COMPTE-RENDU DE LA RÉUNION

ANNUELLE DE LA CTAA/ACTA

NOVEMBRE 88 - CALGARY

Préparé par: Richard Langlois, ing.
Chef - Division
Granulats et Revêtements Bitumineux

SAINTE-FOY, LE 2 FÉVRIER 1989.

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COMPTE-RENDU DE LA RÉUNION ANNUELLE

DE LA CTAA/ACTA CALGARY - NOVEMBRE 1988

1.0 IDENTIFICATION DU PARTICIPANT

1.1 Nom : Richard Langlois

1.2 Fonction : Ingénieur
Chef - Division Granulats et
Revêtement bitumineux

2.0 DESCRIPTION DES VOYAGES

2.1 Endroit : Calgary
2.2 Durée : 12 au 18 novembre 1988
2.3 Autorisation: 88-C-224
2.4 Raison du voyage : Participer à la réunion annuelle de la CTAA et présenter un rapport de direction de la CTAA/ACTA.

3.0 CARACTERISTIQUES DES REUNION

3.1 <u>Type de réunion</u> : Nationale

3.2 <u>Nom de l'organisme</u>: Association Canadienne des Techniques de l'Asphalte (ACTA).

3.3 <u>Contenu de la réunion</u>

3.3.1 <u>Liste des thèmes abordés</u>: Elle est présentée en annexe A avec quelques renseignements sur l'ACTA.

3.3.2 <u>Résumé des conférences et des discussions.</u>

Les sessions techniques ont été des plus intéressantes et très diversifiées: les auteurs venaient de différents milieux, de gouvernements, de municipalités, d'universités et de diverses entreprises privées.

Les principaux faits techniques découlant des diverses rencontres, discussions et présentations techniques se résument ainsi:

1 Varady et Pijl recommandent un sable angulaire à la place d'un sable naturel pour solutionner le problème d'orniérage. L'essai Hveem permet de prévoir l'orniérage

qui ne se produit pas (ou peu) si la stabilité est supérieure à 35 et les vides supérieurs à 2,5%.

2 La température produit un effet de vagues ou de gauchissement (rippling) dans les revêtements bitumineux et cela cause des fissures transversales.

3 Les polymères présentent certains bénéfices sur le bitume conventionnel mais aucun n'est une panacée. Certains, des types plastiques comme le polyéthylène, fournissent un module très élevé; d'autres, les types élastomères (SBR/SBS) offrent une grande ductilité et enfin toute la gamme de possibilités est offerte par les polymères qui se situent entre les deux tels les EVA ou polychloroprène.

4 Les asphaltènes dans les bitumes sont les contributeurs majeurs du PVN.

5 Le béton bitumineux pleine épaisseur (Full dept Asphalt) n'est plus construit en Alberta même si ce type de chaussée résiste très bien à la fissuration.

6 Ken Million a calculé que pour 37 fissures par kilomètre, le revêtement bitumineux a un retrait de 87 mm.

7 La théorie de la succion dans les sols explique non seulement les bris de structure de la chaussée mais, tel que je l'ai proposé, et accepté par Wilson et un groupe d'ingénieurs après la présentation, cette théorie peut expliquer le phénomène d'orniérage par déplacement dans le revêtement bitumineux.

8 La Saskatchewan recycle à chaud environ 200,000 tonnes/an de béton bitumineux. Avec des usines à fournée et tambour-sécheur-malaxeur avec pyrocone le bitume ne conserve que 60% de la valeur prédite par la charte alors qu'avec les tambours-sécheurs-malaxeur à entrée au centre on conserve 80% de cette valeur.

9 Selon Robertson, les bitumes mous rencontrent mieux que les additifs d'huile les exigences de faible volatilité et de viscosités appropriées pour le recyclage à chaud des enrobés bitumineux.

10 Une évaluation par Haas à l'Ile du Prince Edouard a montré que les coûts des différents choix d'entretien variaient de $17.60/m^2 pour un traitement de surface avec couche d'usure posée dans 5 ans, à $20,50/m^2 pour une couche d'usure immédiatement, et à $21,64/m2 pour un délai de 2 ans et une reconstruction.

11 Des essais triaxiaux cycliques ont montré en Alberta que les mélanges bitumineux recyclés résistent mieux à l'orniérage que les mélanges conventionnels. L'addition de polymère augmente aussi de façon significative la résistance à l'orniérage.

12 Selon R. Davis, il faut augmenter la grosseur de la pierre pour augmenter la résistance à l'orniérage des mélanges bitumineux. Il a déjà posé de la pierre de 75 mm dans un revêtement de 140 mm d'épaisseur.

13 Selon M. Geller, la grosseur maximale de la pierre dans un mélange peut être aussi élevée que les 2/3 de l'épaisseur du revêtement et ne devrait pas être inférieure à la 1/2 de l'épaisseur pour fournir une bonne résistance à l'orniérage.

14 La granulométrie des mélanges bitumineux (teneur en pierre, grosses pierres) et la qualité des granulats (faces fracturées et rugueuses, sable manufacturé) sont les deux points les plus importants pour améliorer la résistance à l'orniérage des mélanges bitumineux.

15 Selon CC Dawley un mélange bitumineux résistant à l'orniérage doit avoir les caractéristiques suivantes:

- Pierre retenue sur le tamis 12,5 mm	: 8 à 12%
- Pierre retenue sur le tamis 5 mm	: 45 à 60%
- Feuil minimum de bitume	: 6,5 um
- % VAM comblé par le bitume	: 75 à 80%
- % de sable manufacturé	: 75%
- % de sable naturel	: 25%
- Stabilité minimale	: 10 KN

Selon lui, les coûts de ce mélange est égal ou légèrement inférieurs au mélange conventionnel, car si le coût des granulats augmente, le coût du bitume, de la pose et du compactage diminue.

16 L'influence du trafic qui produit l'orniérage se fait jusqu'à 70 mm de profondeur.

17 L'entrepreneur de Lethbridge en Alberta a trouvé des coûts de 15% supérieurs pour mettre de la pierre 16 mm et 75% de sable manufacturé dans un contrat de mélange bitumineux (Mrs Marty Tallship).

18 Pour concevoir des mélanges résistances à l'orniérage, le professeur Byron Ruth de la Floride recommande

l'utilisation de la presse à cisaillement giratroire pour faire le design.

19 L'Ontario a trouvé que l'échantillonnage par carottes confirme dans 88% des cas les résultats obtenus par les plaques. Leurs lots de contrôle sont de 2000 tonnes et leur sous-lot de 500 tonnes.

20 Selon Stella White de la Saskatchewan 55^{o}C est la température limite du revêtement bitumineux en dessous de laquelle il est impossible d'accroître la densité des revêtements bitumineux par compactage avec rouleaux.

21 L'Ontario a sorti un guide pour rejeter la ségrégation dans les mélanges bitumineux et fait un ajustement de $21/mi^2, pour les surfaces ségragées.

22 Le FWD évalue les designs structuraux selon une équivalence de vitesse de 60 km/h.

23 Une évaluation des mélanges recyclés par L. Wood montre que ceux-ci ont une rigidité, une résistance à la déformation permanente et des caractéristiques à long terme équivalentes ou meilleures que celles des mélanges conventionnels.

24 Selon C.E. Rodier de la ville de Calgary, les mélanges à l'amiante sont parmi, sinon le meilleur, les meilleurs mélanges pour résister à l'orniérage et avoir une excellente durabilité. Certains mélanges avec polymère sont aussi performant que ceux à l'amiante.

25 Même avec polymère, une couche d'usure de béton bitumineux de 40 mm n'arrête pas les fissures de réflexion qui réapparaissent sur un espacement de 8 m peu de temps après la pose (80% à l'intérieur de 2 ans).

3.3.3 Documentation recueillie

L'annexe B fournit les titres des exposés, des conférences et des documents techniques recueillis.

3.4 Liste des personnes assistant aux réunions

Elle est présentée en anne C.

4.0 NATURE DE MA PARTICIPATION

1. Sessions techniques

J'ai posé des questions ou fait des commentaires sur toutes les conférences, particulièrement celles sur l'orniérage des revêtements en béton bitumineux, les mélanges avec bitume polymère.

2. Réunion du C-SHRP

A titre de président du comité consultatif asphalt, j'ai présidé cette réunion de 5heures tenue le 17 novembre 1988. Les minutes de cette réunion sont données à l'annexe D

3. Réunion de l'ONGC

A titre de membre du comité de matériaux, j'ai participé à cette réunion ou j'ai activement contribué à rendre non persuasifs des votes négatifs empêchant l'adoption d'une nouvelle spécification sur les bitumes. Cette réunion s'est tenue le 17 novembre 1988 de 9h00 à 13h00. La nouvelle spécification sur les bitumes incluant leur susceptibilité à la température est enfin adoptée et sera publiée officiellement en 1989 après plus de 10 ans d'efforts.

4. Réunions du bureau de direction de la CTAA

Les 13 et 14 novembre j'ai présenté un rapport verbal sur les cours de béton bitumineux que le MTQ organise avec le comité bipartite. De plus, j'ai moussé la candidature à Montréal pour le congrès 1991.

5.0 POINTS D'INTÉRETS POUR LE MTQ

Tous les faits techniques énumérés dans le résumé des conférences et des discussions sont d'un intérêt pour le MTQ. Les points suivants sont d'un intérêt peut-être plus marqué.

1. Devant le succès dans les autres provinces du mélange bitumineux recyclé, le MTQ ne devrait pas abandonner ce procédé mais plutôt corriger le contrôle qualitatif déficient qui est la cause de certains échecs au Québec. Il s'agit de vérifier les propriétés du bitume récupéré et d'exiger qu'elles rencontrent les normes.

2. Le MTQ devrait équiper le Laboratoire Central d'appareils pour réaliser des essais Triaxiaux cycliques

sur les mélanges bitumineux. Il devrait aussi l'équiper d'une presse à cisaillement giratoire. Cela permettrait de meilleurs designs de revêtements bitumineux.

3. Il faut que les spécifications sur les mélanges bitumineux pour routes fortement sollicitées (donc sujet à l'orniérage) telles que proposées par différentes personnes (dont le sous-comité bipartite design) soient adoptées le plus rapidement possible par le MTQ. Cela veut dire des mélanges plus pierreux, avec de la pierre plus grosse et 75% de sable manufacturé.

4. Comme l'influence du trafic sur l'orniérage se fait jusqu'à une profondeur de 70 mm, la réparation d'un revêtement très orniéré devrait débuter par l'enlèvement d'une couche minimale de 50 mm.

5. Le MTQ devrait adopter le guide de l'Ontario pour rejeter les surfaces ségréguées des revêtements bitumineux.

6.0 AUTRES INFORMATIONS

En résumé, cette réunion a été l'objet d'échanges très fructueux pour tous les participants grâce aux très bonnes dispositions matérielles mises à leur service. La prochaine réunion annuelle se tiendra à Halifax en novembre 1989, et méritera elle aussi que le Québec y délègue des représentants, non seulement pour acquérir de nouvelles connaissances, mais aussi pour faire profiter aux autres ses propres connaissances. De plus, les personnes déléguées devraient avoir une bonne connaissance de l'anglais, des connaissances techniques importantes et une aisance à parler en public afin d'y faire valoir le point de vue du Québec et de faire bénéficier les autres des techniques développées au Québec.

De plus, les suggestions suivantes sont proposées:

Les firmes d'ingénieurs du Québec et les laboratoires privés sont très peu représentés à la CTAA. Cela est dommage car plusieurs recherches sont présentées.
La direction de la recherche au MTQ par son Bulletin Recherche Transport pourrait faire une campagne de sensibilisation.

Chaque délegué du MTQ devrait avoir lors d'un congrès hors Québec un petit "KIT" comprenant des pamphlets, guide de vacance au Québec, épinglettes, etc. qui pourrait servir à la promotion touristique du Québec. Je l'ai fait individuellement avec les moyens du bord et cela a porté des fruits car plusieurs personnes se sont montré intéressés et ont perdu leurs préjugés défavorables.

Les affaires extra ministérielles et le service des communications pourraient préparer ces "KITS" pour les délégués qui seraient intéressés. Cela ne nuirait pas à la mission technique du délégué et créerait un nouvel intérêt qui aurait sûrement des retombés intéressantes pour le Québec.

C.C. MM. Claude Lortie
Pierre Lafontaine
Yvan Demers
Paul Brochu
André Arès
Roger Fortin
Ted Giona
Service- Relations ministérielles
Centre de Documentation

Sainte-Foy, le 2 février 1988.

ANNEXE A

LISTE DES THEMES ABORDÉS

Canadian Technical Asphalt Association

33rd Annual Conference

NOVEMBER 14, 15, 16
1988

Convention Centre
Calgary, Alberta

RENSEIGNEMENTS SUR L'ASSOCIATION CANADIENNE DES TECHNIQUES DE L'ASPHALTE

1. L'Association s'est formee a Victoria, C.-B. les 25 et 26 octobre 1956 au cours d'une reunion qui regroupait quarante-huit personnes.

2. Les buts de l'Association sont:

   a) de presenter une societe technique pour encourager les echanges, entre ses membres et l'industrie, de renseignements sur les caracteristiques et les usages des materiaux a base d'asphalte;

   b) de mettre au service du public les donnees techniques qui ont ete rassemblees et etudiees par ses membres et ce, sans but lucratif;

   c) d'organiser des conferences pour discuter des caracteristiques et des usages des materiaux bitumineux;

   d) d'encourager et de stimuler la recherche de nouvelles technologies reliees aux caracteristiques et aux usages des materiaux asphaltiques.

3. Pour adherer a l'Association, il suffit d'avoir une certaine experience des usages et caracteristiques des materiaux asphaltiques ou de s'y interesser. L'Association accepte egalement des membres bienfaiteurs qui n'ont cependant pas le droit de vote.

4. La premiere reunion annuelle a eu lieu le 1er novembre 1956 en Alberta, a l'hotel MacDonald d' Edmonton. Subsequement, les reunions ont ete tenues dans la plupart des grandes villes canadiennes. Les villes et annees ou ont eu lieu ces reunions sont enumerees dans la section des anciens presidents.

5. L'Association compte environ cinq cent cinquante membres repartis dans chacune des provinces du Canada ainsi qu'un nombre considerable de membres provenant de divers pays etrangers.

6. Les proces-verbaux de chaque conference sont publies annuellement et il s'ensuit une demande considerable de la part de non-membres, comme les bibliotheques, les services d'abonnement, les universites, les organismes gouvernementaux, les centres de recherche, provenant autant d'Amerique du Nord que d'outremer.

7. L'Association est administree benevolement par ses membres et par differents comites qui contribuent a sa bonne marche. L'Association n'emploie pas de personnel permanent.

8. Les formules d'adhesion et les offres de presentation doivent etres adressees au:

   Secretaire-tresorier
   C.P. 13[illegible]
   Victoria, C.-B.
   Canada

CTAA PAST PRESIDENTS

	City in Which Conference was Held
1956 - D.T. Willis	Edmonton
1957 - D.T. Willis	Regina
1958 - W.E. Winnitoy	Toronto
1959 - R.F. Binnie	Winnipeg
1960 - F.C. Brownridge	Montreal
1961 - N.M. McCallum	Victoria
1962 - S.J. Cunliffe	Regina
1963 - W.P. Cheney	Toronto
1964 - H.K. Matthews	Calgary
1965 - A.E. Holberg	Quebec
1966 - J.W.G. Kerr	Vancouver
1967 - G.L. Huot	Halifax
1968 - F. Field	Ottawa
1969 - H.R. Hawthorne	Edmonton
1970 - J. Cewe	Winnipeg
1971 - R.A. Burgess	Montreal
1972 - M.F. Clark	Vancouver
1973 - G.L. Church	Quebec
1974 - A. Chouinard	Regina
1975 - J. Ferguson	Toronto
1976 - J.T. Corkill	Calgary
1977 - D.R. Morrison	Halifax
1978 - D.J. Bird	Winnipeg
1979 - L.H. Runolfson	Ottawa
1980 - R. Langlois	Victoria
1981 - A.T. Bergan	Montreal
1982 - R.B. Diamond	Edmonton
1983 - D.P. Manzer	Quebec
1984 - P. Perrone	Saskatoon
1984 - R. Mack	Moncton
1986 - C. B. Dawley	Vancouver
1987 - H.K. Fraser	Toronto

1988 OFFICERS AND DIRECTORS

W.B. Chambers	President
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J.J. Emery	2nd Vice-President
H.K. Fraser	Past President
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Proceedings Committee

E. Thompson, Chairman	Winnipeg

CTAA

33rd Annual Conference

NOVEMBER 14th, 15th, and 16th, 1988

GENERAL INFORMATION

The Thirty-Third Annual Conference is being held at the Convention Centre, Calgary, Alberta

REGISTRATION

CTAA members and all others interested in the technical problems involved in the production and use of asphalt and allied materials are welcome to attend upon payment of the registration fee. The Registration Desk will be open on November 13th at 7:00 p.m.

The registration fee has been set at $175.00 for members, $225.00 for non-members and $45.00 for spouses.

SOCIAL HOURS AND BANQUET

Tickets for the Social Hour and Banquet will be available at the Registration Desk. Cutoff time for tickets will be 10:00 a.m., Tuesday, November 15th. The registration fee includes one banquet ticket. Additional banquet tickets will cost $40.00 each.

PROGRAMME SUMMARY

Sunday, November 13th

7:00 to 10:00 p.m.	Registration

Monday, November 14th

8:00 a.m. to 5:00 p.m.	Registration
9:00 a.m. to 10:15 a.m.	Business Meeting (Members Only)
10:30 to 12:00 noon	Technical Session
1:30 p.m. to 5:30 p.m.	Technical Session
5:30 p.m.	Western Entertainment

Tuesday, November 15th

8:00 a.m. to 5:00 p.m.	Registration
8:30 a.m. to 12:00 noon	Technical Session
1:30 to 4:30 p.m.	Technical Session (Contractor's Workshop
6:30 p.m.	Reception
7:30 p.m.	Banquet

Wednesday, November 16th

8:30 a.m. to 12:00 noon	Technical Session
1:30 to 4:30 p.m.	Technical Session

The Authors will meet for breakfast with the Daily Program Chairman on the day of their presentation.

The Ladies Program will be available at the registration desk.

1988 CTAA PROGRAM

MONDAY MORNING, November 14th
10:30 am to 12:00 p.m.

CHAIRMAN: Wayne Chambers

Paper #1 "Pavement Rutting Problems in the Light of Hveem and Marshall"

By: B. Varaday and J. Pijl (B.C. Highways)

Paper #2 "Cracking Mechanisms of Asphalt Concrete Pavement at Low Service Temperatures"

By: Reynaldo Roque and Byron E. Ruth, Florida Dept. of Transportation

MONDAY, November 14th
1:30 pm to 5:00 pm

CHAIRMAN: Ed Lyons

Paper #3 "Low Temperature Benefits of Polymer Modified Asphalts"

By: G.N. King, H.W. King, P. Chaverot and T. Hebert, Elf Asphalt

Paper #4 "Asphalt Chemical Components and Physical Properties are Related Mathematically"

By: Troy E. Mullins, Unichem International, Michael D. Shorland, Bear Creek Corporation

Paper #5 "A Study of Low Temperature Transverse Cracking in Alberta"

By: David Palsat, Alberta Transportation

Paper #6 "Failure of Full Depth Asphalt Concrete on Expansion Clay Subgrade"

By: Edward A. Wilson, Clifton Associates Ltd.

TUESDAY, November 15th
8:30 am to 12:00 noon

CHAIRMAN: Doug Grevilie

Paper #7 "A Procedure for the Design of the Bitumen in Hot Recycled Asphalt Concrete"

By: George Stamatinos, Saskatchewan Highways and Transportation

Paper #8 "Mix Design - The Key to Successful Pavement Recycling"

By: W.D. Robertson and B.B. Adams, Esso Petroleum Canada

Paper #9 "Establishing Cost-Effective Rehabilitation Strategies for P.E.I. Highway Pavements"

By: R. Haas, M. Bailey, L. Bell and F. Yurkiv

Paper #10 "An Evaluation of the Influence of Binder Effects on Permanent Deformation of Asphalt Concrete"

By: Chuck McMillan and Ken O. Anderson, Alberta Transportation, University of Alberta

TUESDAY NOVEMBER 15th
1:30 pm to 4:30 pm
CONTRACTOR'S WORKSHOP

CHAIRMAN: John Emery

Paper #11 "Reduction of Low-Temperature Cracking in Asphalt Pavement Through the Use of Large Stone Mixtures"

By: Richard L. Davis, Koppers Company Ltd.

Paper #12 "Reflections about the Influence of Gradation on Resistance to Deformation to Reducing Rutting"

By: Mike Geller, Mike Geller Compaction Consultant

Program "Instability Rutting of Flexible Pavements"

WEDNESDAY, November 16th
8:30 am to 12:00 noon

CHAIRMAN: Frank Gervais

Paper #13 "Cost-Effective Pavement Construction Using Geogrids, Geotextiles and Full Depth Asphalt"

By: P.D. Anderson, Trow Geotechnical Ltd.

Paper #14 "The Variability of Plate and Cored Samples Taken Within Two Meters"

By: R.C. Evers, Ministry of Transportation, Ontario

Paper #15 "Saskatchewan Pavement Cooling Charts: Development of a Tool to Control Paving Operations in Marginal Weather"

By: Stella White, Saskatchewan Highways and Transportation

Paper #16 "Attacking the Problem of Segregated Hot Mix Pavements"

By: P. Korgemagi, Ontario Ministry of Transportation

WEDNESDAY, November 16th
1:30 pm to 5:00 pm

CHAIRMAN: Roland Drouin

Paper #17 "Dynamic Material Behaviour: A Case Study"

By: B. Phang, R. Haas, J. Woodrooffe and A.T. Papagiannakis, Memorial University of Newfoundland

Paper #18 "Evaluation of Hot Recycled Asphalt Mixtures Containing Large Amounts of R.A.P. for Use as Surface Mixtures"

By: A. Samy Noureldin, Indiana Department of Highways

Paper #19 "Effect of Coal Contaminated Aggregate on Asphaltic Concrete Pavement Performance"

By: Vishnu A. Diyaljee, Alberta Transportation and Utilities

Paper #20 "What Happened to Calgary's Surface Overlays?"

By: C.P. Rodier and R.P. Kitchen, City of Calgary

ANNEXE B

DOCUMENTATION RECUEILLIE

PROCEEDINGS

of the

THIRTY-THIRD ANNUAL CONFERENCE

of

CANADIAN TECHNICAL ASPHALT ASSOCIATION

Editor: Elaine Thompson

ISBN 0-921317-14-X

Polyscience Publications Inc.
Montréal, Québec, Canada.

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GENERAL INFORMATION

ABSTRACT

The Canadian Asphalt Mix Exchange began in the early 70's. A group of laboratories wanted to compare their results from standard tests performed on prepared samples of aggregate, liquid asphalt and asphalt concrete. The test results and a statistical review are reported to each participating laboratory. Following the actual testing program, a joint meeting is held to critically review the test results. From this critique, actual test procedures are modified and improved and these new test procedures are implemented for the next year's Exchange. A host laboratory prepares standard samples for each participating laboratory. These samples are tested according to specific instructions and/or standard test methods which had been agreed to from the previous year(s).

This annual report updates and collaborates the data obtained by the laboratories from across Canada who participated in the 1986 Canadian Asphalt Mix Exchange.

ABSTRACT

This paper describes the Petro-Canada pavement performance simulation test facility in which asphalt pavements are built from the subgrade up and tested under full-scale dynamic loads simulating heavy trucks. Pavement performance is monitored over hundreds of thousands of load cycles indicating the long-term pavement load associated performance.

Results of two investigations are given illustrating use of the facility to compare pavement rutting performance of three 85-100 pen asphalt cements and to determine effects of inadequate or marginal compaction levels on long-term pavement performance.

The results of the first investigation indicated that pavement rutting performance varied significantly from one asphalt cement to another even though all test asphalts were of the same penetration grade. Pavements incorporating asphalt cement with higher viscosity figures and better temperature susceptibility provided the best performance whereas pavements incorporating asphalt with lower viscosity and higher temperature susceptibility provided the worst rutting performance under the same test conditions.

The test results of the second investigation showed that construction quality has significant effects on long-term pavement performance. Severe pavement deformation and early failures developed in pavements with marginal/inadequate compaction levels of the hot mix and/or of the granular base layers. Quality construction of the various pavement layers is essential to avoid premature pavement failure.

RÉSUMÉ

Les installations dans lesquelles Petro-Canada simule le rendement des revêtements pour chaussée et où sont élaborés les revêtements d'asphalte sont décrit. Simulant le passage des camions lourds, on répète les essais des milliers de fois pour évaluer le rendement à long terme des revêtements.

Les résultats des deux études, effectuées dans ces installations, sont trouvés dans cet article.

Dans la première étude, le rendement des revêtements composés de bitume à viscosité élevée et ayant une meilleure susceptibilité thermique était beaucoup supérieur à celui des revêtements composé de bitume à faible viscosité et offrant une susceptibilité thermique plus élevée dans les mêmes conditions d'essai, même si la pénétration des bitumes était la même.

Les résultats de la deuxième étude ont démontré que les revêtements dont les niveaux de compactage du mélange chaud et/(ou) des couches de granulat sont à la limite des spécifications ou inappropiés se déforment exagérement et se crevassent prématurément.

USE OF LARGE STONE MIXTURES 43

ABSTRACT

The traditional approach to reducing low temperature cracking in asphalt pavements has been through the selection of a special or a modified binder whose stiffness does not exceed a critical level at the lowest temperature to which the pavement will be exposed. The drawback to choosing a lower viscosity asphalt binder is that the pavement may not have sufficient resistance to deformation at the highest temperatures of exposure.

Resistance to deformation at higher temperatures is usually increased through selection of aggregates with good shape and frictional properties. Modern asphalt mixture designers have neglected, for the most part, the added resistance to deformation which comes from the use of stone which is large in relation to the thickness of the pavement. The inclusion of stone with a top size that is two-thirds the thickness of the pavement greatly increases the bearing capacity of the pavement and reduces its temperature susceptibility. Mix designers who are faced with a wide range of temperatures in their region could find help in coping with these conditions through the judicious use of large stone.

CRACKING MECHANISMS AT LOW TEMPERATURES 57

ABSTRACT

The cracking of flexible pavements at low temperatures has generally been attributed to thermal contraction and limiting stiffness, neglecting the effects of wheel loading and the rate of cooling.

Two pavements constructed in a test pit produced lift-off of asphalt concrete from the crushed stone base during cooling of the pavement. Temperature differentials within the asphalt concrete produced stresses and creep strains which caused "rippling" to occur in the form of a sine wave. Dual wheel loading of the pavement at the lift-off locations gave deflections and strains about twice the magnitude of those obtained when the pavement was in full contact with the base course.

These observations indicate that mechanistic flexible pavement analysis and design methods should be separated into two phases - initial fracture and crack propagation. It is suggested that asphalt viscosity-temperature relationships can be used to predict the low temperature and fracture characteristics of mixtures. Combined with mechanistic behavioural response models, these parameters can eventually provide an evaluation of a pavement's potential for crack development and a more definitive estimate of pavement life and rehabilitation needs.

ATTACKING SEGREGATED HOT MIX PAVEMENT.

ABSTRACT

In 1984 the Ontario Ministry of Transportation rejected large quantities of segregated pavement on one contract, and, on another contract banned a batch plant with a track record of producing segregated pavement from Ministry work.

During the fall of the same year the Bituminous Section reviewed segregated pavements throughout Ontario. Based on this review procedures were developed to address segregation. A system of classification was established; the terms slight, medium and severe were used to visually categorize segregation. Mix that was classified as slightly segregated was considered not to be a problem. Medium segregation was allowed to remain in place in the binder lift but was subject to removal or price adjustment in the surface. Severe segregation was subject to removal from any lift. Operational guidelines were developed covering definitions, disposition of material, magnitude and extent of removals, price adjustments, and remedial procedures.

The Ontario roadbuilders had numerous concerns with the procedures. These included mix design responsibility and thus responsibility for the segregation and non-uniformity of the segregation classification due to its subjective nature.

Because of the emphasis put on segregation the quantity of pavement which was subjected to price adjustment or removal declined from 180,000 square metres in 1985 to 6,600 square metres in 1987.

RÉSUMÉ

En 1984, le ministere des Transports de l'Ontario a rejeté de grandes quantites de revêtement routier segregé objet d'un seul contrat et, en ce qui concerne un autre contrat, a décidé d'exclure une usine de fabrication dont les produits étaient trop souvent défectueux de sa liste des fournisseurs de revêtements ségrégés.

Au cours de l'automne de la même année, la Section des bitumeux a étudié les revêtements ségrégés dans tout l'Ontario. À la suite de cette étude, on a mis au point des procédures de ségrégation. On a créé un systeme de classification et adopté les termes léger, moyen et grave afin de représenter la ségrégation. Les mélanges de la categorie "léger" ne présentent pas de probleme. On a décidé de laisser en place les mélanges classés "moyens" dans le liant routier sous réserve d'enlèvement ou de révision du prix de la surface. Les mélanges classés "graves" doivent être enlevés de tout liant. On a mis au point des directives d'exploitation couvrant les définitions, la disposition des matériaux, l'importance et l'étendue des enlèvements, la révision des prix et les procédures de réparation.

Les constructeurs de routes de l'Ontario ont présenté de nombreuses objections à ces procédures dont la responsabilité de la composition des mélanges, et donc la responsabilité de la ségrégation et de la non-uniformité de la classification de la ségrégation du fait de sa subjectivité.

À cause de l'importance accordée à la ségrégation, la quantité de revêtement sujette à une révision des prix ou à l'enlèvement est tombée de 180 000 m^2 en 1985 à 6 600 m^2 en 1987.

ABSTRACT

In 1987, the Ontario Ministry of Transportation conducted a study to compare test results of plate samples taken at the time of placement, to three cored samples taken in close proximity after construction. The samples were tested for acceptance parameters; asphalt cement, + 4.75 mm and + 75 µm content.

This work was performed on five contracts and the results are contained herein. Tabulated data includes individual test results as well as summaries. Control charts for asphalt content and + 4.75 mm content are presented with both plate and core data points plotted. Scatter charts with asphalt content plotted against + 4.75 mm content including best fit line and correlation coefficient are contained.

Analysis of the data shows that 88% of the time the average values of the three cores support the determinations from the plate samples. However, individual core values can differ significantly from each other and from the plate

Analysis of the control and scatter charts reveal:

1. a mix which has shifted from the design for both the asphalt and +4.75 mm sieve content,
2. a problem of the technician segregating the test portion of samples,
3. examples of mix segregation.

RESUMÉ

En 1987, le Ministere des Transports de l'Ontario a conduit une étude à comparer les resultats des tests sur les plaques échantillons obtenues au moment du placement avec ceux de trois carottes prélevées après la construction, trés près des sites des plaques échantillons. Les échantillons etaient examinés pour les paramètres de convenance - teneur en ciment d'asphalte, + 4.75 mm et + 75 um.

Ce travail etait effectué sur cinq contrats et les resultats sont exposés ici. L'analyse des données révèle que dans 88% des cas les valeurs moyennes des trois carottes confirment les resultats obtenus à partir des plaques échantillons. Toutefois, on constate des différences considérables entre les valeurs obtenues pour chaque carotte et pour les plaques.

L'analyse des tables de contrôle et de dispersion révèle:

1. un mélange dont les teneurs en asphalte et en + 4.75 mm devient des normes,
2. la difficulté pour le technicien de ségreger les parties à tester des échantillons,
3. des exemples de séparations du mélange.

INFLUENCE OF GRADATION ON DEFORMATION RESISTANCE 10[illegible]

ABSTRACT

Rutting and flushing of bituminous concrete pavements has been a reccurring phenomena in every decade for at least 60 years. The problem has been analyzed and resolved many times. These solutions have been well documented in the literature of several countries.

The objective of this review was to seek support from past investigations for the contention that plastic deformation (rutting) in the surface layer could be overcome by grading to higher concentrations of coarse aggregate, using larger effective particle sizes, employing higher laboratory compaction effort and requiring field compaction to lower air voids.

There is ample evidence in the literature to confirm the validity of these possibilities for eliminating rutting in the surface layer. The proviso to these solutions requires adequate underlayer support in the base and subgrade. When such support is inadequate, a mechanically stable surface layer will still be subject to premature rutting or fatigue failure. The use of a compaction index to determine the compactibility of the mix is suggested according to Fromm or Arand.

SASKATCHEWAN PAVEMENT COOLING CHARTS 121

ABSTRACT

Although pavement cooling is not the only factor which determines the final strength and life expectancy of a pavement, it is one of the most important during the final construction process when paving in colder weather. This paper presents some of the results from a cold weather pavement cooling study which was conducted in Saskatchewan. The results illustrate the significance of factors affecting pavement cooling, the experimental verification of a finite difference model and a method of predicting available compacting time when paving in colder weather.

ABSTRACT

Crushed aggregate containing coal was used in the construction of asphaltic concrete pavements on 23 km of secondary and primary highways. Within 5 months after construction, ravelling, pitting and potholing had occurred.

Aggregate with 8% by weight coal was identified during the quarrying and crushing stages. Retained stabilities of 20% to 69% were obtained for crusher and drier sampled aggregates respectively. Based on the higher stability obtained from the processed aggregate, it was decided to allow the use of this material. This decision may have been influenced by a contract deficiency pertaining to the amount of deleterious material that was acceptable.

A 70% retained stability was chosen as the minimum requirement for the production ACP. After 6 km had been paved it was necessary to blend the mix with 20% clean aggregate which raised stabilities above 80%. Ultimately the blended pavement suffered distress as well.

To stop the deterioration, a fog seal was applied to the secondary roadways. Subsequently, a single surface seal coat was applied to all roadways. No further pavement distress manifestations have been reported and the roadways are performing well.

ABSTRACT

A procedure, developed for the design of the bitumen in hot recycled asphalt concrete pavements, has been successfully used in the production of approximately 470 000 tonnes of hot recycled asphalt concrete over the past three years. It allows the pavement designer to choose a DESIGN (field mixed) penetration for the hot recycled asphalt concrete mix and then design the recycled bitumen blend to satisfy these requirements, the procedure provides the following advantages:

a. Consideration is given to the occurrence of bitumen hardening during plant mixing.

b. Only one new bitumen additive in the mixing plant is used, thereby eliminating the need for additional storage tanks or pre-mixing.

c. The concept of APPARENT penetration is introduced which allows for the design of high ratio (reclaimed AC content in excess of 50%) hot recycled AC mixes to suit the needs of the project in terms of final field penetration.

d. The penetration of the lab and field mixes are related to the standard mix and compaction temperatures/viscosity relationships used in mix design.

The development, properties and application of the recycling grade emulsions HF-100R and HF-700R currently used by Saskatchewan Highways and Transportation in the production of High-Ratio hot recycled mixes are discussed, along with a typical design example.

ABSTRACT

To address problems of temperature susceptibility, asphalts are being modified by polymers. A softer asphalt can be used to prevent low temperature brittleness and cracking, when polymer modification improves its high temperature rheology. To evaluate and specify the polymer modified binders, classical asphalt test methods are being supplemented by classical rubber test methods, such as elastometry, and new test methods specific to the new materials, such as force ductility. Heukelom diagrams, PVN values, and other indices indicate the decreased temperature susceptibility of an asphalt modified by a styrene butadiene diblock copolymer chemically crosslinked to the asphalt. Similarly, polymer tests demonstrate the improvement of viscoelastic properties at low temperatures. Sophisticated analytical methods, such as differential scanning calorimetry, FT-IR spectroscopy, and optical and electron microscopy are being used on a research basis to investigate the molecular structuring and low temperature behavior of these materials. Similarly, conventional mix test methods, such as fatigue and stiffness, are being updated. Dynamic modulus testing showed an improvement of 17% higher stiffness at high temperatures, and 10% lower stiffness at low temperatures after polymer modification. A study of thermally induced stresses demonstrates the ability of SB materials to resist cracking at low temperatures. Several field trials of polymer modified materials used in cold climates are reviewed.

Pour pallier aux problemes de susceptibilite thermique on modifie les bitumes par des polymeres. Un bitume plus mou peut etre utilise pour diminuer la fragilite a basse temperature et la fissuration si la modification par un polymere ameliore son comportement rheologique aux temperatures elevees. Pour evaluer et classer les liants modifies par les polymeres on complete les methodes d'essai traditionnelles par les methodes d'essais classiques des caoutchoucs, telle que la mesure de l'elasticite, et par de nouvelles methodes, specifiques de ces nouveaux materiaux, tel que l'essai de ductilite associe a une mesure de la force necessaire a l'elongation. Les diagrammes de Heukelom, l'indice penetration-viscosite, ainsi que d'autres indices informent sur la diminution de la susceptibilite thermique d'un bitume modifie par un copolymere bisequence de butadiene et de styrene chimiquement greffe au bitume. De meme les essais appliques aux polymeres montrent l'amelioration des proprietes elastiques a basse temperature. Des methodes analytiques sophistiquees, telles que l'analyse thermique differentielle, la spectrometrie infra-rouge a transformies de Fourrier et les microscipies optique et electronique seront utilisees pour la recherche visant a preciser la structure moleculaire et le comportement a basse temperature de ces materiaux. De meme les methodes conventionnelles d'essai des enrobes, telles que la fatique et le module, seront adaptees. L'essai de module dynamique montre une amelioration de 17% du module a haute temperature et une diminution de 10% de la fragilite a basse temperature apres modification par un polymere. Une etude sur les contraintes induites par effect thermique demontre la faculte presentee par les materiaux modifies par des copolymeres butadiene-styrene bisequences de resister a la fissuration de retrait thermique. Plusieurs sections experimentales concernant des materiaux modifies par des polymeres utilises dans des pays froids sont passees en revue.

LOW TEMPERATURE TRANSVERSE CRACKING IN ALBERTA [illegible]

ABSTRACT

Low temperature transverse cracking of asphalt concrete pavements is associated with large areas of Canada and can result in reduced pavement riding quality, increased pavement maintenance costs and premature pavement rehabilitation. In this investigation, the performance of asphalt concrete pavements constructed by Alberta Transportation was studied in an attempt to identify the major factors that are influencing low temperature transverse cracking.

The investigation concentrated on the field identification of transverse cracking behavior on 77 highway sections (55 full depth and 22 granular base pavement structures) totalling 991 km of original asphalt concrete pavement constructed on the rural highway network in Alberta between 1970 and 1979. A data file of materials, structural and environmental parameters and characteristics was developed for analysis.

The three most significant variables identified that had the greatest influence on the frequency of transverse cracking were pavement thickness, original asphalt stiffness predicted using McLeod's method and based on site specific temperature conditions, and pavement age. A critical original asphalt stiffness was identified. Using the cracking frequency model, a design map was developed for Alberta that can be used in selecting the appropriate asphalt grade and type that would optimize the low temperature performance of the pavement.

INFLUENCE OF BINDER ON PERMANENT DEFORMATION 237

ABSTRACT

Deformation or rutting in the wheelpaths of asphalt concrete pavements reduces the overall rideability and safety of the roadway. Increased truck tire loadings make rutting a widespread problem and a matter of concern for highway agencies throughout Canada and other countries.

A laboratory testing program conducted as part of a joint project with the University of Alberta and Alberta Transportation and Utilities examined the role of the binder in asphalt concrete pavement rutting. Four grades of conventional paving asphalts, recycled binders targetted to four different grades, and two polymer modified asphalt binders were used to prepare 18[illegible] cylindrical specimens (102 X 204 mm) which were then subjected to repeated triaxial loading.

While the grade of virgin asphalt binder affected the permanent deformation minimally, the rheology of the binder was a more significant factor than were the characteristics of the aggregate or mix. Recycled mixes experienced less deformation than did virgin mixes, apparently a function of the resulting rheology. Polymer modified asphalt mixes were found to increase resistance to permanent deformation more significantly. Models developed for the test data help to illustrate the relative influence of binder rheology on the observed deformations of the various mixes.

ABSTRACT

What happened to Calgary's Surface Overlays?

Until the mid-1980's surface overlay materials in Calgary incorporated asbestos fibres. For a decade these asphalts proved to be a cost effective material for surface course construction. Due to concern for the environment and for occupational health, use of asbestos was stopped and alternate materials had to be found.

The ideal material will be one that:

- can be placed under adverse conditions:
  - low temperatures
  - strong winds,
  - minor precipitation
- will retain high viscosity at high temperatures to avoid flow, rutting, and pushing at intersections.
- will show minimum viscosity increase at low temperatures to avoid transverse cracking.
- will be unaffected by routine chemical spills from traffic.

While searching for this ideal material, a variety of surface overlays have been tried. These have included asphalts modified with latex, tremolite, diatomaceous earth, and several generations of polymers. Field test sections using these materials were begun in 1984 and continued to the present.

Certain types of polymers have produced the most promising results. These polymers are evolving through active research by industry to produce the product we need.

EXTRAIT

Ce qui est arrivé au recouvrement de la chaussée à Calgary.

Jusqu au milieu des 80, les matériaux de recouvrement de la chaussée incluaient les fibres de l'asbestos. Pour une décennie, ces asphaltes ont prouvé être valable du côté économie et performance. Dû aux préoccupations de l'environment ainsi que de la santé, l'utilization des fibres de l'asbestos furent discontinués, alternativement il fallait découvrir d'autre matériaux.

Le matérial idéale devra.

- Avoir l'aptitude d'être placé dans des conditions hostiles
  - basse température
  - vent violent
  - précipitation mineur
- Montrer une viscosité à haute température pour éviter l'écoulement, l'encroûtement ainsi que de la poussée de l'asphalte vers l'intersection.
- Montrer une variation minimum de la viscosité à basse température pour éviter des fissures transversales.
- Avoir l'aptitude d'être placé en couche mince pour éviter trop de changement dans l'élevation sur les sections à travers.
- Montrer aucune sensibilité aux diverses dégoutements chimiques causé par le trafic.

Pendant notre recherche du matérial idéale, plusieurs recouvrements ont été mis à l'épreuve. Entre autre, il y a l'asphalte modifié avec "Latex. Tremolite. des sols Diatomaceous", ainsi que plusieurs sorte de "Polymers". Quelques endroits utilisants ces matériaux ont été controlé au debut de 1984 jusqu'au présent.

Certain type de "Polymers" ont produit des résultats des plus prometteurs. Ces "Polymers" sont developés à travers la recherche active des industries afin de fabriquer le produit dont on a besoin.

SURFACE MIXTURES WITH LARGE AMOUNTS OF R.A.P. 27[illegible]

ABSTRACT

The relative amounts and characteristics of salvaged asphalt and aggregate affect the physical properties, engineering characteristics and value of a recycled paving mixture. Recycled asphalt pavement (R.A.P.) is generally used to produce base course and binder course paving mixtures, which are usually covered with a virgin surface mix. These recycled mixtures usually contain less than 50% R.A.P., due to concerns about long term performance, homogeneity, compatability and permanent deformation characteristics of the recycled mixtures.

Hot recycled asphalt mixtures containing 85% R.A.P. were produced and evaluated in a laboratory study. The recycled binder was characterized by consistency tests and by molecular size distribution analysis (high pressure gel permeation chromatography). Marshall stability, Hveem stability, resilient modulus and the indirect tensile strength of both recycled and virgin paving mixtures were compared. Image analyses were carried out by sawing specimens and observing particle to particle contact and binder distribution inside the sample.

The test data revealed that stiffness, permanent deformation and long term characteristics of the recycled mixture were equivalent to or better than those of a virgin mix. Image analysis indicated the feasibility of using the recycled mixture as a surface course.

DYNAMIC MATERIAL BEHAVIOUR : A CASE STUDY 303

ABSTRACT

This paper describes an experimental study of the dynamic behaviour of pavement materials. It involves measurement and calculation of the asphalt concrete strains caused by the dynamic axle loads of a moving vehicle. The experiment was conducted at the instrumented pavement site constructed by the Ministry of Transportation of Ontario (MTO) on HW 7N North of Toronto. Dynamic axle loads were measured with the instrumented vehicle developed by the National Research Council (NRC) for the RTAC Heavy Vehicles Weights and Dimensions Study. The pavement elastic moduli used in calculating pavement response were obtained by a Falling Weight Deflectometer (FWD).

The study had two objectives; first to evaluate the accuracy of the elastic moduli obtained from the FWD and second to examine the suitability of these moduli for analysis under driving conditions. It was found that the layer moduli obtained by the FWD are 15% higher than the actual values under the conditions of the test. Analysis of the pavement structure under driving conditions, however, revealed that the FWD grossly overestimates asphalt concrete moduli for all the vehicle speeds tested. The back-calculated asphalt concrete moduli ranged from 10% to 35% of the values determined by the FWD for speeds between 10 and 55 km/h, respectively.

ABSTRACT

Deep strength asphalt pavements reinforced with geotextile and geogrid materials can be compared to traditional designs in terms of facilitating construction under unstable subsoil conditions, providing improved performance under heavy vehicle loading and reducing pavement thickness requirements.

Published structural design methodology uses an elastic layer mechanistic approach to assess the contribution of reinforcement grids in layered pavement structures. The combined benefits of geotextile and geogrid reinforcement are expected to be significant, particularly with respect to uniformity of construction and in-situ layer moduli, uniformity of deflection response under load, and reduced surface deformation and cracking.

The paper presents the performance monitoring results from a case study site that includes the construction of four types of pavements - two geotextile and geogrid reinforced pavements (one with deep strength asphalt concrete and the other with asphalt concrete on granular base), an asphalt concrete on granular base with geotextile over the subgrade and a non-reinforced asphalt concrete on granular base. Performance monitoring after one year includes a surface distress survey and non-destructive dynamic deflection testing using the Falling Weight Deflectometer, with elastic layer analysis to assess in-situ stresses and strains in the pavements.

Abstract

Selection of the recycling agent and design of the paving mixture are the critical steps determining the success or failure of asphalt pavement recycling operations, and the durability of the new pavement.

The most important requirements for an asphalt pavement recycling agent are low volatility, to avoid excessive fuming in the mixing operation, and an appropriate viscosity. Higher viscosity recycling agents permit using sufficient new aggregate to correct grading deficiencies in the salvaged paving mix, and to accomodate limitations on the amount of reclaimed material which can be handled by mixing plants. Soft asphalts have been found to satisfy these requirements better than oil type recycling agents.

In designing paving mixes containing recycled material, it is necessary to produce a gradation which gives acceptable voids characteristics, while maintaining a satisfactory total binder content, and rejuvenated binder properties. A method of designing recycled mixes to achieve this is described, and illustrated by examples.

Résumé

La sélection d'un agent de recyclage ainsi que la formulation d'un enrobé sont les étapes déterminantes conduisant au succès ou à l'échec de l'opération de recyclage d'une chaussée, ainsi que de la durabilité de la chaussée rénovée.

Les exigences les plus importantes pour un agent de recyclage sont une faible volatilité afin d'éviter les émanations excessives lors de l'opération de malaxage, et une viscosité appropriée. Une viscosité élevée de l'agent de recyclage permet d'utiliser suffisamment de nouveaux aggrégats pour en corriger la composition granulométrique déficiente de la chaussée récupérée, et de se conformer aux exigences concernant le pourcentage de matériel recyclé pouvant être traité par les usines de malaxage. Les bitumes mous recontrent ces exigences beaucoup mieux que les huiles.

La formulation d'enrobés bitumineux contenant des agents de recyclage requiert une composition granulométrique conduisant à un pourcentage de vides approprié, tout en maintenant un pourcentage en liant satisfaisant, et démontrant les propriétés d'un liant rajeuni. Une méthode de formulation d'enrobes recyclés permettant d'obtenir ces résultats est présentée, et illustrée à l'aide d'exemples.

ABSTRACT

Premature failure of a full depth asphalt concrete pavement on expansive clay subgrade soils in a new residential subdivision in Melfort, Saskatchewan is analyzed. Design and construction followed industry standards, but within three years large decreases in subgrade strength and asphalt cement stripping had drastically reduced structural strength.

Excessive pavement surface deflections caused by subgrade bearing capacity that had dropped by 50 to 80 percent in the five years following construction had initiated micro-cracking. Stripping action by water in the micro-cracks coupled with complete failure of the bond between lifts further weakened the pavement to the point where fewer than ten passes of a legal weight truck axle would render the pavement unfit for traffic.

The developing concepts of effective strength theory and soil suction for unsaturated soils are used to explain the behaviour of the clay subgrade. A mechanism for loss of asphalt concrete strength by stripping of asphalt cement is suggested.

The pavement was removed, then replaced with a deep granular pavement structure with subdrainage. The paper describes the evolution and rationale for the design of this new structure, which has become a new standard for pavement structures over expansive clays in Saskatchewan.

ABSTRACT

This paper discusses the development of mathematical equations to relate the components of an asphalt analysis and several asphalt properties. These equations have been derived by the method of multiple stepwise regression.

A mathematical model is presented which successfully relates five component fractions of asphalt to many of it s physical properties. The statistical methodology and problems in arriving at the best coefficients for the model are discussed, followed by an example of the use of the equations to modify the properties of an asphalt.

The authors point out that asphalt physical properties are defined by the tests to which the material is subjected. As a result of this, any change which is made in the manufacture of the material to alter it s chemistry will affect many properties and some will almost certainly improve and others degrade as those properties which are thought to be most important are modified.

Asphalt is a very complex material and it is necessary to understand all the chemistry/property relationships which have been defined in order to successfully modify the material to suit the user's needs.

Up to fifty percent of Prince Edward Island's paved road network, constructed in the 1960's and 1970's extensively on a soil cement base, has deteriorated to the point where reconstruction or major strengthening are the only feasible alternatives.

A study to develop cost-effective programs of highway rehabilitation was carried out in 1988. It included a review of the existing rehabilitation practices. As local granular material is generally suitable only for gravel base and shoulder portions of construction, crushed stone must be imported, at about $16 per tonne, for most of the hot mix construction. Recycling and chip or slurry seals have been used only to a very limited extent.

Rehabilitation alternatives must minimize the problem of traffic maintenance during construction, which is compounded by high rainfall and soft subgrade conditions.

A number of specific requirements related to materials, local construction industry, performance, costs, implementability and incorporation into the pavement management system have been defined. A comparison of five different rehabilitation alternatives, including an example of life cycle economic evaluation (a necessary component for full evaluation of the alternatives), is provided. Results of the project will provide a key input to the next stage of implementing PEI's pavement management system.

ANNEXE C
LISTE DES PERSONNES
ASSISTANT AUX REUNIONS

CTAA - 1988 CONFERENCE DELEGATE LIST

LAST	FIRST	ORGANIZATION	CITY
Achim	Laurent	PETROLES ESSO CANADA	Montreal
Adams	Brian	ESSO CANADA, RESEARCH DEPT.	Sarnia
Ainsworth	Jack	LAFARGE CONSTRUCTION MATERIALS	Calgary
Alarie	Pierre	DEPARTMENT OF NATIONAL DEFENCE	St. Hubert
Alfano	Carmen	ONTARIO PAVING COMPANY LIMITED	Concord
Anderson	Dave	UNIVERSITY OF ALBERTA	Edmonton
Anderson	Paul	TROW GEOTECHNICAL LTD.	Brampton
Andrews	Monty	STANDARD GENERAL CONSTRUCTION LTD	St. Albert
Ariss	Bob	VANCOUVER PORT CORPORATION	Vancouver
Arndt	Rob	CITY OF CALGARY	Calgary
Badry	Bill	STANDARD GENERAL CONSTRUCTION LTD	St. Albert
Bannerman	Bill	ASL PAVING LTD.	Saskatoon
Barrie	T. L. (Lee)	WARREN MARITIMES LTD.	Fredericton
Beck	Donald	CHEVRON U.S.A. INC.	San Francisco
Beck	Neville C.	KOCH MATERIALS COMPANY	Calgary
Bell	Lee	P.E.I. DEPT. OF TRANSPORTATION	Charlottetown
Bennet	Bill	EBA ENGINEERING CONSULTANTS LTD.	Lethbridge
Berezowski	Michael	HARDY BBT LIMITED	Calgary
Bergan	Arthur	UNIVERSITY OF SASKATCHEWAN	Saskatoon
Berti	John	HUSKY OIL OPERATIONS LTD.	Calgary
Biard	Michel	BEAVER ASPHALTE	Montreal Nord
Bjerke	Ron	ALBERTA TRANSPORTATION	Edmonton
Blackadar	B. M.	WARNOCK HERSEY PROF. SERVICES LTD	Dartmouth
Blair	Dan	KOCH MATERIALS COMPANY	Wichita
Blair	Lorne	WESTCAN BULK TRANSPORT LTD.	Sherwood Park
Bouchard	Greg	BORLAND CONSTRUCTION LIMITED	Winnipeg
Boyle	Joseph	ADI LIMITED	Hampton
Brown	Randall	LBD ASPHALT PRODUCTS (LUBRIZOL)	Deer Park
Brownlow	David C.	CITY OF ETOBICOKE	Etobicoke
Buchel	A.P.	CITY OF WINNIPEG	Winnipeg
Budd	Donald	ASPHALT ENGINEERING CO. LTD.	Mississauga
Burns	James F.	BURNCO ROCK PRODUCTS LTD.	Calgary
Burns	Robert	CITY OF PRINCE ALBERT	Prince Albert
Bush	Ralph	ESSO PETROLEUM CANADA	Edmonton
Callaghan	John R.	B.C. MINISTRY OF TRANSPORTATION	Vernon
Calvez	Georges	CITY OF EDMONTON	Edmonton
Campbell	Matthew C.	CENTRAL ASPHALT LTD.	Saskatoon
Caron	Bernard	MINISTERE DES TRANSPORTS (QUEBEC)	Quebec City
Carrick	John J.	MCASPHALT INDUSTRIES LTD.	West Hill
Cassidy	Bryan	WEATHER-FLEX INC.	Concord
Chambers	Wayne	MODERN ENTERPRISES LIMITED	Moncton
Chan	Joseph	UNIVERSITY OF SASKATCHEWAN	Saskatoon
Chrusch	Ivan E.	KOCH MATERIALS COMPANY	Winnipeg
Clemont	Jim	B. A. BLACKTOP LTD.	Kamloops
Clulow	Michael	ALBERTA TRANSPORTATION	Edmonton
Clusiau	J.	PETRO CANADA INC.	Montreal
Connoly	A. R.	SASK. HIGHWAYS & TRANSPORTATION	North Battleford
Cooper	John	ALBERTA TRANSPORTATION	Athabasca
Corkill	John	ESSO PETROLEUM CANADA	Toronto
Cormier	Rod D.	ULTRAMAR CANADA INC.	Montreal
Cote	Denis	ELF DU CANADA LTEE	Montreal
Cowan	John	NORJOHN LIMITED	Thorold
Cox	Doug	HARDY BBT LIMITED	Edmonton
Creasy	Jack	CONSTRUCTION AGGREGATES LTD.	Vancouver
Crebo	Ron	INGERSOLL-RAND CANADA	Dorval
Crevels	Hubert	CITY OF CALGARY	Calgary
Croteau	Jean-Martin	ASSOC DES CONSTRUCTEURS DE ROUTES	Quebec City
Cully	Martyn John	PETRO CANADA PRODUCTS	Pointe-Aux-Trembles

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D'Antoni	Ed	CITY OF CALGARY	Calgary
Dassylva	Pierre	LES ENTREPRISES P.E.B. LTEE	Quebec City
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Davis	Richard		Pittsburgh
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ANNEXE D

MINUTES DE LA REUNION DU

17 NOVEMBRE 1988 DU COMITE CONSULTATIF

ASPHALT DE C-SHRP

Committee: C-SHRP Asphalt Advisory Committee

Date: November 17, 1988

Location: Palliser Hotel, Calgary

Chairman: Richard Langlois

In attendance:

G. Kennepohl, I. Deme, W. Robertson, H. Sergi, S. Khalil, D. MacLeod, G. Williams

Observers: F. Gervais, J.C. Moreux, V. Puzinauskus, R. Khan

1. OPENING REMARKS

Mr. Langlois opened the meeting and welcomed the members to the second meeting of the committee. He commented on the busy week which had occurred with CTAA and the Standards Board meeting. He indicated that a number of observers were present because of the other activities which had occurred during the week. He continued the opening with a round table introduction of the members. After the introductions, he reviewed the membership of the committee and commented that Mr. Gervais and Mr. Moreux were in attendance in order to provide a balance of industry and agency representatives. He also noted that Mr. Khan had asked to observe the meeting proceedings since it would be focussing on the asphalt specifications which had been approved by CGSB earlier that day. Finally, he introducted Mr. Puzinauskus from the Asphalt Institute who had been invited to the meeting to report on the findings of the recently completed survey of refinery practices, which he had completed for SHRP.

At the conclusion of his remarks, Mr. Langlois emphasized that the official members of the committee were the only ones entitled to a vote on motions, but that the observers were free to offer their opinion during ongoing discussions.

2. REPORT ON "SURVEY OF REFINERY PRACTICES"

Mr. Puzinauskus gave a detailed presentation on the conduct of the survey. (Attached)

During his discussion, Mr. Puzinauskus suggested that it may be possible for Canadian refineries to approach the Asphalt Institute directly in regard to the testing of additional asphalt samples from Canada. He also indicated that the characterization data for the samples obtained during the surveywould be available by April to the University of Texas and that, in his opinion, the information would be in the public domain at that time. He added that the data would be coded so as to prevent the association of individual samples with specific suppliers.

Of primary interest from the presentation was the identification of an AC-10 asphalt from the RedWater source provided by Exxon and AC-10 from the Lloydminister source provided by Husky, as being primary reference asphalts for SHRP.

At the conclusion of the presentation, Mr. Langlois thanked Mr. Puzinauskus for his efforts in attending not only this meeting, but also the activities during CTAA.

3. STATUS REPORT ON SHRP/C-SHRP

Mr. Williams indicated that in order to maintain the focus on development of Terms of Reference, that his update would be very short. He reported the recent appearances in the U.S. program that field validation of the asphalt research would not be accommodated within the pavement studies. This was reported to be a departure from the original intent that the SPS portion of LTPP would be used to ensure the validation of new findings in asphalt binders and asphalt aggregate mixtures. He emphasized the fact that similar developments may occur in C-SHRP since the pavement studies are expected to be launched in April 1989, while the asphalt projects have not yet been referred to the Pavements Committee for consideration. He suggested that the opportunity for integration of the field portion of the asphalt program into the pavement studies was quickly disappearing. He further indicated that a report from the Asphalt Advisory Committee was on the agenda at the Pavements Committee meeting and that Sue Khalil would be delivering that report.

In referring to the SHRP contract plan which had been circulated with the agenda, Mr. Williams noted that opportunities existed for Canadians to participate in contract monitoring efforts through membership on the committees established in the U.S. for each of the research projects. He suggested that members of the Asphalt Committee were ideal candidates to represent the Canadian program on the U.S. committees.

4. A, B, C, QUALITY ASPHALTS

Mr. Langlois introduced the topic for discussion and emphasized that the objective of the meeting was to develop Terms of Reference for the complementary project on A, B, C asphalts. Considerable early discussion ensued with a number of factors being identified very quickly, as follows;

1. With the newly approved Canadian specification for A, B, C asphalts, C-SHRP should support the use and further enhancement of this specification by using it as a base for research.

2. With SHRP focussing on AC-10/20/30 asphalts, the focus of Canadian research must be on softer asphalts.

3. Improved performance correlation of asphalt specifications with field performance must be developed.

4. The focus in Canada and recently at CTAA has been on the identified problems of low temperature cracking and rutting.

5. Studies on cracking and rutting could focus upon the asphalt binder, recycling techniques or polymer asphalt.

6. Additional efforts to characterize softer asphalts in a fashion complementary to the work by the Asphalt Institute may be desirable.

7. With SHRP addressing the issues of aging and stripping, Canadian efforts should focus upon temperature susceptibility.

Mr. Langlois suggested that, in continuing the discussions, the approach should be to develop a skeleton for the research plan including the type of research to be pursued. Individual tasks in support of developing a detailed proposal could then be assigned to various committee members.

Following completion of these tasks, it was suggested that a meeting be held in the late winter to formulate the detailed proposal with a view of issuing the request for a proposal document in June.

Mr. Puzinauskus suggested that the general approach should be to survey the available materials in Canada and then to pursue an approach similar to A-003 in which asphalt-aggregate mixtures would be tested to evaluate standard properties relevant to field performance. He noted that while the A, B, C specification strives to link asphalt binders to field performance, that the relationship is still not developed.

A further round table survey was made of individual opinions based on the rather intense discussion which had taken place. The key observations were as follows;

1. That given the limited resources of the program and the

spirit of the new CGSB specification, that characterization of the asphalt should be on a physical basis only.

2. That the project should look beyond current practice to incorporate either new possibilities or future directions, to be truly an effective effort.

3. That the performance trade-off involving low temperature cracking and rutting continues to be the primary focus.

4. The focus of the research must be upon the liquid asphalt and

while it is necessary to evaluate them in mixtures, that efforts should be made to standardize the aggregates in order to eliminate them as an additional variable.

5. Modification of bituminus structures for high-traffic conditions which optimize the rutting/cracking performance could be pursued using polymers.

6. That the uncertainty concerning the lower band of the C-grade asphalt could be an interesting area for investigation.

Mr. Langlois summarized that while SHRP is pursuing the fundamental research approach including chemical analysis of the binders and a variety of aggregates, that the C-SHRP work would be practical in its approach due primarily to limited resources. He further emphasized that a co-operative spirit would have to be pursued in order to execute any program within the resources available and that minimal contracting of services would be utilized, primarily for specialized testing. He also suggested that field validation should focus upon rehabilitated structures as opposed to new construction, in-keeping with the activities of provincial agencies. The fundamental approach of SHRP and their extensive testing will allow easy extrapolation of Canadian results to other conditions. In support of this approach, the theoretical correlation of pavement performance to asphalt grade must be validated.

It was decided by the committee that a factorial experiment should be established which would seek to study a range of A, B, C asphalts and relate their physical characteristics to their field performance. The experimental design factors were identified as follows;

Asphalt Grade - A, B, C	(3 levels)
Penetration Index	(2 levels)
Penetration - high/low	(2 levels)
Aggregate angularity	(2 levels)

Considerable discussion ensued on the other factors to be investigated within an experiment, with considerable discussion on the pavement factors which would be evaluated in LTPP. It was decided that piggy-backing the asphalt factorial on the proposed pavement experiments would result in only having to do detailed analysis on the factors within the asphalt concrete layer.

Additional discussion continued on what the actual factors should be in selecting the test sections, with one suggestion that critical stiffness could be a controlled factor of the experiment. It was generally agreed that aggregate variations should be kept to a minimum by specifying a 16 mm top size and 50% stone requirement, with only the angularity of the aggregate being variable. It was decided that the proposed experimental matrix should be distributed to all committee members for comment with replies to the National Co-ordinator before December 7, so that Mr. Langlois could report on the results to the Technical Steering Committee meeting on December 13th.

It was further decided that Mr. Kennepohl would work with Mr. Williams in developing the draft factorial and draft Terms of Reference for the project in the very near future.

5. ADJOURNMENT

Since most committee members had midday flights the next day out of Calgary, and since draft documents were to be circulated for discussion purposes, it was agreed that the committee would not meet the following day. Mr. Langlois indicated that a meeting of the committee would be required in the Spring in order to maintain momentum in developing the project. With there being no other business, the meeting was adjourned at 6:35 PM.

Secretary: G. Williams

GW:mjb-g

DRAFT

PERFORMANCE CORRELATION FOR QUALITY PAVING ASPHALTS

(C-SHRP Complementary Project A-2)

1. RESEARCH NEED STATEMENT

Performance-based asphalt cement specifications (CAN/CGSB-16.3-M) have ben developed and brought forward for approval by the Canadian General Standard Board (CGSB). In pioneering specifications that more closely reflect superior performance of the binder in asphalt pavaments, the national basis for formulating such performance-based specifications has come under close scrutiny. An improved understanding of those fundamental properties of asphalt cements which may correlate to performance is still required.

In order to render support to the A, B, C quality specifications, research is needed to better define temperature susceptibility (rate of asphalt consistency change with temperature) which is relevant to performance. More specifically, the significance of apparent differences in susceptibility at pavement performance temparature range versus at asphalt handing temperature range ((PVN at 60° C vs PVN at 135° C or PI). In addition, data is needed to substantiate and quantify field performance.

2. OBJECTIVE

The principal objetive of this research is to improve the understanding of characteristic asphalt cement properties that influence low temperature performance, without adversely affecting rutting and provide correlation with field performance data.

3. STUDY SCOPE

Because the project is complementary to ongoing work in SHRP, and because of additional resources and time constraints, the scope of this research is tailored to asphalt cements only, in deliberate support of the performance specifications. Straight run asphalts without modification by oxidation or polymer addition will be selected from Canadian crude sources.

Furthermore, the study will be limited to two (2) typical aggregates of which one is a heavy duty mix (predominantly crushed material). <u>While the effect of aggregate type and quality on pavement performance is well recognized, the use of only two differing mixes is considered adequate to estabish the low temperature performance of the specified asphalt cements</u>.

The characterization of the asphalts will emphasize collecting (or determining) physical properties mostly by stablished, routine test methods. However, characterization of the asphalts, especially the temperature susceptibility by rheogoniometer is considered important. Chemical characterization may be added at a later date, based on feedback from the SHRP (A-002).

The suggested main performance criteria is mainly low temperature cracking as determined in two (2) different temperature zones. Other performance criteria, in particular rutting, should be kept constant by design.

The study must be completed in 3 years. A detailed research plan based on a survey of paving asphalts use in Canada should be completed in 6 months.

4. PROPOSED RESEARCH APPROACH

The proposed research will encompass two phases;

An important aspect of Phase I is the development and presentation of a detailed research plan. This plan, including a factorial designed experiment, should be submitted for review and approval by the C-SHRP Asphalt Advisory Committee.

The data acquisition in Phase II should be carefully co-ordinated with other ongoing or proposed SHRP and C-SHRP projects where ever possible. Available data for asphalt properties should be utilized whenever possible and appropriate.

A summary of proposed tasks is given in the following:

PHASE I	Task 1	Literature review of performance of asphalts at low temperature.
	Task 2	Survey of paving asphalt uses and practices in Canada.
	Task 3	Selection of asphalts and aggregates to highlight handling/performance temperature descrepancies.
	Task 4	Development and presentation of detailed research plan including the factorial design.
		(Project Review Point)
PHASE II	Task 5	Determination of physical properties of selected asphalts by Routine test methods and rheogoniometer.
	Task 6	Selection and monitoring of <u>existing</u> pavements for field performance evaluation.

Task 7 Identification of <u>new</u> test sites and specification of design, construction and monitoring requirements for field performance determination.

Task 8 Data reduction and correlation of performance with A, B, C asphalt cements.

Task 9 Assessment of minimum performance level for C asphalts

Task 10 Preparation of final research report

Task 11 Presentation of results at a suitable conference, forum, etc. as specified by C-SHRP