DISCUSSION AND SUMMARY:

The 18 calibration curves performed during the study are in Table 3. The intercepts of the lines are different, but the slopes appear to vary only slightly. When the intercepts are ignored and the calibration curves with the largest and smallest slope are plotted through 5.5% asphalt cement content, the close relationship of the curves can be seen (Figure 5) (curve #2 and #17 were omitted because of the low calibration temperature.) The difference of the two curves at 6.5% and 4.5% asphalt cement content is only 0.10% asphalt cement content. If the spread of these calibration curves covers the various combination of materials and mixes in Iowa, then a one point calibration system could be established, similar to the moisture density system in I.M. 309. A single sample would be mixed at the recommended asphalt cement content, tested and the results entered on a chart. The curve closest to that point would be the calibration curve used throughout the project for that mix.

The following was observed from testing when single variables were isolated:

1. The 3 different asphalt cement grades and the 2 different asphalt cement sources produced only minor differences in gauge reading. The largest variation was -0.10% to +0.22% asphalt cement content.

2. The 3 different aggregate combination produced minor differences in gauge reading. The largest variation was -0.26% to +0.15% asphalt cement content.

3. A 10%± variation in the aggregate blend produced insignificant variation in the gauge readings.

4. Extended heating of mixes, (8 hours or more) especially at 275^{0}F or above, will produce a lower gauge reading.

5. Precision of the instrument as measured by a limited number of readings within ASTM Standards.

The Troxler 3241-B Asphalt Content Gauge appears to be a rapid, safe method for determining AC content of mixes. Precision of the current methods (ASTM D2172-81 Quantitative Extraction of Bitumen from Bituminous Paving Mixtures) should not differ by more than 0.52% asphalt for tests on the same batch by

the same operator. The nuclear method appears to be well within that limit, even with a one point calibration. The nuclear method does not provide extracted aggregate for gradation determination. However, should Iowa change gradation control on projects from extracted gradation to cold feed gradation, nuclear gauge testing could replace much of our current extraction work.

TABLE 3
CALIBRATION CURVES

Calibration	Slope(%/count)	Intercept(%)	Agg. #	Asphalt	Temperature
1	0.00406	-4.61	1	Koch AC-5	210^0
2	0.00407	-4.63	1	Koch AC-5	230^0
3	0.00388	-4.28	1	Koch AC-10	75^0
4	0.00446	-5.48	1	Koch AC-20	200^0
5	0.00433	-5.11	1	Koch AC-20	210^0
6	0.00423	-4.83	1	Koch AC-20	230^0
7	0.00422	-4.79	1	Koch AC-20	210^0
8	0.00414	-4 76	1	Koch AC-20	75^0
9	0.00440	-5.22	1	Koch AC-20	250^0
10	0.00415	-4.72	1	Shell AC-5	210^0
11	0.00418	-4.80	1	Shell AC-5	230^0
12	0.00451	-4.72	1	Shell AC-10	220^0
13	0.00427	-4.94	1	Shell AC-20	200^0
14	0.00425	-4.94	1 (70%/30%)	Koch AC-10	190^0
15	0.00412	-4.96	2	Koch AC-10	190^0
16	0.00420	-5.09	2	Koch AC-10	250^0
17	0.00400	-4.71	2	Koch AC-10	75^0
18	0.00407	-4.70	3	Koch AC-10	185^0

RECOMMENDATION:

In the event that Iowa changes gradation control on asphalt projects from extracted gradation to cold feed gradation, nuclear asphalt content gauges should be purchased for use in each of the districts. The estimated cost is $6,700. per unit