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Standard Nomenclature and Definitions for Pavement Components and Deficiencies

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FOREWORD

If individuals involved in pavement management processes are to communicate fully, they must use terms that have the same meaning. The purpose of this report is to foster the establishment of standard nomenclature and definitions for describing pavement conditions. These are intended for use by engineers, educators, administrators, inspectors, and others concerned with pavement distress and decision-making related to traffic safety and pavement rehabilitation.

The first chapter of the report lists and defines general terms related to pavement features, defects, components, and characteristics. The recommended term is shown as nomenclature, and other commonly used terms are shown as synonyms. The same format is used in Chapters 2 and 3 to categorize the most common defects of flexible and rigid pavements respectively, except that deficiencies are illustrated with photographs and drawings. The illustrations are included to enable an inspector to readily identify the deficiency and to convey his findings to those responsible for making basic pavement decisions by simply entering the nomenclature on the inspection report.

Sources used by the subcommittee, appointed to prepare this report, include established definitions of the American Association of State Highway Officials and recommendations by engineers and technical personnel in a number of state highway departments, the Asphalt Institute, the Portland Cement Association, and the military offices of the Department of Defense.

Recommendations and suggestions for expanding or improving the material in this report are invited. They should be addressed to the Highway Research Board for referral to the Committee on Pavement Condition Evaluation. Cooperation of all concerned with pavement management is necessary in standardizing the terminology that will ensure complete and effective understanding.

The committee gratefully acknowledges the valuable contribution of time and effort of the Subcommittee on Standard Nomenclature and Definitions. Members of this subcommittee included A. B. Moe, chairman, A. W. Maner, and F. P. Nichols, Jr.
CONTENTS

1 GENERAL TERMS AND DEFINITIONS 1

Pavement features 2
Profile 2
Texture 2
Pavement defects 2
Aggregate, polished 2
Distortion 2
Distress 2
Failure 2
Roughness 2
Stripping 3
Pavement structure and roadbed components 3
Base course 3
Embankment 3
Roadbed 3

2 FLEXIBLE PAVEMENT DEFICIENCIES 6

Abrasion 7
Blast erosion 7
Bleeding 8
Bump 8
Char 9
Corrugation 9
Cracking, alligator 10
Cracking, block 10
Cracking, contraction 11
Cracking, edge 11
Cracking, longitudinal 12
Cracking, reflection 12

3 RIGID PAVEMENT DEFICIENCIES 19

Blow-up, buckling 20
Blow-up, shattering 20
Cracking, corner 21
Cracking, D 21
Cracking, diagonal 22
Cracking, random 23
Cracking, second stage 23
Cracking, third stage 24
Cracking, transverse 24
Crazing 25

Roadbed materials 3
Pavement, flexible 3
Pavement, rigid 3
Pavement structure 4
Select material 4
Stabilization 4
Subbase 4
Subgrade 4
Performance characteristics 4
Performance 4
Performance index 4
Present serviceability index 4
Service life 5
Serviceability 5

Cracking, slippage 13
Cracking, transverse 13
Depression 14
Imprint 14
Indentation 15
Pothole 15
Raveling 16
Rutting 16
Shoving 17
Streaking 17
Waves 18
Weathering 18

Curling 25
Faulting 26
Joint blast damage 26
Joint failure 27
Joint filler extrusion 27
Joint stripping 28
Pumping 28
Scaling 29
Spalling 29
GENERAL TERMS AND DEFINITIONS

The following terms and definitions are recommended for use in describing features, defects, components, and characteristics of pavement systems. The recommended standard term is shown under nomenclature, and other frequently used terms are shown under synonyms. An asterisk denotes a definition of the American Association of State Highway Officials. Figure 1 shows a cross section of a typical roadway on which this nomenclature appears.

Figure 1  Typical roadway cross section.
**PAVEMENT FEATURES**

**nomenclature** profile
**synonym** none
**definition** The line of intersection of a vertical plane and the surface of the pavement; the outline or silhouette of the pavement surface.

**nomenclature** texture
**synonym** none
**definition** The appearance or character of the surface of a pavement that depends on the size, shape, arrangement, and distribution of the aggregates and cement or binder. A dense, smooth surface would have a fine texture; an open surface would have a coarse texture. The term rough or roughness should not be used for coarse texture (see roughness). Irregularities in the surface such as potholes, grooves, or rim cuts are not textures. Coarseness of concrete surface caused by screeding, brooming, or dragging is texture.

**PAVEMENT DEFECTS**

**nomenclature** aggregate, polished
**synonym** none
**definition** Aggregate that has a low coefficient of friction as a result of traffic action or natural causes.

**nomenclature** distortion
**synonym** none
**definition** Any deviation in the pavement surface from its original shape.

**nomenclature** distress
**synonym** none
**definition** Any indication of poor or unfavorable pavement performance or signs of impending failure; any unsatisfactory performance of a pavement short of failure.

**nomenclature** failure
**synonym** none
**definition** Unsatisfactory performance of a pavement or portion thereof such that it can no longer serve its intended purpose.

**nomenclature** roughness
**synonym** none
**definition** Irregularities in the pavement surface that adversely affect riding quality of the vehicle. See texture.
nomenclature: stripping
synonym: none
definition: Separation of bituminous films from aggregate particles in the presence of moisture.

PAVEMENT STRUCTURE AND ROADBED COMPONENTS

nomenclature: base course
synonym: base
definition: *The layer or layers of specified or selected material of designed thickness placed on a subbase or a subgrade to support a surface course.

nomenclature: embankment
synonym: fill
definition: *A structure of soil, soil-aggregate, or broken rock between the embankment foundation and the subgrade.

nomenclature: roadbed
synonym: foundation
definition: *The graded portion of a highway within top and side slopes, prepared as a foundation for the pavement structure and shoulder.

nomenclature: roadbed material
synonym: basement soil
definition: *The material below the subgrade in cuts and embankments and in embankment foundations extending to such depth as affects the support of the pavement structure.

nomenclature: pavement, flexible
synonym: none
definition: *A pavement structure that maintains intimate contact with and distributes loads to the subgrade and depends on aggregate interlock, particle friction, and cohesion for stability.

nomenclature: pavement, rigid
synonym: none
definition: *A pavement structure that distributes loads to the subgrade having as one course a portland cement concrete slab of relatively high bending resistance.
nomenclature pavement structure
synonym pavement
definition *The combination of subbase, base course, and surface course placed on a subgrade to support the traffic load and distribute it to the roadbed.

nomenclature selected material
synonym select material
definition *Suitable native material obtained from roadway cuts or borrow areas or other similar material used for subbase, roadbed material, shoulder surfacing, slope cover, or other specific purposes.

nomenclature stabilization
synonym none
definition *Modification of soils or aggregates by incorporating materials that will increase load bearing capacity, firmness, and resistance to weathering or displacement.

nomenclature subbase
synonym none
definition *The layer or layers of specified or selected material of designed thickness placed on a subgrade to support a base course.

nomenclature subgrade
synonym none
definition *The top surface of a roadbed on which the pavement structure and shoulders including curbs are constructed.

PERFORMANCE CHARACTERISTICS

nomenclature performance
synonym none
definition measure of the accumulated service provided by a pavement, i.e., the adequacy with which a pavement fulfills its purpose.

nomenclature performance index
synonym none
definition Summary of present serviceability indexes over a time period. Abbreviation PI.

nomenclature present serviceability index
synonym none
definition Numerical index of the ability of a pavement in its present condition to serve traffic. Abbreviation PSI.
<table>
<thead>
<tr>
<th>nomenclature</th>
<th>service life</th>
</tr>
</thead>
<tbody>
<tr>
<td>synonym</td>
<td>none</td>
</tr>
<tr>
<td>definition</td>
<td>A period of time over which a pavement performs its design purpose.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>nomenclature</th>
<th>serviceability</th>
</tr>
</thead>
<tbody>
<tr>
<td>synonym</td>
<td>none</td>
</tr>
<tr>
<td>definition</td>
<td>Ability of a pavement to serve traffic with safety and comfort and with a minimum of detrimental effects to either vehicle or pavement.</td>
</tr>
</tbody>
</table>
chapter two

FLEXIBLE PAVEMENT DEFICIENCIES

In order to facilitate recognition of flexible pavement deficiencies, the most common signs of distress are illustrated and described in this chapter. When a condition is recognized from an illustration, the descriptive term shown under nomenclature will identify the deficiency. Figure 2 shows a cross section of a typical flexible pavement.

Figure 2. Typical flexible pavement cross section
<table>
<thead>
<tr>
<th>nomenclature</th>
<th>abrasion</th>
</tr>
</thead>
<tbody>
<tr>
<td>synonym</td>
<td>none</td>
</tr>
<tr>
<td>description</td>
<td>Scuffing of the wearing course.</td>
</tr>
<tr>
<td>probable cause</td>
<td>Equipment blades, dragging chains, tire chains, or bulldozer cleats. Damage from tractor lugs or wheel rim cuts are indentations (Fig. 19).</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>nomenclature</th>
<th>blast erosion</th>
</tr>
</thead>
<tbody>
<tr>
<td>synonym</td>
<td>none</td>
</tr>
<tr>
<td>description</td>
<td>Deep erosion or scouring of a pavement in which a portion of structure is lost.</td>
</tr>
<tr>
<td>probable cause</td>
<td>Continued jet blast impinging on the pavement; the effect of the combination of heat and blast of sufficient duration to char and blow away the pavement material.</td>
</tr>
</tbody>
</table>
Figure 5

nomenclature bleeding
synonym flushing
description Free bitumen on the surface of the pavement.
probable cause Excess bitumen; rich application of bitumen with insufficient blotter; in joints, excessive amounts of asphalt cement or tar.

Figure 6

nomenclature bump
synonym none
description Localized upward displacement of the pavement.
probable cause Frost heave or upward thrust of ice forming under the pavement; bulging of a soft pavement from shoving; swelling of high clay content base, subbase, or roadbed materials caused by the absorption of moisture.
<table>
<thead>
<tr>
<th>nomenclature</th>
<th>char</th>
</tr>
</thead>
<tbody>
<tr>
<td>synonym</td>
<td>burn</td>
</tr>
<tr>
<td>description</td>
<td>Charred surface in which bitumen has been lost or carbonized.</td>
</tr>
<tr>
<td>probable cause</td>
<td>Hot jet blast that strikes the pavement close to the jet tail pipe for short periods.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>nomenclature</th>
<th>corrugation</th>
</tr>
</thead>
<tbody>
<tr>
<td>synonym</td>
<td>wash board</td>
</tr>
<tr>
<td>description</td>
<td>Transverse undulations at regular intervals in the surface of the pavement consisting of alternate valleys and crests less than 2 feet apart.</td>
</tr>
<tr>
<td>probable cause</td>
<td>Traffic action on an unstable pavement or on a pavement over an unstable roadbed; surface course too soft to resist shoving.</td>
</tr>
</tbody>
</table>
Figure 9

nomenclature: cracking, alligator
synonym: alligatoring; map cracking
description: Interconnected or interlaced cracks forming a series of small polygons that resemble an alligator's hide.
probable cause: Generally, unstable base or roadbed; weakening of pavement caused by enbrittlement over a resilient foundation.

Figure 10

nomenclature: cracking, block
synonym: map cracking
description: Interconnected cracks forming a series of large polygons usually with sharp corners or angles.
probable cause: Hardening and shrinkage of the asphalt; roadbed becoming unstable. Unless corrected, block cracking may increase until it becomes alligatored as a result of water entering the roadbed and decreasing its stability.
| nomenclature | cracking, contraction |
| synonyym     | shrinkage cracking    |
| description  | Horizontal separation of a pavement overlay. |
| probable cause | Shrinkage of the surface course with a possible loss of bond with the underlying layer; loss of flexibility of the surface course. |

| nomenclature | cracking, edge |
| synonyym     | none          |
| description  | Longitudinal cracking near the edge of the pavement. |
| probable cause | Inadequate thickness of the pavement to support traffic; vertical settlement or lateral displacement of embankment or both if there are no traffic loads. |
Figure 13

nomenclature: cracking, longitudinal
synonym: none
description: A crack or break approximately parallel to the pavement centerline.
probable cause: Cold or improperly constructed joint between pavement sections; reflection of underlying joint; settlement of roadbed under traffic; possibly shrinkage of surface course or insufficient pavement thickness.

Figure 14

nomenclature: cracking, reflection
synonym: none
description: Cracking of a resurface or overlay above underlying cracks or joints.
probable cause: Movement of underlying pavement, or lack of bridging over underlying cracks or joints; possibly shrinkage of underlying layer.
**Figure 15**

<table>
<thead>
<tr>
<th>nomenclature</th>
<th>cracking, slippage</th>
</tr>
</thead>
<tbody>
<tr>
<td>synonym</td>
<td>crescent crack</td>
</tr>
<tr>
<td>description</td>
<td>Half-moon or crescent-shaped cracks in the direction of traffic.</td>
</tr>
<tr>
<td>probable cause</td>
<td>Soft asphalt surface course shoved and torn by braking wheels or from starting wheel thrusts; unstable sand mix surface course.</td>
</tr>
</tbody>
</table>

**Figure 16**

<table>
<thead>
<tr>
<th>nomenclature</th>
<th>cracking, transverse</th>
</tr>
</thead>
<tbody>
<tr>
<td>synonym</td>
<td>none</td>
</tr>
<tr>
<td>description</td>
<td>A crack approximately at right angles to the pavement centerline.</td>
</tr>
<tr>
<td>probable cause</td>
<td>Shrinking of the surface courses or pavement structure and possibly traffic action; reflection of cracks under the surface course or insufficient pavement thickness.</td>
</tr>
</tbody>
</table>
Figure 17

<table>
<thead>
<tr>
<th>nomenclature</th>
<th>depression</th>
</tr>
</thead>
<tbody>
<tr>
<td>synonym</td>
<td>bird bath</td>
</tr>
<tr>
<td>description</td>
<td>Localized pavement areas at an elevation lower than that of the adjacent paved areas or of the design elevation.</td>
</tr>
<tr>
<td>probable cause</td>
<td>Subsidence of the roadbed or compression of the roadbed materials; settlement of improperly compacted fill in trenches or patched roadbeds.</td>
</tr>
</tbody>
</table>

Figure 18

<table>
<thead>
<tr>
<th>nomenclature</th>
<th>imprint</th>
</tr>
</thead>
<tbody>
<tr>
<td>synonym</td>
<td>none</td>
</tr>
<tr>
<td>description</td>
<td>Localized impression in the pavement surface.</td>
</tr>
<tr>
<td>probable cause</td>
<td>A tire or other objects standing on a soft pavement surface.</td>
</tr>
</tbody>
</table>
**Figure 19**

| nomenclature | indentation
| synonym       | scarring
| description   | Shearing of or indenting the surface.
| probable cause| Wheel rims of blown tires, tractor cleats, sharp rimmed metal wheels, or sharp objects dragged over the surface.

**Figure 20**

| nomenclature | pothole
| synonym       | chuckhole
| description   | Bowl-shape holes of various sizes in the pavement.
| probable cause| Small, localized disintegration or failure of the pavement from traffic over weakened spots on the surface.
Figure 21

nomenclature: raveling
synonym: surface disintegration
description: The progressive disintegration from the surface downward by the dislodgement of aggregate particles.
probable cause: Uneven distribution of bitumen from the spray bar; insufficient bitumen or binding agent in the surface; traffic action on a weak surface.

Figure 22

nomenclature: rutting
synonym: grooving; channeling
description: Longitudinal depressions that form under traffic in the wheel paths and have a minimum length of approximately 20 ft.
probable cause: Localized and channeled wheel traffic over unstable pavement or foundation; traffic heavier than the design strength of the pavement structure.
Figure 23

nomenclature: shoving
synonym: none
description: Displacement or bulging of paving material in the direction of loading or pressure.
probable cause: Surface course that is too soft to resist the horizontal pressure and that has a poor bond with the underlying pavement.

Figure 24

nomenclature: streaking
synonym: none
description: Alternate lean and heavy lines of bitumen running parallel to the pavement centerline.
probable cause: Clogged nozzles or improperly adjusted nozzles of the spray bar of the bitumen distributor during sealcoating.
Figure 25

<table>
<thead>
<tr>
<th>nomenclature</th>
<th>waves</th>
</tr>
</thead>
<tbody>
<tr>
<td>synonym</td>
<td>none</td>
</tr>
<tr>
<td>description</td>
<td>Longitudinal or transverse undulations in the surface of the pavement, consisting of alternate valleys and crests approximately 2 ft or more apart.</td>
</tr>
<tr>
<td>probable cause</td>
<td>Contour of the roadbed or subsidence of the roadbed or base. A runway with waves is detrimental to aircraft operations.</td>
</tr>
</tbody>
</table>

Figure 26

<table>
<thead>
<tr>
<th>nomenclature</th>
<th>weathering</th>
</tr>
</thead>
<tbody>
<tr>
<td>synonym</td>
<td>none</td>
</tr>
<tr>
<td>description</td>
<td>Gradual disintegration of the pavement wearing surface, increasing the texture and exposing more and more of the aggregates.</td>
</tr>
<tr>
<td>probable cause</td>
<td>Drying out or loss of bitumen caused by climatic conditions.</td>
</tr>
</tbody>
</table>
RIGID PAVEMENT DEFICIENCIES

In order to facilitate recognition of rigid pavement deficiencies, the most common signs of distress are illustrated and described in this chapter. When a condition is recognized from an illustration, the descriptive term shown under nomenclature will identify the deficiency. Figure 27 shows a cross section of a typical rigid pavement.
Figure 28

<table>
<thead>
<tr>
<th>nomenclature</th>
<th>blow-up, buckling</th>
</tr>
</thead>
<tbody>
<tr>
<td>synonym</td>
<td>tenting</td>
</tr>
<tr>
<td>description</td>
<td>Localized upward buckling of the slab occurring usually at a transverse crack or joint.</td>
</tr>
<tr>
<td>probable cause</td>
<td>Excessive expansion of the slab with insufficient joint width; joints fouled with incompressible material preventing the joint from serving its purpose.</td>
</tr>
</tbody>
</table>

Figure 29

<table>
<thead>
<tr>
<th>nomenclature</th>
<th>blow-up, shattering</th>
</tr>
</thead>
<tbody>
<tr>
<td>synonym</td>
<td>none</td>
</tr>
<tr>
<td>description</td>
<td>Localized shattering of the slab occurring usually at a transverse crack or joint.</td>
</tr>
<tr>
<td>probable cause</td>
<td>Excessive expansion of the slab with insufficient joint width; joints fouled with incompressible material preventing the joint from serving its purpose.</td>
</tr>
</tbody>
</table>
cracking, corner

corner break

A break in a pavement at the corner of the slab near the juncture of the transverse joint and longitudinal joint or slab edge.

Overloading the pavement slabs at or near the corners; an unstable foundation or voids formed because of loss of foundation material under the slab.

cracking, D

none

A series of fine, hairline crescent-shaped cracks in the concrete surface usually paralleling a joint or major crack and usually curving across slab corners.

Causes are still under study but generally attributed to freeze-thaw cycles and peculiar aggregate pore structure.
nomenclature: cracking, diagonal

synonym: none

description: A crack similar to a corner crack except that the fracture extends diagonally across the end of the slab.

probable cause: Overloading at the slab ends; insufficient thickness of pavement of lack of support from the roadbed.

nomenclature: cracking, longitudinal

synonym: none

description: A crack or break approximately parallel to the pavement centerline.

probable cause: Lateral contraction; lateral movement and settlement of the roadbed; possibly lateral bending or curling.
**Figure 34**

nomenclature cracking, random

synonym none

description Unrestrained, or uncontrolled, irregular break or separation of the slab.

probable cause Overloading of unreinforced concrete slab; inadequate roadbed support.

---

**Figure 35**

nomenclature cracking, second stage

synonym none

description Transverse crack developing a short distance from the transverse joint, generally at the end of the joint dowels.

probable cause Impact on the edge of a slab past the joint at or near the ends of the dowels on poorly supported slabs; loss of base or roadbed support at the slab ends from pumping or other causes; frozen load transfer dowels.
<table>
<thead>
<tr>
<th>nomenclature</th>
<th>cracking, third stage</th>
</tr>
</thead>
<tbody>
<tr>
<td>synonym</td>
<td>none</td>
</tr>
<tr>
<td>description</td>
<td>Longitudinal crack developing between the second stage crack and the transverse joint and also between other cracks and joints.</td>
</tr>
<tr>
<td>probable cause</td>
<td>Continued application or repetition of heavy loads on a poorly supported slab.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>nomenclature</th>
<th>cracking, transverse</th>
</tr>
</thead>
<tbody>
<tr>
<td>synonym</td>
<td>none</td>
</tr>
<tr>
<td>description</td>
<td>A crack or break approximately at right angles to the pavement centerline.</td>
</tr>
<tr>
<td>probable cause</td>
<td>Insufficient contraction joints or weakened plane joints; overloading an upward curled slab having inadequate roadbed support.</td>
</tr>
</tbody>
</table>
nomenclature: crazing  
synonym: none  
description: Fine, hairline cracks apparently extending only through the surface layer and tending to intersect at an angle of approximately 120 deg forming a chicken-wire pattern.  
probable cause: Weak surface of the slab caused by excessive finishing; possibly rich mortar in surfacing.

---

nomenclature: curling  
synonym: bending; warping  
description: Slab bending.  
probable cause: Uneven expansion or contraction of the top and bottom slab surfaces caused by differences in temperature above and below the slab or differences in moisture conditions between these surfaces.
nomenclature faulting
synonym step-off; step
description Differential vertical displacement of abutting slabs at joints or cracks creating a "step" deformation in the pavement surface.
probable cause One slab settling more than the adjacent slab; uneven roadbed support under the slabs; heaving of one of the slabs. Faulting often occurs at the junction of a rigid and a flexible pavement.

nomenclature joint blast damage
synonym none
description Joint material softened and blown out of the joint.
probable cause Heat and blast from jet aircraft moving slowly or standing near a joint.
<table>
<thead>
<tr>
<th>Figure 42</th>
</tr>
</thead>
<tbody>
<tr>
<td>nomenclature</td>
</tr>
<tr>
<td>synonym</td>
</tr>
<tr>
<td>description</td>
</tr>
<tr>
<td>probable cause</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Figure 43</th>
</tr>
</thead>
<tbody>
<tr>
<td>nomenclature</td>
</tr>
<tr>
<td>synonym</td>
</tr>
<tr>
<td>description</td>
</tr>
<tr>
<td>probable cause</td>
</tr>
</tbody>
</table>
joint stripping

Joint filler coming out of the joint.

Lack of adhesion to the joint edges; incompatible joint material; contaminated joint edges from previously used joint filler.

pumping

The ejection of mixtures of water, clay, or silt along or through transverse or longitudinal joints, cracks, or pavement edges.

Insufficient support from water-saturated bases or roadbeds. When a load is imposed on the slab, it is depressed onto the saturated material underneath, squeezing the water and fines out through the joints and cracks or from under the slab.
nomenclature: scaling 

synonym: none 

description: Progressive disintegration and loss of the concrete wearing surface. Eroding of the surface by reaction from de-icing materials; repetitive freezing and thawing cycles or weakened surface caused by overfinishing.

nomenclature: spalling 

synonym: none 

description: Breakdown or disintegration of slab edges at joints or cracks or directly over reinforcing steel, usually resulting in the removal of sound concrete. 

probable cause: Breakdown of pavement joint edges from traffic action and progressive destruction of the surface adjacent to this damage; possibly weakening of this surface caused by overfinishing of the slab at the joint.
THE NATIONAL ACADEMY OF SCIENCES is a private, honorary organization of more than 700 scientists and engineers elected on the basis of outstanding contributions to knowledge. Established by a Congressional Act of Incorporation signed by Abraham Lincoln on March 3, 1863, and supported by private and public funds, the Academy works to further science and its use for the general welfare by bringing together the most qualified individuals to deal with scientific and technological problems of broad significance.

Under the terms of its Congressional charter, the Academy is also called upon to act as an official—yet independent—adviser to the Federal Government in any matter of science and technology. This provision accounts for the close ties that have always existed between the Academy and the Government, although the Academy is not a governmental agency and its activities are not limited to those on behalf of the Government.

The NATIONAL ACADEMY OF ENGINEERING was established on December 5, 1964. On that date the Council of the National Academy of Sciences, under the authority of its Act of Incorporation, adopted Articles of Organization bringing the National Academy of Engineering into being, independent and autonomous in its organization and the election of its members, and closely coordinated with the National Academy of Sciences in its advisory activities. The two Academies join in the furtherance of science and engineering and share the responsibility of advising the Federal Government, upon request, on any subject of science or technology.

The NATIONAL RESEARCH COUNCIL was organized as an agency of the National Academy of Sciences in 1916, at the request of President Wilson, to enable the broad community of U.S. scientists and engineers to associate their efforts with the limited membership of the Academy in service to science and the nation. Its members, who receive their appointments from the President of the National Academy of Sciences, are drawn from academic, industrial, and government organizations throughout the country. The National Research Council serves both Academies in the discharge of their responsibilities.

Supported by private and public contributions, grants, and contracts, and voluntary contributions of time and effort by several thousand of the nation's leading scientists and engineers, the Academies and their Research Council thus work to serve the national interest, to foster the sound development of science and engineering, and to promote their effective application for the benefit of society.

The DIVISION OF ENGINEERING is one of the eight major Divisions into which the National Research Council is organized for the conduct of its work. Its membership includes representatives of the nation's leading technical societies as well as a number of members-at-large. Its Chairman is appointed by the Council of the Academy of Sciences upon nomination by the Council of the Academy of Engineering.

The HIGHWAY RESEARCH BOARD, an agency of the Division of Engineering, was established November 11, 1920, as a cooperative organization of the highway technologists of America operating under the auspices of the National Research Council and with the support of the several highway departments, the Bureau of Public Roads, and many other organizations interested in the development of transportation. The purpose of the Board is to advance knowledge concerning the nature and performance of transportation systems, through the stimulation of research and dissemination of information derived therefrom.