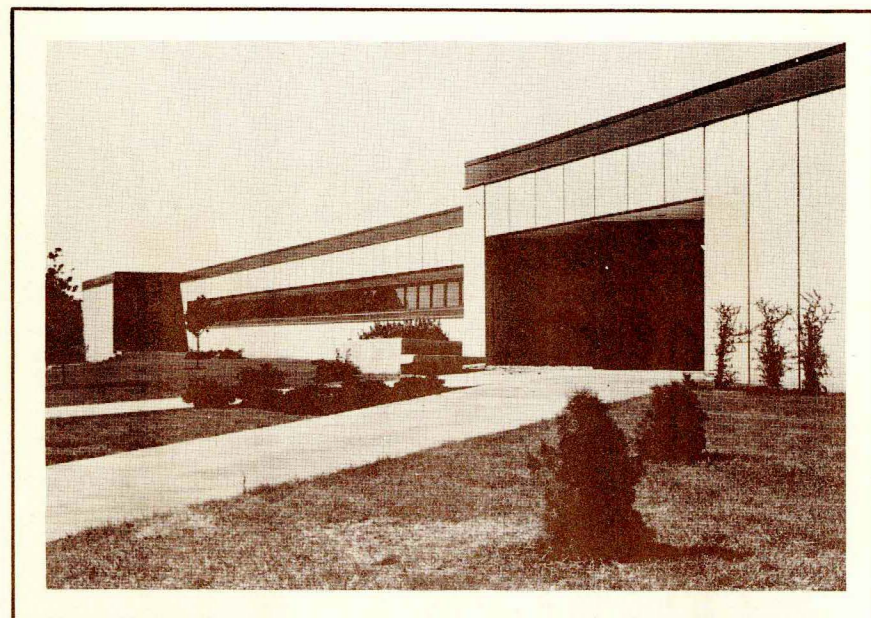
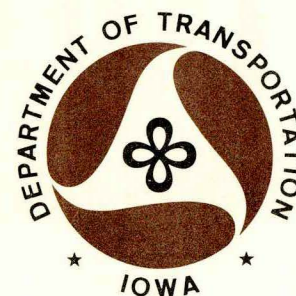


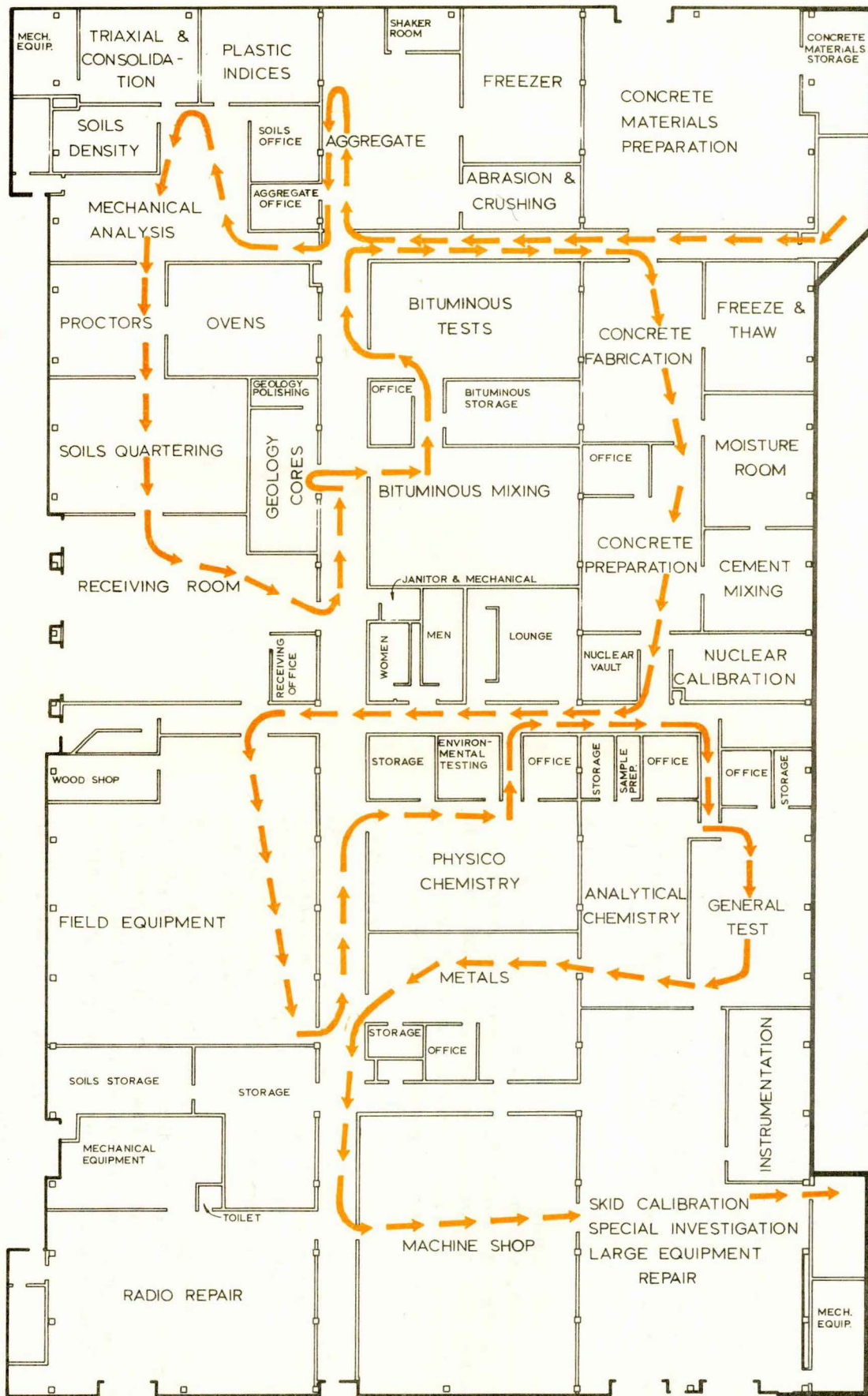
# Office Of Materials



IOWA DEPT. OF TRANSPORTATION  
LIBRARY  
800 LINCOLN  
AMES, IOWA



17-T68M  
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MATERIALS TESTING LAB  
lower floor plan

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## Introduction

The cost of a highway, its serviceability and life and the amount of maintenance required are highly dependent on the materials used in its construction. Consequently, quality control of component materials to produce adequate, economical and safe highways, is a continuous responsibility of the Office of Materials.

The responsibility is discharged through a large staff headed by an Engineering Section, a Geology Section, Administrative Office Section, and a Research Section.

### ENGINEERING

Basically the Engineering Section performs two functions. It furnishes expertise during the planning, designing, specification preparation, and construction of highway projects. It directs the statewide field inspections of projects, materials, and pavement performance to insure that uniform and effective quality control is being maintained. Three engineers head this section.

### GEOLOGY

Quality control of aggregate, the major component of pavements and structures, is the responsibility of the Geology Section. Directed by three geologists, the staff evaluates and maintains records on several thousand aggregate sources throughout Iowa and in nearby states.

To insure a constant supply of quality aggregate the geologists annually examine and analyze thousands of feet of limestone core submitted by producers, as well as physically checking quarries to maintain quality control and compile an aggregate use history to provide for the economic utilization of available materials.

### ADMINISTRATIVE OFFICE

Obtaining material source information, arranging for sampling or inspection by consultants or other public agencies of materials furnished from outside of Iowa, auditing projects for specification compliance and certification and documentation of the activities and services performed by the Office of Materials are all included in the responsibilities of the Administration Office Section.

Not only does the road user (taxpayer) benefit immeasurably from the countless tests and inspections performed by the Office of Materials, but innumerable fringe benefits to other states, public agencies, and associated industries result from the activities of the Office.

## RESEARCH

The research section formulates the research and development needs of the Highway Division as well as assisting in the conduct and evaluation of in-house research projects.

This section also develops agreements with external research organization and monitors those projects to insure that research objectives are being met. All testing and evaluation of new features on projects declared experimental is the responsibility of this section.

## Testing

"One test", the saying goes, "is worth a thousand expert opinions". Every day in dozens of ways the DOT's Office of Materials proves the validity of that statement.

While the Office of Materials is responsible for the examination, testing, and evaluation of all products used in the construction and maintenance of Iowa's highway system, its major responsibility is to be certain that the road user (taxpayer) receives full value for every dollar expended for road materials.

To fulfill such a responsibility the D.O.T. maintains a permanent staff of 120 testing engineers and technicians. Members of this highly trained staff, located throughout the state but generally near sources of highway materials, are under the supervision of the District Engineer.

Thousands of samples of sand, gravel, and stone used for backfill, surfacing and paving are tested annually along with concrete pipe, corrugated metal pipe, clay tile, and other items to determine their acceptability in highway construction and maintenance.

Any material incorporated into the final road structure is described by specifications. Testing and evaluating these materials to determine if they actually meet minimum standards established by the specifications is routine for the Office of Materials. Materials inspected range from fence staples to components used in bridges spanning the Missouri and Mississippi Rivers.

Testing too complex to be performed on site or requiring elaborate physical or chemical analysis is accomplished in the Ames Central Laboratory.

The Laboratory staff of approximately 65 engineers, chemists, technicians and associates is supplemented during the heavy construction season by 10 summer employees. Nearly 60,000 tests are performed annually in the Central Laboratory on some 150 different types of materials. These materials range from highly sophisticated bearing tests on bridge piling to quick tests of mixing water for portland cement concrete.

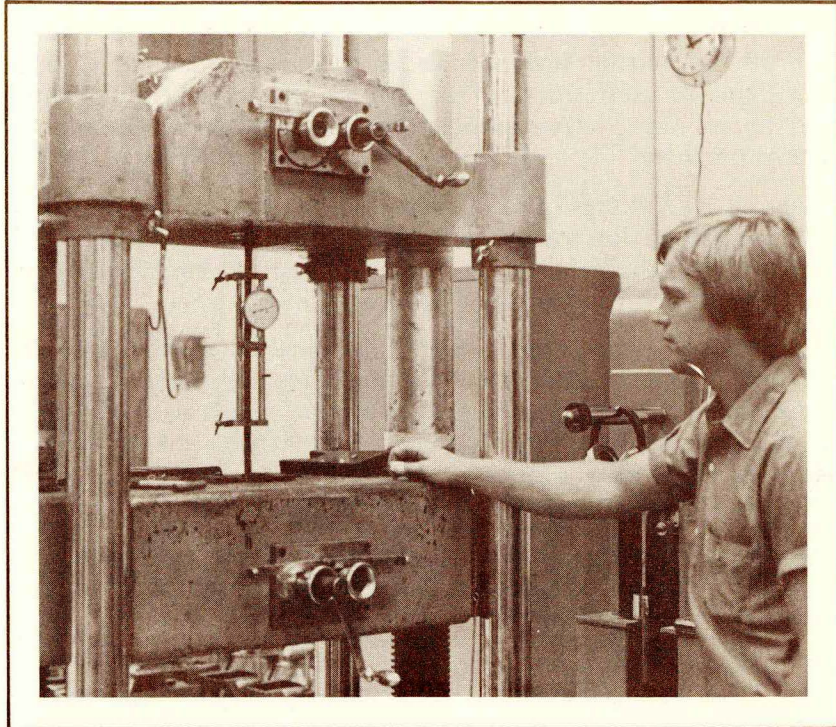
To insure the accuracy of its testing the Laboratory participates in cooperative testing programs with other states and is regularly inspected by the National Bureau of Standards.

Activities of the four main sections of the Materials Laboratory, Compliance, Structural Materials, Evaluations, and Equipment & Instrumentation are described in the following pages.

## Compliance Section

### METALS AND WELDING

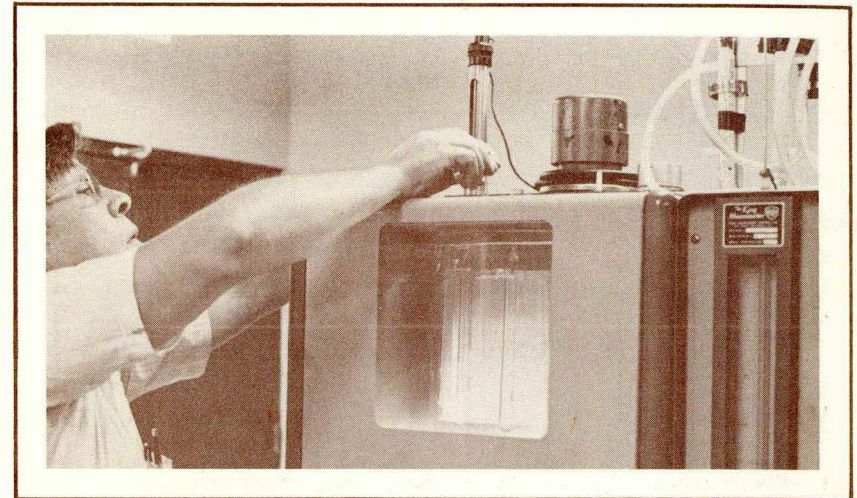
Major duties of the metals section include the testing of the many metals products such as reinforcing steel, high strength fasteners, prestress cable, wire mesh, guardrail, metal signing and lighting materials, bridge castings, etc. that are used in the construction and maintenance of highways. This section has the responsibility for the certification of all welders employed on state projects.



Determining the stress-strain characteristics of prestress cable is one of the functions of the metals section.

### PHYSICO-CHEMICAL

Technicians in the physico-chemical section perform complex testing that is both physical and chemical in character. More than 90 distinctly different tests with variations are performed in this section. General examples include viscosities, distillations, extractions and solubilities of more than 40 different materials. Classifications include bituminous products, paints, automotive products, metallic coatings, fabrics, and miscellaneous materials.

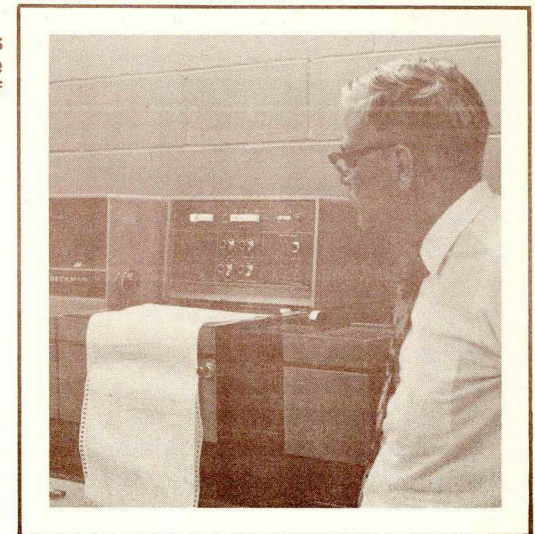


This technician is preparing to check the viscosity of asphalt cement in the physico-chemical section.

### ANALYTICAL CHEMISTRY

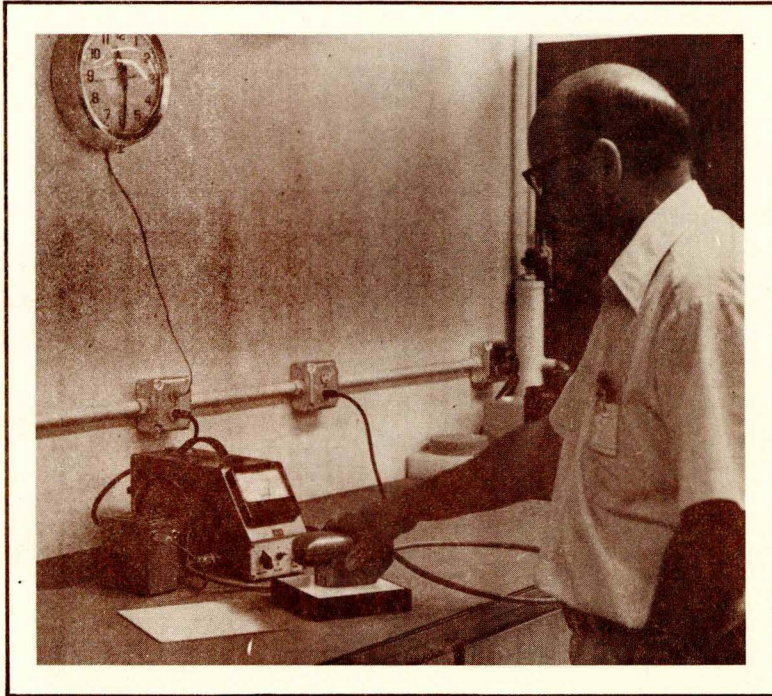
Chemical analysis is a basic testing procedure used on almost all highway construction and maintenance materials. In the section two graduate chemists analyze alloys, cements, aggregates, fertilizers, and miscellaneous products. Analyses may be quantitative or qualitative or both and are performed using standard analytical techniques and employing highly sophisticated instruments such as the spectrophotometer.

Spectrophotometer analysis is used to test the uniformity of a variety of chemicals.



## GENERAL TEST

Materials not assigned to a specific test section are usually tested in this section. Curing compounds, drain tile, plastic film, electrical components, brick, sewer pipe, delineators, reflective sheeting, rubber products, conduit, and dozens of other items serving supporting roles in highway construction are among the materials tested in this section.



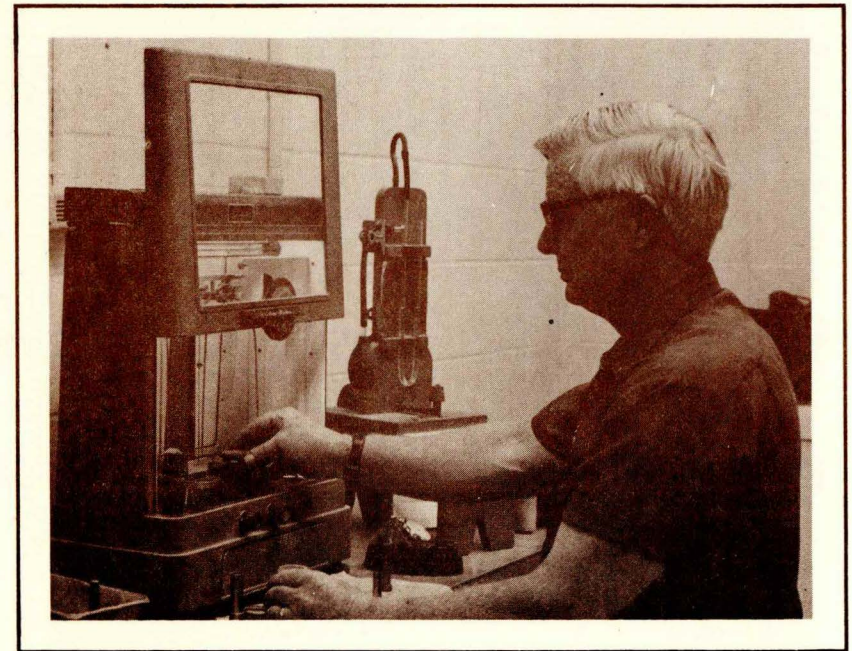
Reflective characteristics of pigmented curing compounds are determined in the general test section.

## Structural Materials Section

### CEMENT AND CONCRETE

The Cement and Concrete section is involved in the evaluation and testing of various standard and experimental concrete mixes that are normally used or proposed for use in construction and maintenance operations. The primary evaluations include concrete characteristics, such as strength, durability, workability, etc.

Physical properties of cements produced for the Department of Transportation's use by approximately 20 different cement plants are constantly monitored. Additional duties include some testing of fine aggregates, hydrated lime, concrete additives, concrete coatings, etc.



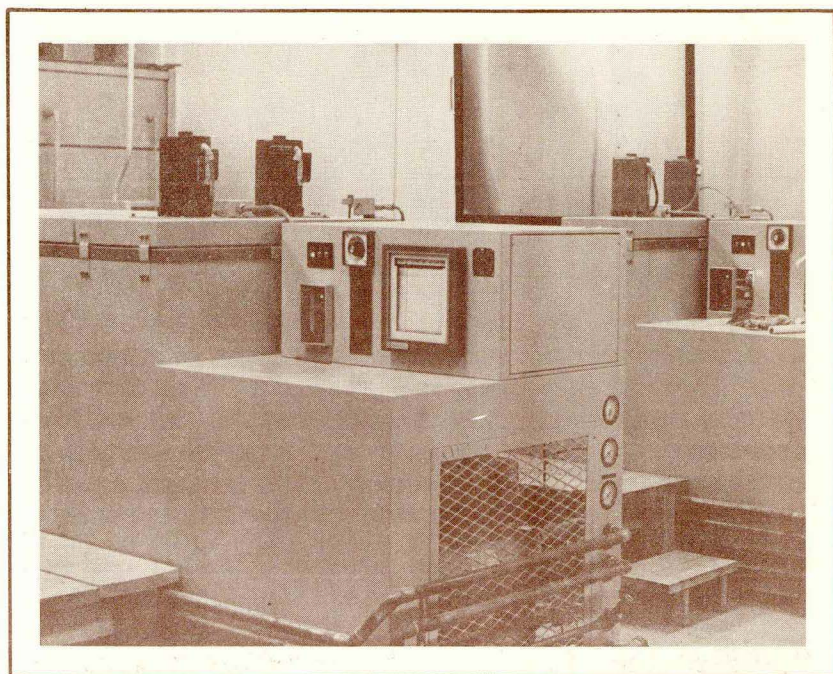
The fineness of cement is checked in the cement and concrete section.

### AGGREGATES

Determining the durability of aggregates used in highway construction and eliminating unsuitable materials through exhaustive testing is the function of the aggregate section of the Laboratory. Aggregates are used in producing portland and asphaltic concrete, for granular surfacing and for stone base in highway construction.

Accelerated freeze-thaw tests to aggregates determine the breakdown time of these materials while abrasion tests predict their wearing characteristics.

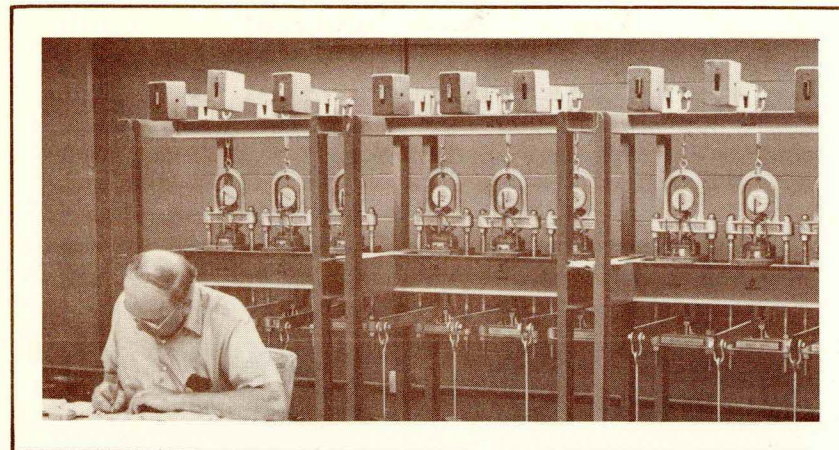
Testing to determine the amount and type of deleterious materials present not only indicates the best use for a particular aggregate but is invaluable in screening our sources of unsuitable material, a technique which can affect great savings to the taxpayer. Inferior materials identified may have use in a lesser role in highway construction.



Durability of aggregates used in construction is determined in automatic freeze-thaw chambers.

## SOILS

From 12 to 15 thousand soil samples are collected annually in the field and carefully tested and classified by the Laboratory's soils section. The samples are obtained throughout the state by soils design personnel in areas of proposed construction or reconstruction, highway relocation, bridge sites and maintenance projects. The potential or lack of potential of the samples for road construction is determined by testing for moisture, density, gradation, plasticity, settlement, sliding, and shrink and swell characteristics.

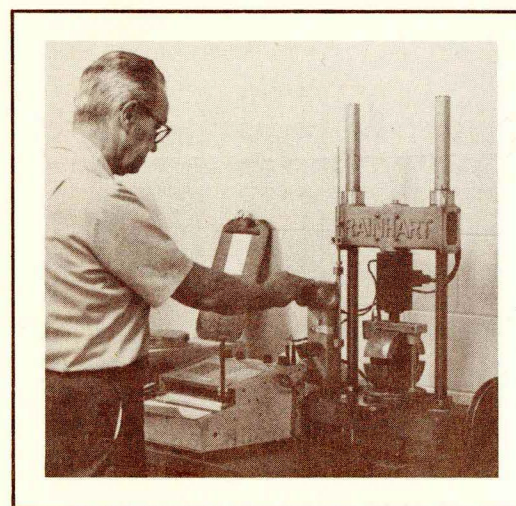


The rate and magnitude of consolidation of soil is tested by means of a consolidometer.

## BITUMINOUS DESIGN

The recipe for any particular bituminous mix calls for precise proportions of different aggregates and asphalt, heated to prescribed temperatures, mixed and tested to predetermined standards. Preparing these trial mixes is the function of the Laboratory's bituminous test section.

Besides the trial mixes, the personnel of this section also perform numerous tests on actual samples obtained from projects in the field. These tests determine if the recipe is being followed and the suitability of the mix under actual conditions.



Determining the stability of compacted bituminous mixtures is a necessity in designing high quality bituminous pavements.

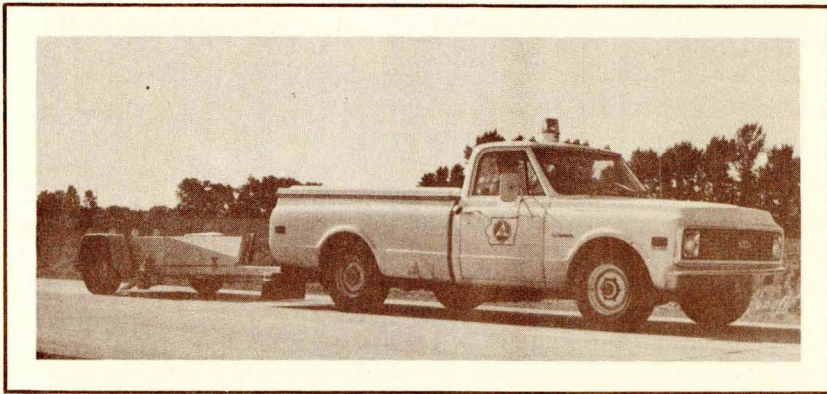
## Evaluations Section

### PAVEMENT EVALUATIONS

As its name implies this section has the responsibility of monitoring and evaluating pavement performance in many ways.

Typical of the duties associated with pavement evaluations is skid resistance measurements. Over 21,000 miles of interstate, primary, and secondary roads are constantly monitored as part of the Department of Transportation's accident reduction program.

Other duties include roughness and deflection characteristics as well as objectively determining the damage, if any, done to county roads and city streets by primary road detour traffic.



Skid Testing Unit

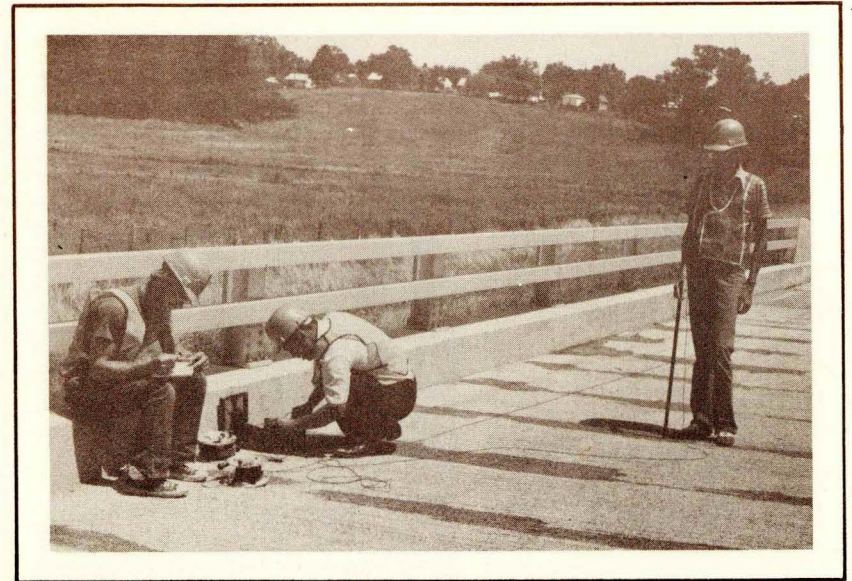


Pavement deflections are measured with a "road rater."

### FIELD MATERIALS EVALUATION

Field crews are dispatched to various areas of the state to evaluate concrete culvert pipe at producing plants for conformance to appropriate specifications.

This section also performs load tests on bridge piling for determining structural adequacy on a routine basis. Other duties include evaluation and tests of bridge decks, special materials application such as anchorage systems, corrosion tests, etc.



This crew is determining if active corrosion of reinforcing steel in the bridge deck is taking place.

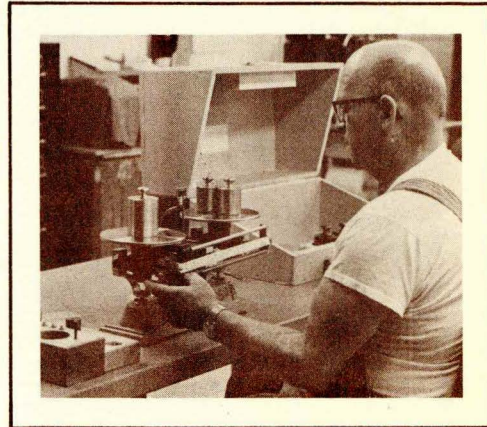


## Equipment & Instrumentation Section

Some testing equipment, because of its highly specialized use, is unavailable from commercial sources. This section is responsible for the design, development, and construction of many precision units as well as modifying existing equipment to cope with particular testing problems.

All the activities associated with maintaining an adequate quantity of suitable and reliable test equipment and supplies required by the construction and materials inspectors is the function of this section. The equipment is issued to district materials offices and laboratories, resident construction offices and to county engineers throughout the state. In addition to maintenance, the section inventories its equipment and keeps a record of usage.

**Insuring the reliability of field balances is a function of the equipment and instrumentation section.**



### Goals

The Office of Materials of your Department of Transportation is striving continually to attain the following major goals:

1. Testing and evaluation of new products to improve service life and reduce construction costs.
2. Make good use of locally available marginal materials.
3. Provide test data to aid in the construction and maintenance of safer transportation facilities.
4. Continual review of its testing program to guarantee compliance with the contract document, thus providing the taxpayer proof of dollar value received for each dollar spent on construction and maintenance.



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Prepared By:  
Office Of Materials/Highway Division  
Iowa Department Of Transportation  
826 Lincoln Way/Ames, Iowa 50010  
(515) 296-1433