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File No. 367

REPORT

ON

DURHAM, NORTH CAROLINA

BY

NATIONAL BOARD OF FIRE UNDERWRITERS

COMMITTEE ON

FIRE PREVENTION AND ENGINEERING STANDARDS

well located in the eastern part of the city. Pressures are generally good and are well maintained.

The arterial system is mainly adequate, and the gridiron is good to fair being adversely affected in some areas by the use of 2-inch pipe for domestic supply.

Fire-flow tests indicate that adequate quantities of water are available in the principal business district except where the delivery is restricted by small mains. In most other areas the distribution system can deliver adequate quantities of water for fire protection.

Valve spacing is very good throughout the system. Valves are in fair to good condition; a valve inspection program is to be started in the near future to provide proper valve maintenance. Hydrant spacing is mainly adequate in the principal business district, and wide elsewhere. Annual inspections are made; hydrants operated during fire-flow tests were found to be in generally fair condition.

FIRE DEPARTMENT

ORGANIZATION. — General. — The fire department is full paid and works an average of 72 hours per week. The department is under the general supervision of the city manager.

Direct supervision is by Chief C. L. Cox, age 46, who has been a member of the department since 1929 and was appointed to his present position in 1946 from the rank of captain. Assistant Chief C. H. Lawson, age 49, and Deputy Chief C. A. Woods, age 50, have been members of the department since 1927 and 1925, respectively, and were appointed to their present position in 1946 and 1953; Captain J. F. Page, age 51, an officer of Ladder Company 9, also has acted as deputy chief since 1953.

Membership.—Total membership of the department is 106 and includes a chief, assistant chief, deputy chief, 18 captains, a master mechanic, a superintendent and acting superintendent of fire alarm, 20 drivers, and 62 privates. The superintendent of fire alarm has been detailed to the city electrician's office for 8 years and, except during emergencies, does no fire alarm duty; one of the privates at present is incapacitated so that his duties are limited to the dispatch desk when he is on duty.

Expenses.—The average annual expense, including the fire alarm system and the amount paid by Durham County for one engine company, for the past four years was $339,076; the appropriation for the fiscal year ending June 30, 1955 was $356,604. In addition, a $200,000 bond issue was authorized in 1951 for the construction of 3 stations and the purchase of 2 pumpers; during this survey bids were being sought for the construction of one station.

Appointments and Promotions.—An applicant for appointment to the department files an application with the chief and, after a satisfactory interview by the chief and/or assistant chief, is directed to take a physical examination which if successfully passed makes the applicant eligible for appointment as vacancies occur. No written examination is given and there are no height or weight limits but the candidates must be between 20 and 28 years of age and after appointment must serve a probationary period of six months.

The first promotion is to driver. A member, who the chief feels has the necessary qualifications, is made a relief driver for at least two years during which time he is given special instructions in the operation of pumps. The chief appoints permanent drivers from among eligible relief drivers. The next promotion is to captain and is made by the chief without benefit of a competitive examination but is subject to the approval of the city manager; a member need not have been a driver to be promoted to captain. The same procedure is generally followed for promotion to deputy chief. The chief and assistant chief are appointed by the city manager and by city charter can only be removed after a hearing before the city manager, the results of which can be appealed to the city council. There are no requirements established regarding minimum time in grade before being promoted. The present chief and assistant chief were appointed from the rank of captain there being no other chief officers eligible for promotion.

Retirement and Pension. — All members are under a pension plan administered by the state. A member may retire at 55 years of age and receive an amount prorated on his years of service. After ten years of service a member may be retired for disability whether service connected or not and would receive a pension equal to 75 per cent of the amount he would have received if he had worked until age 60. If disabled before 10 years service he would receive only what the compensation law provides. A widow's clause can be included in the retirement plan if a member so elects. The pension plan is supported by 5 percent of a member's salary and by a city appropriation. Compulsory retirement is established at 65 but can be extended by council until a member reaches 70 after which it can be further extended, one year at a time.

In addition, all members come under a city compensation plan and the North Carolina Firemen's Relief Fund; this latter organization is supported by money obtained from ½ of 1 per cent of foreign insurance premiums. About 50 per cent of the department is unionized, being affiliated with the American Federation of Labor. There are 8 members 55 years of age or older, of whom four are 62 to 66.

Companies.—There are 6 engine, 3 ladder and one county booster companies in service in 4 stations. Officers and men are assigned to stations rather than to individual companies and there are sufficient officers to provide a captain on each shift for 7 of the 10 companies. Three of these captains have other duties during the day; one is a mechanic, another is the department secretary and acting deputy chief and the third is the fire inspector.

The chief is on duty 5½ days a week and the assistant chief, who is also drillmaster, is on duty 5 days a week, both being on call at other times. A deputy or acting deputy chief is in charge at other times except Sunday when there is no chief officer on duty. Company members are divided in two platoons, each platoon working alternate 24-hour tours with every eighth working day off and an additional working day off about every three months. Vacations extend throughout the entire year and each member receives 14 days; the maximum number of men allowed off from the department at one time is 4 men. Sick leave of one day for each month of service up to five years and 15 days a year for over five years of service is allowed each member; sick leave time is accumulative. Substitutes are provided only for men on military leave. The off shift is recalled only at the discretion of the chief; records that are available indicate that this response is fairly good. House watch is maintained at the dispatcher's desk in fire headquarters 24 hours a day and at other stations until 9:30 P.M.

Two engine companies, the booster company and a ladder company adjoin one edge of the principal business district and the remaining companies are from ½ to 2 miles from the district. Elsewhere all closely built-up areas are within 2½ miles of an engine and ladder company. Running distances to several groups of buildings in which an aerial ladder would be required are up to 3 miles.

APPARATUS AND EQUIPMENT.—See Tables 4 and 5.—Pumpers.—There are six pumpers in service, all of which are equipped with centrifugal pumps. All pumpers have a length of soft suction 2½, 4, 4½ or 5 inches in diameter and each has 2 lengths of hard suction except Engines 6 and 7; all are 3-way radio equipped.

There are two Ahrens-Fox pumpers in reserve; both are equipped with piston pumps. One has a pump of 750-gpm capacity and was purchased in 1924 and the other a 900-gpm pump and was purchased in 1926. Both pumpers are loaded with 1,000 feet of 2½-inch and 200 or 250 feet of ¾-inch hose, and are provided with a small booster tank and a limited amount of minor equipment; one pumper carries only one length of hard suction, while the other has two and both have a length of soft suction plus the usual suction adapters.

All pumpers in service and reserve were tested at draft during this survey. All except Pumper 2 and the reserve 750 gpm Ahrens-Fox were able to deliver their rated capacities at the required pressures. Pumper 2 delivered 98 per cent and the reserve pumper only 56 per cent of its capacity. Engine 6 was unable to complete the pressure tests when a part of the transfer valve broke and changed the pump from pressure into volume operation. Engines 6 and 7 were assembled locally and some desirable features were found to be lacking. Operators performed their duties reasonably well but some showed a need for further instruction in the internal mechanics of a pump. Pumpers are tested about every two years but no records are kept of the results.

Ladder Trucks.—There is one aerial ladder and two service ladder trucks in service; the 100-foot aerial ladder is metal and hydraulically raised. Ladder trucks carry 10 or 11 ground ladders, including 45, 40 and 35-foot extensions; ladders on two of the trucks and three of the larger extension ladders on the third truck are of aluminum alloy. Several of the rungs of the wooden ladders on Ladder 8 were noted to be loose. All ladder trucks are 3-way radio equipped.

Booster Truck.—A booster truck, equipped with a Hale 2-stage high-pressure pump and owned by Durham County, is manned by members of the city department. This truck carries, in addition to other minor equipment, a gasoline powered portable pump for use at fires in the county where there is no public water supply.

Chief's Car.—Miscellaneous Vehicles.—Fuel.—The chief is provided with a 1954 Buick, the assistant chief and deputy chief on duty each with a 1948 Buick, and the fire inspector with a 1946 Ford; all are 4-door sedans and equipped with 3-way radio. The fire alarm superintendent is provided with a 1953 Ford ½ ton pickup truck which is also used by the mechanics and as a general utility truck.

Fuel is generally obtained at the city garage or from a 55-gallon drum equipped with a hand pump brought to stations in the utility truck. Fuel is distributed to apparatus at fires of extended duration in safety cans filled from the drum carried on the utility truck.

Hose.—The 2½-inch hose is double-jacketed cotton, rubber lined, purchased under the usual trade guarantees. New hose is not tested upon receipt but 2½-inch hose in service is tested about every two years to 250 pounds. Records are somewhat incomplete as to age of hose; the date of purchase of each length is stamped on the female coupling. Records indicate that about 46 per cent of the total hose is five years old or

TABLE 4.—FIRE COMPANIES—LOCATION AND EQUIPMENT.

Company	Location	Members on Duty	Apparatus		Hose			Ladders Carried	Booster Tank Gallons
			Make and Type	Put in Service	Size, Inches	Carried, Feet	Spare, Feet		
Eng. 1*hv*	Headquarters: Mangum & Hollo-way Sts.	4	Seagrave * 1000-gpm Pumper	1934	2½ ¾	1400 300	....	1—24′ 2—14′ 1—12′	100
Eng. 2	9th and Knox Sts.	4	Seagrave * 1000-gpm Pumper	1934	2½ 1½ ¾	1400 300	5000 800 850	1—24′ 2—14′ 1—10′	100
Eng. 3*hv*	Main and Elizabeth Sts.	4	Seagrave * 750-gpm Pumper	1943	2½ ¾	1600 250	....	1—24′ 2—14′	100
Eng. 4	McMannen & Cobb Sts.	4	Seagrave * 750-gpm Pumper	1949	2½ 1½ ¾	1500 400 600	..... 450	1—24′ 2—14′	300
Eng. 6*hv*	With Engine 1	4	Ford-Darley 600-gpm Pumper	1953	2½ 1½ ¾	1150 400 600	..... 400	1—20′ 1—14′	500
Eng. 7	With Engine 2	3	Ford-Darley 500-gpm Pumper	1952	2½ 1½ ¾	900 550 600	....	1—20′ 1—14′	400
County	With Engine 1	4 - 5	Mack Booster Truck	1948	2½ 1½ ¾	800 400 600	....	1—24′ 2—12′	600
Lad. 8	With Engine 3	3 - 4	Ahrens-Fox Service Ladder *	1928	.....	.....	.....	10; Total Length, 222′	.....
Lad. 9*hv*	With Engine 1	5	Am.-LaFrance 100-ft. Aerial	1948	.....	.....	.....	11; Total Length, 335′	.....
Lad. 10	With Engine 2	3	Mack Service Ladder	1947	.....	.....	.....	11; Total Length, 272′	.....

* Equipped with Mounted or Portable Turret.
hv Company located in or near High Value District.

less. Hose on apparatus in service and at stations is shown in Table 4; in addition each reserve pumper carries 1,000 feet of 2½-inch and 200 or 250 feet of booster hose. All hose is dried on a sloping rack or in a cabinet dryer and stored at Station 2; there are no drying facilities at the other stations. Hose is shifted on apparatus about once a month.

Hose couplings in Durham and surrounding municipalities except Raleigh are of the usual screw type and of National Standard dimensions; adapters for Raleigh threads are carried on Engine 3.

Appliances.—Minor equipment carried is generally uniform but somewhat incomplete; equipment needed is listed in the Recommended Improvement Program. Few helmets are provided. Heavy and special stream appliances include a ladder pipe on the aerial, a mounted turret on one of the service ladder trucks, and a portable turret, distributing nozzle and a spray type cellar pipe on 4 pumpers. Each pumper is equipped with a fairly good variety of spray and shutoff nozzles. One ladder truck carries a foam generator, a foam aspirating nozzle, 100 pounds of powder and 5 gallons of foam liquid; in addition, there are seventeen 50-pound cans of foam powder in reserve at headquarters.

Emergency equipment available is fairly good except for the number of forcible entry tools. Two ladder trucks carry a canvas evacuator chute and a smoke ejector, and one has a portable oxyacetylene cutting unit. Each of the ladder trucks, one of the pumpers and the booster truck have a portable electric generator, 1 to 4 floodlights and an adequate amount of electric cable. Protective breathing devices consist of 1 or 2 filter-type masks on one pumper and two ladder trucks and a self-contained breathing apparatus on each pumper and 2 to 5 on each ladder truck; ladder 9 also has a resuscitator. Salvage appliances consist of 1 or 2 waterproof covers on all but one of the pumpers and 10 to 12 on each ladder truck. In addition, ladder companies carry mops and squeegees but no roofing paper.

Stations.—Four stations are in use, ranging in age from 5 to 43 years; three are of ordinary and one is of fire-resistive construction. Three stations are 2 stories in height and the other is one story. Fueling facilities are not provided at any of the stations and only one has hose drying facilities. Headquarters station is over-

crowded and has no space for chief officers cars which must be parked on the street. Traffic conditions in front of this station at times might impede responding apparatus.

Repairs.—J. E. Johnson is master mechanic and in charge of all repairs and has been a member of the department since 1912, most of which time he has served as a mechanic. He is assisted by a captain who also serves as a company officer on one shift and a private who also does fire duty on the other shift. The repair shop occupies a very small space at the rear of the apparatus floor in fire headquarters. The shop is equipped with only a few small power tools but a good variety of hand tools, most of which belong to the individual mechanics. When major repair work has to be done the fire department mechanics use the facilities at the city garage. Local machine shop facilities are good. Only a few small spare parts are kept on hand but the local supply of such parts is good; other parts are available from regional distributors or directly from the factory. Battery maintenance is good, each station being supplied with a charger and hydrometer. Records of repairs made to apparatus are kept in a separate journal for each piece. General information for each piece of apparatus is somewhat limited.

TABLE 5.—SUMMARY OF APPARATUS.

	In Service	In Reserve
Pumpers:		
1000-gpm	2	0
900-gpm	0	1
750-gpm	2	1
600-gpm	1	0
500-gpm	1	0
Ladders Trucks:		
Aerial	1	0
Service	2	0
Booster Truck	1	0
Utility Truck	1	0
Chief Officer Automobiles	4	0
Hose, ¾-inch Booster	3,250′	1,300′
Hose, 1½-inch	3,400′	0
Hose, 2½-inch	14,700′	1,000′
Ladders, Total Length	1,175′	86′
Ladders, Short, on Pumpers, Etc.	21	6
Portable Extinguishers	22	1
Large Water Tanks	7	2
Gas Masks Filter Type	4	0
Breathing Apparatus, Self-contained	16	0
Fresh Air Mask	0	1
Portable Turrets	4	0
Mounted Turret	1	0
Ladder Pipe	1	0
Cellar Pipes (Spray type)	4	0
Distributing Nozzles	4	1
Siamese Connections, 2½-inch	3	1
Foam Generator	1	0
Aspirating Foam Nozzles	1	1
Waterproof Covers	43	0
Smoke Ejectors	2	0
Portable Lighting Units	5	0
Special Couplings (For Pumpers from Other Cities)	2	0
Wyes	6	1

OPERATION.—Discipline.—The chief is empowered to enforce discipline, and may transfer or reprimand a member; suspensions or dismissals may also be made but are subject to the approval of the city manager. Rules and regulations were last revised in 1937 and are somewhat obsolete and incomplete. The chief issues special and general orders from time to time but no master file of these orders is kept and at some of the stations a complete and orderly file of these orders was not available. Records of severe breaches of discipline are placed in a member's personal file folder. During 1954 there were no cases of disciplinary action, the last case on record being in 1952. Discipline in general is fairly good.

Training and Instruction.—Drills and training are under the supervision of Assistant Chief Lawson. A 5-story brick drill tower equipped with a standpipe and smoke room is provided at Washington and Morris Streets; the moderately heavy traffic on these two streets creates somewhat of a hazard to the men and apparatus while drilling and restricts the use of water. The floors in the tower are of wood and in generally poor condition. Each company attends the drill tower about two hours a day, five days a week from about April 15 to September 1, weather and fire duty permitting. An informal record is kept of this attendance but does not list the evolutions performed. A general order states that company training will be held in each station, five days a week from 1 P.M. to 3 P.M., under the company officer except for about two weeks before and after the sessions held at the drill tower. No specific outline of subjects to be covered in company training is provided and some stations were noted to have no records of these drills. New men, if a large enough group is appointed at the same time, are given two weeks instruction at the drill tower, but otherwise receive no special training. An officer school was last held for five days in 1953. Exhibition drills held for three days during this survey with all companies, showed that members were familiar with drill tower work but indicated that most needed more training in combined company operations to improve coordination of members as a unit.

Building inspections are made by company officers of hazardous occupancies within their district but on no particular schedule. Some of the officers take notes and make sketches, but records as a whole are poor; little use is made

of these inspections for an analysis of local building conditions from a fire fighting standpoint.

Response to Alarms.—Each station has a set of cards giving the box number and location of every box in the city but show no company assignments. Box locations, to which a company responds on a first alarm, are mounted on the wall at Stations 2, 3 and 4; response to other than box alarms is controlled by the dispatcher at headquarters.

Response to all box alarms, including those in the principal business district, is two engine companies and a ladder company or one engine, the booster company and a ladder company. Response to telephone alarms for fires in buildings is usually the same as for a box alarm from the same vicinity; response to all other alarms is at the discretion of the dispatcher. The chief responds from headquarters during the daytime to alarms of his choosing and at night to working fires in buildings after a specified time. The assistant chief and deputy or acting deputy chief responds to all fires in buildings during the day and at night the assistant chief responds only to a second building fire should the deputy chief be unavailable because of another fire, and to all multiple alarms. On Sunday there is no chief officer on duty; one of the chief officers will respond if called by the officer in charge at a fire.

There are a number of railroad grade crossings, most of which are on main lines, that could delay responding apparatus. Street grades are mainly slight and would offer no delay. Unpaved streets are mostly gravel and would generally not delay apparatus during inclement weather. Wire obstruction in the principal business district is primarily limited to street lighting circuits and generally would not hamper fire department operation; elsewhere wire obstruction is slight to moderate.

Fire Methods.—Fire records show that the majority of fires are extinguished by portable extinguishers or booster lines and the balance by 1½ or 2½-inch lines. The usual procedure is for the first arriving engine company to use its booster line and/or pre-connected 1½-inch line, with the exception of Engines 1, 2 and 3 which carry no 1½-inch hose. The second arriving engine company generally lays a 2½-inch line to back up smaller lines from the first pumper; pumpers seldom connect to hydrants except at large fires. General orders state that connections are to be made to buildings equipped with sprinkler or standpipe systems. Nozzles used on 2½-inch lines have tips ranging in size from ⅞ to 1 inch with extra tips of 1⅛ and 1¼-inch available. The use of spray nozzles is generally limited to booster lines. Ventilation, ladder and salvage work are supposed to be done by a ladder company; salvage work is limited primarily to cleanup work. At one fairly serious fire observed during this survey, fire methods were noted to be somewhat disorganized.

Reports and Records.—Captain J. F. Page, who is also acting deputy chief on one shift, is designated as the department secretary. Each station keeps a journal and makes a daily report, the latter being forwarded to headquarters. Reports for each fire are made by the dispatcher from information received by telephone from companies that responded to the alarm; this report is given each day to the secretary who enters the data in a master fire record book. A monthly and yearly report is made by the secretary and sent to the city manager. Personnel records are kept of each member but are somewhat incomplete.

CHANGES AND IMPROVEMENTS.—Since the 1946 report by the National Board of Fire Underwriters the work week has been reduced from 84 to an average of 72 hours per week. The total membership has been increased by 48 men. Two additional ladder companies and one engine company have been established and Durham County has provided a booster truck which is manned by city firemen. Station 2 has been relocated and bids were being sought during this survey for a new building to replace Station 3; two more stations are to be built and two pumpers will be purchased under a bond issue authorized in 1951. Three pumpers, a booster truck, two ladder trucks and four sedans have been purchased. The rank of deputy chief has been created. The response to alarms in the principal business district has been reduced by one engine company.

Since the survey was conducted Captain J. F. Page has been promoted to deputy chief and construction has been started on a new fire station at East Main Street and Driver Avenue to replace present Station 3. Bids have been received for two 750-gpm pumpers.

CONCLUSIONS.—The fire department is under competent and experienced chief officers. The manpower, although improved, is still somewhat inadequate. The practice of not having a chief officer on duty on Sundays is undesirable, as adequate supervision of companies is necessary particularly since there are insufficient company officers. The lack of a suitable method for appointments and promotion, especially the latter, does not always assure the selection of the best men available and tends to discourage incentive. The number of engine companies is inadequate resulting in protection being especially weak in recently built-up outlying areas. The site for the proposed relocation of Engine 3, while not the most desirable, is considered

satisfactory. The establishment of a county company has improved protection to the city by reducing the number of runs formerly made by city companies into the county. Department repair shop facilities are inadequate as are tools and spare parts available. The living and working space available at headquarters station is inadequate for the number of companies housed. The training program in general is fairly good although consideration should be given to relocating the drill tower because of the hazards presented by traffic and the unsafe condition of the floors. The training program is incomplete and company training lacks proper supervision. It was evident from house inspections made, exhibition drills held, and fire methods observed that an officers school should be permanently incorporated into the training program. The response to alarms is inadequate to high-value areas. Discipline is reasonably well maintained. Records, although fairly good, could be improved by some reorganization and providing a full time clerk.

FIRE ALARM

ORGANIZATION.—The fire alarm system is part of the fire department and under the general supervision of the city manager and the chief of the department. Captain R. O. Mullen, Superintendent of Fire Alarm, has been detailed to the city electricians office as an electrical inspector since 1948 and concerns himself with the fire alarm system only in an emergency. Since 1948 Captain J. M. Durham has maintained the fire alarm system; he has been a member of the fire department since 1934 and a fire alarm mechanic since 1942; he is assisted by a detailed member of one of the headquarters companies when necessary.

Headquarters equipment is housed in a fire-resistive and completely cut-off room, accessible only from the outside, in fire headquarters, a building of ordinary construction. External windows are protected against moderate exposures by wired glass windows in metal frame.

EQUIPMENT.—Apparatus at Headquarters.—Apparatus, of automatic type and Gamewell make installed in 1925, consists of a 12-circuit slate operating board with the usual meters and switches for testing the system for current, voltage and grounds; a 10-circuit, manually rewound repeater with contacts on the drum for 4 alarm circuits; and a metal terminal cabinet recessed in the wall. The remaining headquarters equipment is in the dispatchers room.

Circuits enter fire alarm headquarters underground from a manhole in front of fire headquarters through a duct in the first floor to the terminal cabinet in the equipment room; no protection is provided in this cabinet. Circuits proceed in conduit through the floor to the operating board where each side of each circuit is protected by a carbon-block arrester in a vacuum tube, a 3- or 5-ampere cartridge fuse, both mounted on the back of the board, and a ½- or 1-ampere glass enclosed fuse on the front of the board.

Current for operating the system is furnished by one commercial 120/208-volt a-c circuit that supplies the branch circuits for the station, one of which delivers 120 volts to the rectifiers with batteries floating. A receptacle has been provided so a portable electric generator can be connected to supply the system in an emergency. There are 190 cells suitably mounted on racks in the operating room which has no means of ventilation other than the windows. Batteries are protected by 3-ampere fuses mounted on the battery rack. Two batteries with cells 20 years old were noted to be in very poor condition and the remaining batteries, which have cells 13 years old, are in only fair condition. New cells to replace those in poor condition were received during this survey; there are no spare cells on hand. Two high-rate rectifiers are provided to give batteries a high-rate charge.

At Fire Stations and Elsewhere.—Each station has a punch register, one or more gongs, and a loud speaker connected to one or two box and/or alarm circuits. A punch register in police headquarters and a small gong at the drill tower are the only other instruments connected to the system.

In the dispatchers room in fire headquarters there is a punch register connected to one box circuit; a breakwheel transmitter in a metal box recessed in the wall; code wheels for boxes within the fire limits only; voice amplification, radio and telephone facilities; four switches connected to some box or alarm circuit for alerting stations that an alarm is about to be transmitted; nine switches to change traffic lights in the downtown area to flashing red; and a small cabinet with an ADT bell. The tower bells formerly in service are no longer used.

Boxes.—There are 183 boxes in service, all being Gamewell make and of succession type; however, 18 boxes of an older type will operate only for 4 rounds. Twenty-three boxes are mounted on pedestals, 5 on or in buildings and 155 on available utility poles. There are 11 private boxes, only 2 of which are accessible to the general public; 4 of the private boxes are master boxes and have auxiliary pull stations or sprinkler systems connected to them. All boxes are grounded and conduit leads down poles have weather caps at the top and insulating joints at the box.

Distribution of boxes in the principal business district is fair, 4 additional boxes being needed. Elsewhere distribution is fairly regular but numerous additional boxes are required to properly protect built-up areas. Conspicuousness of boxes is good in the district, all but one box being provided with an indicating light; elsewhere conspicuousness in general is good all boxes and the bands on supporting poles having been painted in the past year.

Twenty boxes were tested during this survey and except for a few minor faults were found to be in generally good operating order and timed to transmit signals from ¾ to 1¼ seconds between blows.

Circuits.—There are 10 box and 2 alarm normally closed circuits in use. The total length of box circuits is about 73 miles of which 26 miles is underground; alarm circuit mileage is 5 miles, all of which is underground; one alarm circuit does not leave fire headquarters. One box circuit is entirely underground and has connected to it all but one of the boxes in the principal business district. Four box circuits do not enter any fire stations or have any instruments connected to them; eight box circuits serve an area greater than that covered by 20 properly spaced boxes.

Underground circuits are of No. 16 rubber-covered copper wire in lead sheath except for a 600 foot length which is in polychloroprene cable. Aerial wire is No. 10 copper-covered steel wire with triple-braided weatherproof or polychloroprene covering. Leads down poles are No. 12 polyvinyl chloride covered copper wire in conduit. Wiring in fire stations is No. 14 rubber-covered copper wire in conduit. Circuits are protected at the entry to Station 4, the only station where they enter aerially, by an inert-gas arrester. Protection is provided at the junction of aerial and underground construction by carbon block arresters in a vacuum tube and 7-ampere fuses; at one such junction inspected, high voltage had destroyed the arrester but had not opened the circuit. It is estimated that at least 1/5 of the aerial wire has insulation in poor condition or missing. The general condition of circuits is fairly good.

Voice Amplification System.—Two-way voice amplification facilities of Gamewell make are installed in all stations. Each station is provided with an amplifier, a microphone, one or more loudspeakers, and switches so that the equipment may be used within each station as a public address system. Voice signals are superimposed on either box or alarm circuits to each station; current supervision of the ac supply for the amplifier is provided in each station. The system is used to dispatch companies to alarms received by telephone and for transmitting general messages to stations.

Radio System.—The department has its own 3-way FM radio system. The base transmitter is located at fire headquarters with a remote control unit in the dispatchers room. All vehicles in the fire department except the reserve pumpers and the utility truck are radio equipped.

Telephone System.—There are four lines from the telephone company central office to the dispatchers room in fire headquarters. Two of these are emergency lines arranged for progressive operation and the other two are for general business. Station 2 has two private lines to it from the central office and all other stations have one line. There is no private switchboard and if the voice amplification system should fail these stations would have to be called over these lines through the telephone company central office. The emergency number is listed in the telephone directory, as is the number of each fire station.

OPERATION.—The acting fire alarm superintendent works five days a week and is on call at other times. A line truck is provided which the superintendent shares with the repair shop.

Dispatchers duties are covered by 3-hour watches drawn by members of the headquarters companies; if the man on watch is a member of a company responding to an alarm he leaves with his company, his place being taken by another member, but should all companies leave, one man remains. The acting superintendent takes current, voltage and ground readings once a day. Readings of the electrolyte are taken about every 90 days and voltage of individual cells about weekly; the system is occasionally run on the batteries alone. Test blows are sent over the system twice a day and voice amplification tests are made every 2 hours from 7 A.M. to 9.30 P.M. One or 2 of the 22 boxes within the fire district are tested each day, 5 days a week, but only one round of each box is allowed to be transmitted over the system, after which the box is shunted out; boxes elsewhere are generally tested only after repairs have been made or circuits cleared of trouble. A map of circuits was made during this survey but is incomplete. Records of current, voltage and ground readings are made but no other records are kept.

Four rounds of box alarms are transmitted automatically over the system. Telephone alarms are usually received at headquarters; a blow is sent over the system to the station or stations concerned and companies are dispatched by means of the voice amplification facilities. Telephone alarms for fires in buildings are not confirmed over the telegraph system. During 1954 there were 1,079 alarms, of which 937 were received by telephone, 124 by box, 17 verbally and one over an ADT system; 229 of these alarms

were in the county. Included in the above total are 62 malicious false alarms, of which 40 were received by box and 22 by telephone.

CHANGES AND IMPROVEMENTS.—Since the 1946 report by The National Board of Fire Underwriters dispatchers have been moved to a room formerly used as a battery room, the batteries having been moved into the equipment room. Forty additional boxes have been installed and conspicuousness has been improved by frequently painting boxes and bands on supporting poles.

CONCLUSIONS.—The fire alarm system is of proper type and fairly well maintained but is inadequate in extent. Headquarters equipment is well housed except for the batteries installed in the same room, but a number of items which would permit proper operation and supervision of the system have not been provided. The use of company members as dispatchers is undesirable, as not all such members can be expected to be properly trained to handle the duties involved, and since they are not on duty in the equipment room cannot make routine tests of the system.

The large amount of aerial circuits, improper protection to circuits in some instances, the only fair condition of the batteries, and many box circuits serving excessive areas adversely affect the reliability of the system. Also, the lack of instruments on some box circuits increases the possibility of an alarm not being received should the repeater fail. Boxes are of proper type and conspicuousness and those that have been provided are generally well distributed; however, many areas have too few boxes. The voice amplification facilities provide for simultaneous communication with all stations and has improved the handling of alarms, which would be improved still further if telephone alarms for fires in buildings were confirmed over the telegraph system. The listing in the telephone directory of the numbers of the individual stations is not desirable. Tests and records are incomplete.

A properly maintained fire alarm system is the most reliable means of transmitting an alarm of fire, and its use by the public should be encouraged.

FIRE DEPARTMENT AUXILIARIES

FIRE MARSHAL.—The chief of the fire department is required by state law to investigate the origin of each fire and submit a written report with all pertinent data to the state insurance commissioner. Charles F. Gold is Insurance Commissioner and ex-officio State Fire Marshal. The commissioner and his deputies have all the powers of an examining court and the authority to investigate and make arrests of anyone suspected of arson. There were four fires of a suspicious nature during 1954; one conviction was secured.

POLICE DEPARTMENT.—H. E. King is Chief and total membership, including 23 school crossing guards, is 130. Police headquarters is in the Durham County Court House at Main and Church Streets.

The department has 35 vehicles, including 24 automobiles, four 3-wheel, and five 2-wheel motorcycles, of which two have a sidecar, and two trucks; all vehicles except three 3-wheel motorcycles and one truck are equipped with 3-way FM radio. There is no telegraph signaling system but foot patrolmen report hourly by means of telephones installed at 9 major street intersections. Alarms of fire are received at police headquarters on a punch register or by telephone from fire headquarters. A prowl car is sent to all alarms except those for fires of a minor nature and a traffic car is dispatched if additional help is requested. Traffic lights in the downtown area can be turned to flashing red by the fire alarm dispatcher to aid responding apparatus. Unauthorized building construction is not reported. In general police cooperation with the fire department is good.

TELEPHONE SYSTEM. — The Durham Telephone Company serves approximately 22,000 subscribers with about 27,000 instruments in use, through machine-switching central offices. Included in the above figures are 16 telephone booths located at principal intersections throughout the city. Service is through 1-, 2- and 4-party lines with about 20, 2 and 78 per cent, respectively, of each service. The main office is in two communicating buildings of ordinary construction adjacent to fire headquarters and near the principal business district. Two other 1-story buildings of fire-resistive construction house automatic central office equipment at other locations in the city. The principal external exposures to the main office are by fire headquarters on the west across a 7-foot alley and the rear of mercantile buildings on the south; external openings are protected by wired-glass windows in metal frames. Internal protection consists of the usual first aid appliances. Standard, double fire doors are installed at the openings between the two buildings but over one of these openings is a 3-foot square unprotected opening.

Circuits are underground in the principal business district and along major thoroughfares and are in aerial cable elsewhere except for a small amount of open wire in outlying areas. Four

lines are provided from the central office to telephones in the dispatchers room in fire headquarters; two of these lines are arranged for progressive operation and are listed for emergency calls. In addition, each fire station has one or 2 lines from the central office. Calls made to the operator are received by Southern Bell Telephone Company long distance operators in a building outside the city and as a service they will dial the fire department number. Calls made by dialing the emergency number are supervised and logged by Durham Telephone Company operators. Periodic tests are made for electrolysis but little or no trouble is found.

PUBLIC SERVICE CORPORATIONS.—The Duke Power Company provides electric service to the city and the Public Service Company of North Carolina, Inc. serves the city with gas. Both of these companies will respond to fires on request but do not maintain emergency crews on duty.

PRIVATE FIRE PROTECTION.—Most of the manufacturing plants are equipped with automatic sprinklers. Some of the larger plants have stationary fire pumps, yard hydrants and hose houses. Some of the large tobacco sales warehouses of extensive area are not protected by automatic sprinklers.

OUTSIDE AID.—Some outside aid can be obtained from the part or full paid departments in Chapel Hill, 10 miles distant, Butner 16 miles, and Raleigh 23 miles; however no definite arrangements have been made with these departments.

STRUCTURAL CONDITIONS AND HAZARDS

BUILDING DEPARTMENT

ORGANIZATION AND CONTROL.—Personnel.—State and municipal laws provide for the supervision of construction, repair or alteration of all buildings by a building inspector. The building inspector is appointed by the city manager to serve at his pleasure. Duties of the office include the enforcement of state and municipal laws, issuing permits, inspection of buildings, the general supervision of the plumbing department and the maintenance of public buildings.

Edison H. Johnson was appointed Building Inspector in 1945. He is assisted by an assistant building inspector, a plumbing inspector, and two secretaries who also serve the electrical inspector.

Procedures.—A permit must be obtained before the construction, alteration, repair or removal of any building may be started. Application is made in triplicate on printed forms which require brief data on proposed construction and must be accompanied by plans and specifications; copies of applications are kept on file. If approved, a permit card is issued and must be posted on the job. Permits for installation of tanks for the storage of flammable liquids must also be obtained from the building inspector. Appeals on the ruling of the building department are heard by the Board of Adjustment.

Buildings under construction are generally inspected for foundation, framing and final; more inspections are made when necessary. Certificates of occupancy are generally issued upon completion and approval of construction. Applications, copies of permits, inspection records and the plans and specifications are kept on file in the building inspector's office in City Hall for approximately 5 years. Older plans are stored in a fireproof vault in the same building.

State Laws. — The North Carolina Building Code adopted in 1933 and revised in 1953 applies to all new buildings except dwellings, outbuildings, apartments with not more than two families, agricultural buildings not within the limits of incorporated municipalities and temporary buildings used for construction purposes. The code closely follows the 1949 edition of the National Building Code except for the limitation of building areas which are somewhat excessive.

Municipal Ordinances.—The municipal building code adopted in 1947 provides for new construction and alterations to existing buildings. Most features of the code follow those of the National Building Code. Notable deficiencies in the code exist in the area limitations for heavy timber, ordinary and unprotected metal construction, the required wall thicknesses, and the height requirement for parapets. Approved protection is required for openings in exterior walls, if exposed within 50 feet. Wooden shingles are prohibited within the city limits.

In August 1951, an ordinance on substandard housing was passed which provided for the repair, closing or demolition of dwellings unfit for human habitation due to defects increasing the hazards of fire, accidents, or other calamities. The ordinance provides for minimum standards to which all residential buildings must comply. Since that date over 7,000 buildings have been condemned, of which close to 6,000 have already been demolished or had defects corrected.

The zoning ordinance, adopted April 16, 1951, divides the city into 15 use districts with provisions to regulate and restrict the location, occu-