ATT-17/96, PLANT CALIBRATION
Part I, Drum Mix Asphalt Plants

1.0   SCOPE

This method describes the procedures for calibrating the aggregate proportioning system using split and unsplit stockpiles and the asphalt system of drum mix asphalt plants.

2.0   EQUIPMENT

calculator	plant log book
tachometer	1 tared haul truck
stop watch	1 distributor truck
graph paper	

Data Sheets: Drum Plant Aggregate Calibration, MAT 6-38
                      Drum Plant Asphalt Calibration, MAT 6-39

3.0   PROCEDURE

3.1   General

3.1.1   Drum Mix Plants

The drum mix system consists of a proportionally controlled cold feed system, which feeds onto an inclined conveyor that uses a belt scale to determine the weight of the aggregate (in tonnes per hour) being fed to the drum mixer. The asphalt proportioning system is interlocked with the aggregate conveyor and enters the drum mixer simultaneously with the aggregate. Plants are designed for remote controlled operation which utilizes digital readout of the automatic monitoring system. A surge storage system is incorporated to ensure a smooth truck traffic and constant plant operation. Figure 1 shows the flow of materials through a drum mixer.

Before the plant calibration can begin, the plant must be set up and all systems must be functioning properly.

3.1.2   Establishing the Production Rate

The desired mix production rate for the project must be established prior to the plant calibration. The Project Manager and Contractor shall arrive at a figure after considering the capacity of the equipment at the plant and on the road, the number of trucks and haul distance, and the nature of the construction.

This is necessary because a constant production rate will minimize the asphalt and aggregate fluctuation and produce a better end product. The moisture content of the stockpile will also affect this determination. The belt scale will be calibrated in the running range of the plant.
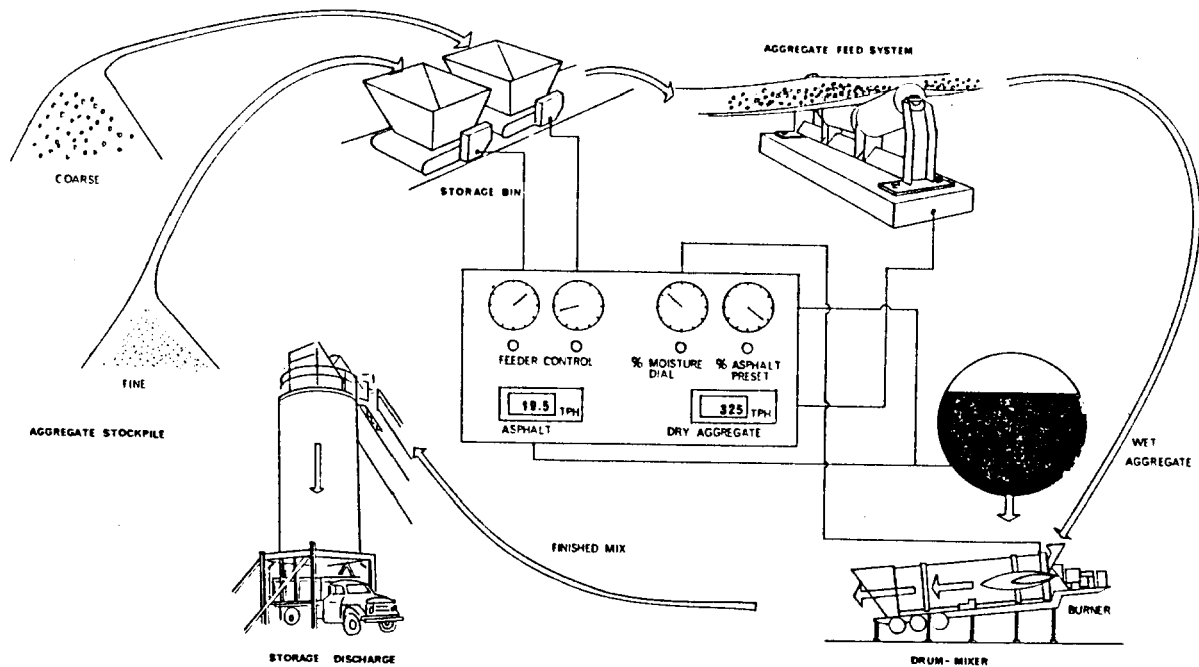
DRUM MIX PLANT FLOW OF MATERIALS

FIGURE 1

3.1.3 Responsibilities

The Contractor is responsible for:

a) calibrating the asphalt plant before commencement of each contract, prior to production of any specified mix or at any time during the project that the quality control test data does not conform to the specifications;

b) operating all plant controls and making required plant adjustments during the plant calibration; and

c) completing the Drum Plan Calibration Certificate (for each plant calibration).

The aggregate and asphalt calibration data sheets (MAT 6-38 and 39) must be completed by the quality control technologist. When requested, copies of the completed forms should be submitted to the Department's representative.

3.1.4   Calibration Overview

The purpose of the plant calibration is to ensure that the plant accurately proportions the asphalt and aggregate.

The belt scale, test weights and cold feed bins are part of the aggregate system and require calibration.

Aggregate is diverted to a truck, the aggregate is weighed and its weight is compared to the totalizer tonnes counted. The span setting is adjusted until the totalizer count is within ±0.5% of the weight of the aggregate in the truck. The wet aggregate production rate is determined at each setting and compared to the established production rate.

The purpose of the belt scale calibration is to verify that the totalizer tonnes counter counts the correct number of tonnes of **wet** aggregate passing over the belt scale.

The test weights are calibrated by adding weights to the belt scale. Totalizer readings are taken at the start and end of the test. The test is timed and meter readings are taken during the simulated loading. The wet aggregate production rate is determined by the totalizer. The tonnes counted by the totalizer are compared to the meter readings. Adjustments are then made to the meters until their readings are within ±1% of the weight simulated production rate.

The test weights can later be added to the belt scale to verify that the load cell and totalizer are reading the same as when the aggregate was diverted into a truck. This check does **not** confirm the accuracy of the belt scale.

For split stockpiles, blend sands and filler additions, the cold feed bins of the drum mix plant must be calibrated.

The cold feed bins are calibrated by diverting aggregate into a truck. During a timed period, meter readings are taken at the controls and tachometer readings are taken on the electric motor on the feeder conveyor. The weight and moisture content of the aggregate is determined and the calculated dry aggregate production rate should be similar. The run is confirmed at the same setting and then repeated at other bin trimmer settings. For each bin, a graph of dry aggregate production rate versus corresponding bin speeds is drawn. The production rate required to give the desired stockpile proportion is calculated. The bin speed required to produce the calculated bin production rate is picked off the calibration graph. The bin trimmer settings are then adjusted and tachometer readings taken until the bin speed equals the speed picked off the graph.

In summary, the bin calibration is required to:
a)   Determine the dry aggregate flow rate, in tonnes per hour, of a cold bin.
b)   Set up and check the bins to ensure the proper aggregate proportions are maintained.

The asphalt proportioning system is calibrated at three dial settings: one at the design asphalt content, one at an asphalt content above and one at an asphalt content below the design or target.

During calibration, test weights are added to the belt scale to simulate the desired production rate. Asphalt is diverted or pumped into a tank or distributor truck. Readings are taken on the flow meter or revolution counter and totalizer counter. Readings are also taken on the dials and meters, and a tachometer reading may be obtained on the asphalt pump. The weight of asphalt and weight of simulated dry aggregate is obtained. Asphalt and aggregate production rates are calculated as well as asphalt content and asphalt pump speed. The calculated values are compared to the meter and dial readings. Dial and meters are adjusted until they are within tolerance limits of the actual values. The weight of asphalt per revolution of the pump or the weight of asphalt per unit volume of the flow meter device is calculated. The asphalt is then diverted to the storage tank. The procedure is repeated at the same production rate but at a lower asphalt content and then is repeated at the same production rate at a higher asphalt content. Finally the procedure is repeated at the design or target asphalt content at a lower production rate (the asphalt is diverted to the storage tank). A graph of asphalt production rate in t/h versus speed of asphalt pump in rev/min is plotted. A second graph of actual asphalt content versus dial reading is also plotted.

In summary, the asphalt proportioning system is calibrated to:

a)   Check and correct the dial settings and meter readings.

b)   Determine the weight of asphalt per revolution of the asphalt pump or unit volume of the flow meter. This weight is used in the drum plant inspection test procedure performed for each unit.

c)   Generate the calibration graph which is used to determine the asphalt production rate of plants not equipped with a revolution counter if the pump speed (as taken with the tachometer) is known.

3.2   Calibration of Belt Scale and Test Weights

3.2.1   General

Drum mix asphalt plants are equipped with various types of aggregate totalizers. The following sections outline the procedure for calibrating Ramsey 40-15, Ramsey 40-20, Ramsey 10-201 Micro-Tech, and Barber-Greene totalizers.

The belt scale must be calibrated at two or more production rates prior to construction. The belt scale is calibrated:

a)   At the production rate established in Section 3.1.2 (minimum of 5 runs) and

b)   At a lower production rate after the span has been set (minimum of 2 runs).

The test weights are calibrated after the belt scale is calibrated.

3.2.2 Ramsey 40-15 Totalizer

3.2.2.1   Belt Scale Calibration

1.   Before the calibration, the belt scale conveyor must run for about one hour to warm up the system.

2.   The bypass chute must be in the bypass position. Ensure that material does not enter the mixing drum.

3.   Run approximately 10 tonnes of aggregate over the belt scale conveyor to ensure proper seating of the conveyor belt on the rollers and better weighting accuracy.

4.   While the aggregate is running, have the master feed control adjusted until the aggregate meter reads the expected production rate. With split stockpiles, more than one bin of the same size of aggregate may have to be used.

5.   Use the bypass chute to discard the aggregate.

6.   With the belt scale conveyor running empty, place the Moisture Content Dial Setting on zero.

7.   Place the AC test switch in the x10 position, as shown in Figure 2. This multiplies the count rate on the totalizer tonnes counter by 10 so that an accurate zero can be obtained.

8.   Adjust the totalizer fine zero control until the tonnes counter does not count forward or backward. Record the reading as Zero Setting in Column "AA" of the Drum Plant Aggregate Calibration data sheet (MAT 6-38) as shown in Figure 3.

9.   Place the AC test switch back to the normal position.

10.   Record the Span Setting in Column "H".

Figure 2

11.   Record the Initial Totalizer Reading (column "B") to the nearest two hundredths of a tonne.

12.   Position a tared truck capable of handling at least 10 tonnes of aggregate, under the bypass chute. Be sure that the bypass chute and the truck box are clear of all excess material and the chute is still in the bypass position.
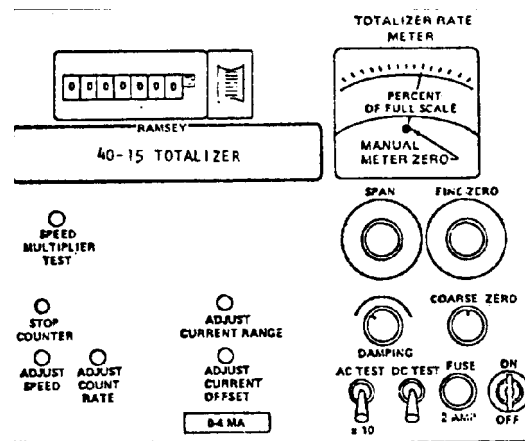
13. Have the contractor run all conveyor belts, except the bin feeder belt.

14. Simultaneously start the bin feeder belt and the stop watch.

15. When at least 10 tonnes of aggregate have run over the belt scale and before the truck box over-flows, simultaneously stop the bin feeder belt and the stop watch.

16. When the totalizer tonnes counter stops counting, record on the data sheet the Final Totalizer Reading (column "A").

17. Convert the loading time in minutes and seconds to seconds and record as Elapsed Time (column "F").

18. Weigh the loaded truck on the platform scale and record the net weight in kg as Truck Scale Wt. of Aggregate (column "D").

   NOTE: The driver of the truck may either be in or out of the truck when taking the tare weight or the loaded weight, but the same condition must be maintained for all weighings. Also no weight must be added to the truck between weighings, such as filling the tank with fuel.

19. Calculate the wet aggregate Production Rate in tonnes/hour (column "G") using the formula:

$$Prod.\ Rate\ (t/h) = \frac{Truck\ Scale\ Wt.\ of\ Aggregate\ in\ kg}{Elapsed\ Time\ in\ seconds} \times 3.6$$

20. Calculate the Totalizer Count in tonnes (column "C") as follows:

$$Totalizer\ count\ (t) = Final\ Totalizer\ Reading - Initial\ Totalizer\ Reading$$

21. Determine the Truck Scale Weight of Aggregate in tonnes (column "E") as follows:

$$= \frac{Truck\ Scale\ Wt.\ of\ Aggregate\ in\ kg\ (column\ "D")}{1000\ kg/t}$$

22. Compare the Totalizer Count (column "C") to the Truck Scale Wt. of Aggregate (column "E"). If the two weights are within ± 0.5%, proceed to Section 3.2.2.2, Test Weights Calibration.

23. If the belt scale weight does not check within ± 0.5% of the truck scale weight:

   a)   Determine the New Span Setting (column "I") using the formula:

$$New\ Span\ Setting = \frac{Truck\ Scale\ Wt.\ of\ Aggregate\ (t)}{Totalizer\ Count\ (t)} \times Span\ Setting$$

b)   Have the contractor adjust the span dial setting until it equals the calculated new span setting (column "I"). The recommended range for the span dial is between 300 and 700.

c)   Repeat the calibration procedure as per steps 11 to 23 until the totalizer count and the truck scale weight are within ± 0.5%.

24.   If the belt scale cannot meet this accuracy the contractor must:

a)   find the problem with the belt scale and/or truck weigh scale,
b)   correct the problem, and
c)   recalibrate the belt scale.

25.   Have the contractor adjust the master feed control to produce a production rate approximately 25% lower than the expected production rate.

26.   Repeat steps 7 to 24.

3.2.2.2   Test Weights Calibration

The following procedure shall be performed immediately after the belt scale calibration.

1.   Have the contractor hang on the belt scale or lower the test weight handle, if applicable, weights that approximately simulate the expected production rate.

2.   Ensure the Moisture Content Dial Setting is on zero.

3.   When the totalizer tonnes counter is at an even tonne, simultaneously take a totalizer reading and start the stop watch.

4.   Note and record the Aggregate Meter Reading in t/h (column "M"), the Process Meter Reading in t/h (column "0"), if applicable, and the Rate Meter Reading in % (column "P"), if applicable, as shown in Figure 3.

5.   When at least six minutes have elapsed and the totalizer counter is at an even tonne, simultaneously take a totalizer reading and stop the stop watch.

6.   Record the number of tonnes counted by the totalizer as Totalizer Count (column "J").

7.   Convert the Elapsed Time in minutes and seconds to seconds and record it in column "L".

8.   Determine the Totalizer Count in kilograms (column "K") as follows:

Totalizer Count (kg) $'$ *Totalizer Count in t* $\times$ 1000 *kg/t*

DRUM PLANT AGGREGATE CALIBRATION

Alberta
TRANSPORTATION
AND UTILITIES

PROJECT _40-30_ FROM _OLD HAY RIVER_ TO _ALBERTA RESOURCES_

PIT NAME _TWELVE MILE CREEK_ LOCATION _SW 10-53-27-5_

PROJECT MANAGER _I. M. GOOD_ DISTRICT _8_

CONTRACTOR _BLACK TOP PAVING_ PLANT _DOUGLAS 400_

BELT SCALE CALIBRATION

AA	A	B	C	D	E	F	G	H	I
ZERO SETTING	TOTALIZER READING		TOTALIZER COUNT A - B	TRUCK SCALE WT. OF AGGREGATE		ELAPSED TIME	PROD. RATE 3.6D/F	SPAN SETTING	NEW SPAN SETTING EH/C
	FINAL	INITIAL			D/1000				
	t	t	t	kg	t	s			
500	19.8	9.1	10.7	11200	11.2	105	384	505	529
500	30.4	19.8	10.6	11420	11.42	105	392	505	544
500	41.8	30.4	11.4	11390	11.39	105	391	544	544
500	53.3	41.8	11.5	11495	11.495	105	394	544	544
500	64.7	53.3	11.4	11405	11.4	105	391	544	544
500	74.7	64.7	9.7	9670	9.67	120	290	544	542

CALIBRATION OF TEST WEIGHTS

J	K	L	M	N	Ø	P
TOTALIZER COUNT		ELAPSED TIME	* AGGREGATE METER READING	TOTALIZER PRODUCTION RATE 3.6K/L	* PROCESS METER READING	RATE METER READING
	1000 J					
t	kg	s	t/h	t/h	t/h	%
38.0	38000	363	377	377	377	75

* ADJUST METER UNTIL EQUAL TO N

RAMSEY TOTALIZER ELECTRONIC CALIBRATION

40-20 TOTALIZER SPAN CALIBRATION NO. _356_ 40-15 D.C. TEST _____ t/h

FIGURE 3

9. Calculate the Totalizer Production Rate in t/h (column "N") using the formula:

$$\text{Totalizer Prod. Rate } (t/h) \; ' \; \frac{\text{Totalizer Count in kg}}{\text{Elapsed Time in s}} \times 3.6$$

10. Compare Aggregate Meter Reading (column "M"), and Process Meter Reading (column "O"), if equipped, to the Totalizer production Rate (column "N"). The meters must be within 1% of the production rate.

11. If the meters are not within 1% of the production rate, the contractor must adjust the meters until they equal the production rate.

12. Have the contractor remove the test weights from the belt scale or raise and lock the test weight handle, if applicable.

3.2.2.3   Belt Scale Electronic Calibration

1.   Have the belt scale conveyor running with all test weights removed.

2.   Place the DC Test switch in the up position. This will simulate 60% of full
scale on the Rate Meter.

3.   Repeat steps 2 to 10 of Section 3.2.2.2.

4.   Transfer the Totalizer Production Rate (column "N") to the 40-15 DC test line.

5.   Return the DC Test switch to the normal position.

3.2.3   Ramsey 40-20 Totalizer

3.2.3.1   Belt Scale Calibration

1.   Repeat steps 1 to 6 of Section 3.2.2.1.

2.   Turn the Mode selector, as shown in Figure 4, to the zero position.

3.   Ensure the test weight handle is up and locked.

4.   Depress the START TEST button and observe the counting on the calibration
counter.

5.   When approximately 6 minutes have elapsed, the test automatically stops.

6.   When a blinking display appears on the Calibration Counter, take a counter
reading. The reading must be "0" ± 1 (99 999, 0 or 1).

NOTE: The Calibration Counter is an up/down electronic unit. When it
reaches 00 000, it continues to count down; the next count is then 99
999. A negative count is obtained when a 9 is shown on the extreme
left hand digit of the calibration counter.

7.   If the reading is not "0" (zero):

  a)   For a positive count, divide the Calibration Counter Reading by two (2).

        If the count was negative, subtract the Calibration counter Reading
        from 100 000 and divide the result by 2.

  b)   have the lock lever at the bottom of the ZERO dial released, then move the
        ZERO dial as many divisions as the calculated result of step (a).

    NOTE: For a positive count, the ZERO dial must be decreased. If the
                count was negative, the setting must be increased.

  c)   have the ZERO dial relocked.

8.   Repeat steps 4 to 7 until the Calibration counter display is 0 ± 1. The recommended range for the ZERO dial is between 300 and 700.

9.   Enter the Zero Setting in column "AA" of the Drum Plant Aggregate Calibration data sheet.

10.   Record the span setting in column "H".

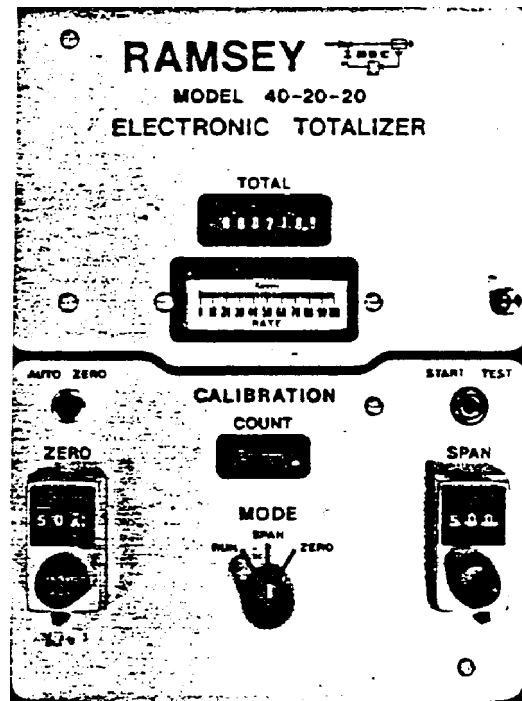11   Record the Initial Totalizer Reading (column "B") to the nearest tenth of a tonne.

     NOTE: The totalizer count has seven digits of which the last digit is calibrated in tenths of tonnes. For example 0014793 should read as 1479.3 tonnes.

12.   Set the Mode Selector to the RUN position.

13.   Repeat steps 12 to 25 of Section 3.2.2.1.

     NOTE: When repeating steps 14 and 15, use the FEEDER control on the push button panel to start and stop the material flow. Do not stop the cold feed unless absolutely necessary.

14.   Repeat the belt scale calibration at the lower production rate by performing steps 2 to 12 of this section followed by steps 12 to 24 of Section 3.2.2.1.

FIGURE 4

3.2.3.2   Test Weights Calibration

The calibration of test weights of 40-20 totalizers is performed in the same manner as for 40-15 totalizers.

1.   Repeat steps 1 to 12 of Section 3.2.2.2.

3.2.3.3   Belt Scale Electronic Calibration

Some 40-20 totalizers have an electronic calibration setting located on the Mode switch. This switch simulates a loaded belt scale.

1.   Have the belt scale conveyor running with all test weights removed.

2.   Place the Mode selector switch to the Electronic Calibration position.

3.   Push the START TEST button. The calibration counter will start counting.

4.   When the test is complete, the display will blink. Record the electronic calibration counter display reading on the Drum Plant Aggregate Calibration data sheet as 40-20 Totalizer Span Calibration No. This number will be used as the calibration standard for subsequent checks.

5.   Place the Mode selector on the RUN position.

3.2.4   Ramsey 10-201 Micro-Tech Totalizer

3.2.4.1   Belt Scale Calibration

1.   Before the calibration, have the belt scale conveyor run for about one hour
      to warm up the system.

2.   The bypass chute must be in the bypass position. Ensure that the material
      does not enter the mixing drum.

3.   With the belt scale conveyor running empty, set the moisture content dial
      setting at zero.

4.   Run approximately 10 tonnes of aggregate over the belt scale conveyor to
      ensure proper seating of the conveyor belt on the rollers and to improve the
      weighing accuracy.

5.   While the aggregate is running, have the master feed control adjusted until
      the aggregate meter reads the expected production rate. When using four
      stockpiles, more than one bin of the same size of aggregate may have to be
      used.

6.   Use the bypass chute to discard the aggregate.

7.   Determine the previous span setting by pressing "SET-UP 2, ENTER".
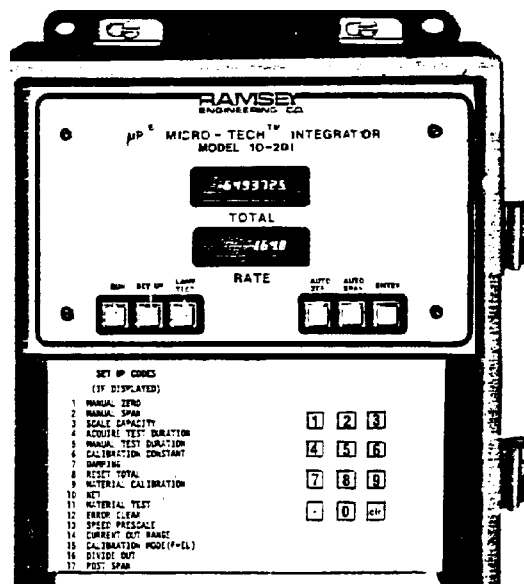   Figure 5 shows the Ramsey 10-201 Micro Tech Totalizer.

FIGURE 5

8.   Record the Span Setting in column "H" of the Drum Plant Aggregate Calibration Data Sheet (MAT 6-38).

9.   Press the "AUTO ZERO" button twice. The auto zero light comes on and the upper display shows the accumulated zero error. A minus sign indicates a negative error.

10.   At the end of the zero test the "ENTER" light will flash. Press "ENTER" and the 10-201 totalizer calculates a new zero and stores it, discarding the old zero.

11.   Record the displayed Zero Setting in column "AA" of the data sheet.

      NOTE: The zero or span setting can be recalled at any time by pressing SET-UP 1 or SET-UP 2, ENTER. After recalling the setting, the 10-201 totalizer must be returned to the normal operating condition by pressing the "RUN" button.

12.   Press "SET-UP 9, ENTER". This zeros the totalizer counter and makes it count to the nearest 0.01 tonnes.

13.   Position a tared truck capable of handling at least 10 tonnes of aggregate under the bypass chute. Be sure that the bypass chute and truck box are clean and that the chute is in the bypass position.

14.   Have the contractor run all the conveyor belts, except the bin feeder belt.

15.   Simultaneously start the stop watch and press the "ENTER" button of the totalizer, while the contractor starts the bin feeder belt.

16.   When at least 10 tonnes of aggregate have run over the belt scale and before the truck overflows, simultaneously stop the bin feeder belt and stopwatch.

17.   When the totalizer counter stops counting press "ENTER" twice to stop the counter and store the test tonnage.

18.   Record the displayed Totalizer Count in column "C".

19.   Convert the loading time to seconds and record as Elapsed Time in column "F".

20.   Weigh the loaded truck on the platform scale and record the net weight in kilograms as Truck Scale Wt. of Aggregate (column "D").

21.   Calculate the wet aggregate Production Rate in t/h (column "G") using the formula:

$$\text{Prod. Rate } (t/h) \; ' \; \frac{\text{Truck Scale Wt. of Aggregate in kg}}{\text{Time in Seconds}} \times 3.6$$

22.   Determine the Truck Scale Wt. of Aggregate in tonnes (column "E") as follows:

$$\text{Truck Scale Weight } (t) \; ' \; \frac{\text{Truck Scale Wt. of Aggregate in kg}}{1000 \; kg/t}$$

23.   Compare the Totalizer count (column "C") to the Truck Scale Wt. of Aggregate in t (column "E"). The totalizer count must be within ±0.5% of the truck scale weight for two consecutive runs.

24.   If the belt scale weight is not within ±0.5% of the truck scale weight:

   a)   calculate the New Span Setting (column "I") using the formula:

$$\text{New Span} \; ' \; \frac{\text{Truck Scale Wt.}}{\text{Totalizer Count}} \times \text{Span Setting}$$

   b)   Have the contractor adjust the span setting to the new setting. This can be done manually by pressing "SET-UP 2, ENTER". Key in the new span and press "ENTER". Record the new span setting for the next run in column "H" of the data sheet.

   c)   Repeat steps 9 to 24 until the totalizer count matches the truck scale weight within ±0.5% for 2 consecutive runs.

25.   Have the contractor reduce the master feed control to produce a 25% lower production rate and repeat steps 9 to 24.

3.2.4.2   Test Weights Calibration

1.   Ensure the scale is in the "Run" mode.

2.   Repeat steps 1 to 12 of Section 3.2.2.2.

3.2.5   Barber-Greene Totalizer

3.2.5.1   Belt Scale Calibration

1.   Repeat steps 1 to 6 of Section 3.2.2.1.

2.   Have the contractor remove the Contec Controls nameplate covering the rocker switches and push the Rocker Switch #4 down to the "Calibrate" mode.

3.   In the "Calibrate" mode, a bar appears on the upper left corner of all digital displays, as shown in Figure 6. The displays show the following:

   a)   **AGG. T.P.H**.: Dry aggregate count in fractions of a tonne: the display will show a zero in the left most digit; the middle digit is an accumulation of tenths of tonnes; and the right most digit is an accumulation of hundredths of tonnes.

   b)   **Filler T.P.H.** (if applicable): aggregate belt speed sensor.

   c)   **ASPHALT T.P.H**.: digital load cell voltage, scaled for display range of -24 to 999.
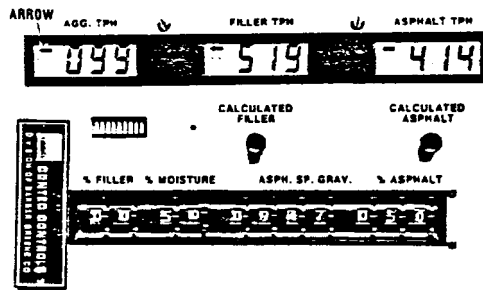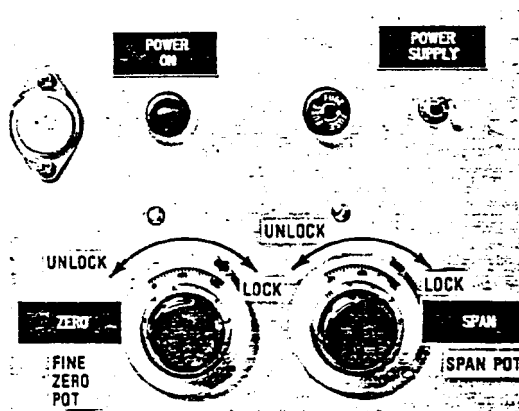

FIGURE 6

4.   Turn the fine zero dial as shown in Figure 7 until the ASPHALT T.P.H. display shows all zeros. Note that the display shows negative as well as positive numbers.

FIGURE 7

5.   Record the Zero Setting in column "AA" of the Drum Plant Aggregate Calibration data sheet (MAT 6-38) as shown in Figure 3.

6.   Record the Span Setting in column "H".

7.   Record the Totalizer Reading (column "A") as follows:

   a)   the full tonnes are shown in the Aggregate Total counter, and

   b)   the tenths and hundredths of tonnes are shown in the Agg. T.P.H. meter, middle and right digits respectively (i.e., the totalizer reading shown in Figures 6 and 8 is 53.99 t).
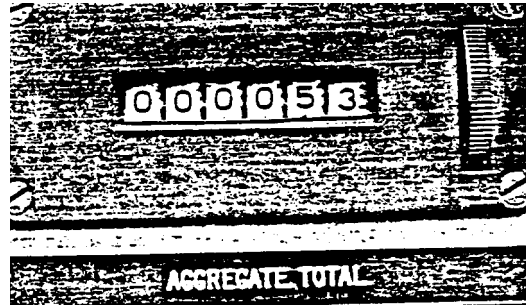
FIGURE 8

8.   Repeat steps 12 to 26 of Section 3.2.2.1.

3.2.5.2   Test Weights Calibration

1.   Repeat steps 1 to 3 of Section 3.2.2.2.

2.   Note and record the Aggregate Meter Reading (Aggregate TPH) in column "M"; the Belt Speed (Filler TPH) in column "0"; and the Load Cell Voltage (Asphalt TPH) in column "P". Cross out and substitute the headings of columns "0" and "P".

3.   Repeat steps 5 to 12 of Section 3.2.2.2.

3.3 Split Stockpiles or Aggregate Addition

3.3.1 General

If using a split stockpile and/or if adding blend sand, filler or coarse material to the crushed aggregate, the cold feed bins of the drum mix plant must be calibrated. The bin calibration is performed after the calibration of the belt scale and test weights.

Drum plants have from 2 to 4 cold feed bins. Each bin motor speed (rev/min) is controlled by an individual trimmer or dial on the control panel. The master dial controls all the bin trimmers together without affecting the established proportions (gradation).

Each cold feed bin must be individually calibrated. When two bins have the same aggregate size and the same gate opening, one test run should be performed on the second bin to ensure the output is similar.

3.3.2 Cold Feed Bin Calibration

1. Obtain the desired wet mix production rate (determined in Section 3.1.2), the expected mix moisture content, and design asphalt content (from the Mix Design) or the target asphalt content.

2. Determine the desired dry mix production rate in t/h as follows:

$$Dry\ Mix\ Prod.\ Rate = \frac{Wet\ Mix\ Production\ Rate}{100\ \%\ Mix\ Moisture\ Content\ in\ \%} \times 100\%$$

3. Determine the desired total dry aggregate production rate in t/h using the formula:

$$= \frac{Dry\ Mix\ Production\ Rate}{100\ \%\ Design\ or\ Target\ Asphalt\ Content\ in\ \%} \times 100\%$$

4. Calculate the dry aggregate production rate in t/h for each bin as follows:

$$= \frac{Stockpile\ Proportion\ in\ \% \times Total\ Dry\ Aggregate\ Production\ Rate\ (t/h)}{100\%}$$

e.g., 425 t/h Wet Mix Production Rate with 5.9% asphalt content and 0.3% moisture content

$$Dry\ Mix = \frac{425}{100.3} \times 100 = 423.7\ t/h$$

$$Dry\ Aggregate = \frac{423.7}{105.9} \times 100 = 400\ t/h$$

Bin Proportions: 53% coarse, 35% fines and 12% blend sand

$$400 \times \frac{53}{100} = 212 \ \textit{t/h coarse aggregate}$$

$$400 \times \frac{35}{100} = 140 \ \textit{t/h natural fines}$$

$$400 \times \frac{12}{100} = 48 \ \textit{t/h blend sand}$$

5.   Have bin number 1 filled with representative aggregate from the coarse stockpile.

6.   Set the master potentiometer at 100 and the individual bin trimmers at 50.

7.   Have a tared haul truck under the calibration chute.

8.   Record the Bin No. and Gate Opening in column "Q" and the Bin Trimmer Setting in column "R", as shown in Figure 9.

9.   With the gathering and inclined conveyors running, simultaneously start the feeder conveyor and stop watch.

10.   Record the Bin Meter Reading in column "S" and the Aggregate Meter Reading in column "Z".

11.   Take two or more tachometer readings on the electric motor on the feed conveyor. Record as Bin Speed in rev/min (column "T").

12.   When the truck is full, stop the feeder and stop watch while leaving the gathering and incline conveyors running.

13.   Record the elapsed time in seconds in column "V".

14.   Weigh the truck with the material and subtract the tare. Record as Wet Wt. of Aggregate in column "U":

15.   Obtain a representative moisture content sample of the aggregate in the truck as directed in ATT-38, SAMPLING, Gravel and Sand.

16.   Determine the Aggregate Moisture content as directed in ATT-14, MOISTURE CONTENT, Open Pan Method, and record it in column "X".

17.   Calculate the Wet Aggregate Production Rate in t/h (column "W") using the formula:

$$\textit{Wet Agg. Prod. Rate (t/h)} = \frac{\textit{Wet Wt. of Aggregate (kg)}}{\textit{Elapsed Time in Seconds}} \times 3.6$$

DRUM PLANT AGGREGATE CALIBRATION

Alberta TRANSPORTATION

PROJECT _40.30_ FROM _WILDHAY RIVER_ TO _ALBERTA RESOURCES_
PIT NAME _TWELVE MILE CREEK_ LOCATION _SW 10-53-27-5_
PROJECT MANAGER _I. M. GOOD_ DISTRICT _8_
CONTRACTOR _BLACKTOP PAVING_ PLANT _DOUGLAS 400_

BELT SCALE CALIBRATION

AA	A	B	C	D	E	F	G	H	I
ZERO SETTING	TOTALIZER READING FINAL t	TOTALIZER READING INITIAL t	TOTALIZER COUNT A-B t	TRUCK SCALE WT. OF AGGREGATE kg	D/1000 t	ELAPSED TIME s	PROD. RATE $3.6D/F$	SPAN SETTING	NEW SPAN SETTING EH/C
500	19.8	9.1	10.7	11200	11.2	105	384	505	527
500	30.4	19.8	10.6	11420	11.42	105	392	505	544
500	41.8	30.4	11.4	11390	11.39	105	391	544	544
500	53.3	41.8	11.5	11495	11.495	105	394	544	544
500	64.7	53.3	11.4	11405	11.4	105	391	544	544
500	74.4	64.7	9.7	9670	9.67	120	290	544	542

CALIBRATION OF TEST WEIGHTS

J	K	L	M	N	O	P
TOTALIZER COUNT t	1000 J kg	ELAPSED TIME s	▪ AGGREGATE METER READING t/h	TOTALIZER PRODUCTION RATE $3.6K/L$ t/h	▪ PROCESS METER READING t/h	RATE METER READING %
38.0	38000	363	377	377	377	75

▪ ADJUST METER UNTIL EQUAL TO N

RAMSEY TOTALIZER ELECTRONIC CALIBRATION

40-20 TOTALIZER SPAN CALIBRATION NO. _356_ 40-15 D. C. TEST _____ t/h

SPLIT STOCKPILES

PROPORTIONS: BLEND SAND _12_ % COARSE _53_ % FINE _35_ %

Q	R	S	T	U	V	W	X	Y	Z
BIN NO.	GATE OPENING cm	BIN TRIMMER SETTING	BIN METER READING	BIN SPEED rev/min	WET WT. OF AGGREGATE kg	ELAPSED TIME s	WET AGG. PROD. RATE $3.6V/W$ t/h	AGGREGATE MOISTURE CONTENT %	DRY AGG. PROD. RATE $\frac{100W}{100+X}$ t/h / AGGREGATE METER READING t/h
1	26	50	50.3	875	11165	300	134	2.6	131 — 135
1	26	50	49.8	870	11080	300	133	2.6	130 — 135
1	26	70	70.7	1225	10980	210	188	2.6	183 — 190
1	26	95	95.4	1665	10615	150	255	2.6	248 — 260
2	26	50	50.1	875	11180	360	112	6.1	105 — 110
2	26	50	50.2	875	11270	360	113	6.1	106 — 115
2	26	70	70.2	1225	11590	271	154	6.1	145 — 155
2	26	90	90.4	1575	9705	180	198	6.1	187 — 200
3	15	50	49.5	875	7440	360	74	9.7	67 — 75
3	15	50	50.1	875	7490	360	75	9.7	68 — 75
3	15	30	28.7	500	4310	360	43	9.7	57 — 45
3	15	15	14.5	250	3470	600	20.8	9.7	17 — 25

SEND A COPY TO TRANSPORTATION LABORATORY

DATE _86.06.27_ MATERIALS TECHNOLOGIST _R. STEPHEN_

FIGURE 9

18.   Determine the Dry Aggregate Production Rate in t/h (column "Y") as follows:

$$Dry\ Agg.\ Prod.\ Rate\ (t/h) = \frac{Wet\ Aggregate\ Production\ Rate}{100\ \%\ Agg.\ Moisture\ Content\ in\ \%} \times 100\ \%$$

19.   Compare the Dry Aggregate Production Rate (column "Y") to the Aggregate Meter Reading (column "Z"). The two figures should be the same.

20.   Perform a second and third run at the same settings to ensure that the aggregate flow rate is consistent. All three runs should be within 5% of each other.

21.   Repeat steps 7 to 20 at two other bin trimmer settings that will cover the range of plant production.

22.   Repeat steps 6 to 21 for the fines and sand bins. The sand bin gate should be set fairly low to obtain a consistent feed.

23.   When the aggregate calibration is complete, draw graphs for each bin. Plot the dry aggregate production rate in t/h versus the speed in rev/min of the feeder motors. Figure 10 shows an example of graphs drawn from the calibration.
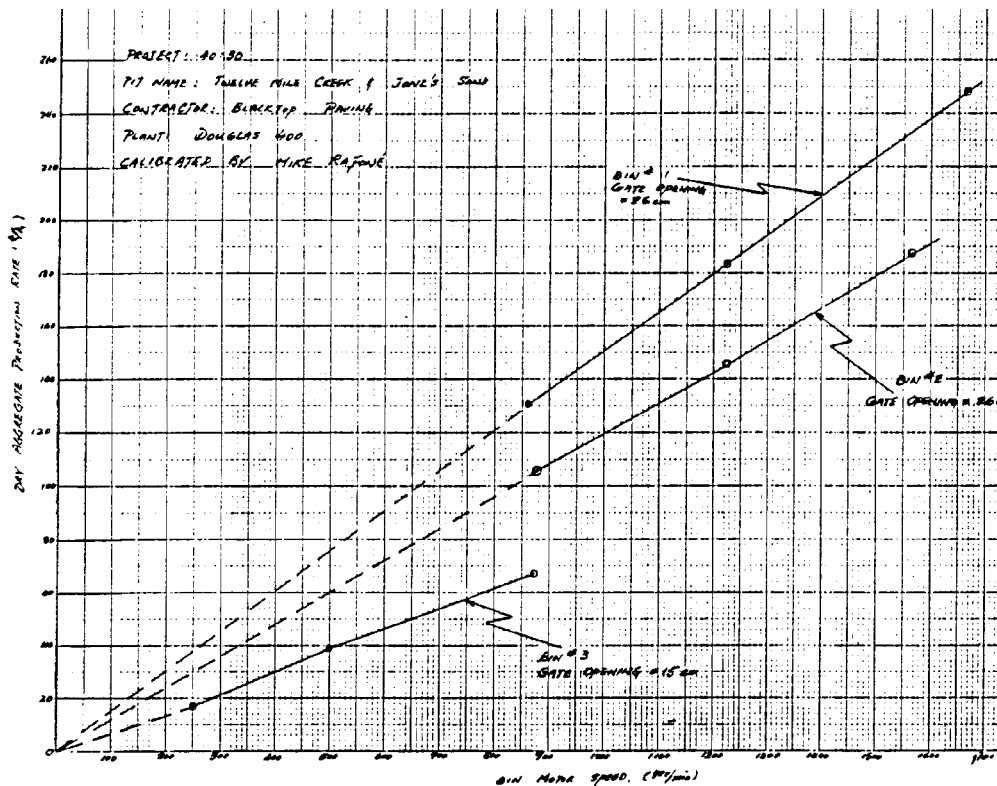

FIGURE 10

3.3.3   Setting the Proportions

1.   Determine the speed in rev/min from each graph for each bin to achieve the dry aggregate production rate determined in step 4 of section 3.3.2.

  e.g., Bin #1 Coarse 212 t/h = 1420 rev/min (from graph)
     Bin #2 Natural Fines 140 t/h = 1180 rev/min (from graph)
     Bin #3 Blend Sand 48 t/h = 620 rev/min (from graph)

  NOTE: The above data was based on the master potentiometer at 100, therefore, the master setting should be a percentage of the aggregate production rate.

2.   Set each bin motor speed by adjusting the individual bin trimmers and taking tachometer readings until the tachometer readings on each bin equals that determined in step 1 above. A truck may have to be placed under the calibration chute to catch the aggregate.

3.   The bin motors must increase and decrease proportionately. Verity if as follows:

  a) Decrease the master potentiometer to 70.

  b) Use a tachometer to determine the speed of each bin motor.

  c) Use the bin graphs to determine the production rate from each bin. The graphs may have to be extended for this check.

  d) Add the production rates together to obtain the total production rate.

  e) Multiply each production rate by one hundred and divide the result by the total production rate. The result is the percent split of each size and should not change by more than 1.0%.

  e.g., Bin #1 coarse 1010 rev/min = 151 t/h (from graph)
     Bin #2 natural fines 870 rev/min = 104 t/h (from graph)
     Bin #3 blend sand 450 rev/min = 35 t/h (from graph)

            TOTAL = 290 t/h

Bin #1 $\dfrac{151}{290} \times 100 ' 52\%$ *as compared to* 53%

Bin #2 $\dfrac{104}{290} \times 100 ' 36\%$ *as compared to* 35%

Bin #3 $\dfrac{35}{290} \times 100 ' 12\%$ *as compared to* 12%

3.4   Calibration of the Asphalt System

The asphalt system is calibrated after the belt scale calibration. The data obtained is recorded on the Drum Plant Asphalt Calibration, MAT 6-39. When requested, a copy of the form is sent to the department.

The temperature of the asphalt cement in the storage tanks should be at the temperature to be used throughout the project.

3.4.1   Control Console Dials

Figures 11, 12 and 13 are typical examples of Cedarapids, Barber-Greene and Boeing control console layouts.

On most drum mix plants, the following control console dials are set prior to the calibration:

1.   Relative Density dial, also known as the Specific Gravity dial (Imperial system), Asphalt Compensation dial or kilograms per volume (gallon, in the Imperial system) dial.

         Leave this dial at the setting used on the previous project.

         Record the Relative Density Dial reading in the title block of the data sheet as shown in Figure 14.
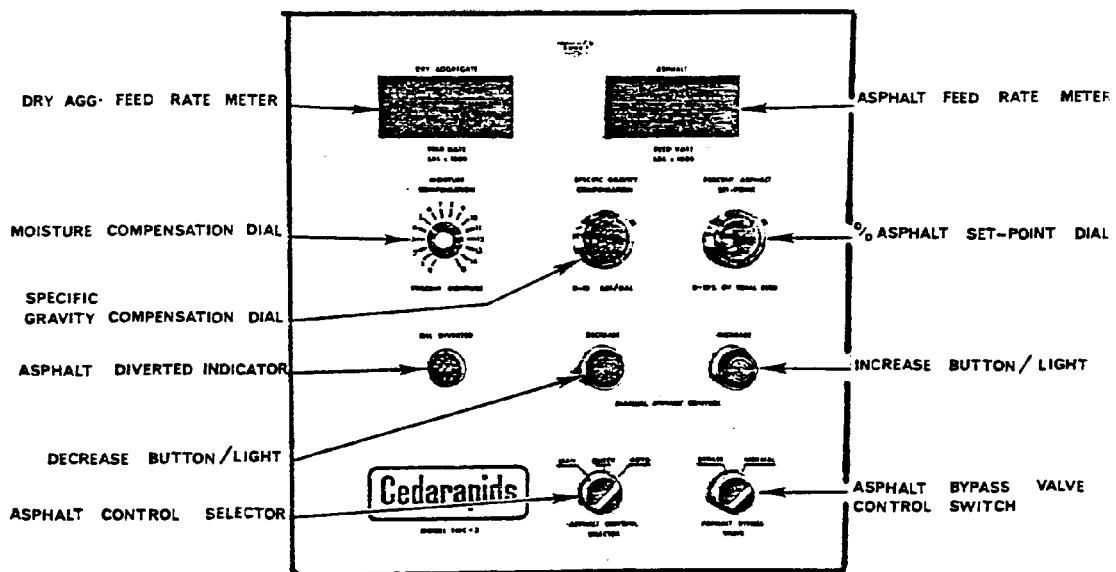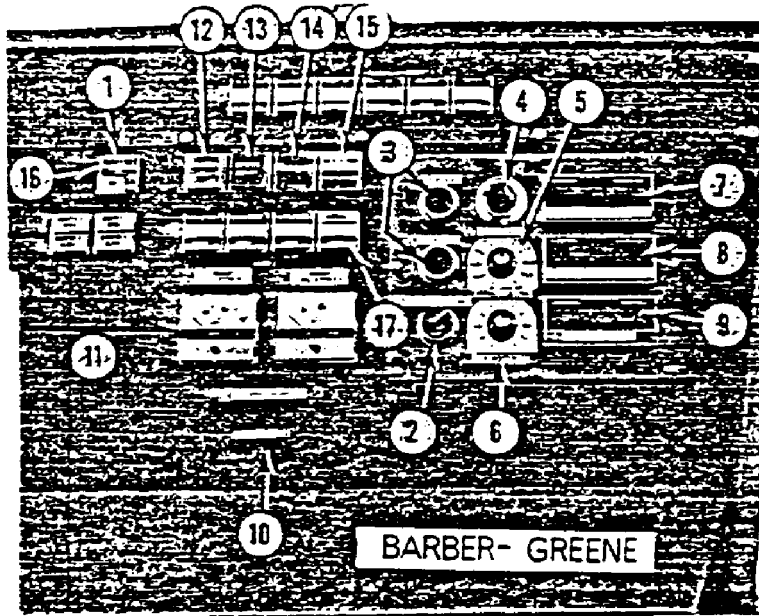

FIGURE 11

1 Power On/Off Switch
2 Auto/Off/Manual Switch
3 Increase-Decrease Asphalt Buttons
4 Percent Asphalt Dial
5 Pounds Per Gallon Dial
6 Percent Moisture Dial
7 Calculated TPH Meter
8 Asphalt Delivered TPH Meter
9 Aggregate TPH Meter

10 Asphalt Gallon Counter
11 Water GPM Meter (when used)
12 Master Stop Button
13 Master Start Button
14 Master Interlock Light
15 Asphalt Valve Return Light
16 Asphalt Valve Spray Light
17 Asphalt Control Button

2. Percent Asphalt Dial or Asphalt Set Point.

The asphalt is calibrated at three settings on the dial. One setting at the design (or target) asphalt content, one setting 0.5% above and one setting 0.5% below the design (or target) asphalt content.

3. Percent Moisture Dial.

This dial is set at zero during the asphalt calibration.

4. Asphalt Tonnes Per Hour Meter, Flow Meter, or Revolution Counter, Rev/Min Meter (for Boeing Plants).
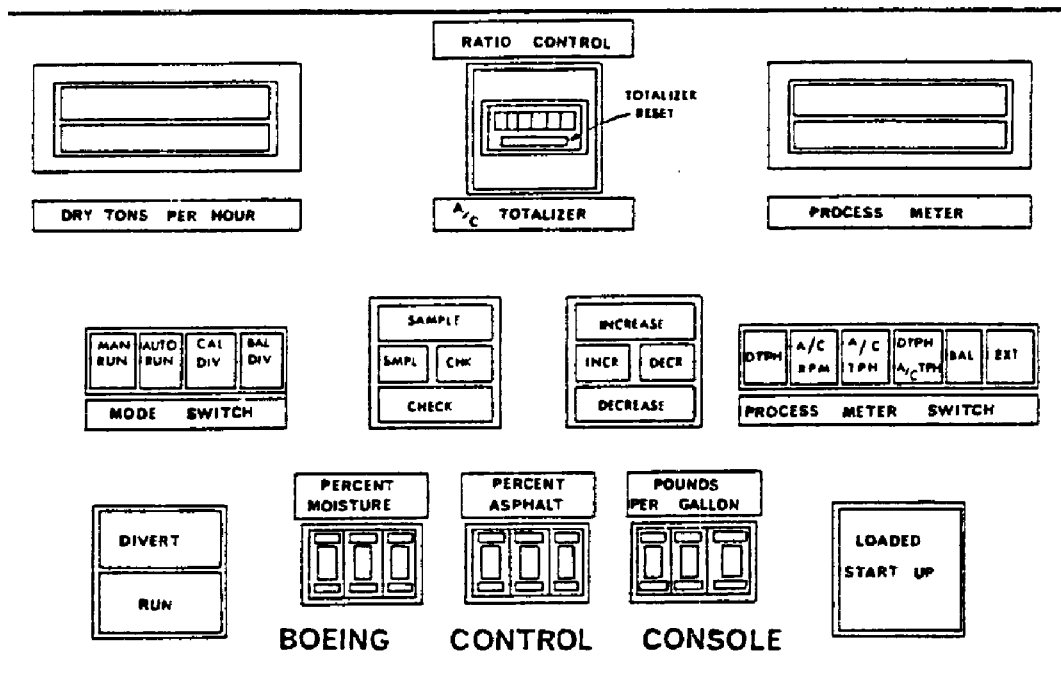
FIGURE 12

FIGURE 13

The flow meter and revolution counter should be zeroed or an initial reading should be taken prior to the asphalt calibration.

3.4.2   Asphalt Calibration Procedure

1.   Have the asphalt lines and pump brought to operating temperature by pumping asphalt through the lines and returning it to storage.

> **NOTE:**   The asphalt must be pumped into a tared container of at least 4000 litres capacity, usually a distributor truck. If a distributor truck is used, check to ensure that the tank is clean, as a small amount of water or emulsion will cause hot asphalt to foam and spray out of the tank.

DRUM PLANT ASPHALT CALIBRATION

Alberta TRANSPORTATION

PROJECT _____40:36_____ JOB NO. _____T 766 8_____ DISTRICT _____EDSON (B)_____

PIT NAME _____TWELVE MILE CREEK_____ PIT LOCATION _____SW 10-53-27-5_____

PROJECT MANAGER _____R. JOHNSON_____ CONTRACTOR _____BLACKTOP PAVING_____ PLANT _____Douglas 400_____

TEST WEIGHTS _____5 @ 10 kg_____ RELATIVE DENSITY DIAL _____9.43_____

RATE METER READING _____75_____ % ASPHALT TEMPERATURE _____140_____ °C

A	B	C	D	E	F	G	H	I	J	K
WT. OF ASPHALT PUMPED kg	TOTALIZER AGGREGATE COUNT t	ELAPSED TIME s	REV. OR VOLUME COUNTED rev. OR vol.	PERCENT ASPHALT DIAL READING %	ACTUAL A/10B %	ASPHALT PROD. RATE METER READING t/h	ACTUAL 3.6A/c t/h	ASPHALT PUMP SPEED METER OR PUMP READ. rev/min	ACTUAL 60D/c rev/min	WT. PER REV. OR VOL. A/D kg/rev OR kg/vol.

CALIBRATION OF METERS

A	B	C	D	E	F	G	H	I	J	K
4530	75	716	1982	5.9	6.0	22.7	22.7	22.7	165	2.29
4210	70	890	1838	5.9	6.0	17.1	17.0	17.0	125	2.29

CALIBRATION OF ASPHALT PROPORTIONING SYSTEM

A	B	C	D	E	F	G	H	I	J	K
1299	20	181	567	6.4	6.5	24.4	24.5	177	178	2.29
1096	20	198	479	5.4	5.5	20.6	20.6	151	150	2.29
1301	20	254	568	6.4	6.5	18.5	18.4	135	134	2.29
1100	20	253	480	5.4	5.5	15.8	15.7	114	114	2.29

* KD

D - REV. = REVOLUTIONS OF THE PUMP

D - VOLUME = GALLON METER COUNT

REMARKS

MATERIALS TECH _____D. SMITH_____ DATE _____86.05.23_____

FIGURE 14

2.   Set the percent asphalt dial at the design asphalt content setting and record as Percent Asphalt Dial Reading (column "E"). Also set the percent moisture dial at zero.

3.   Place on the belt scale the weights used for the calibration of test weights and record the weight in the title block of the data sheet.

4.   Place the asphalt control system in the automatic mode.

        NOTE: Some asphalt plants cannot be placed in the automatic mode until the asphalt reading is up to the proper production rate.

5.   Simultaneously perform the following:

        a)   When the totalizer turns to a whole tonne, start pumping asphalt into a tared distributor truck.

        b)   Start the stop watch.

        c)   Take the initial reading on the Aggregate Totalizer Tonnes Counter, Revolution Counter or AC Totalizer, and Flow Meter.

        d)   If the plant is not equipped with a Revolution Counter or Flow Meter, use a tachometer to obtain the asphalt pump speed in rev/min.

6.   Record on the data sheet the Asphalt Production Rate Meter Reading (column "G") and the Asphalt Pump Speed Meter Reading (column "I").

7.   When the totalizer tonnes counter has counted at least 50 tonnes for plants with production rates above 200 t/h or counted 25 tonnes for plants with production rates below 200 t/h and the counter is at an even tonne, simultaneously perform the following:

        a)   Stop pumping asphalt into the distributor truck.

        b)   Stop the stop watch.

        c)   Take the final reading on the Aggregate Totalizer Tonnes Counter and Revolution Counter or Flow Meter.

8.   Record the time in seconds in column "C", the Totalizer Aggregate Count in column "B" and the Revolutions or Flor Meter Count in column "D".

9.   Have the loaded distributor truck weighed and record the net weight as Wt. of Asphalt Pumped (column "A").
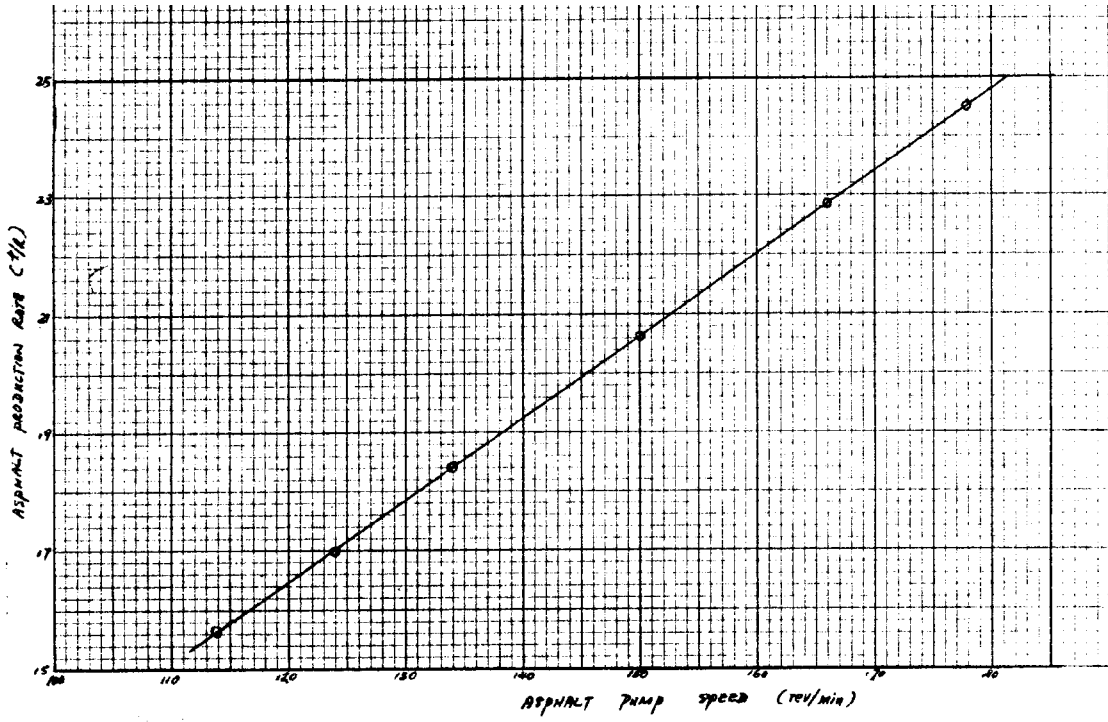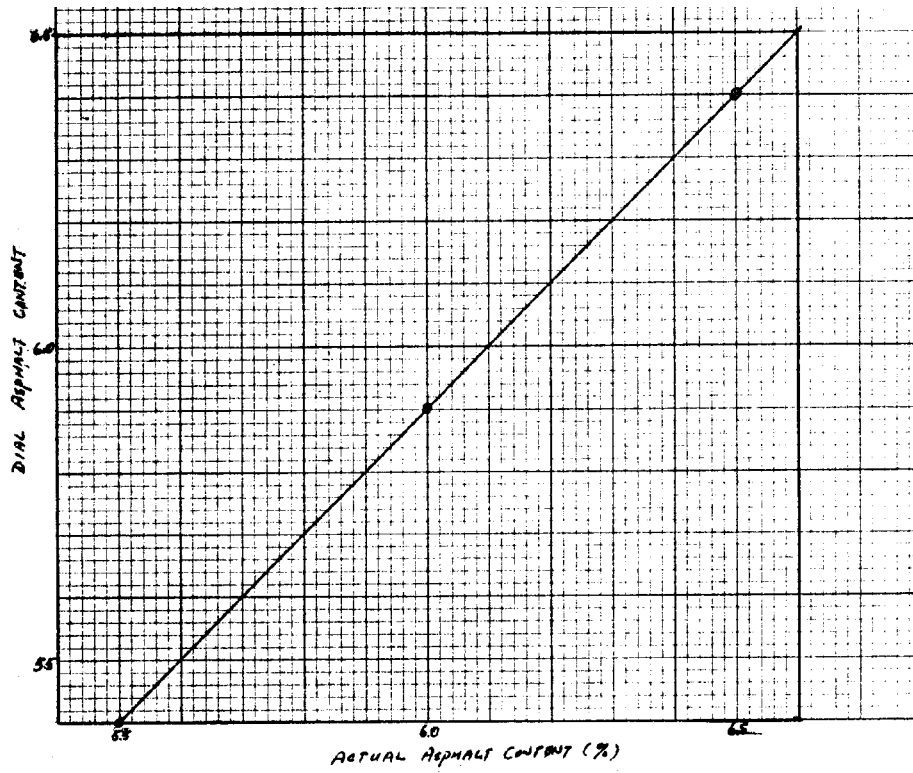
FIGURE 15

FIGURE 16

10. Calculate the actual asphalt content in % (column "F") using the formula:

11. Determine the actual asphalt production rate in t/h (column "H") as follows:

$$Actual\ Asphalt\ Content\ (\%) \cdot \frac{Wt.\ of\ Asphalt\ Pumped\ in\ kg \times 100\ \%}{Totalizer\ Aggregate\ Count\ (t) \times 1000\ kg/t}$$

$$Actual\ Asphalt\ Prod.\ Rate\ (t/h) \cdot \frac{Wt.\ of\ Asphalt\ Pumped\ in\ kg \times 3600\ s/h}{Elapsed\ Time\ in\ s \times 1000\ kg/t}$$

12. Calculate the actual speed of the asphalt pump in rev/min (column "J") using the formula:

$$Actual\ Asphalt\ Pump\ Speed\ (rev/min) \cdot \frac{No.\ of\ Revolutions \times 60\ s/min}{Elapsed\ Time\ in\ s}$$

13. Determine the weight of asphalt per revolution in kg/rev (column "K"), as follows:

$$Wt.\ of\ Asphalt\ per\ Rev \cdot \frac{Wt.\ of\ Asphalt\ Pumped\ in\ kg}{No.\ of\ Revolutions}$$

14. If the plant is equipped with a flow meter, determine the weight of asphalt in kg per unit volume of the flow meter (column "K") using the formula:

$$Wt.\ of\ Asphalt\ per\ Unit\ Volume \cdot \frac{Wt.\ of\ Asphalt\ Pumped\ in\ kg}{Flow\ Meter\ Count}$$

    NOTE: The weight per revolution or unit volume should not fluctuate by more than 2%.

15. Compare the Percent Asphalt Dial (column "E") to the Actual (column "F"). If the two figures do not agree, the electronics controlling the dial must be adjusted until the dial reads within ±0.3% of the Actual.

16. Compare the Asphalt Production Rate Meter Reading (column "G") to the Actual (column ""H") and the Asphalt Pump Speed Meter Reading (column "I") to the Actual (column "J"). If any of the calculated values do not agree with the corresponding meter readings, the electronics controlling the meters must be adjusted so that the meters will read within 1% of the calculated values.

17. Take weight off the belt scale to simulate an aggregate production rate 25% lower than the desired output.

18. Repeat the calibration procedure at the design asphalt content, at the 25% lower output, as directed in steps 2 to 16.

19. Once the meters have been calibrated and the weight of asphalt per rev or volume determined, place the asphalt content dial at 0.5% above design asphalt content.

20. Replace the weights on the belt scale to simulate the desired (established) production rate.

21. Have the asphalt diverted to the storage tank.

22. Simultaneously perform the following:

    a) Start the stop watch.

    b) Take the initial reading on the totalizer tonnes counter and flow meter or revolution counter.

    c) If the plant is not equipped with a revolution counter or flow meter, use a tachometer to take the asphalt pump speed in rev/min.

23. Record on the lower portion of the data sheet, the Asphalt Production Rate Meter Reading (column "G") and the Asphalt Pump Speed Meter Reading (column "I").

24. When 20 tonnes have elapsed on the aggregate totalizer tonnes counter, simultaneously perform the following:

    a) Stop the stop watch.

    b) Take a final reading on the totalizer and the flow meter or revolution counter.

25. Record the Elapsed Time in s (column "C"), the Totalizer Aggregate Count (column "B") and the Revolutions or Flow Meter Count (column "D").

26. Calculate the Weight of Asphalt Pumped (column "A") using the formula:

$$\textit{Wt. of Asphalt } (\textit{kg}) = \textit{Wt. of Asphalt Per Revolution} \times \textit{No. of Revolutions, or}$$
$$= \textit{Wt. of Asphalt Per Unit Volume} \times \textit{Flow Meter Count}$$

27. Repeat steps 10 to 12.

28. Repeat steps 22 to 27 with the Percent Asphalt Dial at a setting 0.5% below the design asphalt content.

29. The asphalt system should track within ±0.1%. If the % asphalt varies by more than ± 0.1%, either the belt scale or asphalt electronic proportioning system has not been calibrated properly. If this is the case, a calibration of the electronics must be done by the contractor. If any changes are made to the electronics, the plant must be recalibrated.

30.   Take off weights on the belt scale to simulate an aggregate production rate 25% lower than the desired output.

31.   Repeat steps 22 to 27 with the Percent Asphalt Dial at a set 0.5% above the design asphalt and at a setting 0.5% below.

32.   Plot a graph of Actual Asphalt Production Rate in t/h versus Actual Asphalt Pump Speed as shown in Figure 15. This graph can be used in the future to check the readout of the "asphalt delivered" meter.

33.   Plot a graph of Percent Asphalt Dial versus Actual as shown in Figure 16.

4.0   HINTS AND PRECAUTIONS

1.   The belt scale must be warmed up for 1 hour before any tests.

2.   If settlement or movement of the belt scale conveyor occurs, the contractor must recalibrate the belt scale and ensure that it is reading accurately.

3.   The belt scale should be checked for accuracy daily with known amounts of test weights.

4.   Make sure that percent moisture and relative density dials are set correctly.

5.   Check the unit totalizer asphalt content against the calibration asphalt content. Unless there is a malfunction with the flow meter counter, revolution counter, or the electronics in the asphalt proportioning system, the two asphalt contents must be the same. If they are not, the plant must be recalibrated.

6.   The zero dial on the totalizer must be used to zero the tonnes counter, so that it does not count forward or backward when no aggregate is passing over the belt scale. The contractor should check the zero periodically throughout the day.