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**JOURNAL OF THE
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**THE COMMONWEALTH OF MASSACHUSETTS
BOARD OF REGISTRATION OF PROFESSIONAL
ENGINEERS AND OF LAND SURVEYORS
PROPOSED RULES AND REGULATIONS
FOR ADJUDICATORY PROCEEDINGS**

Article I, of the Constitution of the Boston Society of Civil Engineers entitled OBJECTS states: "The objects of this Society are: the professional improvement of its members, the encouragement of social intercourse among engineers and men of practical science, and the advancement of engineering. For the promotion of these objects, stated meetings of the Society shall be held and a library maintained for the use of its members."

The Boston Society of Civil Engineers has faithfully fulfilled its objectives. The Society has consistently published proposed building codes, zoning codes, boring data, soil mechanics, and lecture series notes. The Society has further enhanced the publication of these various items, by conducting regular Society meetings where free discussion of these proposals have been had.

The Massachusetts Board of Registration of Professional Engineers and of Land Surveyors is required by law to have proper rules and regulations, approved, and on file with the Secretary of State. Finally, after many unsuccessful attempts, the first "set" of proposed rules and regulations have been prepared and are now ready for adoption procedures. These Rules and Regulations are entitled "Proposed Rules and Regulations for Adjudicatory Proceedings."

The Boston Society of Civil Engineers, in line with its long established policy of publishing pertinent engineering information for the benefit of the engineering profession as a whole, has decided to publish in its Journal the "Proposed Rules and Regulations for Adjudicatory Proceedings."

One of the legal requirements, for the adoption of proposed rules and regulations, is the proper legal notice for said rules and regulations. Therefore, the following five paragraphs are to be published in the December 4th edition of the Journal of the Engineering Societies of New England:

"The Massachusetts Board of Registration of Professional Engineers and of Land Surveyors is considering the promulgation of Rules and Regulations for Adjudicatory Proceedings be-

fore the Board and the Board has drafted Proposed Rules and Regulations in furtherance of this purpose. The Proposed Rules and Regulations would replace Rules and Regulations Governing Formal Hearings which were adopted on August 2, 1963 and are in effect at present.

These Rules and Regulations have been drafted pursuant to the authority conferred by General Laws, Chapter 30A and Chapter 112, Section 81E which authorizes the Board to "make such rules and regulations as are necessary or proper for the conduct of its duties."

Copies of the Proposed Rules and Regulations are available for public inspection at the Board's office, Room 1512, State Office Building, 100 Cambridge Street, Boston, Massachusetts, between the hours of 8:45 a.m. and 5:00 p.m. Requests for copies of the Proposed Rules and Regulations should be sent to the Board at 100 Cambridge Street, Boston, Massachusetts 02202.

Interested parties may submit such written views, arguments, or data with respect to the Rules and Regulations as they desire by addressing same to the Chairman of the Board. All communications with respect to the Proposed Rules and Regulations received within 60 days of the date of publication of this notice will be considered before final action on adopting the Rules and Regulations is taken by the Board.

The Board does not contemplate that an oral hearing or oral argument on the Proposed Rules and Regulations will be held. Should any interested party disagree, a request for a hearing or argument must be filed with the Board within the aforesaid 60-day period, specifically setting forth why the opportunity for the submission of written views and arguments does not afford adequate opportunity to present any relevant evidence or argument."

PROPOSED RULES AND REGULATIONS FOR ADJUDICATORY PROCEEDINGS

GENERAL INFORMATION

Establishment of the Board

s. 1.00 — The Great and General Court of the Commonwealth of Massachusetts created by Chapter 13 of the General Laws, Section 45 and by Chapter 643 and 741 of the Acts of 1941, the Massachusetts Board of Registration of Professional Engineers and of Land Surveyors. These Acts provided for the so-called "permissive" registration.

The original Act was amended by Chapter 646 of the Acts of 1955 whereby a sixth Board member was added to the Board membership. This sixth member was to be both a registered land surveyor and a professional civil engineer, however, principally engaged in the practice of land surveying.

Chapter 13 of the General Laws, Section 45, which established a Board of Registration of Professional Engineers and of Land Surveyors was further amended by Chapter 584 of the Acts of 1958. The amended law is known as Chapter 112 of the General Laws and is the so-called "mandatory" registration law which is now being administered by the Board.

The Massachusetts Board of Registration of Professional Engineers and of Land Surveyors shall hereinafter be referred to as the "BOARD."

SCOPE AND APPLICATION OF THE RULES

s. 1.01 — The following rules govern procedure in "adjudicatory proceedings" conducted before the Board which is subject to the provisions of G. L. c. 30A, the State Administrative Procedure Act. "Adjudicatory proceedings" are defined by the Act as proceedings "in which the legal rights, duties or privileges of specifically named persons are required by constitutional right or by any provision of the General Laws to be determined after opportunity for an agency hearing." (G. L. c. 30A, s. 1(1). Such proceedings may include, but are not limited to, hearings relating to applications for licenses or other permits; hearings on contemplated suspensions, revocations or other disciplinary actions; and adversary proceedings where the rights of more than one party are to be adjudicated by the agency. The rules contained herein are not applicable to hearings of other agency activities which do not conform to the definition of "adjudicatory proceedings." However, where the rules do apply, no agency may waive or otherwise modify them except to the extent specifically provided herein.

DOCKET

s. 1.02 — The Secretary of the Board shall keep a book known as a docket, and shall enter therein all papers relating to every proceeding to which these rules apply.

OFFICE HOURS

s. 1.03 — The office of the Board shall be open from 8:45 a.m. to 5:00 p.m. each weekday except Saturdays, Sundays, and legal holidays.

COMMUNICATIONS

s. 1.04 — All communications, including correspondence, motions and pleadings should be addressed and filed with the Board of Registration of Professional Engineers and of Land Surveyors, State Office Building, 100 Cambridge Street, Boston, Massachusetts 02202.

DATE OF RECEIPT

s. 1.05 — All communications, including correspondence, motions and pleadings, shall be deemed to be filed or received on the date on which they are actually received by the Board.

COMPUTATION OF TIME

s. 1.06 — Computation of any period of time referred to in these rules shall begin with the first day following that on which the act which initiates such period of time occurs. When the last day of the period so computed is a day on which the office of the Board is closed, the period shall run until the end of the following business day. When such period of time, with the intervening Saturdays, Sundays and legal holidays counted, is five (5) days or less, the said Saturdays, Sundays and legal holidays shall be excluded from the computation; otherwise such days shall be included in the computation.

EXTENSIONS OF TIME

s. 1.07 — It shall be within the discretion of the Board to extend, for good cause shown, any time limit prescribed or allowed by these rules. All requests for extensions shall be made by motion in accordance with s. 3.01. The Board shall notify all parties of its action upon the motion. Extensions shall be granted only when the Board is satisfied that good cause has been shown, and not otherwise.

SIGNATURES

s. 1.08 — Every application, notice, pleading, petition, complaint, motion, brief, memorandum and other document shall be signed by the filing party or by one or more attorneys, in their individual names on behalf of, and representing the said filing party. This signature constitutes a certificate by the signer that he has read the document; that to the best of his knowledge every statement contained in the instrument is true; and that it is not interposed for delay.

EX PARTE COMMUNICATIONS

s. 1.09 — In an adjudicatory proceeding no person not employed by the Board shall communicate *ex parte* with any member of the Board or any employee of the Board involved in the decisional process, with respect to the merits of that or any other proceeding. In an adjudicatory proceeding, if any *ex parte* communication is directed to any person in violation of the first sentence, the members of the Board and all other parties shall be immediately informed of the substance of the communication and the circumstances of its receipt; provided, that a request for information with respect to the status of an adjudicatory proceeding shall not be prohibited by this section.

PLEADINGS

INITIAL PLEADING

s. 2.01 — (1) An initial pleading, as used herein, shall refer to any paper or document by which an adjudicatory proceeding may be commenced. Such papers or documents shall include but not be limited to applications, petitions, charges, complaints and appeals.

(2) Every initial pleading, as far as possible, shall contain the following:

- (a) A title which indicates either the nature of the proceedings or the parties involved therein.
- (b) The complete name and address of the party filing the pleading.
- (c) The name of the Board.
- (d) The name and address of all parties if known.
- (e) A clear and concise statement of the facts upon which the pleading is maintained.
- (f) A prayer setting forth the relief sought.
- (g) If the party filing the pleading is represented by counsel, the name and address of the attorney.
- (h) All charges of fraud, deceit, gross negligence, incompetency, or misconduct preferred against any registrant shall be in writing, shall be sworn to by the person making them, and shall be filed with the Secretary of the Board.

(3) The Board may print or otherwise duplicate forms to be filled out and used as initial pleadings. When such forms are available the Board may require their use.

ANSWER

s. 2.02 — Any party may file with the Board an answer to an initial pleading within ten (10) days after service of the document to which the answer is directed. All allegations contained in said initial pleading which are not specifically admitted are deemed denied. All new matters contained in said answer shall be deemed denied.

The answer shall contain but not be limited to the following:

- (a) A clear and concise statement identifying the party filing the answer and the matter to which the answer relates.
- (b) A clear and concise statement of all matters upon which the party relies.

REPLIES

s. 2.03 — There shall be no reply other than an answer as provided in s. 2.02.

AMENDMENTS TO PLEADINGS

s. 2.04 — Leave to file amendments to any pleading will be allowed or denied as a matter of discretion; provided, however, leave to amend shall be freely given as justice requires. If amendment is made to an initial pleading, the answer to said amended pleading, if any, shall be filed within seven (7) days.

WITHDRAWAL OF PLEADINGS

s. 2.05 — A party desiring to withdraw a pleading filed with the Board shall file a motion for withdrawal, in accordance with s. 3.01. If any party has an objection thereto, he shall, within ten (10) days after receipt of said motion, file a statement with the Board setting forth the reasons for his objection and serve a copy of same, in accordance with s. 4.01, on each party. An objecting party may, as of right, have a hearing on the motion to withdraw if, at the time of filing he so requests. In the absence of objections or a request for hearing, the motion of withdrawal shall, within thirty (30) days after the filing thereof, be deemed allowed, unless otherwise ordered; provided, however, that this paragraph shall not be construed as effecting withdrawal of the following, unless all parties thereto including the Board so agree:

- (1) Any pleading in any proceeding in which a hearing has been held.
- (2) Any formal complaint.
- (3) Any application for a license.

MOTIONS

s. 3.01 — An application to the Board for an order to take any action or to enter any order after initial pleading or answer shall be by motion which, unless made during a hearing or trial, shall be made in writing, shall state specifically the grounds therefor, and shall set forth the action or order sought. A copy of all motions made in writing, or reduced to writing at the request of the Board shall be served upon the parties in accordance with s. 4.01 of these rules.

Upon the filing of a motion, the Board shall notify all parties of their right to request a hearing thereon. Such request must be made within five (5) days of receipt of the above-mentioned notice. Notice of hearing shall be given by the Board to the parties at least five (5) days prior to the date set for hearing, unless such notice is waived. If no hearing is requested, the Board shall act upon the motion forthwith.

MOTION FOR SPECIFICATIONS

s. 3.02 — Where a party makes a reasonable showing that he cannot frame an answer to an initial pleading based upon the allegations as they appear in such initial pleading, he may, at any time prior to the time within which an answer may be filed, move for specifications or for a more definite statement of the allegations. Such a motion shall be filed in accordance with s. 3.01 and shall identify the defects complained of or the details desired. The Board shall grant such motions as justice requires, but shall disallow motions which clearly have been filed for purposes of delay or harassment. If the motion is allowed, the party called upon to clarify his pleading shall file specifications within seven (7) days of being notified of such allowance and the party who has moved for specifications shall file his answer, if any, within seven (7) additional days.

SERVICE

s. 4.01 — (1) By the Board. Service of complaints, orders, decisions, pleadings, motions, processes, and other documents of the Board shall be by registered or certified mail.

(2) On the Board. For the purpose of proceedings under these rules only, service upon the Board may be effected by filing the paper or papers with the Secretary of the Board of Registration of Professional Engineers and of Land Surveyors, State Office Building, 100 Cambridge Street, Boston, Massachusetts, 02202.

(3) Parties and other persons. All papers, including, but not

limited to applications, notices, pleadings, petitions, motions, briefs, memoranda, and other documents, filed by any party or other person with the Board or a hearing examiner shall be served by personal delivery or by first-class mail upon all parties to the proceedings. Proof of service shall accompany all papers when filed or shall be filed within ten (10) days thereafter.

PARTIES; INTERVENTION

SUBSTITUTION OF PARTIES

s. 5.01 — The Board may, on motion, at any time in the course of any proceeding, permit such substitution of parties as justice or convenience may require.

INTERVENTION

s. 5.02 — Any party not initially joined in the action or proceeding shall be permitted to intervene. In the discretion of the Board, any person not a party may be permitted to intervene in any action or proceeding. A person or party desiring to intervene shall file a motion in accordance with s. 3.01, which motion shall state therein the grounds for intervention.

EVIDENCE; SUBPOENAS

EVIDENCE

s. 6.01 — The Board, as provided in G. L. c. 30A, s. 11, need not observe the rules of evidence observed by courts, but shall observe the rules of privilege recognized by law, except as otherwise provided by any law.

MATTERS FOR OFFICIAL NOTICE IN AGENCY PROCEEDINGS

s. 6.02 — (1) Official notice may be taken of such matters as might be judicially noticed by the courts of the United States or of this Commonwealth and, in addition, the Board may take notice of general, technical, or scientific facts within its specialized knowledge; provided, that any party shall on timely request be afforded an opportunity to contest the matters of which official notice is to be taken.

(2) Official notice in any agency proceeding by the Board also may be taken of any fact alleged, presented, or found in any other agency proceeding or of the status and disposition of such proceeding; provided, that the parties shall be afforded in all circumstances where such notice is taken an opportunity to contest the matters of which official notice is to be taken.

OBJECTIONS AND EXCEPTIONS

s. 6.03 — Formal exceptions to rulings on evidence and procedure are unnecessary. It is sufficient that a party, at the time that a ruling of the Board is made or sought, makes known to the Board the action which he desires taken or his objections to such action and his grounds therefor; provided, that if a party has no opportunity to object to a ruling at the time it is made or to request a particular ruling at an appropriate time, such party, within three (3) days of notification of action taken or refused, shall state his objection and his grounds therefor.

SUBPOENAS

s. 6.04 — The Board and all other parties shall have authority in accordance with G. L. c. 30A, s. 12 and G. L. c. 112, s. 81-P to issue subpoenas requiring the attendance and testimony of witnesses and the production of any documents in question in the proceeding.

PRODUCTION AND VIEW OF OBJECTS

s. 6.05 — A party may file a motion for the production or view of any object which relates to the subject matter of any proceeding then pending before the Board. Said motion shall be filed in accordance with s. 3.01 and shall be granted in the discretion of the Board where justice requires.

DEPOSITIONS AND STIPULATIONS

DEPOSITIONS

s. 7.01 — (1) At any time during the course of a proceeding, the Board may, in its discretion, order that the testimony of a witness be taken by deposition. Application to take testimony by deposition shall be made by motion, in accordance with s. 3.01.

Such motion shall set forth the reason for desiring the deposition; the time when, the place where, and the name and address of the person before whom the deposition is desired; the name and address of each witness, and the subject matter concerning which each witness is expected to testify. The Board shall allow the motion only upon a showing that circumstances are such that the witness to be deposed cannot appear before the Board without substantial hardship being caused. If such hardship is financial in nature, any party may agree to reimburse the witness for expenses, including loss of wages, incurred by appearing; and in such cases the motion to allow taking of a deposition shall be denied. Motions for the

taking of depositions shall not be allowed if the depositions result in any undue burden to another party or in any undue delay of the proceeding. If the motion is allowed, the Board shall give at least five (5) days notice of the taking of the deposition to all parties.

(2) Depositions shall be taken orally before a person having power to administer oaths, such person to be designated by the Board. Each witness testifying upon deposition shall be duly sworn, and the adverse party shall have the right to cross-examine. Objections to questions shall be in short form, stating the ground of objection relied upon. The questions asked, the answers thereof, and all objections shall be reduced to writing, signed by the witness, and certified by the officer before whom the deposition is taken. The said officer shall forward the deposition to the Board. Subject to appropriate rulings on objections, the deposition shall be received in evidence as if the testimony contained therein had been given by the witness in the presence of the Board.

(3) After notice is served for taking a deposition, upon motion made in accordance with s. 3.01 and made prior to the date set for such taking by any party or by the person to be examined, the Board may, for good cause shown, order that the deposition shall not be taken; that certain matters shall not be inquired into; or that the scope of the examination shall be limited to certain matters. The Board may make any other order necessary to protect the party or witness from harassment or oppression.

(4) Wherever used in this section, the word "witness" shall be construed to include parties.

STIPULATIONS

s. 7.02 — In the discretion of the Board, the parties may, by stipulation in writing filed with the Board at any stage of the proceeding, or orally made at the hearing, agree upon any pertinent facts in the proceeding. In making its findings, the Board need not be bound by any such stipulation.

HEARING NOTICE OF HEARING

s. 8.01 — The Board shall notify all parties and intervenors of a scheduled hearing in any pending matter. Such notification shall include, but need not be limited to, the time, date, place and nature of the hearing and shall be served at least seven (7) days prior to the hearing on all parties or others according to s. 4.01 except as provided in G. L. c. 112, s. 81P.

HEARING

s. **8.02** — (1) Presiding Officer. The hearing shall be conducted by a duly appointed hearing officer, the Board chairman, or a member of the Board appointed by the chairman to conduct the hearing.

(2) Quorum. Where the hearing is to be conducted before the members of the Board, a quorum for purposes of conducting the hearing shall be a majority of the members.

(3) Power of Presiding Officer. The presiding officer shall initially make all decisions regarding the admission or exclusion of evidence or any other procedural matters which may arise in the course of the hearing.

(4) Sworn Testimony. All testimony given at a Board hearing shall be under oath administered by the presiding officer or any member of the Board.

(5) Order of Presentation. The moving or complaining party shall present his evidence or testimony first. Where there is more than one moving or complaining party the order of presentation shall be in the discretion of the Board. After all the evidence and testimony of the complaining or moving parties have been received, all other parties shall be allowed to present their evidence or testimony. All parties, other than the party introducing the testimony, shall be allowed to cross-examine any witness immediately after his testimony has been received.

(6) Conduct. All parties, counsel, witnesses, and other persons present at a hearing shall conduct themselves in a manner consistent with the standards of decorum commonly observed in the courts of this Commonwealth. Where such decorum is not observed, the Board may take such action as it deems appropriate.

TRANSCRIPTS

s. **8.03** — At the request of any party, made in writing at least three (3) days before the hearing date, or of its own accord, the Board shall order that all proceedings in a pending case be taken by sound recording or be officially reported by a stenographer appointed for that purpose and duly sworn or both. The Board shall require any party requesting a copy of the transcript to pay the reasonable costs of preparing said transcript before the Board makes the transcript available to the party. Any objections to the accuracy of the transcript not raised within thirty (30) days after the transcript is made available to the objecting party shall be deemed to be waived.

HEARING OFFICERS

s. 8.04 — Where authorized by statute, the chairman of the Board may appoint a hearing officer. The hearing officer shall have all those powers conferred on the Board in the conduct of hearings except that the hearing officer shall not be empowered to make any decision which would finally determine the proceedings. A comprehensive report shall be filed with the Board by the hearing officer after termination of the hearing.

HEARING OFFICER'S REPORT, INITIAL AND FINAL DECISIONS

s. 8.05 — (1) Any party may, in advance of hearing, request in writing a copy of the hearing officer's report or, in the event that the final decision is to be rendered by persons, a majority of whom have neither heard nor read the evidence, a copy of the tentative decision of the official at the hearing. Unless the tentative decision or the hearing officer's report is adverse to the Board, said decision or report shall be mailed to each party after the expiration of the time set for filing briefs. If the decision or report is adverse to the Board, no copy thereof need be mailed.

(2) Upon the proper filing and service of objections, the Board shall allow either oral or written arguments to be presented to a majority of the Board who are to render the final decision, the choice to be in the discretion of the Board.

ORAL ARGUMENT

s. 8.06 — A party shall have a right before the close of the hearing to argue orally, but the Board may impose reasonable limitations upon the length of such argument. The Board may in its discretion permit additional oral argument at any time after the close of a hearing, provided all parties are given reasonable opportunity to be heard.

CONSOLIDATION; CONTINUANCES; SATISFACTION OF COMPLAINT CONSOLIDATION

s. 9.01 — The Board upon its own motion, or upon motion by a party or other person joined in the proceeding, may order proceedings involving a common question of law or fact to be consolidated for hearing on any or all of the matters in issue in such proceedings.

CONTINUANCES

s. 9.02 — The Board may, for good cause shown, grant a postponement or a continuance of proceedings.

SATISFACTION OF COMPLAINT

s. 9.03 — In any proceeding in which a party is charged with the commission of an act contrary to law, the proceeding shall not be discontinued except with the consent of the party charged.

BRIEFS AND POST-HEARING PROCEDURE

BRIEFS

s. 10.01 — Briefs may be filed by a party or any interested person either before or during the course of a hearing, or within such time thereafter as the Board shall designate. Failure to file a brief shall in no way prejudice the rights of any party.

FILING OF DOCUMENTS SUBSEQUENT TO HEARING

s. 10.02 — The Board may, for good cause shown, allow the parties to file evidentiary documents of any kind, or exhibits, at a time subsequent to the completion of the hearing, such time to be determined by the Board. If a request for such subsequent filing is granted, the requesting party shall, on or before the date set for filing, send copies of all documents or exhibits which are the subject of the request to all other parties. If such requirement for copies is impracticable, the Board may suspend the above provision; in such cases, the Board shall allow reasonable inspection of the original by all parties.

REOPENING HEARINGS

s. 10.03 — A party may, at any time prior to the rendering of a decision by the Board, move that the hearing be reopened for the purpose of receiving new evidence. Such motions shall be filed in accordance with the provisions of s. 3.01 and shall be granted only for good cause shown. The Board shall notify all parties of its action upon the motion. Notwithstanding the above, the Board may, at any time prior to the rendering of a decision, reopen the hearing on its own motion. In case of such reopening on motion of the Board, the parties shall be notified, and the hearing shall not be convened less than five (5) days after the sending of such notice.

REHEARING; REARGUMENT; RECONSIDERATION

s. 10.04 — Any party may file a motion for rehearing, reargument, or reconsideration within thirty (30) days after a receipt of a final decision of the Board. Such motion shall be filed in accordance with s. 3.01 and in addition, shall include a statement of all matters alleged to have been erroneously decided and if applicable, a statement as to any newly discovered matters or circumstances that have arisen subsequent to the final decision. The filing of said motion shall not operate as a stay of execution unless so ordered by the Board.

UNIFORM RULES FOR ADOPTING ADMINISTRATIVE REGULATIONS

RULE 1. DEFINITION OF REGULATION

The following rules govern the procedures to be followed by the Board which is subject to the State Administrative Procedure Act when promulgating regulations (G. L. c. 30A, ss. 2 and 3). The term "regulation" is defined by the Act as "the whole or any part of every rule, regulation, standard or other requirement of general application and future effect adopted by an agency to implement or interpret the law enforced or administered by it." (G.L. c. 30A, s. 1 (5)) "Regulation" does not, however, include advisory rulings, rules relating to the internal management of the Board and not directly related to the rights or procedures available to the public, or decisions rendered in adjudicatory proceedings. Accordingly, these rules apply to the Board which is acting in a quasi-legislative capacity, i.e., either promulgating substantive regulations consistent with applicable statutes or promulgating rules governing its own procedures. Where these rules apply, no agency may waive or otherwise modify them except to the extent specifically provided herein.

RULE 2. PETITION FOR ADOPTION OF REGULATIONS

Any interested person or his attorney may at any time petition the Board to adopt, amend, or repeal any regulation. The petition shall be addressed to the Board and sent to the secretary by mail or delivered in person during normal business hours. All petitions shall be signed by the petitioner or his attorney, contain his address or the address of his attorney; and set forth clearly and concisely the text of the proposed regulation. The petition may be accompanied by any supporting data, views or arguments.

RULE 3. INITIAL PROCEDURE TO HANDLE RECOMMENDED REGULATIONS

Upon receipt of a petition for the adoption, amendment or repeal of a regulation submitted pursuant to Rule 2 or upon written recommendation by a member of the Board that a regulation be adopted, amended or repealed, the Board shall consider the petition or recommendation at its next scheduled meeting and shall, thereupon, determine whether to schedule the petition or recommendation for further proceedings in accordance with Rule 5 or 6. If the regulation has been presented to the Board by petition under Rule 2, the Board shall within ten (10) days after the meeting notify the petitioner of the Board's action.

RULE 4. PARTICIPATION AT PRELIMINARY MEETING

During the meeting referred to in Rule 3, the Board may, but shall not be required to, entertain comments or questions from members of the audience. The chairman or other presiding officer may at any time terminate participation by the audience.

RULE 5. PROCEDURE FOR THE ADOPTION, AMENDMENT OR REPEAL OF REGULATIONS WHERE NO PUBLIC HEARING IS REQUIRED

(1) *Notice* — Notice of the proposed action to adopt regulations shall be given by the Board at least twenty-one (21) days prior to its proposed action, unless some other time is specified by any applicable law. The Board shall publish the notice in at least two (2) newspapers of general circulation, and where appropriate, in such trade, industry, or professional publications as the Board may select. The Board shall likewise notify in writing any person specified by any law and any person or group which has filed request for notice pursuant to G. L. c. 30A, s. 3 (1) (b).

The notice shall contain the following:

- a. The Board's statutory authority to adopt the proposed regulation.
- b. The procedure for submitting data, views or arguments as set forth in section (2) of this rule.
- c. The text of the proposed regulation (if the proposed regulation is lengthy, it need not be set out verbatim; however, the notice should either describe the substance of the proposed regulation or state the subject matter and issues involved) and the complete text should be on file in the Board's office.

d. Any additional matter required by any law.

The above notwithstanding, the Board shall also comply with any applicable statute which contains provisions for notice which differ from those contained herein.

(2) *Procedure* — Within twenty-one (21) days after the publication and sending of notice regarding the proposed action, any interested person may submit a signed letter, brief or other memorandum stating his views or arguments concerning the proposed action. The letter, brief or memorandum shall be addressed to the Board and sent to the secretary by mail or delivered in person during normal business hours. The Board shall, at its next scheduled meeting, consider the proposed action. Within thirty (30) days after this meeting, the Board shall give written notice of the disposition of the proposed action to all persons required to receive personal notice under section (1) of this rule and such other persons submitting a letter, brief, or other memorandum.

(3) *Oral Participation* — The Board may afford any interested person or his duly authorized representative, or both, an opportunity to present data, views or arguments orally before the Board during the meeting at which the proposed action is to be considered. If the Board finds that such oral presentation is unnecessary or impracticable, it may require written presentation according to section (2) of this rule.

(4) *Waiver of Notice and Participation* — If the Board finds that the requirements of notice and opportunity to present views on its proposed action are unnecessary, impracticable or contrary to the public interest, the Board may dispense with such requirements or any part thereof. The Board's finding and a brief statement of the reasons for its finding shall be incorporated in the regulation, amendment or repeal as filed with the Secretary of State under rule 8.

RULE 6. PROCEDURE FOR THE ADOPTION, AMENDMENT OR REPEAL OF REGULATIONS WHERE A PUBLIC HEARING IS REQUIRED

(1) *Notice* — Notice of a public hearing shall be given at least twenty-one (21) days prior to the date of the hearing, unless some other time is specified by any applicable law. The Board shall publish the notice in at least two (2) newspapers of general circulation and where appropriate, in such trade, industry, or professional publications as the Board may select. The Board shall

likewise notify in writing any person specified by any law and any person or group which has filed written request for notice pursuant to G. L. c. 30A, s. 2 (1) (b).

The notice shall contain the following:

- a. The Board's statutory authority to adopt the proposed regulation.
- b. The time and place of the public hearing.
- c. The text of the proposed regulation. (If the proposed regulation is lengthy, it need not be set out verbatim; however, the notice should either describe the substance of the proposed regulation or state the subject matter and issues involved) and the complete text should be on file in the Board's office.
- d. Any additional matter required by any law.

The above notwithstanding, the Board shall also comply with any applicable statute which contains provisions for notice which differ from those contained herein.

(2) *Procedure* — On the date and at the time and place designated in the notice referred to in section (1) above, the Board shall hold a public hearing at which a majority of the Board shall be present. The meeting shall be opened, presided over and adjourned by the chairman or other member of the Board designated by the chairman. Within ten (10) days after the close of the public hearing, written statements and arguments may be filed with the Board. The Board shall consider all relevant matter presented to it before adopting, amending or repealing any regulation.

(3) *Oral Participation* — Any interested person or his duly authorized representative, or both, shall be given an opportunity to present orally statements and arguments. In its discretion the Board may limit the length of oral presentation.

(4) *Emergency Regulation* — If the Board finds that the immediate adoption of a regulation is necessary for the public health, safety or general welfare, and that observance of requirements of notice and public hearing would be contrary to the public interest, the Board may dispense with such requirements and adopt the regulation as an emergency regulation. The Board's finding and a brief statement of the reasons for its finding shall be incorporated in the emergency regulation as filed with the Secretary of State in accordance with rule 8. Any emergency regulation so adopted shall state the date on which it is to be

effective and the date upon which it shall expire. If no effective date is stated, the regulation shall be presumed to take effect upon being filed with the Secretary of State under rule 8. An emergency regulation shall not remain in effect for longer than three months unless during the time it is in effect the Board gives notice and holds a public hearing and adopts it as a permanent regulation in accordance with these rules.

RULE 7. AVAILABILITY OF REGULATION

The secretary of the Board shall be responsible for keeping a book containing all the Board regulations. In addition, the secretary shall compile and publish the regulations which are currently in effect. All the regulations of the Board shall be available for inspection during normal business hours in its office at the State Office Building, 100 Cambridge Street, Boston, Massachusetts 02202.

RULE 8. FILING OF REGULATION

Upon the adoption of a regulation, an attested copy shall be filed with the Secretary of State together with a citation of the statutory authority under which the regulation has been promulgated. The regulation shall take effect upon filing unless a later date is required by any law or is specified by the Board in the regulation.

RULE 9. ADVISORY RULING

Any interested person or his attorney may at any time request an advisory ruling with respect to the applicability to any person, property or factual situation of any statute or regulation enforced or administered by the Board. The request shall be addressed to the Board and sent to the secretary by mail or delivered in person during normal business hours. All requests shall be signed by the person making it or his attorney, contain his address or the address of his attorney, and state clearly and concisely the substance or nature of the request. The request may be accompanied by any supporting data, views or arguments. Upon receipt of the request the Board shall consider it at its next scheduled meeting and shall within ten (10) days thereafter notify the petitioner that the request is denied or that the Board will render an advisory ruling. If an advisory ruling is rendered, a copy of an advisory ruling. The Board may at any time rescind a decision to render an advisory ruling. If an advisory ruling is rendered, a copy of the ruling shall be sent to the person requesting it or his attorney.

WAVE PROPAGATION IN AN ELASTIC PLATE WITH WAVY BOUNDARIES

by

Samuel Sutcliffe* and Carroll E. Meserve**

INTRODUCTION

In the analysis of the behavior of physical systems it is often necessary to make numerous idealizations in order to effect a tractable mathematical model of the system. In many cases the effects of such idealizations are small and have little effect on the interpretation of the mathematical solution in terms of the behavior of the real system. It sometimes occurs, however, that significant forms of behavior of the real system are lost in the process of idealization. For example, buckling phenomena are not observed in the analysis of elastic systems when the quadratic terms in the strain-displacement relations are neglected. Thus, it is important to assess the effects of idealizations when possible, either by more precise analysis, or preferably, by a combination of analysis and careful experimentation with the real system.

In the problem which is considered herein, the effect of a single idealization on the analysis of the dynamic behavior of an infinite plate is studied by perturbation theory, and the circumstances under which secondary effects become important are identified. The specific problem considered is that of the steady-state oscillations of an infinite elastic plate in a state of plane strain in which the boundaries are not flat, but wavy in the form of a small amplitude sine curve.

The propagation of elastic waves in perfectly flat plates has been studied extensively as evidenced by the ample bibliography in Ewing et al.¹ The effects of boundary surfaces on the propagation of electromagnetic and acoustic waves has also been studied extensively (see bibliography in Lysanov²). The propagation of elastic waves in media with irregular boundaries has received much less attention, but several notable papers should be mentioned. Bredhouskish³ considers Rayleigh waves along the wavy boundary of a half-space, and Sato⁴ the generation of Rayleigh waves at a rough boundary. Eringen and Samuels⁵ treat the propagation of elastic waves in a half-space with a wavy boundary, and Dunkin and Eringen⁶ treat the reflection of elastic waves from the wavy boundary of a half-space.

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**Research Engineer, General Electric Corp., Valley Forge, Pennsylvania.

ANALYSIS

Consider an infinite, perfectly elastic plate which is bounded by the surfaces $y = \pm (\frac{1}{2}h + \epsilon \sin \alpha x)$, $z = z$, see Fig. 1, where ϵ is small compared to h and unity. Consider the system to be in a state of plane strain, and define u, v as the displacements in the x and y -directions, respectively. Potential functions φ and ψ are defined in the usual way, such that $u = \varphi_x + \psi_y$ and $v = \varphi_y - \psi_x$, where subscripts denote differentiation.

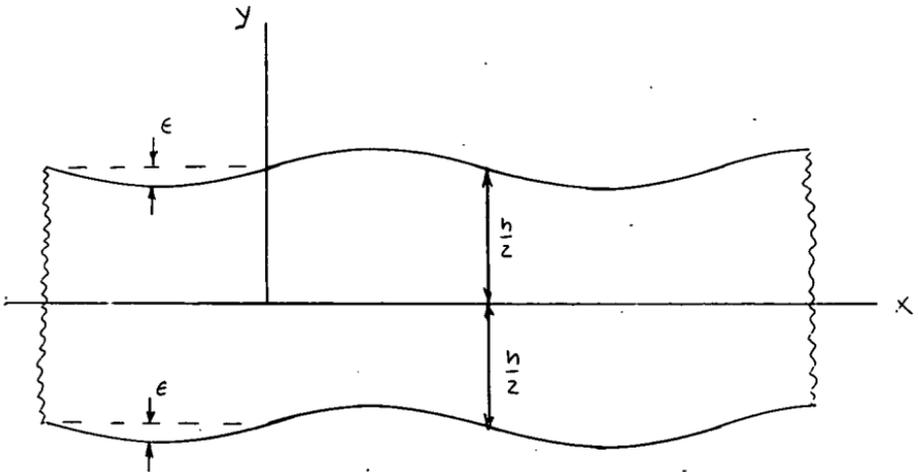


FIGURE 1. Cross-section of Wavy Plate

The equations of motion in terms of the potential functions are:

$$\begin{aligned} \nabla^2 \varphi - \frac{1}{c_1^2} \varphi_{tt} &= 0 \\ \nabla^2 \psi - \frac{1}{c_2^2} \psi_{tt} &= 0 \end{aligned} \quad (1)$$

where c_1 and c_2 are the dilatational wave velocity and the shear wave velocity, respectively.

Steady-state solutions of (1) which represent waves traveling in the positive x-direction can be taken in the form:

$$\begin{aligned}\varphi &= (A_1 e^{\nu y} + A_2 e^{-\nu y}) e^{i(\omega t - kx)} \\ \psi &= (A_3 e^{\nu' y} + A_4 e^{-\nu' y}) e^{i(\omega t - kx)}\end{aligned}\quad (2)$$

$$\text{where } \nu = \sqrt{k^2 - \frac{\omega^2}{c_1^2}}, \quad \nu' = \sqrt{k^2 - \frac{\omega^2}{c_2^2}}.$$

The solution given in (2) will be denoted as the primary wave. In addition a secondary wave will be considered in the form:

$$\begin{aligned}\varphi_3 &= \epsilon (B_1 e^{\bar{\nu} y} + B_2 e^{-\bar{\nu} y}) e^{i(\omega t - \bar{k}x)} \\ \psi_3 &= \epsilon (B_3 e^{\bar{\nu}' y} + B_4 e^{-\bar{\nu}' y}) e^{i(\omega t - \bar{k}x)}\end{aligned}\quad (3)$$

$$\text{where } \bar{\nu} = \sqrt{\bar{k}^2 - \frac{\omega^2}{c_1^2}}, \quad \bar{\nu}' = \sqrt{\bar{k}^2 - \frac{\omega^2}{c_2^2}}$$

The solution to the differential equations (1), up to first order in ϵ is given by the sum of (2) and (3).

Boundary conditions require that the surface tractions on the top and bottom surfaces vanish. Including terms up to first order in ϵ , the boundary conditions are given by:

$$\begin{aligned}\sigma_y + \epsilon \cdot 2 \gamma_{xy} \alpha \cos \alpha x &= 0 \\ \gamma_{xy} + \epsilon \cdot (\sigma_x - \sigma_y) \alpha \cos \alpha x &= 0\end{aligned}\quad (4)$$

for $y = \pm (\frac{1}{2}h + \epsilon \sin \alpha x)$.

The stresses are defined in terms of the potential functions by the expressions:

$$\begin{aligned}\sigma_x &= \lambda \nabla^2 \varphi + 2\mu (\varphi_{xx} + \psi_{xy}) \\ \sigma_y &= \lambda \nabla^2 \varphi + 2\mu (\varphi_{yy} - \psi_{xy}) \\ \gamma_{xy} &= \mu (\psi_{yy} + 2\varphi_{xy} - \psi_{xx})\end{aligned}\quad (5)$$

where λ and μ are the Lamé constants for the medium.

Substitution of (2) and (3) into (4) and (5), and making the approximation $\exp \pm \nu (1/2 h + \epsilon \sin \alpha x) = (\exp \pm \nu 1/2 h) \bullet (1 + \epsilon \nu \sin \alpha x)$ yields the equation:

$$\begin{aligned} & e^{i k x} [D(k, \nu, \nu')] \{A\} + \epsilon e^{-i k x} [D(\bar{k}, \bar{\nu}, \bar{\nu}')] \{B\} + \epsilon \sin \alpha x e^{-i k x} [D_1(k, \nu, \nu')] \{A\} \\ & + \epsilon \alpha \cos \alpha x e^{-i k x} [D_2(k, \nu, \nu')] \{A\} = 0 \end{aligned} \quad (6)$$

where $\{A\} = \begin{bmatrix} A_1 \\ A_2 \\ A_3 \\ A_4 \end{bmatrix}$, $\{B\} = \begin{bmatrix} B_1 \\ B_2 \\ B_3 \\ B_4 \end{bmatrix}$ and

$$[D(k, \nu, \nu')] = \begin{bmatrix} [2\nu^2\mu - \lambda(k^2 - \nu^2)]e^{\nu/2} & [2\nu^2\mu - \lambda(k^2 - \nu^2)]e^{-\nu/2} & 2i\nu'k\mu e^{\nu/2} & -2i\nu'k\mu e^{-\nu/2} \\ -2i\nu k\mu e^{\nu/2} & 2i\nu k\mu e^{-\nu/2} & (k^2 + \nu'^2)\mu e^{\nu/2} & (k^2 + \nu'^2)\mu e^{-\nu/2} \\ [2\nu^2\mu - \lambda(k^2 - \nu^2)]e^{-\nu/2} & [2\nu^2\mu - \lambda(k^2 - \nu^2)]e^{\nu/2} & 2i\nu'k\mu e^{-\nu/2} & -2i\nu'k\mu e^{\nu/2} \\ -2i\nu k\mu e^{-\nu/2} & 2i\nu k\mu e^{\nu/2} & (k^2 + \nu'^2)\mu e^{-\nu/2} & (k^2 + \nu'^2)\mu e^{\nu/2} \end{bmatrix}$$

$$[D_1(k, \nu, \nu')] = \nu [D(k, \nu, \nu')] \begin{bmatrix} -1 & 0 & 0 & 0 \\ 0 & 1 & 0 & 0 \\ 0 & 0 & -1 & 0 \\ 0 & 0 & 0 & 1 \end{bmatrix}$$

$$[D_2(k, \nu, \nu')] = \begin{bmatrix} -2i\nu k\mu e^{\nu/2} & 2i\nu k\mu e^{-\nu/2} & 2(k^2 + \nu'^2)\mu e^{\nu/2} & 2(k^2 + \nu'^2)\mu e^{-\nu/2} \\ -2(k^2 + \nu'^2)\mu e^{\nu/2} & -2(k^2 + \nu'^2)\mu e^{-\nu/2} & -4i\nu'k\mu e^{\nu/2} & 4i\nu'k\mu e^{-\nu/2} \\ -2i\nu k\mu e^{-\nu/2} & 2i\nu k\mu e^{\nu/2} & 2(k^2 + \nu'^2)\mu e^{-\nu/2} & 2(k^2 + \nu'^2)\mu e^{\nu/2} \\ -2(k^2 + \nu'^2)\mu e^{-\nu/2} & -2(k^2 + \nu'^2)\mu e^{\nu/2} & -4i\nu'k\mu e^{-\nu/2} & 4i\nu'k\mu e^{\nu/2} \end{bmatrix}$$

PRIMARY WAVE SOLUTION

Taking the terms of zero order in ϵ in (6) yields the primary wave solution, which is the same as the perfectly flat plate solution.

Thus, for ϵ arbitrary, (6) yields the determinantal equation defining the phase velocity-frequency relations for the flat plate, i.e.,

$$\det [D(k, \nu, \nu')] = 0 \quad (7)$$

Equation (7) has been studied extensively by Gogoladze⁷ and Tolstoy and Usdin⁸.

SECONDARY WAVE SOLUTION

Taking the terms of first order in ϵ in (6) yields the secondary wave solution:

$$e^{-i\bar{k}x} [D(\bar{k}, \bar{\nu}, \bar{\nu}')] \{B\} = -e^{-ikx} \sin \alpha x [D_1(k, \nu, \nu')] \{A\} - e^{-ikx} \alpha \cos \alpha x [D_2(k, \nu, \nu')] \{A\} \quad (8)$$

Noting that (8) must be satisfied for all x , (8) can be split into two equations:

$$\begin{aligned} [D(\bar{k}, \bar{\nu}, \bar{\nu}')] \{B\} &= \frac{1}{2\bar{z}} [D_1(k, \nu, \nu')] \{A\} - \frac{\alpha}{\bar{z}} [D_2(k, \nu, \nu')] \{A\} \\ [D(\bar{k}, \bar{\nu}, \bar{\nu}')] \{B\} &= -\frac{1}{2\bar{z}} [D_1(k, \nu, \nu')] \{A\} - \frac{\alpha}{\bar{z}} [D_2(k, \nu, \nu')] \{A\} \end{aligned} \quad (9)$$

where the first of (9) applies for $\bar{k} = k + \alpha$, and the second applies for $\bar{k} = k - \alpha$

Equations (9) can be interpreted as four secondary waves, a dilatational wave and a shear wave with phase velocity $\frac{\omega}{k + \alpha}$, and a dilatational wave and shear wave with phase velocity $\frac{\omega}{k - \alpha}$. If $\alpha < k$ all the secondary waves travel in the positive x -direction, if $\alpha > k$, one pair of secondary waves travel in the positive x -direction, the other pair in the negative x -direction.

QUASI-RESONANCE

As long as $\det [D(\bar{k}, \bar{\nu}, \bar{\nu}')] \neq 0$, finite amplitudes of the primary waves, represented by $\{A\}$ will result in finite values of $\{B\}$. Since the stresses and displacements corresponding to the secondary waves are multiplied by ϵ , the secondary wave amplitudes are given by $\epsilon \{B\}$, and are therefore small compared to the primary wave amplitudes.

If, however, k and α are such that $\det [D(\bar{k}, \bar{\nu}, \bar{\nu}')] = 0$, $\{B\} \rightarrow \infty$ and the secondary wave amplitudes take the form $\epsilon \cdot \infty$, where ϵ is small. Since the secondary wave amplitudes vanish entirely when $\epsilon = 0$, the indication is that an observable rather than unbounded

response occurs, thus the term "quasi-resonance". Since $\det[D(\bar{k}, \bar{v}, \bar{v}')] = 0$ is of exactly the same form as the phase velocity-frequency relation for a perfectly flat plate, it may be concluded that "quasi-resonance" occurs when one of the secondary phase velocities $\frac{\omega}{k+\alpha}$ or $\frac{\omega}{k-\alpha}$ coincides with the phase velocity of one of the modes of the same plate without a wavy boundary. Because of the dispersive nature of waves in plates, it is probable that "quasi-resonance" would be significant only in the lower symmetric and antisymmetric modes.

EXAMPLE

Consider the case in which the primary wave is in the lowest symmetric mode. In this case the axial stress is uniformly distributed with respect to y , and the shearing stress is zero.

Specifically,
$$\{A\} = \begin{bmatrix} A_1 \\ A_2 \\ 0 \\ 0 \end{bmatrix} \quad \text{and} \quad v = \sqrt{k^2 - \frac{\omega^2}{c_1^2}} = 0 \quad \text{so that} \quad k = \frac{\omega}{c_1}$$

For a given waviness of the boundary with frequency α , the secondary wave amplitudes will be of order ϵ unless $k = k + \alpha$ or $k = k - \alpha$ is such that $\det[D(\bar{k}, \bar{v}, \bar{v}')] = 0$, that is, "quasi-resonance" occurs when one of the secondary phase velocities $\frac{\omega}{k+\alpha}$ or $\frac{\omega}{k-\alpha}$ coincides with the phase velocity of one of the flat plate modes. The first symmetric mode is excluded, however, since it would require $\alpha = 0$, i.e., no boundary waviness.

The most interesting mode in this case is the first flexural (antisymmetric) mode, since it is the lowest secondary mode in which "quasi-resonance" can occur.

Taking a hypothetical low velocity material with $c_1 = 10^4$ in/sec, $v = 1/4$, so that $c_2 = .576 \times 10^4$ in/sec, and assuming $w = 1000$ Hz, $h = 1/4$ in. yields the phase velocity of the first flexural mode as 0.159×10^4 in/sec (see ¹, pg. 286).

Thus, for "quasi-resonance" for flexural waves in the positive x -direction, $\frac{\omega}{c_1 + \alpha} = 0.159 \times 10^4$, and $\alpha = 3.33$ radians/in. Therefore, if the waviness of the boundary has a period of 1.885 inches, a primary, symmetric disturbance of the form $\exp i \omega(t - 10^{-4}x)$ will generate a secondary response of the form $\exp i \omega(t - 6.28 \cdot 10^{-4}x)$ which should be observable.

SUMMARY AND CONCLUSIONS

The effects of boundary waviness on the propagation of elastic waves in an infinite plate have been studied by first order perturbations. For a given primary wave, four secondary waves are generated, two dilatational waves and two shear waves. In most cases the amplitudes of the secondary waves are of the order of the amplitude of the boundary perturbation, and therefore small. For certain combinations of parameters, however, "quasi-resonance" phenomena occur, indicating that an observable response will occur.

The results of this analysis would be particularly useful when undertaking an experimental investigation of elastic wave propagation in order to determine dynamic material properties or dispersive characteristics of a system, since the unrecognized occurrence of "quasi-resonance" phenomena could lead to gross misinterpretation of the experimental results.

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PROCEEDINGS OF THE SOCIETY

October 25, 1967. — A joint meeting of the Boston Society of Civil Engineers and the Massachusetts Section of the American Society of Civil Engineers was held this evening at the Student Union Building, University of Massachusetts, Amherst, Mass. The student chapters of the New England colleges were especially urged to attend.

At 6:30 P.M., a dinner was served in the Commonwealth Room, Student Union Building, and delegates from Northeastern University, Tufts University, Worcester Polytechnic Institute, University of New Hampshire, University of Massachusetts, University of Rhode Island, University of Vermont and Norwich University were present.

President Kinsel extended a cordial welcome to the students.

The secretary announced the names of applicants for membership.

President Kinsel introduced James P. Archibald, Vice President of Mass. Section of ASCE, and Thomas A. Grow, Secretary of Western Mass. Section of ASCE, and asked them to conduct any necessary business of ASCE at this time.

President Kinsel then introduced the guest speaker of the evening, Dr. T. William Lambe, who gave a most interesting talk on "Lunar Soil Mechanics. The talk was illustrated with slides.

A question period followed the talk. Two hundred fifty members and guests attended the dinner and meeting.

The meeting adjourned at 9:20 P.M.

Respectfully submitted,

Charles O. Baird, Jr.
Secretary

TRANSPORTATION SECTION

On Wednesday, October 18, 1967, a meeting of the B.S.C.E. Transportation Section was held at 47 Winter Street, Boston, Massachusetts. Approximately 22 members were present.

Mr. Charles H. Flavin, Jr., Chairman opened the meeting at 7:10 P.M.

Minutes of the previous meeting were read and accepted.

Mr. Flavin then introduced the speaker for the evening Mr. William R. McGrath, Transportation-Engineering Coordinator, Boston Redevelopment Authority, whose talk was entitled "The Approach to Transportation Planning in the Boston Area."

Mr. McGrath's talk put the finger on "diffusion of transportation authority" as being the cause for retarded transportation progress in the Boston Area. He gave specific examples relating to each one of the transportation planning agencies in the area.

Mr. McGrath then made the following suggestions for improvement of the transportation program:

1. Create a focus for transportation authority by the creation of a regional agency.
2. Have this regional authority pursue possible new federal-aid financing program for the establishment of a regional arterial highway system.
3. Attack the problem of "modal Split" through the use of new financing methods.

Respectfully submitted,

Maurice Freedman, Clerk

STRUCTURAL SECTION

A regular meeting of the Structural Section was held in the Society rooms on the evening of November 8, 1967. The meeting was called to order by Vice-Chairman Fritz Hampe at 7:05 P.M.

Mr. Hampe introduced the speaker of the evening, Prof. John Scrivener, visiting professor at M.I.T. from New Zealand, who spoke on "Prestressed Concrete Cylinder Shell Roofs" (Illustrated). Prof. Scrivener talked about his experience with prestressed cylinder shell roofs based on an aluminum model. The meeting adjourned at 8:15 P.M. after an interesting discussion period. There were 22 members and guests present.

Respectfully submitted,

Albert B. Rich,
Clerk

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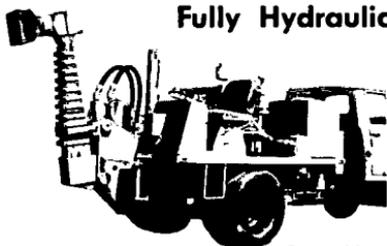
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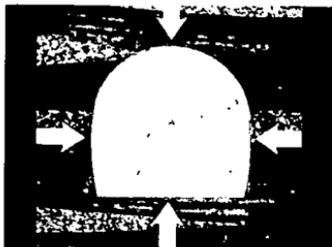
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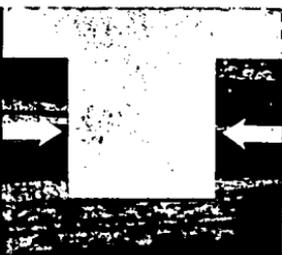
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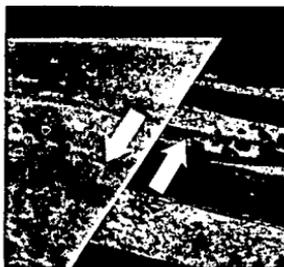


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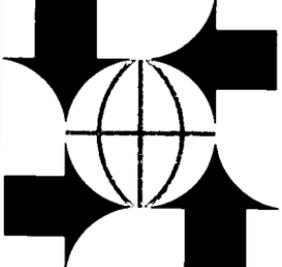


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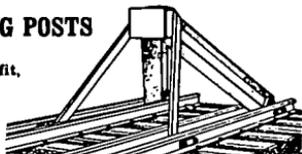
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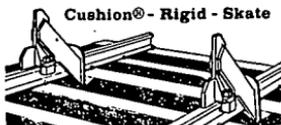
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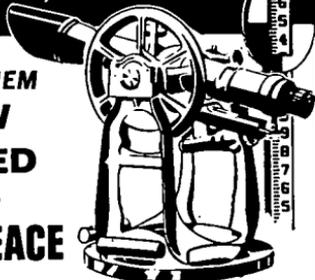
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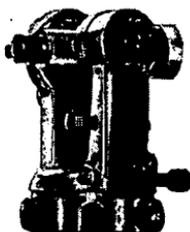
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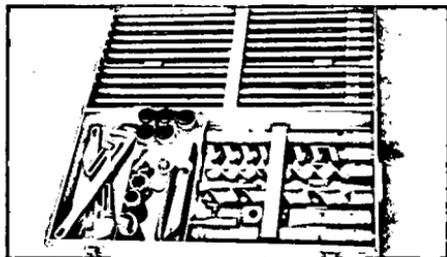
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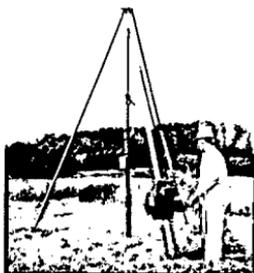
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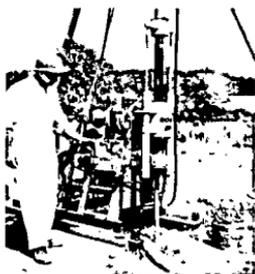
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