard wiring and equipment in certain hazardous locations, the overfusing of some circuits, much wiring in poor condition, and the use of flexible cords to supply permanent installations; some cords were damaged, some overloaded, one was stuck to a steam line, and many were subject to damage.

SUPPLY AND DISTRIBUTION.—Electric power is distributed by the Carolina Power and Light Company. The major source of power is from the Sutton Steam plant several miles west of the city. Transmission, at 110 kv, is from an extensive network of this company which is interconnected with neighboring power companies in this and adjoining states. From the Eagle Island substation, across the Cape Fear River, and the East Wilmington substation, current is distributed at 22 kv to supply 6 substations in Wilmington. Two circuits extend under the river to the Castle Street terminal; elsewhere throughout the city all power lines are aerial. Primary distribution in the city is mainly at 4000 volts to pole mounted transformers; some underground vaults are provided in the principal business district. Secondary voltage is mainly 120/240 volts single phase. No power lines are on Front Street in the principal business district, all buildings being supplied from the rear.

Street lighting is mercury vapor in multiple circuits in the principal business district and on main streets elsewhere; other lighting is series-incandescent with a maximum voltage of 2400. There is no trouble from electrolysis; the telephone company makes tests.

CONCLUSIONS.—Control over electrical installations is exercised by the building department. The city electrician is available for consultation and review of complicated plans. The National Electrical Code is in effect and is being enforced. Electrical contractors are licensed by the state and journeymen by the city. New work is generally well installed; old wiring ranges

CONFLAGRATION HAZARD

from good to poor. The local utility requires approval before providing service. Reinspections are made only upon request or after interruption to a service. Wires are aerial throughout the city except along Front Street in the principal business district. There is no trouble from electrolysis; the telephone company makes tests. Records are good.

CONFLAGRATION HAZARD

PRINCIPAL BUSINESS DISTRICT.—General.—The district is bounded by the Cape Fear River, Dock, Second, Market and Third Streets, Corcoran Alley, Second and Walnut Streets, a line 125 feet west of Nutt Street, and Grace Street.

The principal business district lies in the west central portion of the city along the east bank of the Cape Fear River. It consists of 18 blocks and part blocks covering 48.3 acres, is mostly regular in shape, and slopes up from the river quite sharply to Front Street. The maximum length is 2000 feet or 5 blocks along Front Street; the maximum east-west dimension is 1300 feet or 4 blocks along Chestnut Street. Of the total block area 66 per cent is built upon and 31 per cent of the district is in streets. Street widths range from 25 to 99 feet, the latter being the width of Market Street, with most being 66 feet wide. Values are mainly low to moderate; the few higher values are represented by office buildings, a hotel, and some department stores. Accessibility to all blocks is good; exposures are moderate from the east and south; large area warehouses form a moderate to severe exposure on the north; the river bounds the district on the west.

Building Construction.—Fire areas and heights of buildings in the district are shown in Table 4 under Building Department. As shown therein wood frame and fire-resistive construction account for only small percentages of the total; the former exists only in small area buildings and the latter is made up of 10 buildings. The remaining construction is of ordinary type notably lacking in structural features necessary for restricting the spread of fire. Buildings equipped with automatic sprinklers account for 9 per cent of the built-on area and include one fire-resistive building; no wood frame construction is so protected. Four buildings are of excessive height; all are 5 stories high and of ordinary construction. Twenty-seven per cent of the built-on area is in fire areas of ordinary construction greater than 10,000 square feet; of these areas two exceed 20,000 with one over 40,000 square feet. Unpierced masonry walls occur with moderate frequency; many of these walls are 4 inches too thin at least in part. Parapets where provided are almost always deficient in height and

some are lacking. About one-quarter of the exposed openings in exterior walls are protected and only a few buildings have properly protected floor openings. Of 50 communicating openings between buildings or fire areas only one is adequately protected.

Individual Block Hazard.—Blocks are mainly regular in shape and moderate in area. The area built upon in individual blocks ranges from 12 to 92 per cent with nine exceeding 70 per cent. The hazard of spreading fires is moderately high in a few blocks due primarily to excessive fire areas of ordinary construction and the general absence of those features tending to restrict the spread of fire. In the block bounded by Third, Chestnut, Second and Princess Street. 50 per cent of the built-on area is in a single fire area of ordinary construction. Though a portion of that fire area is equipped with automatic sprinklers a fire starting in the unprotected sections could spread to involve most or all of the block especially since a second excessive fire area adjoins the one in question; together they account for 62 per cent of the built-on area. Though other blocks are subject to spreading fires the probability of involving a whole block is very small.

Probability of General Conflagration.—Block fronts are mainly compactly built with multi-story buildings most of which are of fire-resistively-weak ordinary construction. Vertical and exposed exterior openings are almost wholly unprotected, there are many excessive fire areas, unpierced fire and exterior walls occur with only moderate frequency, few buildings are equipped with automatic sprinklers, and parapets are low in height. Favorable factors include good accessibility, good street widths except in the western part of the district, the small amount of wood frame construction, and the fairly small number of buildings exceeding three stories in height. The water available for fire fighting is adequate throughout the district and the fire department is a fairly effective force. Because of the many favorable factors the probability of a general conflagration is remote. Fires should be confined to the group of origin, except in the block mentioned in the preceding section where the entire block is subject to involvement; and in the western section of district where fires could cross narrow Water Street to involve buildings in adjoining blocks.

OUTSIDE THE PRINCIPAL BUSINESS DISTRICT.—Minor Business Districts.—Minor business districts exist along Third and Fourth Streets from Market to Nixon Street, along Castle Street from Fifth to Tenth Street, and at the intersection of Dawson and Seventeenth Streets, the latter being the one experiencing

much recent growth. At the first two mentioned districts conditions are similar. Buildings are of low heights, generally of small area with some large, of ordinary and wood frame construction, have unprotected exterior openings and are easily accessible. No building is of fire-resistive construction or equipped with automatic sprinklers, but municipal fire-fighting facilities are fairly good. Though the fire-resistively weak construction lends itself to spreading fires the many favorable factors should enable the fire department to confine fires to the building or immediate group of origin. Conditions at the new minor business district, the last referenced, are better due to improved construction and good separation between buildings. Here too the water supply is adequate and fires should generally be confined to the building of origin.

Industrial Districts.—There are three main industrial districts in the city, two north of and the other south of the principal business district, and all extending to the Cape Fear River. The major occupancies are fertilizer manufacturing, warehousing of cotton, chemicals, sugar and other products, creosoting of lumber, and the receiving, storage and shipping of flammable liquids, molasses and liquid sugar. The district immediately north of the principal business district has the greatest congestion and considerable wood frame construction. A few of the warehouses are broken up into smaller fire areas by fire walls with adequate protection afforded communicating openings; some of the buildings are protected by automatic sprinklers. The very severe pier fire of 1953 occurred in this district, completely destroying a number of warehouses which have not been replaced. Serious fires are probable throughout this district and especially at the location of three excessive-area wood frame warehouses which expose each other and are not equipped with automatic sprinklers. However, with the fairly good municipal fire-fighting facilities such fires should be prevented from assuming conflagration proportions. In the district north of the aforementioned good spacing between groups of buildings should assist the fire department in confining fires to the group of origin; a few of the buildings are equipped with automatic sprinklers. The district south of the principal business district contains tank farms for flammable liquids. The principal product stored is gasoline which is primarily shipped by truck transport. Though the installations are mainly of good type the huge storage make very severe fires possible. A very excessive area wood frame warehouse exposes a group of tanks storing kerosene and a steel fabrication plant adjoins a gasoline tank farm. With the fair water supply, the fire department should normally prevent serious fires from spreading beyond the place of origin. Manufacturing plants are located

throughout the city either in individual buildings or small groupings; at two such sites the water available is moderately deficient but because of good separation fires should be confined to the building of origin.

Residential Districts.—There are a number of housing developments in the city one or two stories in height and of fire-resistive, ordinary or wood frame construction. The number of units per building is fairly small and separation between buildings is good, so that even among the two-story, wood frame buildings fires should seldom involve more than the building of origin. In the older residential districts, those near to or adjoining the principal business district, buildings are of wood frame construction, mostly two stories high and although detached are close enough together to seriously expose each other so that sweeping fires involving a number of such buildings are probable.

UNUSUAL CONDITIONS. — In October, 1954 hurricane Hazel struck the Wilmington area causing very extensive damage especially to the beach communities east of Wilmington. In the city damage was relatively light; the Cape Fear River overflowed its banks and flooded Water Street in the principal business district. Some ships broke loose from their moorings and much plate glass was broken, but there were no serious interruptions of essential services though some power distribution difficulties did occur.

CONCLUSIONS.— In the principal business district the fairly good municipal fire-fighting facilities plus the good accessibility and street widths tend to offset somewhat the fire-resistively weak construction, excessive fire areas, and lack of protection to exterior and wall openings so that the probability of a conflagration is remote though serious group fires are probable and could, at one location, involve an entire block. In minor business district fires should be confined to the building or immediate group of origin despite the fairly high percentage of wood frame construction as areas are mostly small, accessibility is good and heights are low. The greatest potential for a spreading fire exists in the industrial districts where a number of wood frame warehouses could be involved and where a very large storage of flammables exists. However, if caught in the early stages the fire department, which is a fairly effective force, should be able to contain most fires. In residential districts fires should be confined to the building of origin except in some of the older sections near the principal business district where, because of the narrow separation between 2-story wood frame buildings, fires could involve a number of dwellings.

RECOMMENDED IMPROVEMENT PROGRAM

Recommendations marked with a star (★) are deemed of most importance and their early adoption is urged.

WATER SUPPLY

1. That records be completed and the originals safely filed.
2. That the water department be properly notified of large fires so that regular response of emergency crews can be assured.
3. That in any future construction at the filter plant, plans be adopted to duplicate piping so that a break or repair of a valve will not interrupt the entire supply.
4. That the mains shown in red on the accompanying map be installed.
5. That additional hydrants be installed so that there is at least one at each street intersection with intermediate hydrants where necessary so that they are not over 500 feet apart.

FIRE DEPARTMENT

6. That additional company officers be appointed so that one will be on duty at all times with each company during vacations and sick leaves.

★7. That sufficient men be appointed immediately so that there will be at least 5 on duty at all times with each engine and ladder company.

8. That the department membership be further increased as soon as practicable so that the least number on duty at all times will be 7 men with each high-value company, and 8 men with the engine-ladder company.

9. That all promotions be made under civil service regulations or the equivalent after written competitive examinations, and due consideration given to seniority and service record.

★10. That an additional engine company be established in the vicinity of Colonial Drive and Wrightsville Avenue.

11. That Pumper 2 be equipped with a 3-section 35- or 40-foot lightweight extension ladder.

12. That a modern aerial ladder truck be purchased and placed in service and the present ladder truck be held in reserve.

13. That the following equipment be provided where not already furnished:

- a. To each pumper: 2 electric hand lights, distributing nozzle, 2 salvage covers, sprinkler head stops, squeegees, siamese, and 2½-inch wye.

b. To the pumper-ladder truck: Block and tackle, 2 forks, asbestos gloves, gas and water keys for street mains, 4 electric hand lights, 4 life belts, life net, 4 Type N gas masks and 2 self-contained breathing apparatus or 6 of the latter, cellar pipe, distributing nozzle, roof cutter, two 125-foot sections of ¾-inch rope, 8 salvage covers, roofing paper, sprinkler heads and stops, and hand saws.

c. To the ladder truck: Claw tools, block and tackle, 2 portable extinguishers, heavy duty jacks, gas and water keys for street mains, 4 electric hand lights, 4 Type N gas masks and 2 self-contained breathing apparatus or 6 of the latter, distributing nozzle, two 125-foot sections of ¾-inch rope, 8 salvage covers, roofing paper, sprinkler heads and stops, and hand and power saws.

14. That suitable refueling and hose drying facilities be provided at all stations.

★15. That suitable training facilities, including a drill tower, a structure in which fires can be built, and necessary equipment be provided in an area where the use of smoke and water will not be restricted and that a more complete training program be developed under the direction of a full time drillmaster, the program to include officer and company schools, frequent practice on the training grounds by companies, both individually and combined, and daily company drills in stations.

16. That company members make inspections of all buildings other than 1- and 2-family dwellings, in their respective districts; reports in the form of notes and sketches to be made of building construction and hazards, and to be used as subjects for discussion in the training program.

17. That the response schedule be expanded to include definite assignments of apparatus to second or greater alarms of fire; this to be kept in card form at each station.

FIRE ALARM

18. That the system be improved by continuing to place circuits underground in ducts used exclusively by communication circuits.

19. That additional circuits be provided so that none will serve an area greater than that which would be protected by 20 properly spaced boxes on aerial wire circuits or 30 boxes on circuits entirely underground or in messenger sup-

ported aerial cable; the above figures may be doubled if the ground feature is used.

20. That additional boxes be installed so that one will be visible from and be within 500 feet of every building in high-value districts, and be within 800 feet of important groups of buildings, elsewhere.

21. That a separate fire department radio system be provided, this to include adequate dispatching and recording facilities at headquarters and 3-way radio units on chiefs automobiles, and other fire department vehicles.

22. That at least two telephone trunk lines be reserved for emergency calls only and be properly listed in the telephone directory.

23. That a sufficient number of specially trained, full-time fire alarm dispatchers be appointed so that one will be on duty at all times.

24. That telephone alarms be confirmed over the fire alarm telegraph system after first notifying the nearest company of the exact location of the fire over the voice-amplification system.

25. That more complete tests and records be maintained as planned.

BUILDING DEPARTMENT

26. That the deficiencies in the state building code be corrected by enacting municipal ordinances.

27. That the fire limits be expanded to include all business and commercial districts.

FIRE PREVENTION

28. That the personnel of the fire prevention bureau be increased by at least one man immediately and others in the future.

29. That the bureau make complete inspections of all potentially hazardous occupancies at regular intervals.

30. That the program of improving and completing records be continued.

ELECTRICITY

31. That a complete reinspection of old wiring be made, that defects be corrected, and that old wiring be reinspected at suitable intervals.

32. That efforts be directed toward the removal of overhead wires in business, industrial, and other closely-built sections so that ultimately all such overhead obstructions to fire fighting will be eliminated.

CONFLAGRATION HAZARD

★33. That owners of existing defectively constructed buildings which involve serious life hazard or are so located as to form conflagration breeders be required to protect floor, fire wall, and exposed window openings.

★34. That approved automatic sprinkler equipments be required in all basements used for storage or for mercantile purposes and in all buildings which by reason of their size, construction or occupancy involve serious life hazard or might act as conflagration breeders.

GENERAL SUMMARY

City in General.—Population about 50,000. City important port and railroad center. Some short steep grades in principal business district; fairly level elsewhere. Most streets paved and in good condition; average width about 66 feet. No snowfall or prolonged cold weather; high winds and tornadoes infrequent; area subject to hot, dry weather and hurricanes.

Water Supply.—Municipal system with efficient organization; records being improved. Source of supply adequate; pumped to filtration plant and repumped to distribution system. Raw-water pumping and filter capacities adequate; high lift pumps deficient in reserve. Few unreliable features in piping around filter plant. Two supply lines to distribution system; fairly good storage and pressures. Arterial system and gridiron of minor distributors mainly good. Valve spacing generally good; condition fairly good. Distribution of hydrants good in principal business district, fairly good elsewhere; condition generally good.

Fire Department.—Full paid under competent chief officers. Additional engine company required; deficient in men. Appointments under civil service but methods of promotion inadequate. Discipline good. Most apparatus in good condition but ladder truck and reserve pumper old and in only fair condition. Hose supply adequate but no drying facilities provided. Generally good repair force and facilities; all stations except fireboat station in generally good condition. Training seriously hampered by lack of training grounds; very few building inspections by companies. Response to first alarms fairly good but provisions for subsequent alarms inadequate. Fire methods fairly good. A few records incomplete but others mainly good.

Fire Alarm.—Automatic system. Headquarters equipment new and mainly complete with provisions for expansion. Circuit construction generally good but some circuits serve excessive areas. Boxes of good type but additional boxes needed. Telephone facilities adequate but no lines reserved for emergency calls. Good use made of voice amplification system but no department radio system in service or full time dispatchers. Tests and records somewhat incomplete.

Fire Department Auxiliaries.—Duties of fire marshal performed by state insurance commissioner. Police cooperation with both fire and building departments good. Telephone services well distributed. Public utility crews respond upon request. Some private fire protection but very little aid available.

Summary of Fire-Fighting Facilities.—Water supply works adequate and fairly reliable; quantities available in principal business district adequate, elsewhere mainly good. Fire department fairly well equipped but undermanned and without proper training facilities. Fire alarm system of proper type but dispatchers duties performed by company members.

Building Department.—State laws mainly adequate; few municipal ordinances. Fire limits inadequate to protect all business and commercial areas but protects principal business district; restrictions adequate; wooden shingle roofs prohibited in city. Enforcement of code mainly adequate. Records good.

Fire Prevention.—Few good state laws; municipal code complete. Fire prevention bureau has two inspectors; procedures need some improvement. Local conditions generally only fair but improvement noted. Records fair but being improved.

Electricity.—National Electrical Code adopted as standard by the state; enforced by building department. New work generally well installed; old wiring poor to good; electricians licensed; agreement with utility. Outside distribution all overhead except along one street. No trouble from electrolysis; tests by telephone company. Records good.

Conflagration Hazard.—In the principal business district fires should be confined to the building or group of origin except in one block where total involvement is possible. Minor business districts are subject to individual or small group fires only. Very serious fires are probable in industrial districts especially among the warehouses and in areas where bulk flammables are stored. In most residential districts fires should be confined to the building of origin.

April, 1958

COMMITTEE ON FIRE PREVENTION AND
ENGINEERING STANDARDS.

WILMINGTON, N.C.

FILE No. 35 APRIL, 1958

KEY

GENERAL

Principal Business District
Fire limits (Outlined by grey band)

WATER SUPPLY

Mains 8 inches and larger in diameter
Mains 6 inches in diameter
Mains 4 inches in diameter
Recommended mains
Fire flow tests designated by numbers
Hydrants
Valves

FIRE DEPARTMENT

Apparatus in service identified as follows: M - Fireboat
Y - Pumper L - Aerial ladder truck X - Pumper-ladder truck
O - Indicates company location
Recommended changes shown in red

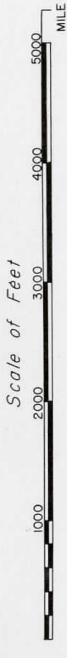
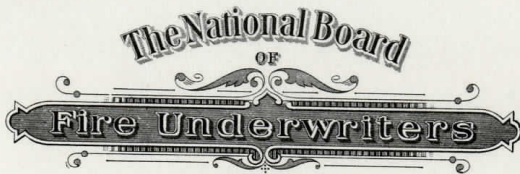


TABLE A - FIRE FLOW TESTS

NUMBER	DISTRICT	ELEVATION	DISCHARGE - (gpm)		TOTAL OF GROUP	PRESSURE (psi)		QUANTITY (gpm at 20 psi)		
			INDIVIDUAL HYDRANTS	TOTAL OF GROUP		HYDRANTS CLOSED	HYDRANTS OPEN	REQUIRED	AVAILABLE	
1	PB	25	970	1320	1910	69	60	7000	10500	
2		30	1120	1260	1340	66	56	7000	8500	
3	MB	40	980	1060	1100	3140	59	3000	6500	
4		53	1190	1320	2510	63	51	3500	5000	
5			980	1470	2450	67	43	2000	3500	
6	IND	32	650	810	1460	61	46	4000	2500	
7			650	680	1020	66	31	4500	2700	
8		6	1180	1220	2300	74	63	4500	5700	
9			490	1040	1530	63	42	3000	2300	
10	INS	20	640	650	750	2040	66	46	3500	3200
11		15	670	760	1430	69	47	2500	2500	
12		25	720	880	1600	64	42	3000	2300	
13	RES	26	790	960	1080	2830	64	51	2000	5500
14		26	680	1180	1860	65	53	2000	3800	
15		26	630	1120	1950	62	50	1500	3600	
16		39	710	1080	1790	59	49	2000	3700	
17		47	680	980	1860	54	44	2000	3600	
18		30	650	670	1060	2380	64	46	1500	3900
19		58	570	1160	1730	51	41	2500	3200	
20		21	850	960	1650	68	48	1500	2900	

DISTRICTS: PB - Principal Business, MB - Minor Business, IND - Industrial, INS - Institutional, RES - Residential.



83 JOHN STREET · NEW YORK 38

TO THE RECIPIENT OF THIS REPORT:

Attached is copy of our report covering the fire fighting facilities, water supply, fire department, fire alarm system, structural conditions and hazards of your community.

It is made available to you for whatever value it may have to the welfare of your community, but in view of the vital information contained therein, which might be of potential value to an enemy planning the destruction of important facilities, it is requested that you consider this material as confidential information and exercise every care to see that it is made available only to persons who are authorized to have such information. Please provide similar safeguards for information contained in earlier reports.

We recognize that there are occasions where rather widespread public discussion of the conclusions and recommendations contained in the report is desirable but it is confidently believed that such discussion will not in any way be impaired or restricted by the request that the report and maps contained therein be safeguarded by the recipient to the fullest practical degree.

Very truly yours,

General Manager

LAV:cm