



## Validity Deflection In Multilayer Test With SAP 2000

[1]Sabaruddin, [2]Nurul Izzah, [3]Muh Akbar

[1] Universitas Khairun, [2] Universitas Khairun, [3] Universitas Khairun

[1] sabaruddin.abuahmad@gmail.com, [2] Second Author Email, [3] Third Author Email

**Abstract**—This testing multilayer categorized as a form of non-standard test method is not popular likely to be developed, the validity of the results of testing of multilayer indispensable. For the validity of research results are used as a test tool is SAP 2000 (focus on the calculation of deflection that occurs under a layer of concrete). Results of research specimen closed conditions, specific dimensions show the difference between the value of deflection multilayer testing with deflection value SAP 2000 amounted to 15,29 %.

**Index Terms**—Multilayer, Deflection, SAP 2000

### I. INTRODUCTION

Throughout the author's search, it was found that until now there has been no multilayer testing in the civil engineering laboratory, whereas in general, multilayer testing can be used as a form of independent testing called multilayer testing. Seeing these conditions, the researchers ventured to conduct multilayer testing research into a test method, where the process follows SNI 19-17025-2000 (revised to SNI ISO/IEC 17025:2008), this SNI refers to ISO/IEC 17025:2005. Based on SNI ISO/IEC 17025:2008, validity/validation is the confirmation of a method by testing and providing evidence that certain things in a method have been fulfilled [1]. Validity needs to be done by the laboratory to, namely non-standard methods, this method is self-developed, standard methods are used beyond their intended scope, standard method modified, standard methods to confirm and ensure that they are appropriate for use.

Referring to SNI ISO/IEC 17025:2008, it can be stated that multilayer testing is categorized as a form of non-standard testing method which is likely to be developed into standard testing through a validation process, so the validity of multilayer test results is very necessary [2]. In this paper, the validity of the research results used as a test tool is SAP 2000 (focusing on the calculation of deflections that occur under the concrete layer in a closed spectrum) [3]. The results of the research on the closed condition test specimens with specific dimensions showed a difference in the deflection value of the multilayer test with the SAP 2000 deflection value of 15,29 %.

### II. LITERATURE REVIEW

Multilayer testing on a laboratory scale test object with a static load centric monotonic, following the loading

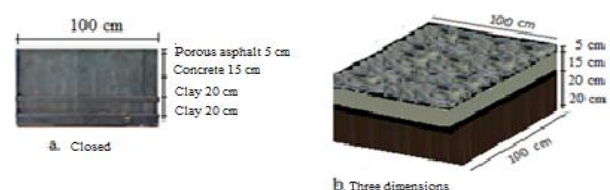
procedure according to ASTM D1194-72 [4], in this case simultaneously using a set of test tools in the form of a steel frame, steel box (enclosed on all four sides), hydraulic jack, and transducer (canister type load cell, strain gauge type PMFLS-60 asphalt, concrete strain gauge type PL-60, LVDT or linear variable differential transducer, soil pressure gauge) as well as the data logger and a computer station and its programs. Testing begins with the determination of geometric specimen, the thickness of the layers of porous asphalt according to the thickness used Pusjatan in the North Coast, the thickness of the layers of cement concrete and reaction subgrade follow the guidance on the structure and building planning of road pavement cement concrete, which published the department of settlement and regional infrastructure (Pd T-14-2003).

The SAP (Structural Analysis Program) is a program structure analysis using the Finite Element Method and able to analyze static and dynamic problems. SAP Software developed starting in 1970 by Prof. Edward L. Wilson and Ashraf Habibullah from the University of California, Berkeley California USA. This software initially can only work on mainframe computers [5]; [6].

### III. METHODOLOGY

#### A. Test objects

Dimensions and illustrations of the test specimen, material properties, as well as testing settings and installation tools, visualization of the results can be seen in Figure 1, Figure 2 and in Table 1 below:



**Fig 1.** Test object

Porous asphalt is spread and compacted on top of a concrete slab that had been water-soaking binder layer

No	Layer	Thicknes (h)  (cm)	Density (ρ)  (kg/cm)	Elasticity  Modulus (E)  MPA  (kg/cm)	Poisson  Ratio  (μ)
1	Porous asphalt	5	2109	93.53 / (953.74)	0.16
2	Concrete	15	2400	26089.72 / (266041.10)	0.40
3	Clay	40	1700	62.00 / (632.22)	0.15

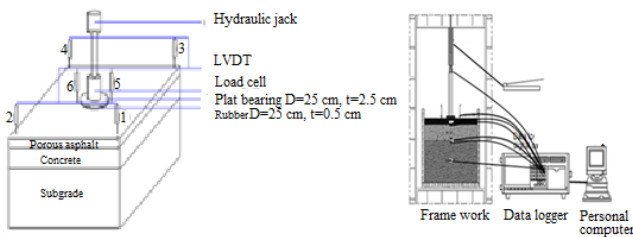


Fig 2. Testing setting, installation tools, visualization

**B. Examination**

Set up testing, installation and visualization tools on the pavement before the test is carried out pavement structure consists of three layers: (1) layer of soil as much as two layers with a thickness of 20 cm each solidified to obtain CBR as desired. (2) concrete slab without reinforcement layer, without any connection with a thickness of 15 cm. (3) asphalt porous with a thickness of 5 cm [7]; [8].

**IV. ANALISYS RESULT AND DISCUSSION**

**Load and Deflection**

The test results and multi-layer prediction at maximum load, see Table 2 and Figure 3. While output in SAP 2000 can be seen in Figure 4.

Table II. Deflection on pavement structure

Closed condition
Maximum load
126.78 Kn
Surface stress
2.58 (Mpa)

(prime coat) [9]. Once the surface of the test specimen average position then process to install the measuring instrument linear variable differential transducer as many as six (6) units in the surface layer porous asphalt. subsequently conducted a monotonic static loading in the middle of the pavement structure, the test object with a closed condition (assuming the side of the pavement wearing joints) [10]; [11]; [12]. While the basic side pavement using the spring constant. Settings loading or calibration of load cell at the time of the data logger pointed to zeros. provides loads using hydraulic jack and load cell at a steady pace (0:02 mm / sec) on the pavement surface to obtain the maximum load.

Maximum deflection (mm)		
Multilayer experimental	Multilayer prediction	Percentage difference
1	2	1 & 2
0.817	0.817	0

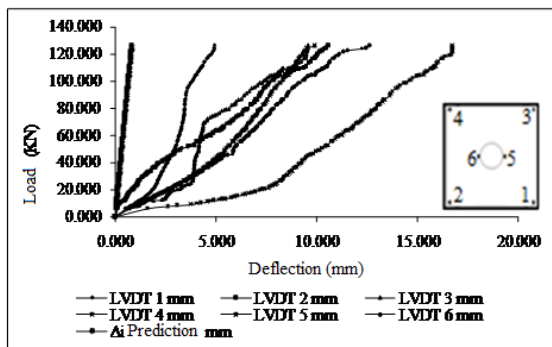


Fig 3. Relations load and deflection

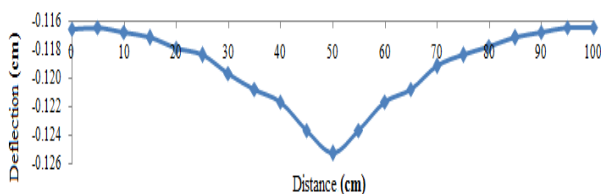


Fig 4. Deflection diagram

According to the table 2 above prediction and testing of multi-layer showing the value of a maximum deflection of 0817 mm,

The overall condition of the vertical deflection directly corresponds to Figure 3, showing the pavement structure is able to withstand a maximum load of 126.78 kN, which does not indicate a sudden deflection, which means that the structure of the pavement with the maximum load is not damaged [13]; [14]; [15]. Figure 3 showed all the quality varied positions each marked with the amount of deflection and angle of inclination (smallest deflection occurs in the angle of the largest, begitipula the contrary, this condition also characterizes the stiffness of the material condition of the pavement structure) [16]; [17]. Variations in the quality represented by the deflection and angle respectively, implicitly indicate, that the radius of stiffness relative affect the deflection, in addition to other influences such as the contact area, modulus of subgrade reaction and workload. This proves, the radius of stiffness relative is a representation of the material used, which is in direct contact with other pavement layers. Additionally fingers relative stiffness indicates the stiffness of the material. Load and Deflection

#### AUTHORS' CONTRIBUTIONS

Provides one form of testing in civil engineering laboratories, with the name multilayer testing

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### AUTHORS PROFILE



**SABARUDDIN**, Undergraduate program Moslem University of Indonesia; Postgraduate school Moslem University of Indonesia , doctoral program at UNHAS , Indonesia, publications:  
Bamboo Pile Installed into Soft Ground to Increase Required Reinforcement Force for Coastal Dike, Assessment of the Jati Besar Highway of the City of South Ternate Uses Pavement Condition Index (PCI), Application of pavement condition index (PCI) on the assessment of the Kalumata highway section of the City of South Ternate , research work : Predicted overall stability of embankment on very soft soil reinforced by bamboo piles based on full-scale test data, Study of the Effect of Using Togafo Aggregate on Marshall Parameters of Porous Asphalt Mix, membership: PII, MTI, HATI, IABI..



**NURUL IZZAH** Undergraduate program Khairun University, Indonesia, Postgraduate school Khairun University, Indonesia



**MUH. AKBAR** Undergraduate program Khairun University, Indonesia