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### Laboratory testing of pavement crack sealants

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***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**

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Canada<sup>1</sup>

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# ***Presentation***

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

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## ***Problem Statement***

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

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## ***Objectives***

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

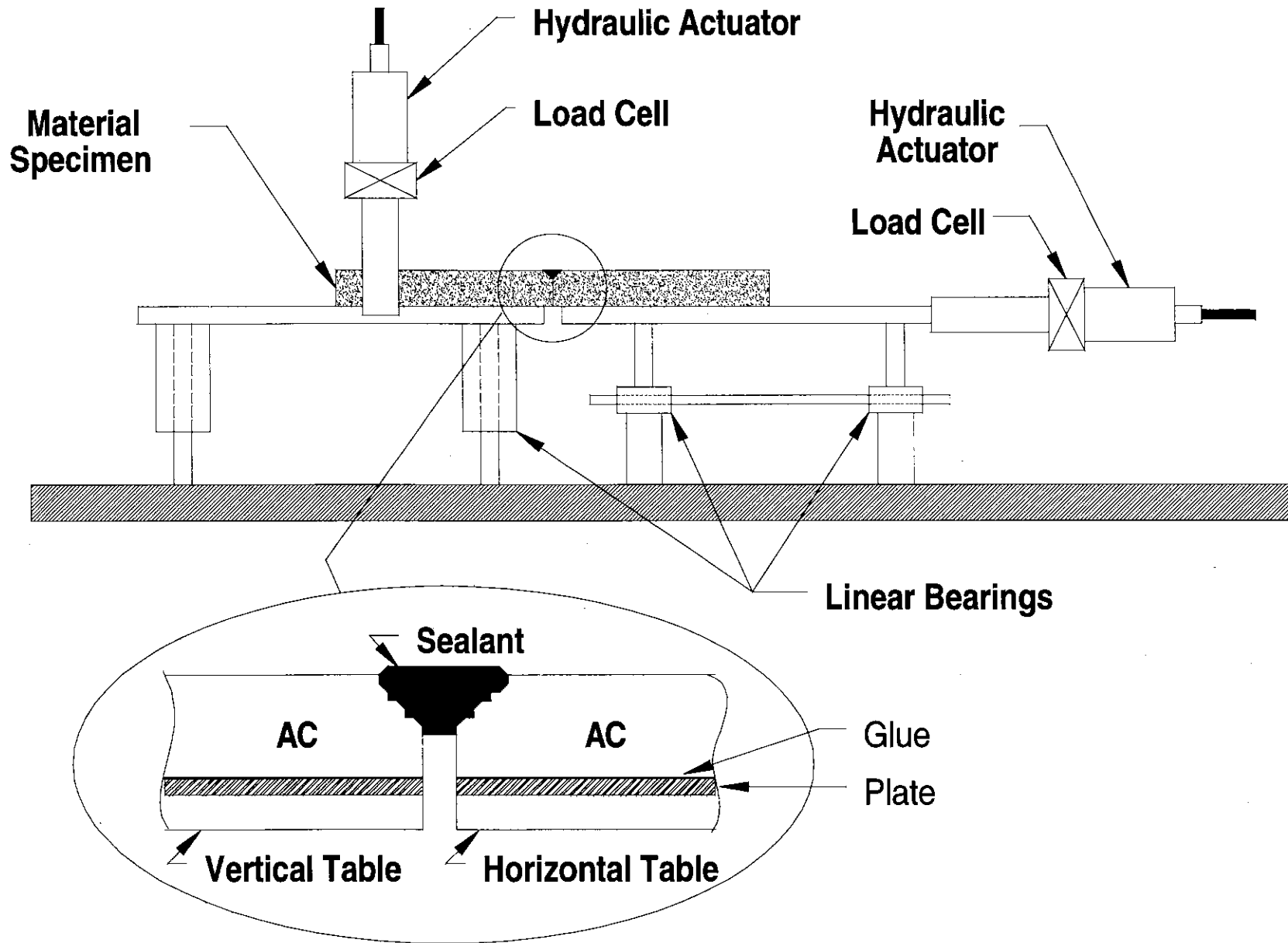
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## ***Laboratory Testing Equipment***

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

# ***Samples Preparation***





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## ***Test Results***

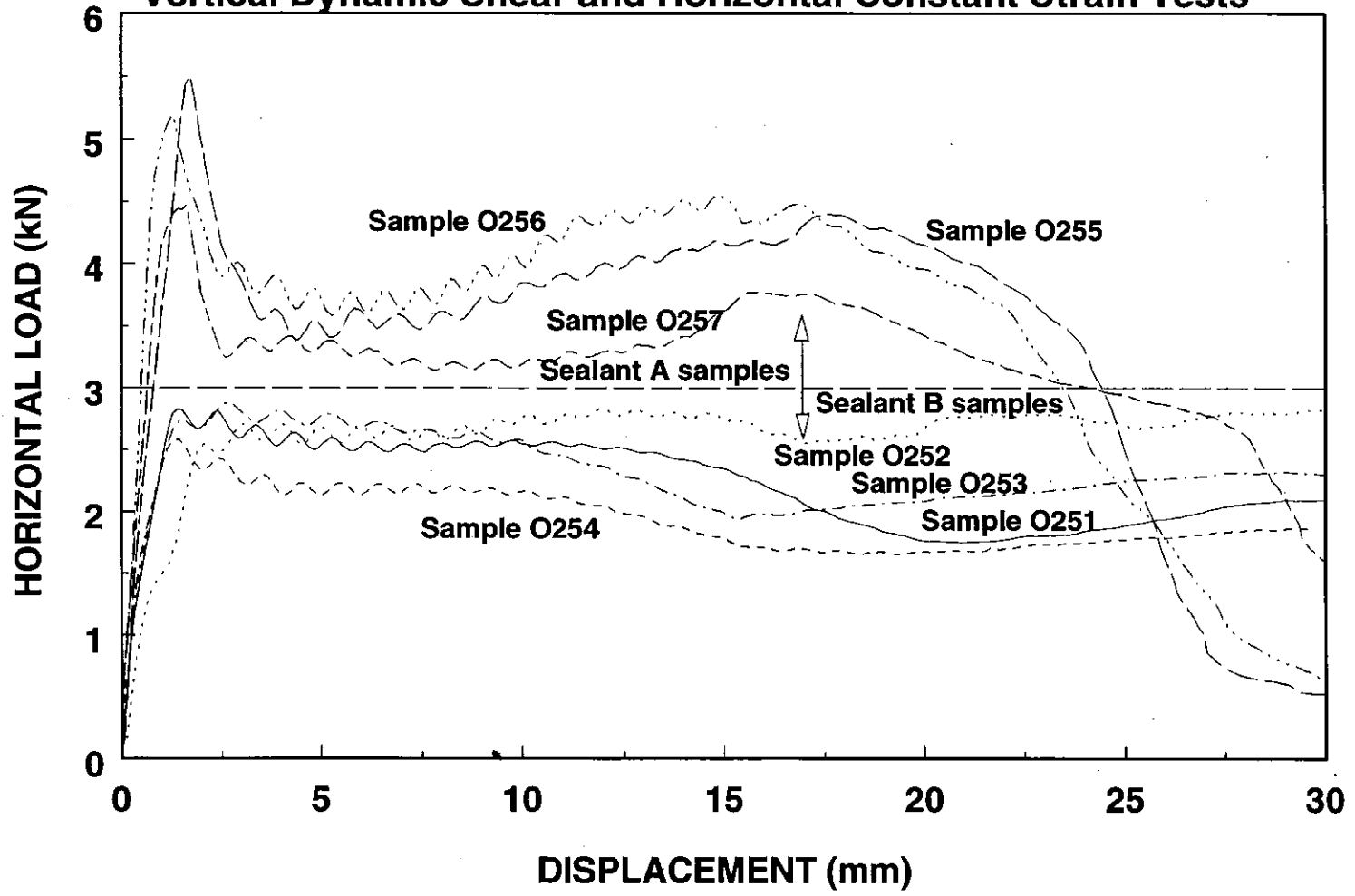
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- Series I**
- Series II**

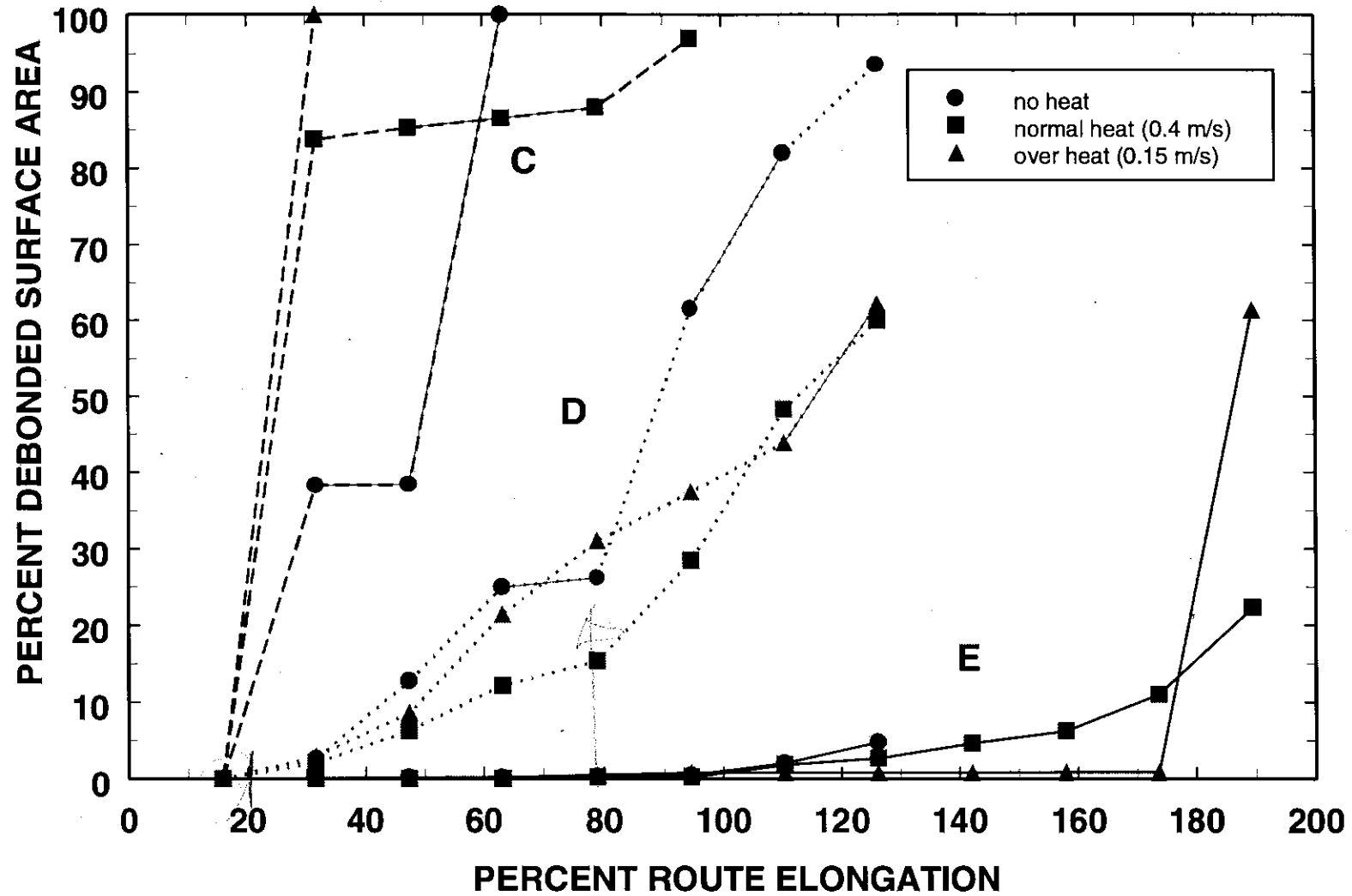
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# SERIES I - CHANGING TEMPERATURE TESTS (-30 to -40°C)

## 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

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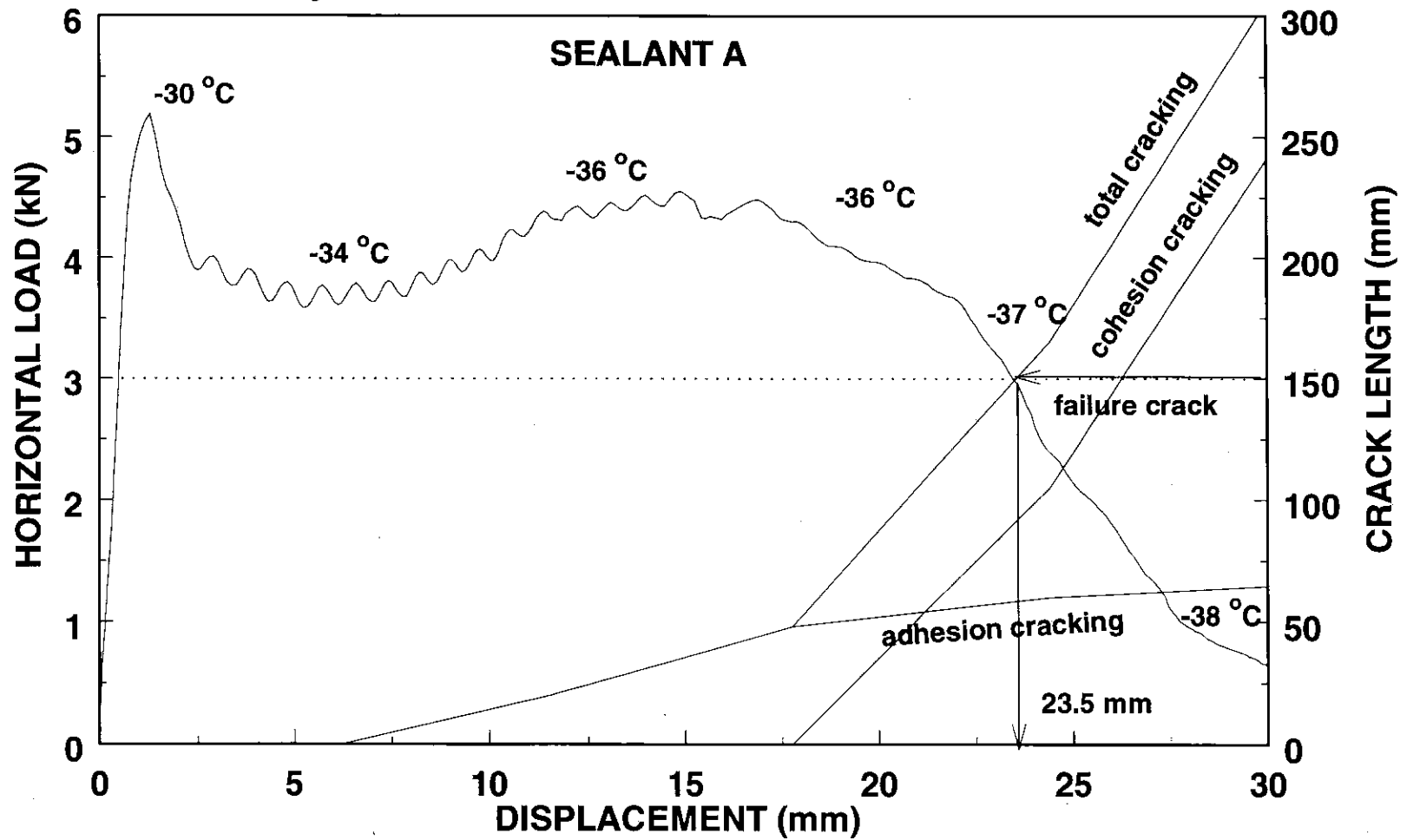
## ***Conclusions***

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- ❑ 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 <sup>1</sup>		
	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		

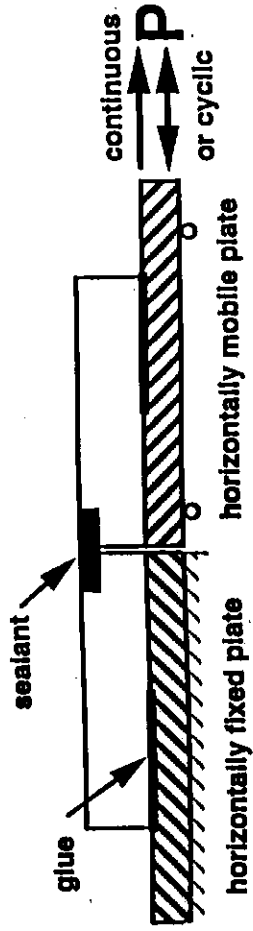
Loading Conditions:

Horizontal: 0.10 mm/min

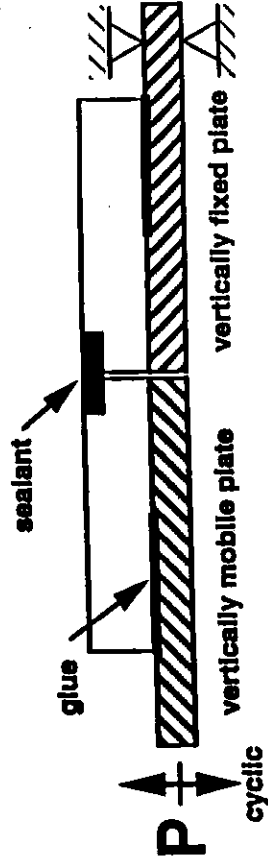
Vertical:  $\pm 0.127$  mm ( $\pm 0.005$ in.) 1 Hz sine wave

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

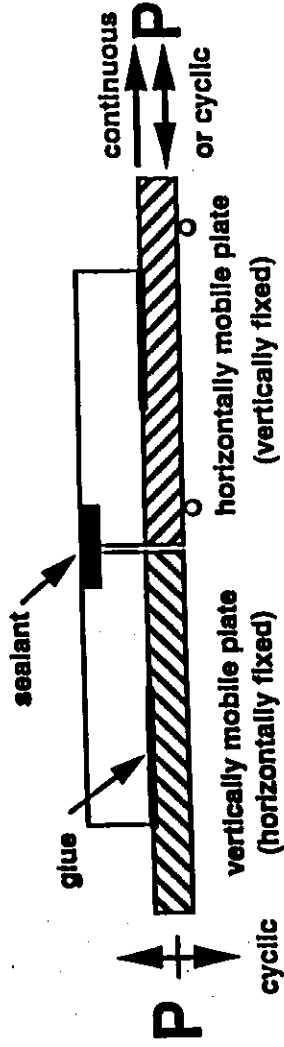
<sup>1</sup> Failure point defined as cracking  $\geq 50\%$  of rout length (300 mm)



a) Horizontal Continuous or Cyclic Loading



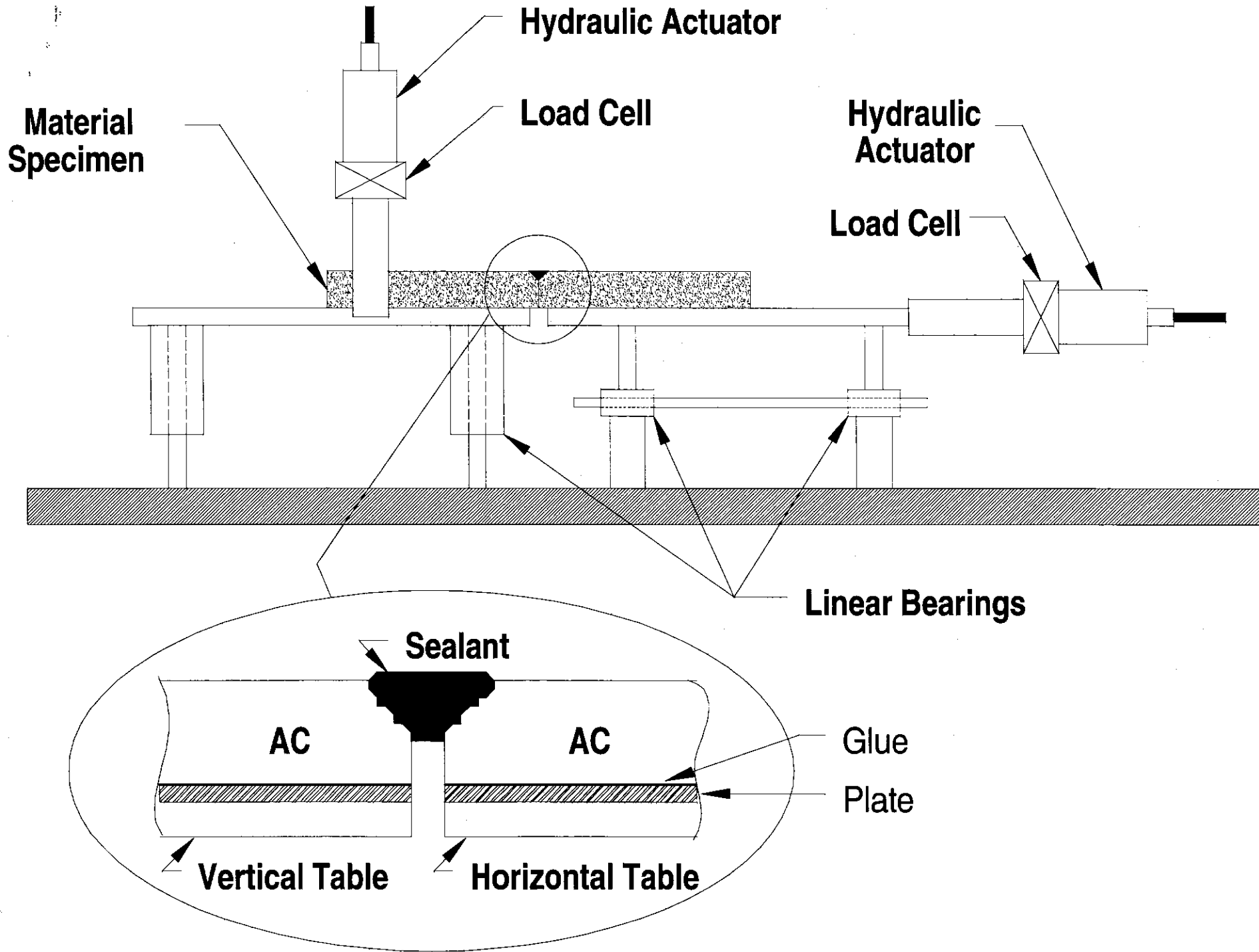
b) Vertical Cyclic Loading



c) Combined Horizontal and Vertical Loading

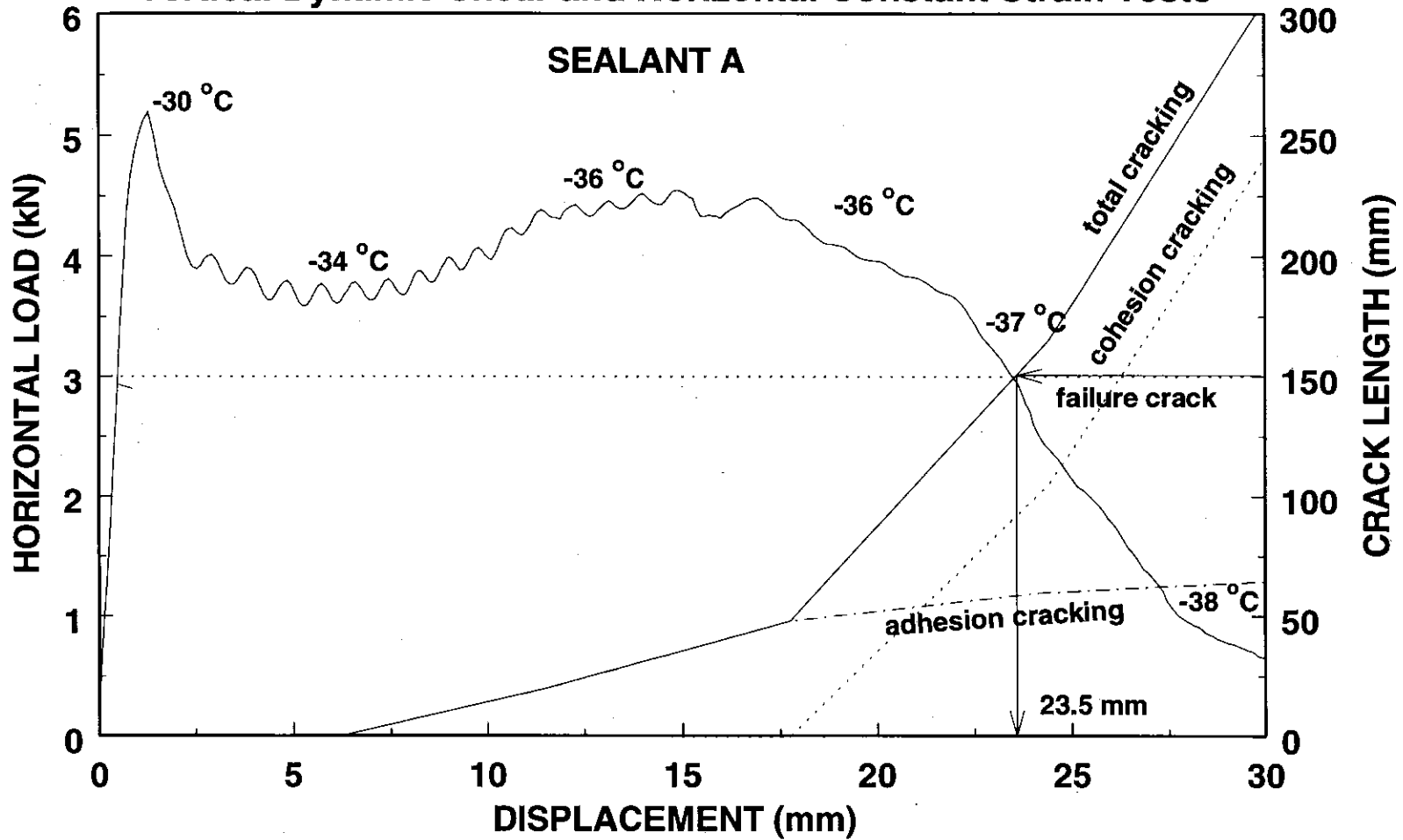
Figure A3: Types of test methods for evaluating pavement crack routing and sealing techniques.





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

Vertical Dynamic Shear and Horizontal Constant Strain Tests



# Sealant Debonding

## All Sealants

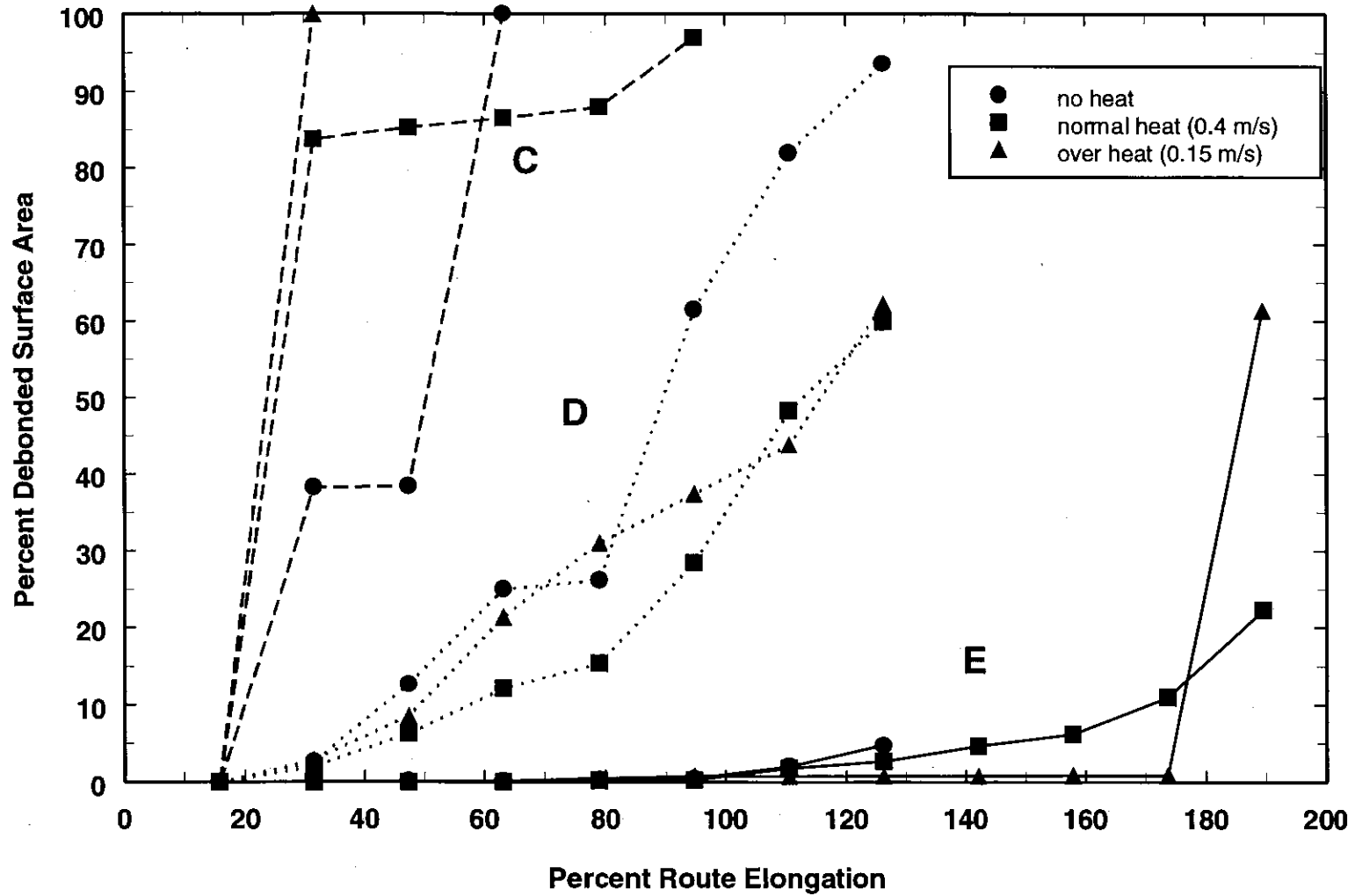


Table 1:

**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 <sup>1</sup>		
	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:  $\pm 0.127$  mm ( $\pm 0.005$ in.) 1 Hz sine wave

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

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

**Table 2:**

**Elastic Modulus Estimation**

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