



NRC Publications Archive Archives des publications du CNRC

Laboratory testing of pavement crack sealants Svec, Otto J.; Masson, J. F.; Gervais, M.

For the publisher's version, please access the DOI link below./ Pour consulter la version de l'éditeur, utilisez le lien DOI ci-dessous.

<https://doi.org/10.4224/23002759>

NRC Publications Record / Notice d'Archives des publications de CNRC:
<https://nrc-publications.canada.ca/eng/view/object/?id=d450da02-6dc9-47fe-811b-ffc4458de7ef>
<https://publications-cnrc.canada.ca/fra/voir/objet/?id=d450da02-6dc9-47fe-811b-ffc4458de7ef>

Access and use of this website and the material on it are subject to the Terms and Conditions set forth at
<https://nrc-publications.canada.ca/eng/copyright>
READ THESE TERMS AND CONDITIONS CAREFULLY BEFORE USING THIS WEBSITE.

L'accès à ce site Web et l'utilisation de son contenu sont assujettis aux conditions présentées dans le site
<https://publications-cnrc.canada.ca/fra/droits>
LISEZ CES CONDITIONS ATTENTIVEMENT AVANT D'UTILISER CE SITE WEB.

Questions? Contact the NRC Publications Archive team at
PublicationsArchive-ArchivesPublications@nrc-cnrc.gc.ca. If you wish to email the authors directly, please see the first page of the publication for their contact information.

Vous avez des questions? Nous pouvons vous aider. Pour communiquer directement avec un auteur, consultez la première page de la revue dans laquelle son article a été publié afin de trouver ses coordonnées. Si vous n'arrivez pas à les repérer, communiquez avec nous à PublicationsArchive-ArchivesPublications@nrc-cnrc.gc.ca.





National Research
Council Canada

Conseil national
de recherches Canada

NRC **CNRC**

Institute for Research in Construction

***Laboratory Testing of Pavement
Crack Sealants***

O.J. Svec, J.F. Masson and M. Gervais

Institute for Research in Construction

Canada¹

Presentation

- Problem Statement**
- Objectives**
- Testing Equipment**
- Testing Program**
- Test Results**
- Conclusion**

Problem Statement

- Demand for crack sealants improvement**
- Field simulation**
- Current techniques are not satisfactory**

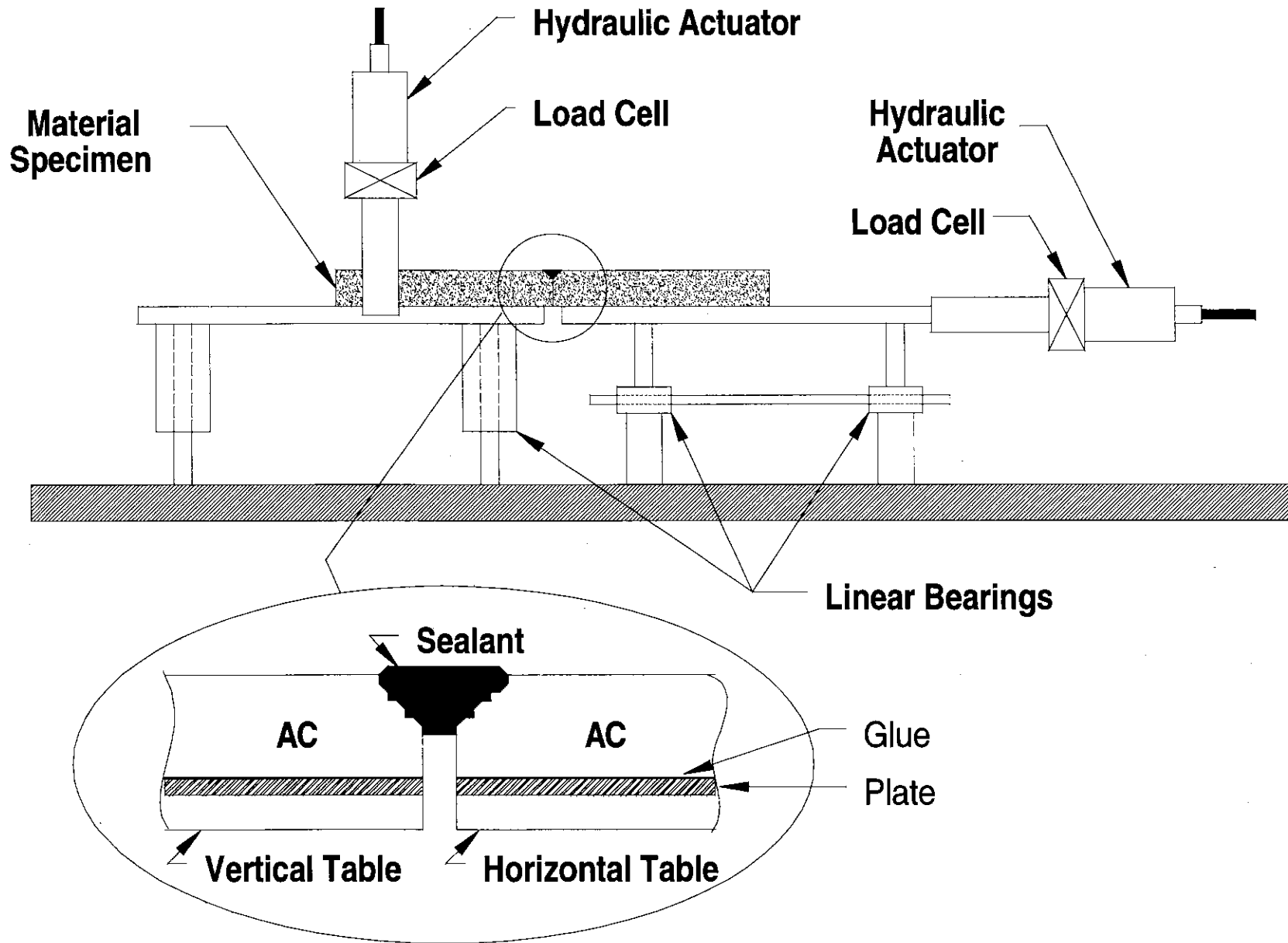
Objectives

- ❑ Develop testing procedure for evaluation of crack routing and sealing rehabilitation techniques in laboratory**
- ❑ Determine the best combination of sealant and crack repair technique**

Laboratory Testing Equipment

- ❑ **Construction Material Testing System (Loading Table)**
 - **Vertical - shear stress (dynamic - ± 0.127 mm/sec)**
 - **Horizontal - tensile stress (static - 0.1 mm/min)**
- ❑ **Environmental Chamber**
 - **-40°C to +40°C**

Samples Preparation



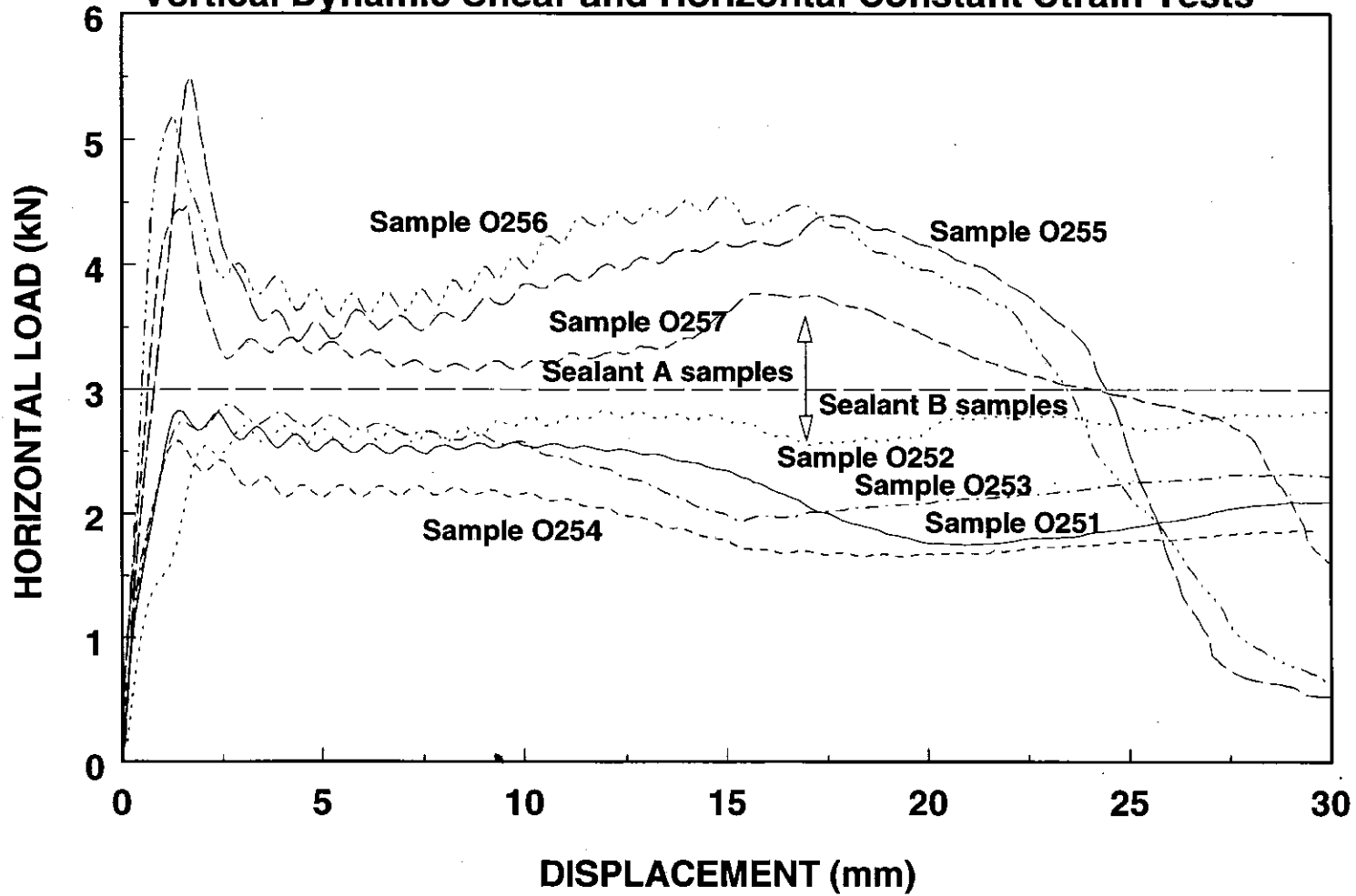
Test Results

- Series I**
- Series II**

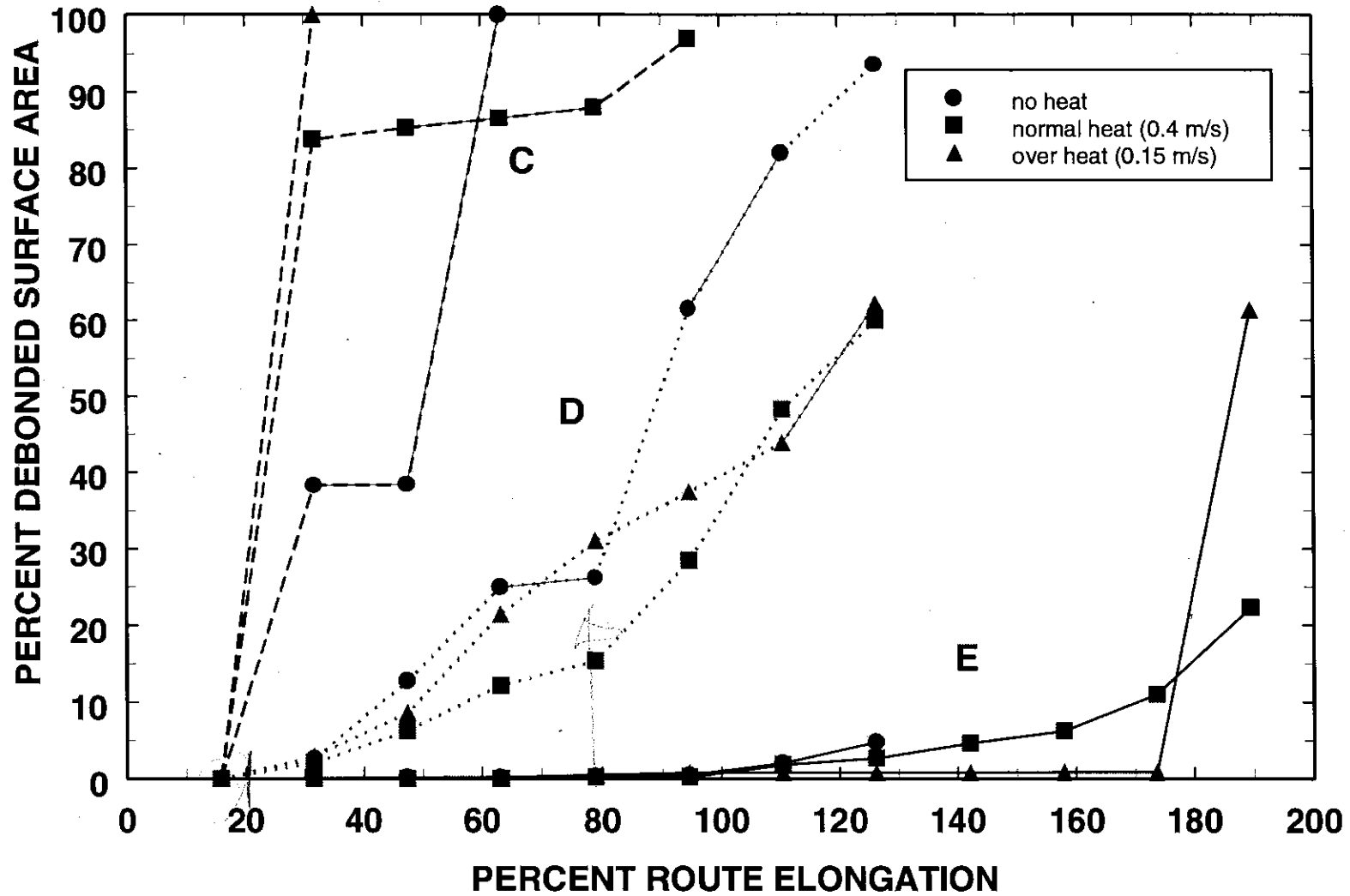
new

SERIES I - CHANGING TEMPERATURE TESTS (-30 to -40°C)

Vertical Dynamic Shear and Horizontal Constant Strain Tests



SERIES II - SEALANT DEBONDING



Elastic Modulus Estimation

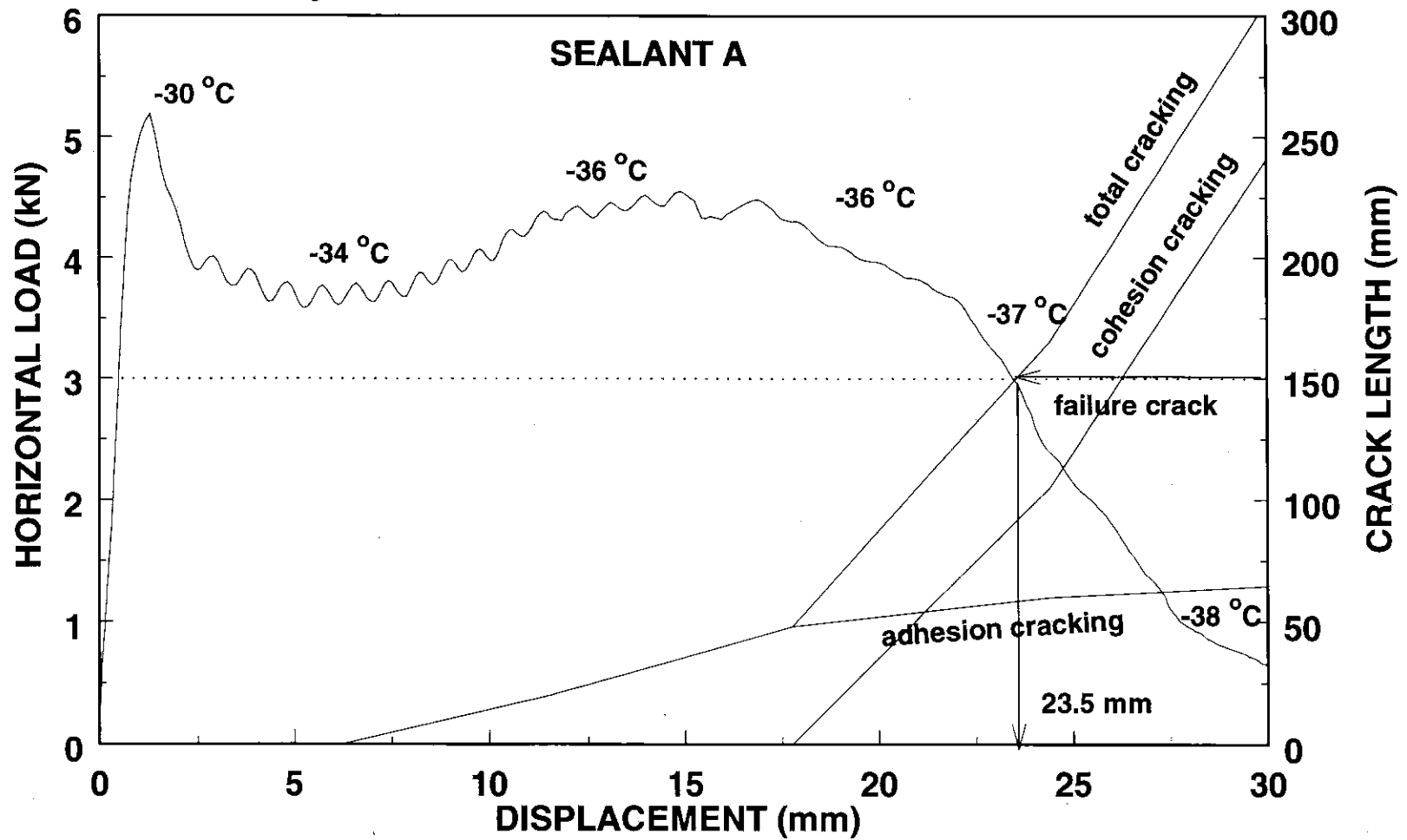
Sealant "E"	Sealant "C"	Sealant "D"
sample modulus number (kPa)	sample modulus number (kPa)	sample modulus number (kPa)
bb1-5 194.3	cr1-5 205.5	hs1-5 176.3
bb6-10 141.3	cr6-10 170.2	hs6-10 211.1
bb11-15 144.6	cr11-15 161.8	hs11-15 185.9
mean 160.1	mean 179.2	mean 191.1

Conclusions

- ❑ Results affected by temperature of sealant during pouring**
- ❑ Rout heating does not significantly influence results**
- ❑ Flexible material behaves better than stiffer material**
- ❑ CMTS closely simulates field conditions**

SERIES I - CHANGING TEMPERATURE TEST (-30 to -40°C)

Vertical Dynamic Shear and Horizontal Constant Strain Tests



Series I: Changing Temperature Tests (-30°C to -40°C) Vertical Dynamic Shear and Horizontal Constant Strain

Sealant/ Test Number	Readings at peak load			Readings at end of test			Readings at failure point ¹		
	load (N)	disp. (mm)	energy (N-mm)	energy (N-mm)	cycles	disp. (mm)	load (N)	disp. (mm)	cycles
Sealant A	5,054	1.54	4,946	100,356	17,600	29.97	2,999	25.5	15,033
Sealant B	2,751	2.39	4,820	67,858	17,220	29.94	No cracking / failure		

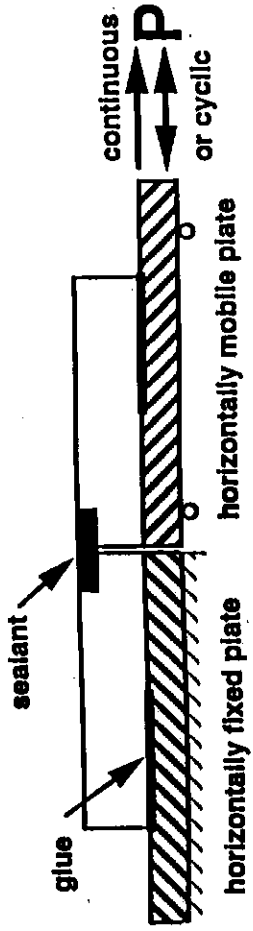
Loading Conditions:

Horizontal: 0.10 mm/min

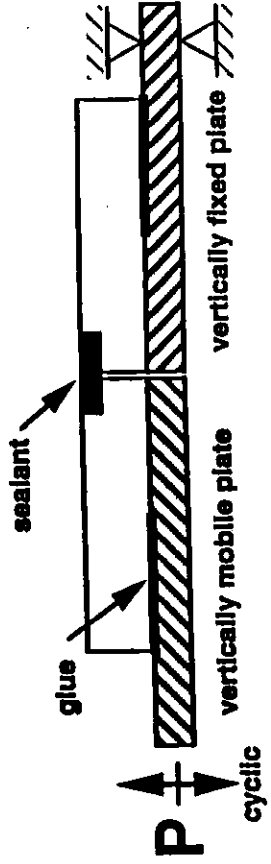
Vertical: ± 0.127 mm (± 0.005 in.) 1 Hz sine wave

Temperature change: -30°C to -40°C (achieved -30°C to -38°C)

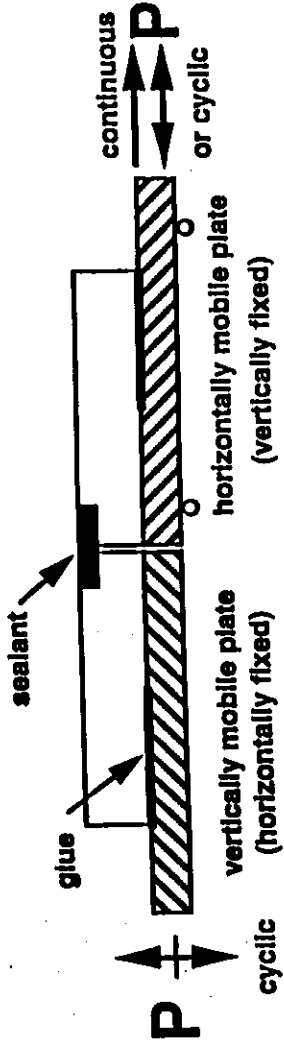
¹ Failure point defined as cracking $\geq 50\%$ of rout length (300 mm)



a) Horizontal Continuous or Cyclic Loading

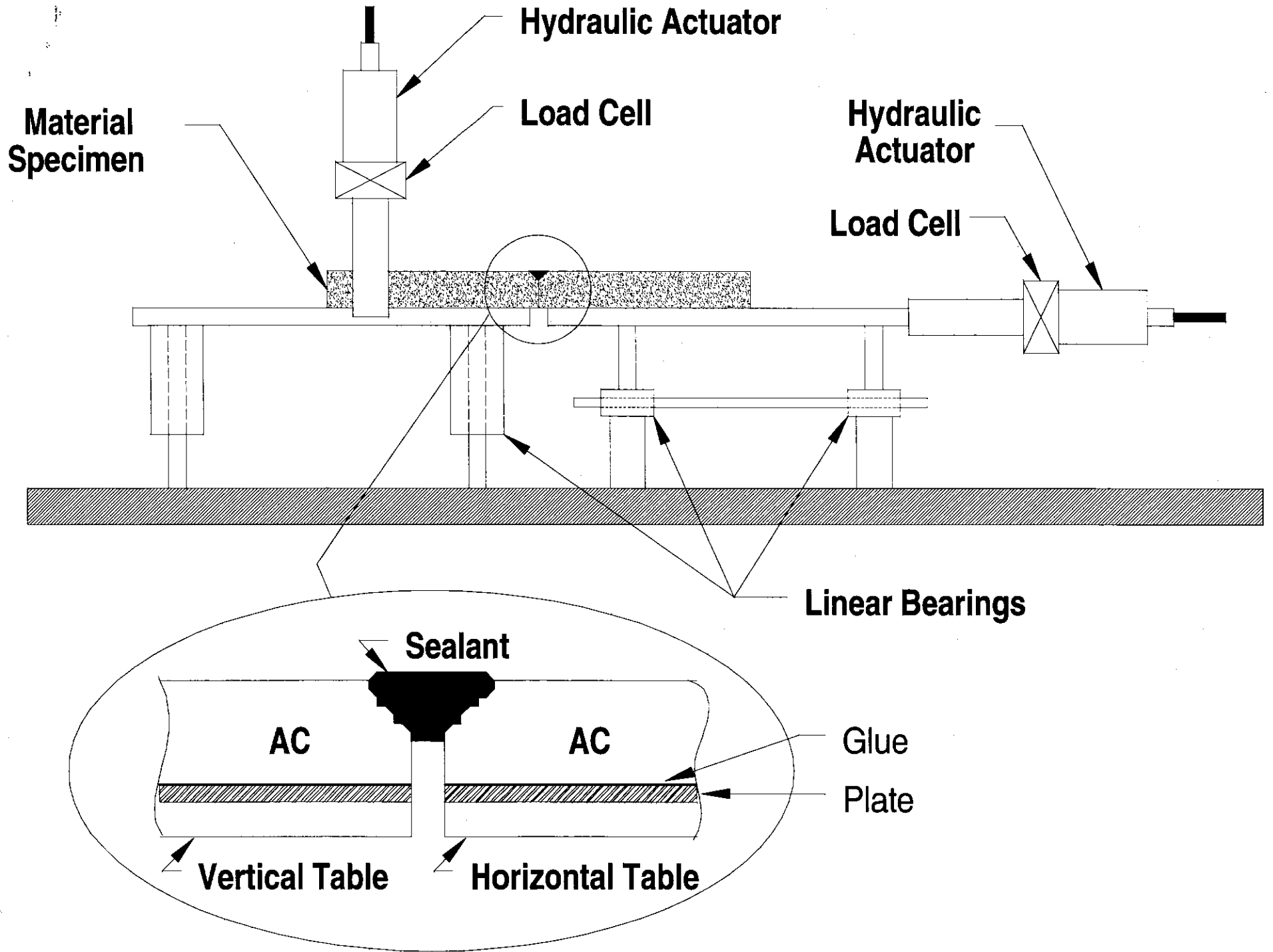


b) Vertical Cyclic Loading



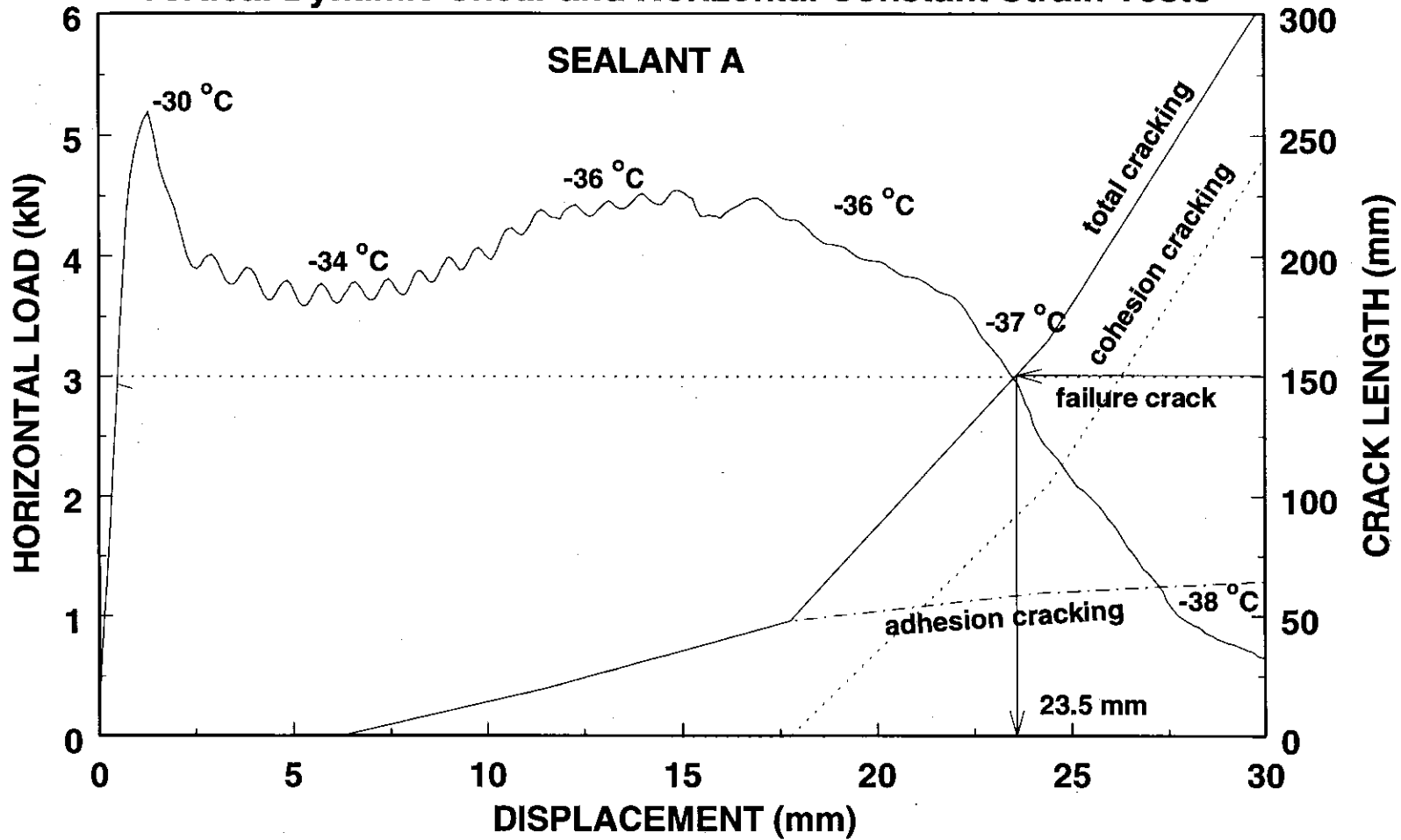
c) Combined Horizontal and Vertical Loading

Figure A3: Types of test methods for evaluating pavement crack routing and sealing techniques.



SERIES I - CHANGING TEMPERATURE TEST (-30 to -40°C)

Vertical Dynamic Shear and Horizontal Constant Strain Tests



Sealant Debonding

All Sealants

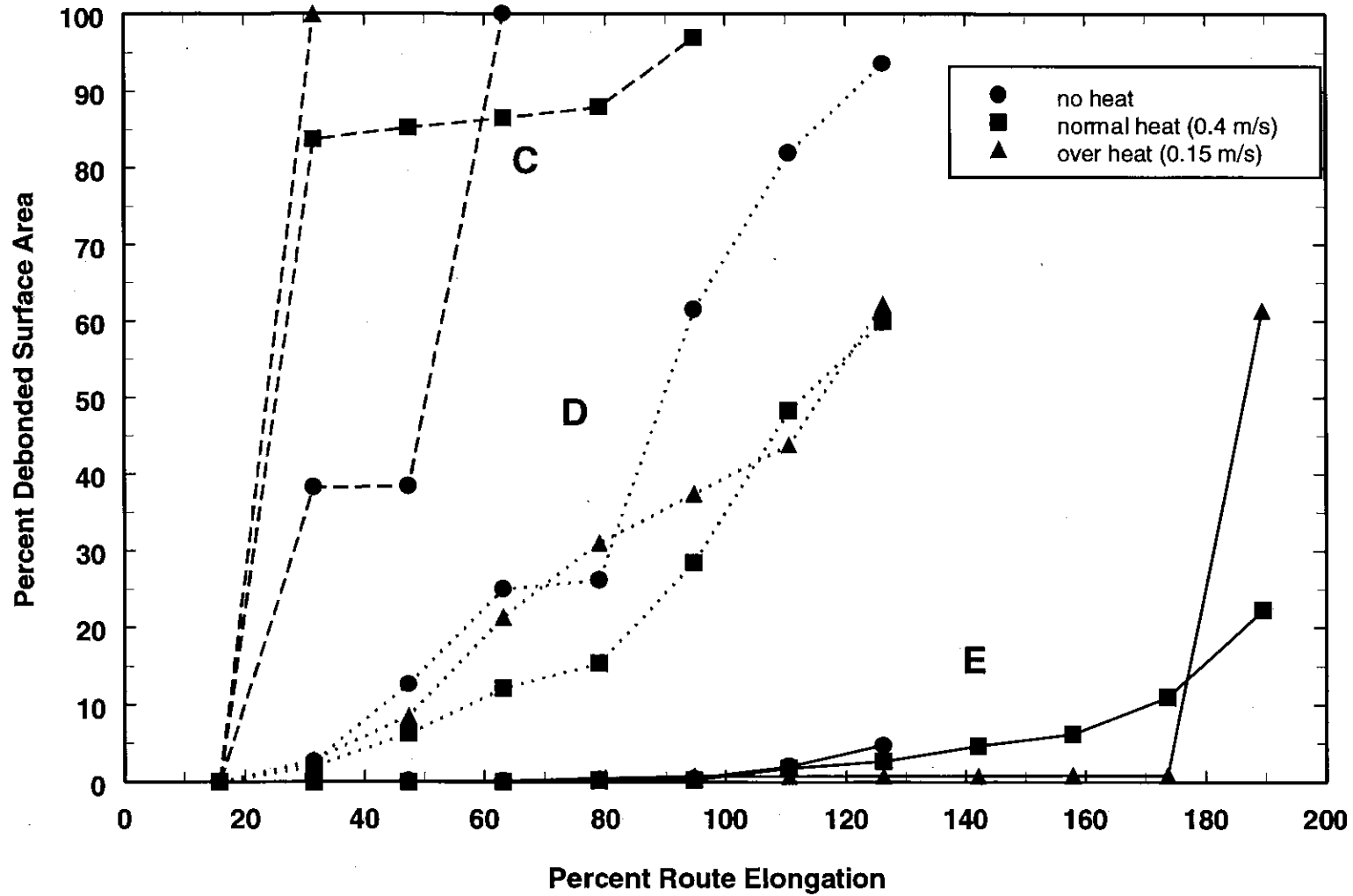


Table 1:

**Series I: Changing Temperature Tests (-30°C to -40°C)
Vertical Dynamic Shear and Horizontal Constant Strain**

Sealant/ Test Number	Readings at peak load			Readings at end of test			Readings at failure point ¹		
	load (N)	disp. (mm)	energy (N-mm)	energy (N-mm)	cycles	disp. (mm)	load (N)	disp. (mm)	cycles
Sealant A	5,054	1.54	4,946	100,356	17,600	29.97	2,999	25.5	15,033
Sealant B	2,751	2.39	4,820	67,858	17,220	29.94	No cracking / failure		

Loading Conditions:

Horizontal: 0.10 mm/min

Vertical: ± 0.127 mm (± 0.005 in.) 1 Hz sine wave

Temperature change: -30°C to -40°C (achieved -30°C to -38°C)

¹ Failure point defined as cracking $\geq 50\%$ of rout length (300 mm)

Table 2:

Elastic Modulus Estimation

Sealant "E"	Sealant "C"	Sealant "D"
sample number	sample number	sample number
modulus (kPa)	modulus (kPa)	modulus (kPa)
bb1-5	cr1-5	hs1-5
194.3	205.5	176.3
bb6-10	cr6-10	hs6-10
141.3	170.2	211.1
bb11-15	cr11-15	hs11-15
144.6	161.8	185.9
mean	mean	mean
160.1	179.2	191.1