DISTRIBUTION OF THE NUMBER OF FAULTS AND TIME OF RESTORATION OF ELEMENTS OF SEWER NETWORKS

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ABSTRACT

Particular attention should be paid to the reliability of drainage networks in areas prone to seismic impact, as in some cases accidents in them cause more damage than earthquakes themselves. Particular attention should be paid to the reliability of drainage networks in areas prone to seismic impact, as in some cases accidents in them cause more damage than earthquakes themselves. Therefore, seismic zones are taken into account during the laying of networks

Keywords: Drainage, seismic.

Collected and systematized statistical data on the failure of elements of drainage networks in the cities of the Fergana Valley are a complete characteristic of the random variable and establish the relationship between their possible values. allows us to determine the laws of distribution. relevant probabilities. The established laws of distribution of the number of faults in a timely manner and the time of their recovery allow, with some probability, to confirm the probability of not only the entire wastewater system of the city, but also a certain number of faults. on its individual elements, as well as to determine the time required to restore their working condition.

There are statistics on accidents in the drainage networks in Dushanbe made of ceramic pipes collected during the period from 1975 to 1979, on the basis of which we will try to establish the law of distribution. timely failures. For this purpose, the whole range of random N values (number of accidents) presented in the form of a simple statistical aggregate is divided into intervals or “discharges”. The number of wastes that need to be grouped statistically should not be too large, because in this case the distribution rows are expressionless, irregular oscillations are found, and very few, because when the number of wastes is small, their distribution characteristics are described. very rudely by the statistical series. Practice shows that in most cases it is wise to choose numbers of order 10-20.

The length of the waste is determined by the formula

Table-1

year	Monthly number of accidents on ceramic pipes, F 150-500m * Sewerage network in Fergana											
	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII
1975	27	36	77	23	50	67	78	61	67	38	94	77
1976	64	48	84	35	63	59	0	83	6	68	56	61
1977	36	62	68	85	86	62	43	69	72	62	80	30
1978	63	85	95	83	71	98	121	111	89	65	58	77
1979	66	57	44	55	66	86	43	49	43	51	59	61

Interval	25.5-35.5	35.5-45.5	45.5-55.5	55.5-65.5	65.5-75.5	755-85.5	85.5-95.5	95.5-105.5	105.5-115.5	115.5-125.5
Medium range	30	40	50	60	70	80	90	100	110	120
Frequency	2	6	5	16	9	10	7	2	1	1
Frequency P	0.033	0.1	0.083	0.266	0.15	0.166	0.166	0.033	0.016	0.016

$$C = \frac{N_{max} - N_{min}}{1 + 3.2 \lg \eta}$$

where C is the length of the numbers; N_max, N_min is the maximum and minimum value of the random variable; η is the number of values of the random variable. We calculate the number of Ni values for each i-th number (frequency). Divide this number by the total number of observations and find the frequency that corresponds to this category:

$$P_i^* = \frac{N_i}{\eta}$$

Table 1 shows the statistical sequence of the distribution of the number of accidents in ceramic pipes of drainage networks in Fergana, in which the number of wastes is arranged on the axis of their number and the corresponding frequencies and frequencies. Among the numerical characteristics of a random variable that represent the most important properties of a distribution, the mathematical expectation, variance, and standard deviation or standard are determined by the following formulas. As the first mathematical model for the timely determination of the distribution law of the number of ceramic pipe failures of the drainage network in Fergana, we obtain the law of normal distribution, i.e. the Moivre-Laplace-Gauss law of probable distribution .

$$.F(N) = \frac{1}{\delta^* \sqrt{2\pi}} * e^{-\frac{(N_1 - M^*)^2}{2\delta^2}}$$

We determine the ordinates of the curve expression by substituting the calculated values of the statistical mathematical expectation and the standard deviation into the expression. The evaluation of the theoretical closeness of the statistical distribution was constructed according to Pearson's suitability criterion and determined according to the formula.

$$\chi^2 = \Pi\Sigma \frac{(p_1^x - p_1)}{P_2} \geqq -3.69$$

where χ^2 is Pearson's adaptability test [-χ^2 distribution]; p is the statistical probability; p1 -theoretical probability, for the case under consideration, χ^2 = 3.69. from the value of χ^2 and the number of degrees of freedom, the probability is determined that the measure of the discrepancy between the theoretical and statistical distribution for obvious random reasons is not less than the value of χ^2 actually observed. a series of experiments given. If this probability is very small, then the experimental results should be considered contrary to the assumption that the distribution law of a random variable is equal to F [N]. If the probability is relatively high, the distributions between the theoretical and statistical distributions may be found to be insignificant and due to random causes, and the random value of the distribution under F [N] law can be assumed to be reliable or impossible. contrary to experimental data.

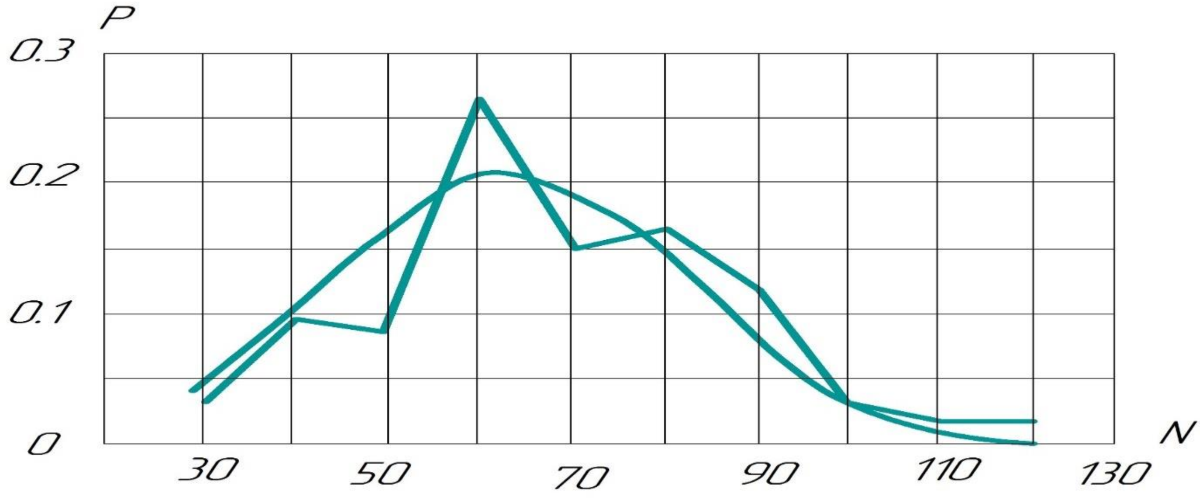


Figure 1. The area of distribution of the experimental frequencies of the monthly number of accidents and the alignment theoretical curve of the law of normal distribution.

The degree of freedom is determined by the following formula:

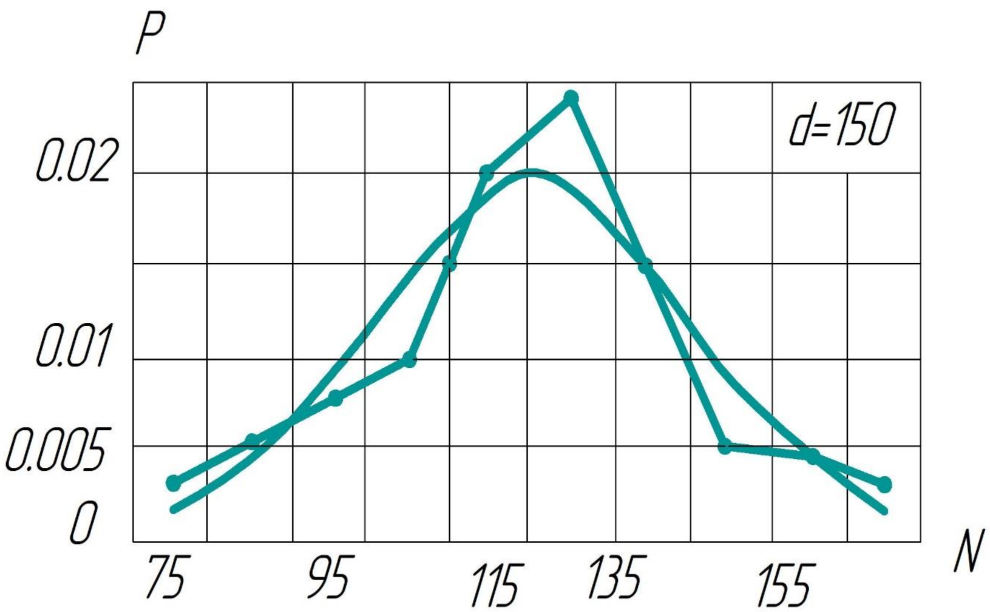
$\tau = K - S$

where K is the number of digits; S is the number of interconnected links.

In the case under consideration, the number of degrees of freedom is equal to D = 8 because K = 10 and S = 2, i.e., the mathematical expectation and variance of the theoretical distribution are consistent. statistical features. Using D and ch2, using Table 3 , we determine the probability that a quantity with ch2 distribution with degree of freedom ch exceeds a given P2 value, which is P = 0.88. This probability is not very high, so the hypothesis that the random value of the change in the number of accidents in pipes made of ceramic pipes is distributed according to the usual law can be considered reliable. The analysis of statistical data on failure of drainage network elements given in Annex I of this work shows that the number of accidents in pipes of different materials decreases with increasing diameter. In addition, the number of accidents in pipes with a diameter of more than 300 mm is much lower than in pipes with a diameter of 150, 200, 250 and 300 mm. In addition, accidents do not occur in some months, so failures of drainage network elements with a diameter of 350 mm and above are relatively rare, and the law of their timely distribution should be different from the usual.

Figure 2 shows the distribution of the experimental frequencies of the monthly number of accidents in ceramic pipes with a diameter of 150-500 mm in Fergana and their theoretical curves. The given graphs are the law of distribution of break times for pipes of 400 and 500 mm diameterMoivre-Laplace-Gauss convincingly shows that it is slightly different from the distribution. The first mathematical model for determining the distribution of the number of distortions over time in pipes with a diameter greater than 300 mm was the law of distribution of rare events, i.e. Poisson's distribution law:

$$P_n = \frac{a^n}{n} * e^a$$



Where a is the perimeter of the Poisson distribution; n are the values of the random variable.

Figure 2. Perimeter of Poisson distribution; n are the values of the random variable.

Similar studies made of ceramic, asbestos-cement, cast iron and reinforced concrete pipes of different diameters for the drainage networks of the Fergana Valley confirm the correctness of the adopted mathematical model. In our opinion, the description of the distribution of the number of faults at the time of elements of drainage networks of different diameters by the law of normal distribution and Poisson's law of distribution is their purpose, the essence of their work, as well as the currently accepted basic design principles.

A **seismic** scale is a table used to estimate (measure) the strength (intensity) of vibrations that occur at the surface during an earthquake. Vibration strength is assessed based on the extent and shape of the residual deformation (change) in the soil, the degree of damage to buildings and structures, and other external factors.

Drainage, drainage of agricultural lands - see. x. engineering method of reclamation; system of hydraulic structures for the removal of excess soil-groundwater and soluble toxic salts from the soil layers, which interfere with the normal development of crops.

The study of the reliability of the elements of technical systems and the determination of numerical values of its indicators is based on the application of mathematical methods of processing statistical data on probability theory and their long-term performance. Water disposal systems, as well as plumbing systems, are queuing systems, the operation of which is characterized by periodic changes in operating time and fault recovery. Therefore, drainage networks can be classified as renewable with key indicators specific to these systems. The operation of sewer networks shows their low reliability, which is mainly due to frequent failures due to barriers [barriers] of pipe crossings. During strong and destructive earthquakes, drainage networks in seismic zones can cause significant damage due to pipe breakage, rupture of round joints, longitudinal cracks and pipelines at hard joints, displacement of turning points, etc. radi. The effect of earthquake intensity up to 2 points for drainage network elements has not been determined.

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