

1.1.38. DEVICE WITH ADVANCED FACILITIES FOR NON-DESTRUCTIVE TESTING OF MECHANICAL PROPERTIES OF CONCRETE

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At present the extent of nondestructive testing of concrete strength and reinforced concrete construction grew considerably. Wide application in nondestructive testing of concrete obtained the sclerometric methods, based on the determination of the strength of material on the base of its response to the impact intrusion of the rigid indenter. The advantages of the methods is the operability of carrying out measurements; the possibility of the realization of the hundred percent control of article without the disturbance of its load-carrying ability; higher energy of the action on the material in comparison with the ultrasonic testing, which makes it possible to create the stresses, which exceed ultimate strength, and to increase thus the reliability of control. At the same time these methods have some imperfection. The main of them is their low information capability. The result of measurement is the integral characteristic of the physical-mechanical properties of concrete (strength). This limits the field of application of a method. Determination of the elastic and plastic properties of concretes separately is impossible. To remove these imperfections is possible, if we will record not one or several impact parameters, but full process of the indenter intrusion into the material tested.

Such method was developed in the Institute of Applied Physics of National Academy of Sciences of Belarus. A principle of the method is based on local impact loading of the material tested, recording of the analog signal of indenter velocity and calculation of the mechanical characteristics of the material tested, using special algorithms. A sensing gauge consists of magnet attached to indenter and coil fixed on the device frame.

Mathematical treatment of array of velocity values allows obtaining a number of impact parameters by the result of one test impact. Maximum contact force, maximum penetration depth, impact duration and restitution coefficient of indenter velocity are the most essential parameters. Using this parameters the main mechanical characteristics of concrete (strength, hardness, dynamic elastic modulus and viscosity) are calculated in accordance with the accepted models of material deforming.

Application of the method for concrete properties testing was realized in device IPM-1. the device is produced in two modifications: IPM-1B and IPM-1A. Portable device IPM-1B is made as the one-piece unit, which includes impact gauge, electronic module of analog-digital converter, processor, display and self-contained power supply. Installation IPM-1A is made as the two separate units: impact gauge and electronic module, which must be connected to personal computer. Using of PC for data processing allows obtaining more detailed information about the material deforming process. User can get not only calculated values of concrete properties but directly impact parameters (both as maximum values and as graphical time dependence). The most essential advantages of the device IPM-1 in comparison with purchasable analogs are:

- high self-descriptiveness of measurement results. By the result of one test impact user gets information about elastic, plastic and viscous properties of a material under test. This information allows to sufficiently spreading of an area of the method application. The device IPM-1 successfully applies for testing of elastic modulus of asphalts. Also the device can be used for testing of hardening of concrete.

- expanded measuring range allows testing both asphalts having strength less than 1 MPa and high-strength concrete (more than 60 MPa) using the same device.
- high self-descriptiveness of the data about impact process. Presence of the set of impact parameters allows developing of concrete testing techniques based on two or more input parameters. Such techniques allow decreasing of measurement uncertainty caused by an influence of different negative factors.
- sufficiently high impact energy (1,5 J), which allows decreasing data scattering caused by material heterogeneous.

In paper also performance attributes of the device IPM-1 and results of asphalts and concrete properties tests are presented.