08:34:39 OCA PAD AMENDMENT - PROJECT HEADER INFORMATION 10/30/96

Active

Project #: E-20-M27 Cost share #: Rev #: 1
Center # : 10/24-6-R8975-0A0 Center shr #: OCA file #:
Work type : RES
Contract#: AGREEMENT DATED 960604 Mod #: LTR DTD 961028 Document : AGR
Prime #: Contract entity: GTRC

Subprojects ? : N CFDA: NA
Main project #: PE #: NA

Project unit: CIVIL ENGR Unit code: 02.010.116
Project director(s):
LAI J S CIVIL ENGR (404)894-2285

Sponsor/division names: LW SCIENTIFIC INCORPORATED / TUCKER, GA
Sponsor/division codes: 261 / 028

Award period: 960515 to 970114 (performance) 970114 (reports)

Sponsor amount	New this change	Total to date
Contract value	0.00	12,591.00
Funded	0.00	12,591.00
Cost sharing amount		0.00

Does subcontracting plan apply ?: N

Title: DEV OF A SIMPLIFIED LOADED WHEEL TESTER FOR EVALUATING RUTTING OF ASPHALT...

PROJECT ADMINISTRATION DATA

OCA contact: Brian J. Lindberg 894-4820

Sponsor technical contact	Sponsor issuing office
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Security class (U,C,S,TS) : U ONR resident rep. is ACO (Y/N): N
Defense priority rating : NA NA supplemental sheet
Equipment title vests with: Sponsor X GIT
ITEMS OF EQUIPMENT TO BE SUPPLIED BY SPONSOR.
Administrative comments -
LETTER DATED 10/28/96 AUTHORIZES EXTENSION OF PROJECT THROUGH
JANUARY 14, 1997.

GEORGIA INSTITUTE OF TECHNOLOGY
OFFICE OF CONTRACT ADMINISTRATION

U

NOTICE OF PROJECT CLOSEOUT

SR457

Closeout Notice Date 01/14/97

Project No. E-20-M27_____ Center No. 10/24-6-R8975-0A0_

Project Director LAI J S_____ School/Lab CIVIL ENGR_____

Sponsor LW SCIENTIFIC INCORPORATED/TUCKER, GA_____

Contract/Grant No. AGREEMENT DATED 960604_____ Contract Entity GTRC

Prime Contract No. _____

Title DEV OF A SIMPLIFIED LOADED WHEEL TESTER FOR EVALUATING RUTTING OF ASPHALT

Effective Completion Date 970114 (Performance) 970114 (Reports)

Closeout Actions Required:	Y/N	Date Submitted
Final Invoice or Copy of Final Invoice	Y	_____
Final Report of Inventions and/or Subcontracts	Y	_____
Government Property Inventory & Related Certificate	N	_____
Classified Material Certificate	N	_____
Release and Assignment	N	_____
Other _____	N	_____

Comments_____

_____

Subproject Under Main Project No. _____

Continues Project No. _____

Distribution Required:

Project Director	Y
Administrative Network Representative	Y
GTRI Accounting/Grants and Contracts	Y
Procurement/Supply Services	Y
Research Property Managment	Y
Research Security Services	N
Reports Coordinator (OCA)	Y
GTRC	Y
Project File	Y
Other _____	N
_____	N

NOTE: Final Patent Questionnaire sent to PDPI.

Georgia Loader Wheel Tester
and
Rolling Compactor

USER'S GIUDE

by

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January, 1997

TABLE OF CONTENTS

INTRODUCTION

This users manual is prepared for the purpose of allowing the user to operate the rolling compactor for fabricating the asphalt beam specimens and to use the Georgia Loaded Wheel Tester (GLWT) for evaluating rutting characteristics of asphalt mixtures in accordance with the procedure "GDT-115 METHOD OF TEST FOR DETERMINING RUTTING SUSCEPTIBILITY USING THE LOADED WHEEL TESTER".

This manual is organized into three parts:

Part 1: Use of Rolling compactor
Part 2: Use of Loaded Wheel Tester
Part 3: Appendix containing the supporting documents

Part 1, which includes Chapter 1, 2 and 3, describes the proper use of the rolling compaction machine from unpacking and installing when received, to normal operation procedures for compacting asphalt beam samples and adjustment procedures for some important operations.

Part 2, which include Chapter 4, 5, and 6, describes the use of the loaded wheel tester from unpacking and installing, to normal operation procedures for testing to determine the rut depth of the asphalt beam samples as well as adjustments and calibrations procedures for some important operations.

Part 3. includes appendixes A, B and C. Appendix A describes the GDT-115 procedure. Appendix B lists the key replacement parts, the specifications and the manufacture's names for the parts. Appendix C offers some tips for improving the operation of the machines.

Comments, suggestions and questions regarding the operation of the machines are welcome. Please send them to the following address:

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CHAPTER 1
UNPACKING AND INSTALLING OF ROLLING COMPACTOR

1.1 Checking the Parts

The following parts are included in a box shipped along with the rolling compaction machine. The contents in the box include the following:

A. An additional bottom plate for the beam mold.
B. This user's manual.

1.2 Location and Power Source

Location: The overall dimensions of the machine are 0.90 m (35 in.) wide by 1.06 m (42 in.) long by 1.80 m (72 in.) high. The machine is fitted with 4 wheels at the base and can be easily moved to near the asphalt batching facility. The machine should be located on a level floor having at least 0.3 m (12 in.) in the back, 0.3 m on the right side, 0.75 m (30 in.) on the left side and 0.9 m (36 in.) in the front.

Electrical Requirements: A 120 volt, 30 ampere fused electrical outlet is required. It is recommended that a separate circuit serving only this machine be provided and should be equipped with a circuit breaker. Do not use an extension cord.

1.3 Names of Parts

This section points out the major parts of this rolling compaction machine and gives a brief description of the function of each. The part names introduced in this section will be used throughout this manual. The machine, as shown in Figure 1,2 and 3, consists of the following four basic components:

- Rolling compactor assembly
- Sliding motion assembly
- Beam sample mold
- Hydraulic system and operational control

Rolling Compactor Assembly The rolling compactor assembly generates the force for compacting the beam samples. The assembly, shown in Figure 2 and 3, consists of:

(A1) a load frame
(A2) a double action hydraulic cylinder
(A3) a compaction roller
(A4) two horizontal restraining assembly

(A5) a compaction head (a nylon pad)

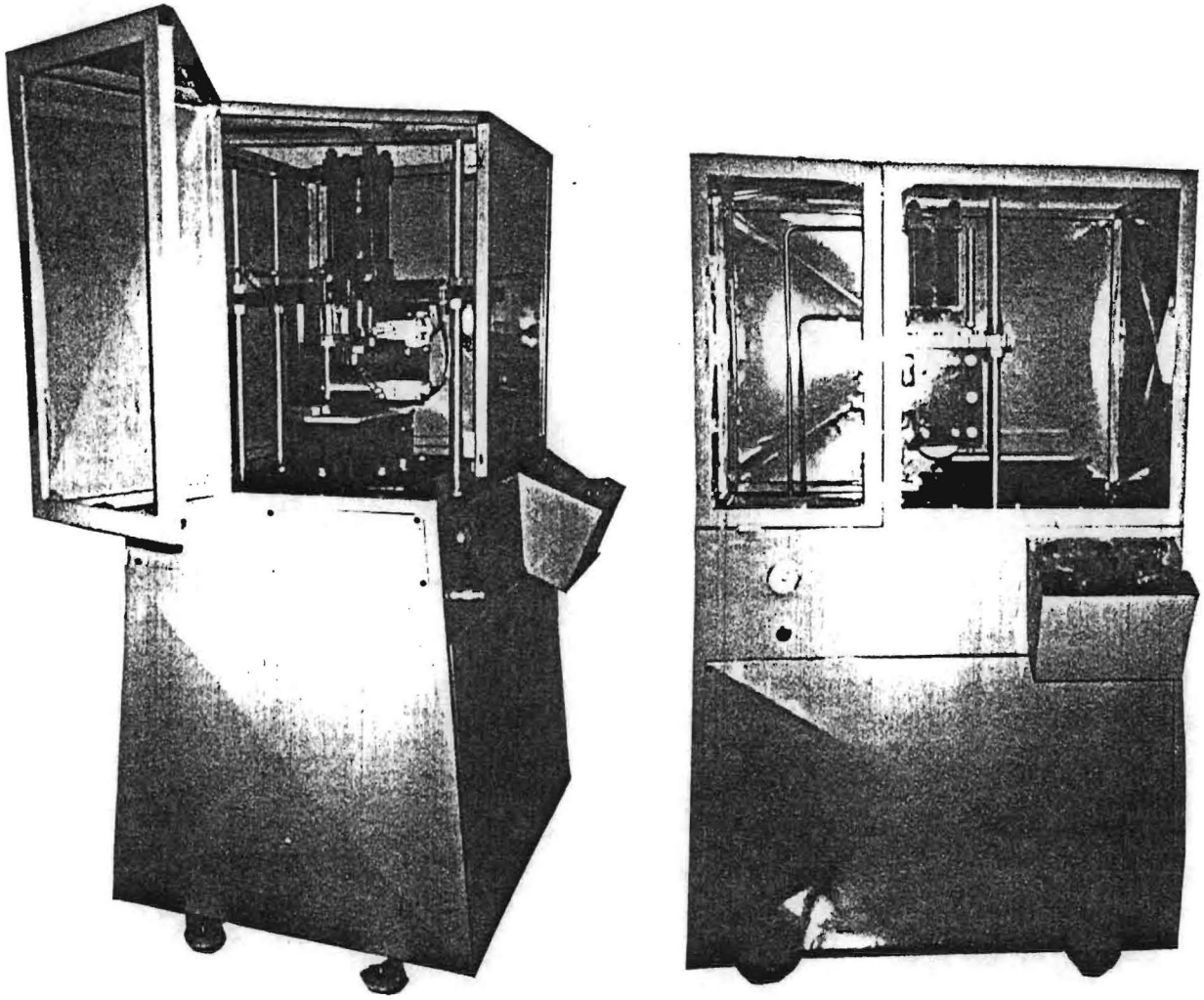
Sliding Motion Assembly This assembly generates the reciprocating sliding motion of the sliding table. The assembly shown in Figure 2 consists of:

(B1) a sliding table assembly
(B2) a horizontally aligned double action hydraulic cylinder
(B3) beam sample mold restraining brackets

Beam Sample Mold It consists of a split side mold and a loosely fitted bottom plate. This beam sample mold assembly is inside the beam restraining brackets.

Hydraulic System and Operational Control The hydraulic system generates the force for driving the vertical actuator (A2) and the horizontal actuator (B2) for controlling the operation of the beam sample compaction. The system consists of:

(C1) hydraulic pump
(C2) oil tank
(C3) flow control valve
(C4) limiting switches
(C5) control panel



Rolling Compaction Machine (Model RCM-2)

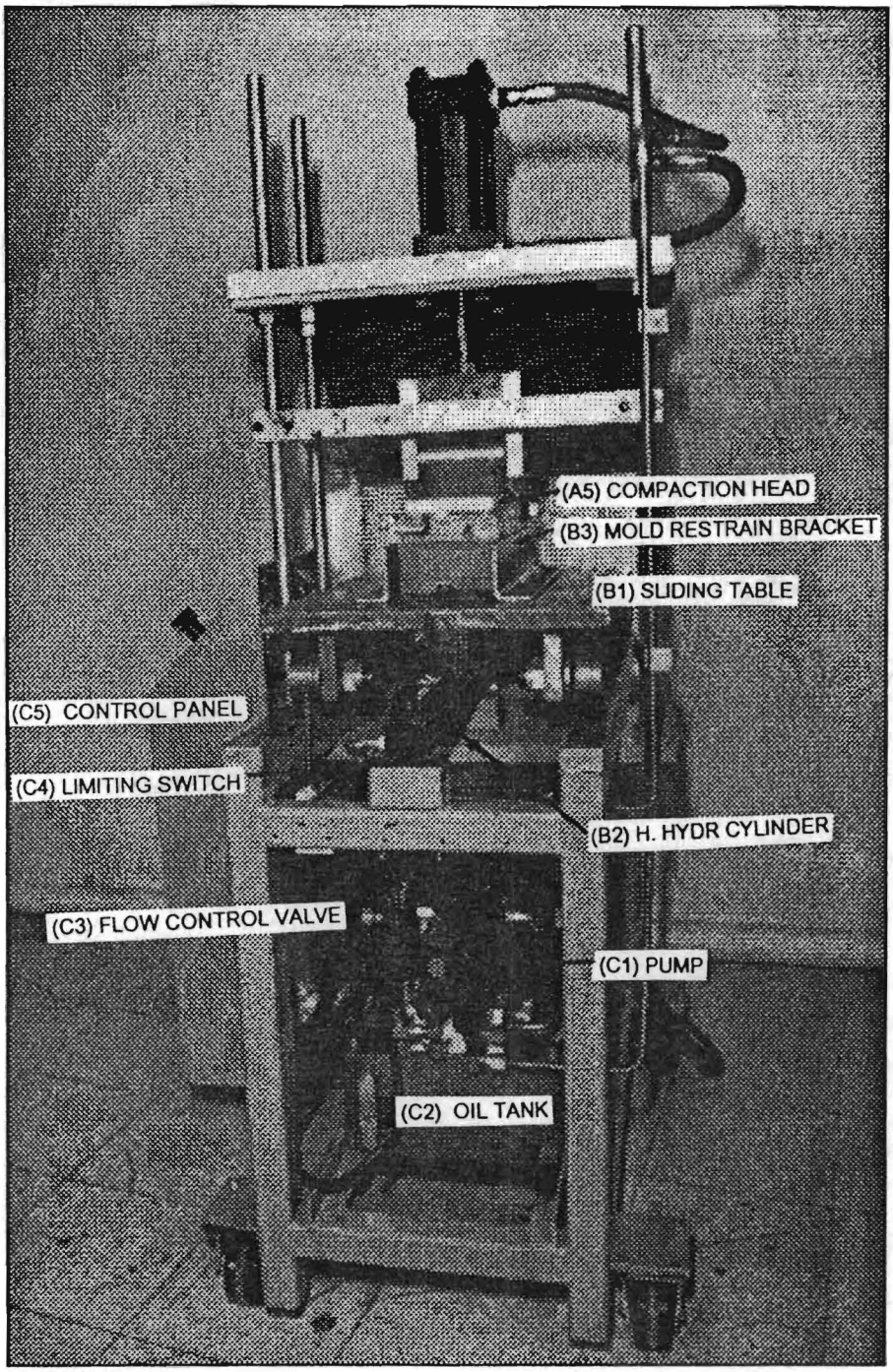


FIGURE 2 ROLLING COMPACTOR (side view)

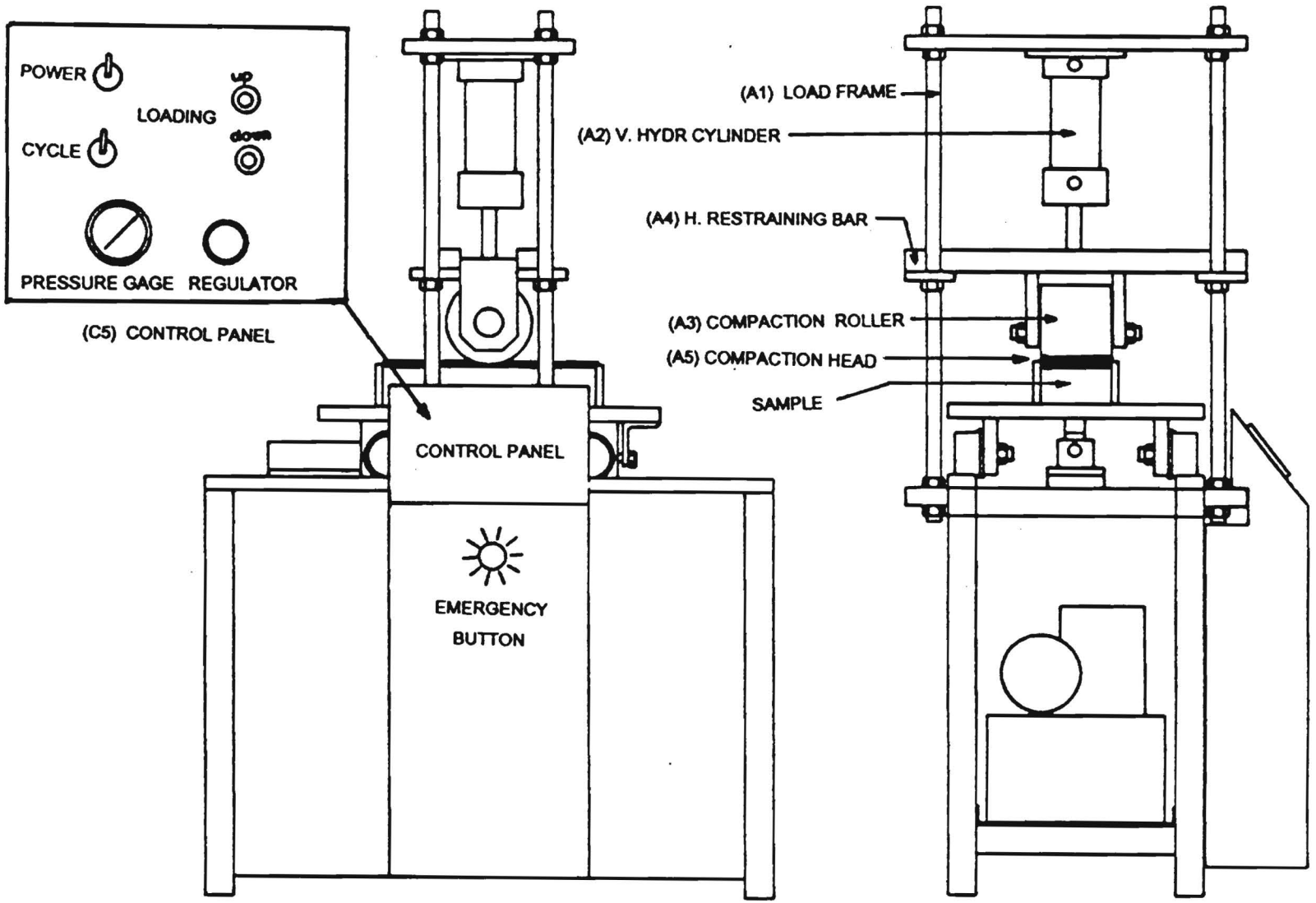


FIGURE 3 SCHEMATIC OF ROLLING COMPACTOR

1.4 Installing

After the machine is wheeled to the designated location, lock the wheels. Lower the leveling pads and check the level of the sliding table.

Check that the oil gage (on right side of the oil tank, Figure 2 (C2), which should indicate that the hydraulic fluid in the pump reservoir is full. Add hydraulic fluid to the tank if needed. Reference to Appendix B for the hydraulic fluid recommended by the manufacture.

Perform the following initial installation:

(a) Open the safety door.
(b) Pull the sliding table to the far left.
(c) Check that the beam sample mold is secured by the beam mold restraining brackets and that the wooden dummy beam sample is in the beam mold.
(d) The beam mold is secured by the restraining brackets.
(e) Place the nylon pad on top of the dummy beam sample.
(f) Close the safety door.

1.5 Testing the Machine

(a) Make sure that the machine is unplugged to the power source.

(b) On the control panel, make sure that both the POWER switch and the CYCLE switch are switched to OFF position. Turn the pressure regulator knob counter-clockwise all the way. This is very important to prevent a sudden application of a very large vertical load by the compaction roller on the beam sample when the power is turned on.

(c) Double check (b) again, then plug the main electrical cord to the power source.

(d) Turn the POWER switch to ON. This will start the hydraulic pump. If the pump does not start or shuts down after it is running for a brief moment, immediately turn off the POWER switch and check with Section 3.1 for trouble shooting.

(e) Turn the CYCLE switch to on. The sliding table should start the slow reciprocating motion. The speed of the motion should be quite slow, preset at about 30 mm per second (about 10 seconds for the sliding table to travel from one end to the other). If the sliding table moves faster than that or the sliding table will not automatically reverse the movement, immediately turn off the CYCLE switch and the POWER switch. Reference to section 3.2 and 3.3 to correct the problem.

(f) Push the DOWN loading switch (momentary)and the compaction roller should start to extend downward until it contacts with the steel kneading head. Watch closely the pressure gage reading. It should indicate a very low pressure reading of about 0 to 10 psi, if the pressure regulator has been turned counter-clockwise all the way in step (b) above. If the compaction roller is not extending downward and the pressure gage shows a low pressure reading (10 psi or lower) then turn the pressure regulator clock-wise slowly to increase the pressure until the vertical actuator starts to extend downward. As the compaction roller is slowly extending, the sliding table may temporally stop the sliding motion. This is normal. After the roller is in contact with the compaction head, the sliding table will resume the sliding movement. At this point, the roller should be exerting a compaction force to the beam sample through the nylon pad while the beam sample is undergoing the reciprocating motion with the sliding table. At this time do not increase the pressure beyond 100 psi as this may damage the dummy beam sample.

(g) Observe closely the relative movement of the compaction roller with respect to the steel kneading compaction head. The sliding table has been preset at a total traveling distance of 250 mm and centered at the compaction roller. This will allow the loose asphalt mix near the ends of the beam mold to be fully compacted by the force exerted by the compaction roller. If the roller were traveled too close to the ends then the roller may apply too much excessive forces on the loose asphalt mix in these region. If the sliding table is traveling not far enough or too far from these positions, turn off the CYCLE switch and refer to Section 3.3 for adjustment.

(h) While the sliding plate is in motion, push the UP loading button momentary. This should cause the roller to retract. Push the DOWN loading button again should cause the roller to extend downward.

(I) While the sliding table is in motion toward right and the compaction roller is pressed against the compaction head, momentarily press the LEFT button. This should cause the sliding table to reverse the direction of motion toward left. Momentarily press the RIGHT button should cause the sliding table to reverse the direction of motion toward right.

(j) While the sliding table is in motion and the compaction roller is pressed against the compaction head, push the red emergency stop button. This should cause the sliding table to stop immediately. Pull back the emergency stop switch should resume the operation.

(k) While the sliding able is in motion and the roller is pressed against the compaction head, turn the CYCLE switch to OFF. This should immediately

cause the compaction roller to retract upward, and the sliding table to travel to the far left and stop there. Turn off the POWER switch.

(l) Open the safety door, loosen and remove the long bolt on the left side for tightening the front and back restraining brackets. Loosen (need not to remove) the other long bolt on the other end. Loosen the front restraining bracket. Loosen and remove the left beam mold restraining bracket from the sliding table. Remove the split beam mold (including a bottom fitting plate) from the sliding table.

This completes the initial testing of the machine.

Procedures for operating the rolling compaction machine for fabricating asphalt beam sample are presented in Chapter 2.

CHAPTER 2
OPERATING THE ROLLING COMPACTOR

2.1. Asphalt Mix Design

Weights of aggregates, asphalt cement and admixtures needed to fabricate the 75 mm by 125 mm by 300 mm asphalt beam sample should be determined to meet the actual laboratory density requirement at the optimum asphalt cement content. Procedures for calculating the weights of the various ingredients for the asphalt beam sample are given in Appendix A - GDT-115.

2.2. Mixing

Heat aggregate, asphalt cement, and utensils to the specified temperatures normally used in preparing asphalt mixes for the Marshall samples. The procedure for mixing the asphalt mixes is similar to that for preparing the Marshall samples. After mixing, place the entire batch of the mixture in an one gallon can, close lid and place in an oven set at an approximately 350 °F. Heat until mixture temperature is 10 °F above the normal compaction temperature for Marshall samples for the grade of asphalt cement being used.

2.3 Rolling Compaction

1. Remove the heated split beam mold (including the bottom plate) from oven and place it on top of a counter adjacent to the compaction machine. Apply a light coat of oil on the inside surfaces of the mold. Remove the can containing the mixture from oven, shake the can, remove lid, and pour entire batch of mixture in the mold. Spade the loose mixture in the mold thoroughly with bullet nose rod and level the mixture. Empty the second batch of the asphalt mixture into the beam mold (if two separate batches are prepared each contains ½ of the total weight of the asphalt mix), spade the loose mixture, leveling the mixture, scrape some mix from the edges toward the middle to form a dome shape.

2. Transfer the beam mold on the sliding table. Secure the beam mold on the sliding table using the beam mold restraining brackets using the following procedures. Slide the beam mold against the back side and right end restraining brackets, place the left end restraining bracket tightly against the beam mold and tighten the bolt against the sliding table, place the long bolt into the slots on the back and the front restraining brackets and tighten the bolts (the one on the right end also) to have beam mold secured by the front and the end restraining brackets, then tighten the bolts on the front bracket against the sliding table. Place the nylon pad on top of the asphalt mix. Close the safety door.

3. Turn on the POWER switches, and then the CYCLE switch. The sliding table should start the cyclic motion. Before applying the vertical load, make sure that the pressure regulator has been turned down (counterclockwise). Press the DOWN button to start the initial compaction loading. Turn the pressure regulator clockwise slowly to gradually increase the pressure to 700 kPa (200 psi). Allow the beam to be compacted at this pressure for three full cycles. After that, increase the pressure by 350 kPa (100 psi) each time and allow 3 full cycles of compaction under each pressure reading until the beam sample is compacted to the required density. For E-mix, B-mix and SMA-mix the max compaction pressures required are approximately at 2100 kPa (600 psi), 2450 kPa (700 psi) and 2800 kPa (800 psi) respectively. At this point, the horizontal reference line inscribed on the side of the nylon pad should be flushed with the top edge of the beam mold. The vertical limiting switch should be activated at this position to cause the roller to retract, if this switch has been properly positioned. When steel kneading head is used, the pressure applied by the compaction roller can be increased more rapidly.

4. Closely watch the evenness of the beam sample under compaction by observing the distance between the reference line inscribed on the nylon pad directly under the roller and the top edge of the beam mold. Uneven compaction could happen if the initial pressure was too high relative to the internal shear resistance of the mix or the loose asphalt mix was not evenly placed in the mold. This unevenness can be correct by using the LEFT and the RIGHT buttons on the control panel to manipulate the sliding table movements to apply additional loadings on the nylon pad at the positions where the beam sample need additional compaction.

5. When the required compaction has been achieved, turn off the CYCLE switch then turn off the POWER switch. Open the safety door. Remove the beam mold from the machine, place on a counter, and remove the split beam mode (except the bottom plate) from the compacted beam sample while the beam sample is still warm.

CHAPTER 3

MAINTENANCE AND TROUBLE SHOOTING OF ROLLING COMPACTOR

3.1 Pump does not start or pump shuts down after running for a brief moment

The problem could be the circuit has been tripped off or the fuse is burned due to circuit overload. The fuse is located inside the control panel. To access to the fuse requires to remove the right front panel.

3.2 Sliding table is moving too faster or too slow

Open the lower front panel. Adjust the flow control valve for the horizontal cylinder. The valve is shown in Figure 2 (C3). The flow valve preset position could have been disturbed. Turn the knob counter-clockwise to slow down the sliding table motion and clockwise to speed up the motion. Apply a small increment in each adjustment. The adjustment of the knob is very sensitive.

3.3 Adjusting the sliding plate traveling

The reciprocating action of the sliding plate is controlled by the two limiting switches positioned at each ends (see Figure 2, C4). The positions of these two limiting switches have been preset. It is possible that the position of these limiting switches could be disturbed from the normal positions. The following steps should be followed to readjust the limiting switch position.

(1) Turn the POWER switch to OFF and open the safety door.

(2) The limiting switches can be reached from opening the bach middle panel. Manually push the sliding table to approximately to the center. Examine the left and the right limiting switches. The limiting switch contact arm should be at the vertical position, point upward and each should be about 125mm from the center of the compaction roller. Loosen the screws and readjust the limiting switches.

(3) Make sure that nothing is on the sliding table traveling path, close the safety door. Turn the POWER switch to ON and then the CYCLE switch to ON. Watch the sliding table motions. Adjust the limiting switches until the sliding table stops at the proper positions.

CHAPTER 4

UNPACKING AND INSTALLING LOADED WHEEL TESTER (Model LWT-2)

4.1 Checking the Parts

The following parts are included in a box shipped along with the loaded wheel tester(LWT). The contents in the box include the following:

1. A digital dial-indicator
2. A rutting measurement guide
3. Three spare hoses
4. A 7/16" socket wrench and an Allen wrench
5. A digital temperature sensor
6. An asphalt concrete block

4.2 Location and Power Source

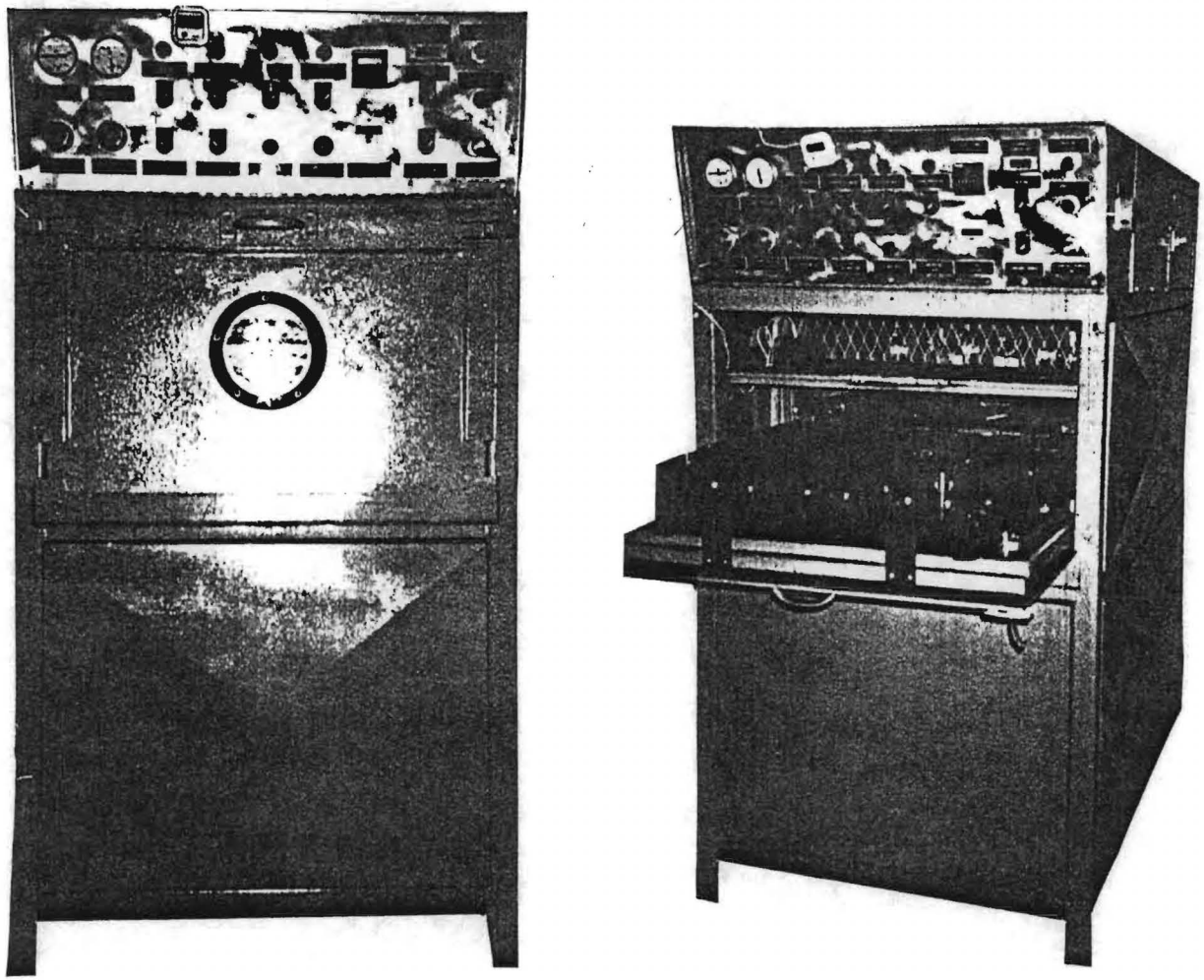
Location: The overall dimensions of the machine are 1.25 m long by 0.9 m wide by 1.40 m high. The machine should be located on a level floor. Use the 4 leveling pads to level the machine. The machine is normally operated from the front. A space of 1 meter in front of the machine should be adequate for the normal operation. A 0.5 meter space is needed for access to both sides of the machine.

Electrical Requirements: A 115 volt, 30 ampere fused electrical outlet is required. It is recommended that a separate circuit serving only this machine be provided and is equipped with a circuit breaker. Do not use an extension cord. Operation of the air pump require a separate 115 volts electrical outlet.

4.3 Names of Parts

This section points out the major parts of the loaded wheel tester and gives a brief description of the function of each. The part names will be used throughout this manual. The machine, as shown in Figure 4, consists of the following basic components:

Wheel tracking system
Loading system
Rutting measurement system
Temperature control system
Operation control system



Georgia Loaded Wheel Tester (Model LWT-2)

Wheel Tracking System The wheel tracking system, see Figure 5 and 6, is to subject the three asphalt beam test samples to a reciprocating linear motion at a frequency of 60 cycles per minute. The system consists of:

(D1) A driving assembly, consisting of a motor, a gear reducer and a cam
(D2) A sliding plate
(D3) A hose rack which holds 3 rubber hoses.
(D4) Beam sample tray
(D5) Beam sample confining brackets

Loading System The loading system, see Figure 6, consists of three air cylinders each attached with an aluminum wheel, and the pressurized hoses. The magnitude of the wheel load is controlled by the air pressure in the cylinders, adjustable by the pressure regulator, see Operation Control . The magnitude of the contact pressure exerted on the asphalt beam samples is generated and adjustable by the pressure in the hoses.

(E1) Three air cylinders (inside the middle compartment located on the top of the machine, see Figure 5)
(E2) Aluminum wheels
(E3) Hoses and hose rack

Rutting Measurement System

Figure 7 shows the rut depth measurement device.

(F1) A detachable rut-depth measurement guide
(F2) An electronic indicator.

Temperature Control The environmental chamber and the heating and thermostat, shown in Figure 5, are used to conditioning and maintaining the asphalt samples to a prescribed constant test temperature.

(G1) The heater and blower
(G2) The hot air circulation pipes
(G3) Chamber temperature sensor
(G4) Beam sample preconditioning shelf
(G5) An auxiliary asphalt beam sample temperature sensor

Operation Control All the controls for operating the loaded wheel test are mounted on the control box on top of the machine, see Figure 4 and Figure 8.

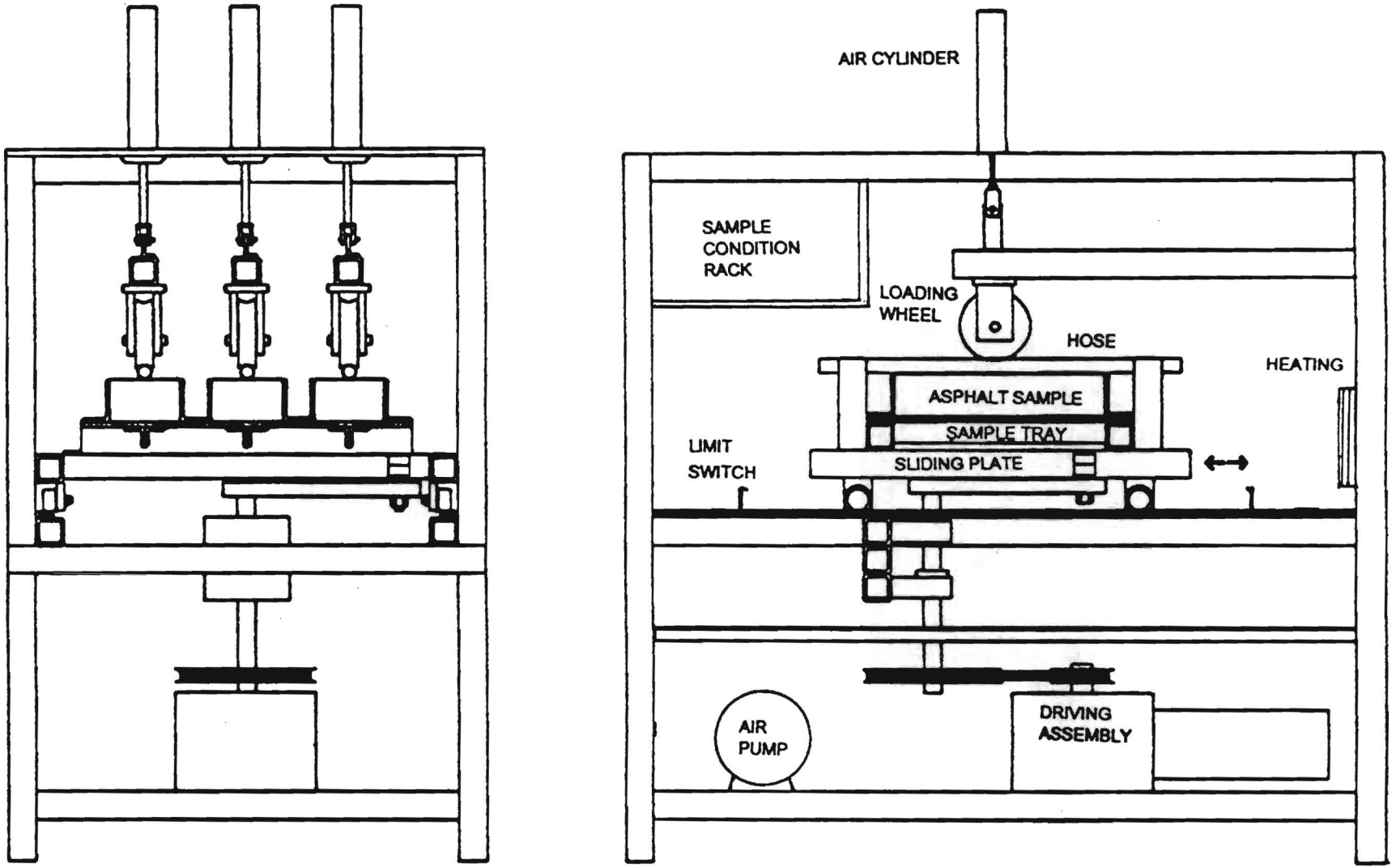


FIGURE 6 SCHEMATIC OF LOADED WHEEL TESTER

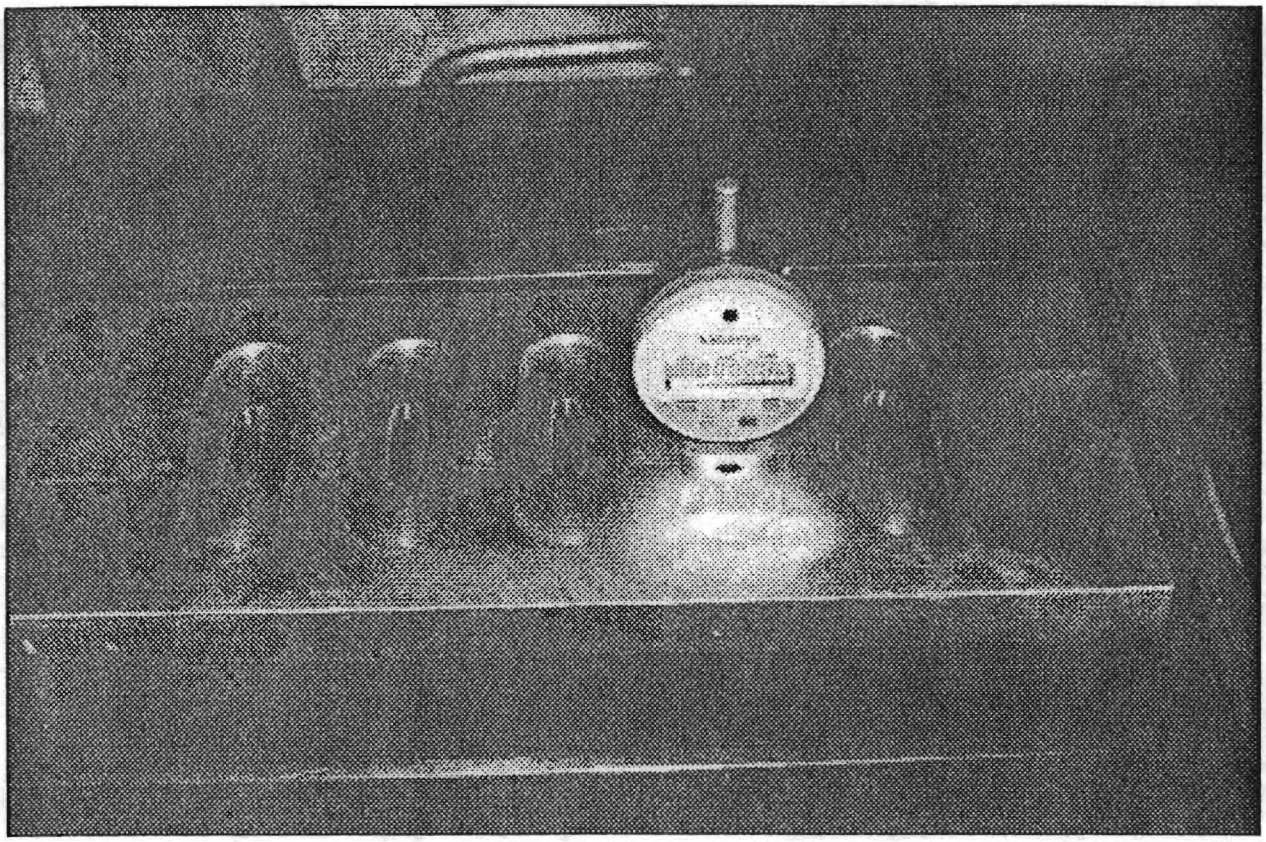


FIGURE 7 RUT-DEPTH MEASURING DEVICE

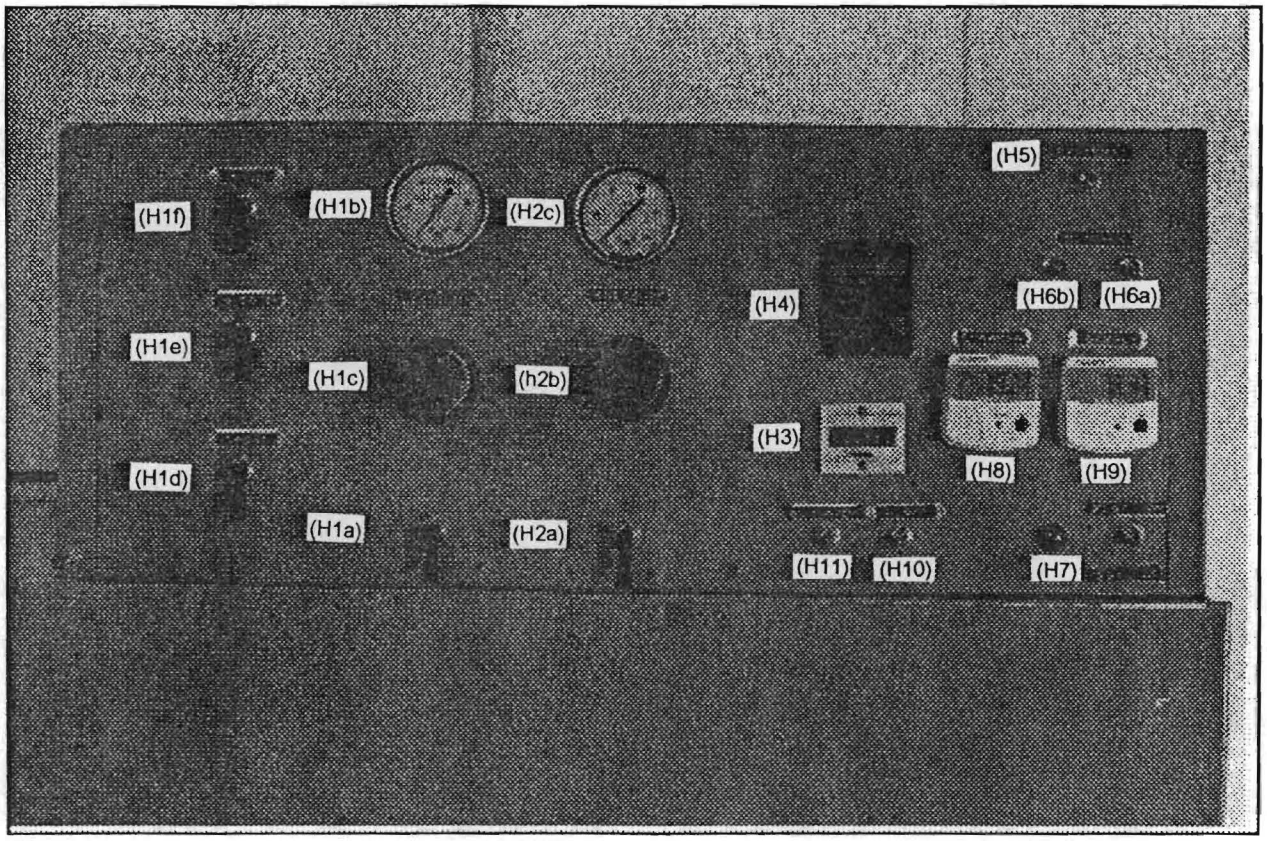
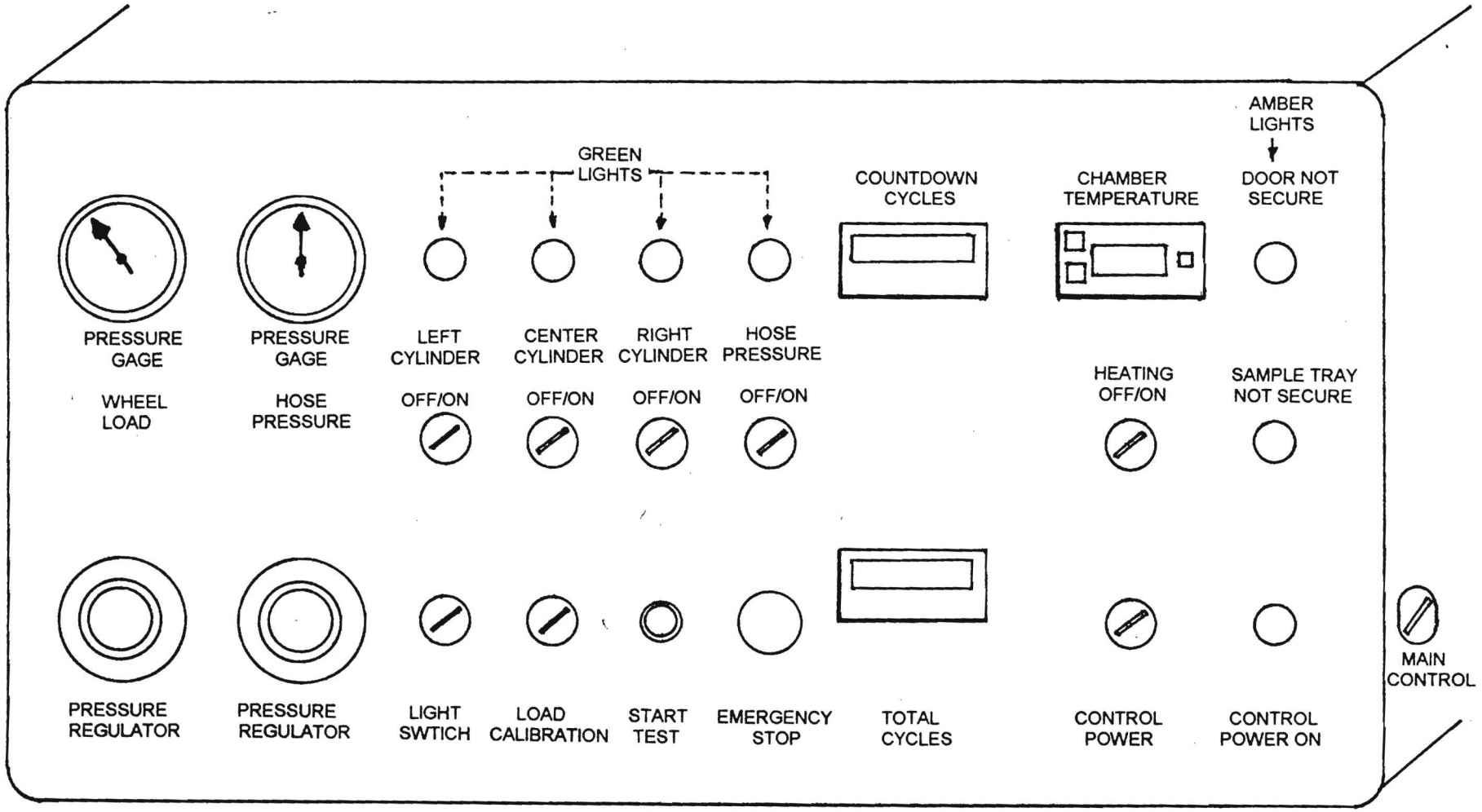


FIGURE 8 CONTROL BOX


GREEN
LIGHTS
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COUNTDOWN
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LEFT
CYLINDER
CENTER
CYLINDER
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OFF/ON
HEATING
OFF/ON
SAMPLE TRAY
NOT SECURE
MAIN
CONTROL
PRESSURE
REGULATOR
PRESSURE
REGULATOR
LIGHT
SWTICH
LOAD
CALIBRATION
START
TEST
EMERGENCY
STOP
TOTAL
CYCLES
CONTROL
POWER
CONTROL
POWER ON

(H1) Wheel load control including
  (H1a) Pressure gage, indicating air pressure in the air cylinders
  (H1b) Pressure regulator, regulating the air pressure in the air cylinders
  (H1c) Three ON/OFF switches controlling the left, center and right air cylinders.
  (H1d) Three green lights above the air cylinder ON/OFF switches, the light illuminates when the air cylinder switch is turned to ON position.

(H2) Hose pressure control including
  (H2a) Pressure gage, indicating hose pressure
  (H2b) Pressure regulator, regulating the pressure in the hoses
  (H2c) An ON/OFF switch to control pressure in all three hoses.
  (H2d) A green light above the hose pressure switch, the light illuminates when the hose pressure is turned to ON position.

(H3) COUNTDOWN counter, presetting the number of cycles for the test to be performed.

(H4) TOTALIZING counter, registering the total number of repetitions

(H5) Chamber light switch

(H6) LOAD CALIBRATION switch, to enable performing the calibration of the air cylinders when the switch is turned to ON position

(H7) START TEST push switch, to start the loaded wheel testing

(H8) EMERGENCY STOP button, push in to activate the emergency stop and pull bach to resume the testing.

(H9) Chamber temperature and beam sample temperature controller/indicator. This multi-function temperature controller can set and regulate the chamber temperature and display the actual chamber temperature.

(H10) HEAT ON/OFF switch to turn on the heating

(H11) Power ON/OFF switch. The amber light to the right will illuminate when the switch is turned to ON position.

(H12) Top and middle amber lights are the indicators for the security switches. When the front door is not secured, the operation of the machine is disabled and the top amber light is illuminated. The sample tray should be in the locked position and a limiting switch is activated. Anytime when the sample tray is not secured to the sliding table, the machine operation is disabled and the amber light is illuminated.

(H13) Main POWER CONTROL ON/OFF switch located on the right side of the control box.

The front panel is attached to the control box by 6 screws. The panel can be removed to expose the wiring and the fuses.

4.4 Installing

After the machine is moved to the designated location, lower the 4 leveling pads to free the wheels. Adjust the level pads to level the machine. Perform the following installations:

(a) Check that the power cords are disconnected to the power source. Open the front door and the top portion of the right side panel. Remove the temporary restrains for securing the sliding table during shipping. Also check the position of the chamber temperature sensor. It should be located at abut the same elevation of the beam sample surface.

(b) While the front door is open, remove the sample tray restraining pin and pull the sample tray all the way out. The sample tray will be fully disengaged from the sliding table and rests on the front door. The hoses, which are attached on a rack, should remain at their fixed positions on the sliding table and should not be affected by the movement of the sample tray. The hose rack and the three hoses can be lifted up and removed from the sliding table through the right side of the machine. This is needed only when the hoses are to be replaced. (See Chapter 6).

(c) Close the right side panel.

(d) Three dummy wood beam samples have been secured in the beam sample tray. Check that they are properly secured in the positions by the beam sample confining brackets. Push the beam sample tray back in and use the lock pins to secure the tray on the sliding plate.

(e) While the front door is opened, place the dummy asphalt concrete block in the preconditioning shelf, insert the auxiliary temperature sensor probe into the predrilled hole, and place the temperature indicator on top of the control box. Close the front door. This completes the installation.

4.5 Testing the Machine

(a) Make sure that the main power cord and the air pump power cord are disconnected to the power source.

(b) On the control panel, make sure that both the START TEST switch and the HEATING switch are turned to OFF position. The MAIN POWER CONTROL switch is on OFF position. The COUNTDOWN counter and the TOTALIZING counter are zeroed. Switch the PRESSURE and 3

CYLINDER ON/OFF switches to OFF position. Turn the LIGHT switch to OFF position. It is assumed that Section 4.4 Installing step (e) has been completed and the front door is closed.

(c) Plug the main power cord and the air pump power cord to the power source.

(d) Turn the MAIN POWER CONTROL to ON and the CONTROL POWER switch on the front panel to ON. Turn the LIGHT switch to ON. The air pump should automatically be turned on and start to build up the pressure in the air lines. It will take about several minutes for the air pump to build up the line pressure to about 120 psi and will automatically shut off. The pressure readings in pressure gages for both the PRESSURE and LOADING should increase gradually to the preset values. The WHEEL LOAD pressure gage has been preset to 40 psi, which corresponds to a 445 N (100 lb.) of force to be applied by each air cylinder to the pressurized hose. The HOSE PRESSURE gage has been preset to 100 psi for the pressure in the hoses. The pressure readings should remain steady once they have reached the preset values. If the pressures are fluctuating and the air pump is on and off frequently, this may indicate leaking in the air lines. Try to isolate the sources of leakage and tighten the fittings, if needed. Turn the HOSE PRESSURE switch to ON position. This will pressurize the hoses to the preset pressure.

(e) Set the COUNTDOWN counter to 10, and turn the LOAD CALIBRATION switch to ON position. When this switch is at the ON position, the automatic testing sequence by activating the START TESTING switch is disabled and the system is set in manual mode. With three CYLINDER switches all are in OFF position, push the START TEST button momentarily can manually move the sliding table as this button is pressed down and stop when released. Next, turn each CYLINDER switch to ON and then OFF to chech if the aluminum wheel will extend and retract under the commend. To start the automatic loaded wheel testing, turn the LOAD CALIBRATION switch to OFF position and turn all three CYLINDER switches to ON position (notice that the wheels are not extended down by this action). When these steps are all checked, push the START TEST switch. This will immediately cause the loading wheels to extend downward and apply the force on the rubber hoses. After about 2 seconds delay the motor will be turned on to start the reciprocating motion of the sliding plate. As the sliding table completes one cycle, the number in the COUNTDOWN counter will be reduced by one, while the number registered by the TOTALizing counter will increase by one. After 10 complete cycles, the COUNTDOWN counter counts down to zero and automatically stops the reciprocating motion of the sliding plate and retracts the loading wheel. Check and verify that the TOTALizing counter registers a total of 10 cycles. Turn the LOAD CALIBRATION switch to ON. Open the front door and use the

START TEST button (by momentary depress the button) to move the sliding plate to be positioned near the front door opening. If all the processes are performed as described, then close the front door and turn off the chamber light. This completes the testing of the rutting test operating.

(f) Use the following steps to check the temperature. Open the front door and check the auxilary temperature sensing probe which should be firmly inserted into the dummy asphalt concrete block. Close the front door. The CHAMBER TEMPERATURE control system has been preset to 40 °C (105 °F). This can be checked by depress the square button located on the right of the readout window. For other temperature setting, see the manual of the temperature control system for instructions for changing the temperature setting. Turn the HEATING switch to ON position. The thermostat will automatically turn on the heater and the blower. The chamber temperature indicator should show a gradual increase of the temperature in the chamber. When the chamber temperature reaches the preset temperature, the thermostat will shut off the heating. The chamber temperature will oveshoot beyond the preset temperature for seveal degrees. This is normal and does not need to make adjustment of the temperature setting. When the chamber temperature slowly drop below the preset temperature by 1 °F, the heating cycle will start again. During the heating cycle, a small red light on the right of the readout window is luminated. The sample temperature indicator, which shows the actual temperature in the dummy asphalt concrete block, should also show a graduate increase in the temperature, although at a slower rate. It will take about 20-30 minutes for the chamber to reach the preset temperature, and about 90-120 minutes for the asphalt concrete block to reach the preset temperature. Once the asphalt concrete block reaches the preset temperature, the temperature in the sample should remain constant, fluctuating by no more than 1 °C.

CHAPTER 5
OPERATING THE LOADED WHEEL TESTER

5.1. Place and Secure Beam Samples

1. Open the front door and use the START TEST button on the control panel to position the sliding plate at the front door (after the LOAD CALIBRATION button is turned to ON position). Pull up the lock pins and pull the beam sample tray out.

2. Remove the screw and the restraining bracket against the front end of each beam sample. Loosen the screws and the beam sample side restraining brackets. Then remove the beam samples from the sample tray.

3. Reverse the steps described above to place three asphalt beam samples and the end shim blocks in the sample tray.

4. With all three beam samples properly secured, measure the initial beam surface profile using the rut depth measurement guide and the electronic indicator. The procedure for making the measurement is described in section 5-3 in the following.

5. After that, push the beam sample tray back in, insert the pins to secure sample tray on the sliding table, and close the front door.

5.2. Start Loaded Wheel Testing

1. Set the COUNTDOWN counter to the number of repetitions for the test to be run. Reset the TOTALizing counter to zero. Turn the LOAD CALIBRATION switch to OFF.

2. Check the beam temperature indicator reading to be at the testing temperature.

3. Turn the hose pressure switch to ON and check the pressure gage reading for the pressure in the hoses. The pressure has been preset at 100 psi. Use the pressure regulator directly under the pressure gage to adjust the pressure, if needed.

4. Turn all three CYLINDER switches to ON and check the pressure gage reading for the pressure to be applied by the air cylinders. The pressure has been preset to 40 psi which corresponding to 445 N force (100 lbs.). Use the pressure regulator directly under the pressure gage to adjust the pressure, if needed.

5. Push the START TEST button. This will immediately cause the loading wheels to lower down and exert the preset load on the pressurized hose. After about 2 seconds delay, the reciprocating motion will start.

6. The test will continue until the preset number of repetitions has been completed and the COUNTDOWN counter has counted down to zero. At this point, the test will be automatically terminated. The loaded wheel will retract, the reciprocating motion will stop. The number of repetitions during this test period should be indicated on the TOTALizing counter.

5.3 Rut Depth Measurement (This procedure will be revised fro Model-2 machine)

1. Use **Section 5.1** step 1 to pull the sample tray out from the sliding table.

2. Place the rut depth measurement guide over the beam sample, and set the guide on top of the sample side restraining brackets with the front end of the guide firmly butt against the beam sample right end restraining bracket. Place the electronic indicator into the slots with its base resting firmly on the groove and slide the indicator along the groove to detect the maximum rut reading, see Figure 7. This maximum rut reading represents the deepest depression of the beam sample at this particular position. Record the reading and then proceed to the next slot and use the same process to obtain the maximum rut reading. After five rut readings have been taken from one beam sample, proceed to the next beam sample and do the same.

5.4 Precondition the Test Samples

The beam sample preconditioning shelf can be reached from the front door. Place the beam samples on the shelf and close the front door. If the heating has been turned on and the chamber has been heated to the preset test temperature, the time required to heat the beam samples from room temperature to the test temperature is about 2 hours.

CHAPTER 6

MAINTENANCE AND TROUBLE SHOOTING OF LOADED WHEEL TESTER

6.1 Replacing Hoses

The high pressure hoses have the life expectancy of about 20-30 tests, depending on the type of abrasiveness of the asphalt mixes being tested. Use the following steps to replace the hoses:

1. Turn the HOSE PRESSURE switch to OFF position.
2. Open the front door and and the right side panel.
3. Disconnect the air supply line connecting to the three hoses from front door.
4. Lift then pull out the hose rack from the right side opening. Set the hose rack on a table.
5. Unscrew and disconnect the hose end fittings at both ends of any one of three hoses. Remove the hose from inside of the hose rack.
6. Loosen the hose clamps and remove the plugs from the hose. Replaced the warn out hose with the spare new hose. Insert the plugs into the hose ends and use the hose clamps to tighten the hose and the plugs. The distance between the end plugs is important. Use the other two hoses which have not been replaced as the reference. Insert the hose inside the hose rack and reconnect the end fittings to the plugs and thghten the fittings. It is important that the hose clamp screw at the front end should be positioned on the side, not at the bottom or at the top of the hose.
7. Repeat step 5 and 6 for replacing the other two hoses.
8. Reverse the step 3 and 4.
9. Turn on the HOSE PRESSURE switch to ON and watch for any leakage.

SUGGESTION: We strongly suggested three spare new hoses cut to the exact same lenght be kept at all time. (see Appendix B for the specification for the hoses).

6.2 Adjust Test Temperature

The test temperature has been preset at 40 °C. The test temperature can be changed by adjusting the temperature setting. Following the instructions provided in the manual to make the temperature setting changes.

6.3 Calibration of Loading

The loading exerted by the three air cylinders versus the pressure gage reading have been precalibrated with 40 psi gage reading corresponding to 445 N (100 lb.) force. The three air cylinders have been precalibrated separately. All of them have the same calibration relations shown above.

The calibration relations shown above should be checked occassionally by the proving ring and the calibration chart provided with this machine. The following steps should be followed to carry out the calibration of the air cylinders.

1. Turn the LOAD CALIBRATION switch to ON position. Open the front door and right side panel. Pull the sample tray out from the front door. Remove the hose rack.
2. Cut a 20 in. long 2x4 wood beam and place it over the sliding table, (see Figure 9). Place the proving ring on the wood beam directly under the right loading wheel.
3. Turn the WHEEL LOAD pressure regulator counter-clockwise to zero. Then turn the RIGHT CYLINDER switch to ON position.
4. Slowly turn the pressure regulator clockwise to increase the pressure, read the pressure gage reading and the dial gage on the proving ring corresponding to 100 lbs. force. Repeat this process several times. Lock the pressure regulator at this pressure gage reading.
5. Repeat and check the calibration for the other two cylinders.
6. After complete the calibration, reverse the steps described in step I and 2 above.

It is strongly suggested that air cylinders should be calibrated periodically to ensure that the loading remains the same.

APPENDIX A

MODIFIED GDT-115 METHOD OF TEST FOR DETERMINING RUTTING SUSCEPTIBILITY USING THE LOADED WHEEL TESTER

APPENDIX A

MODIFIED GDT-115 METHOD OF TEST FOR DETERMINING RUTTING SUSCEPTIBILITY USING THE LOADED WHEEL TESTER

A. SCOPE:

The Georgia Loaded Wheel Tester will be used to test the rutting susceptibility of asphalt-aggregate mixtures. This method describes the procedures needed to accomplish this task.

B. APPARATUS

1. 12,000 gram scale, accurate to 0.1 gram.
2. Mixing utensils (bowls, spoon, spatula, bullet nose rod)
3. Hot plate
4. Heating ovens for aggregate and asphalt cement.
5. 125 mm wide x 300 mm long beam mold
6. Rolling compaction machine and compaction pad.
7. Georgia Loaded Wheel Tester

C. PREPARATION OF SAMPLE:

1. Mixture proportions are batched in accordance to the desired Job Mix Formula. Required batch sizes are determined in accordance to Section F below. The target voids in total mix (Va) for the compacted mixture should be 7.0% +/- 1.0%, unless specified otherwise.

2. Heat aggregate, liquid asphalt, molds, and utensils to specified temperatures. Temperatures for mixing aggregate and asphalt cement and for compaction of asphalt-aggregate mixtures should (1) based on equi-viscous ranges specified by SHRP or (2), for GaDOT use only, conform to the Asphalt Concrete Mixture Control Temperature Chart published quarterly by the Bituminous Control Unit.

3. Dry mix aggregates and hydrated lime(when lime is used) first, then add optimum percentage of asphalt cement.

4. Place ENTIRE mixture in one gallon cans, close lids and place in an oven for aging accordance to the following procedure. (1) 4 hours at 135 °C and then heat the mixture to the compaction temperature as specified by SHRP, or (2) for GaDOT use only, 1 hour at approximately 176 °C then heat the mixture until meets compaction temperature as specified on Asphalt Concrete Mixture

Control Temperature Chart for the source of asphalt being used. Higher temperatures may be required if modified asphalt is used.

5. Remove heated mold from oven, place on compaction machine. Remove the cans containing the asphalt mixture from oven and place entire batch of asphalt mixture in heated mold. Spade sample thoroughly with spatula a total of 20 times evenly around the perimeters, 20 times evenly in the interior and form the top to a dome shape. Place mold against two fixed mold constraints and secure the other two mold constraints. Place compaction pad on top. Close the safety shield.

6. Turn on the pump and power switches. Turn the pressure regulator to 350 kPa (50 psi) and turn on the "CYCLE" switch to start the horizontal cyclic movements of the sliding plate. After 5 second delay the compaction roller will move down to start the initial compaction loading. When the roller is in contact with the compaction pad, increase the compaction load to 700 kPa (100 psi) shown on the pressure gage and allow 3 full cycle of compaction under this load. Increase the compaction load to at each 700 kPa (100 psi) increment and allow 3 full cycles of compaction at each pressure until the beam sample is compacted to the required density. At this point, the horizontal reference line inscribed on the side of compaction pad should be approximately flushed with the top edge of beam mold. The vertical limiting switch should be activated and cause the roller to retract. Press and hold the "DOWN" button, if additional compaction is needed.

7. When the required compaction has been achieved, turn off the "CYCLIC" switch which cause the sliding plate to park at the far side and the roller to retract. Open safety shield. Remove compaction pad and side constraints. Remove the beam mold from the machine, place on firm counter top and remove the split beam mold (except the bottom plate) from the sample.

D. SAMPLE CONDITIONING

1. Beam samples should be left at room temperature (approximately 25 °C) to allow the entire beam sample to cool for 3 hours.

2. After the room temperature conditioning, samples should be placed in testing chamber with temperature stabilized at 40 °C until the samples reach the test temperature.

E. PROCEDURE

METHOD A

1. Testing chamber temperature should be stabilized at 40 °C.
2. Place test samples into the sample holding plate and secure the restraint brackets.
3. Take an initial reading (at 3 locations: center, 50 mm left of center, and 50 mm right of center). Make sure that the rut depth measurement stand firmly sits on top of the sample constraints.
4. Push sample holding tray in and secure on sliding plate. Close chamber door.
5. Set PRESET COUNTER to 8000 cycles. Check or adjust pressure gage reading to 700 kPa (100 psi) for pressure in hoses. Check or adjust pressure gage reading for wheel load magnitude to 445 N (100 lb). Verify the temperature of the dummy sample placed next to the test beam samples is at 40 °C.
6. Turn on "LOAD" switch to start the testing. A complete test will take approximately 3.5 hours. At end of test cycle, machine will automatically stop and a red light will be illuminated.
7. Open chamber door, position the sliding plate at the door and unlock and pull out the sample holding tray. Take rut-depth readings at the same locations as in step 4 above.

METHOD B:

300 mm Roadway Cores are used in this method for evaluation.

1. Saw core to give sample specimen 75 mm thick x 125 mm x 225 mm.
2. Proceed with test as outlined in Method A above with the exception that spacers must be used to center specimens in sample tray.

F. CALCULATIONS

1. Beam Weight

   (a) V_{beam} (Volume of Specimen) = 75 mm x 125 mm x 300 mm = 2812.5 cm^3.

   (b) (Density @ Opt., g/cm^3) X (2812.5 cm^3)
   = Total weight of beam in grams

   (c) (Total weight of beam in gms.)/N = No. of gms. per layer
   N is the number of layers per beam. Beam may be batched in 1,2 or 3 layers

2. Individual weights for dry aggregate, lime and liquid A.C. per layer

(a) (No. of gms./layer) x (% A.C. @ Opt.) = No. of Grams of A.C.

(b) (No. of gms./layer) - (Grams of A.C.) = No. of Grams of aggregate(+ lime, if used)

(c) (Gms of Agg. + Lime)/1.01 = No. of Grams of Dry Aggregate

(d) (Gms. of Agg. + Lime)-(Gms. of AGG.)= No. of Grams of Lime

G. REPORT

Report rut depth to the nearest 0.1 mm. If the average rut depth for the three beams exceed 7.5 mm the asphalt-aggregate mixture shall be reported as failing.

APPENDIX B
LIST OF MAJOR PARTS

Item	Manufacturer	Model No.
Loaded Wheel Tester		
1. air cylinder (3)	Parker/Hannifin	L073801200
2. solenoid	Parker/Hannifin	52401-1115
3. limiting switch	Grainger	3A096
4. motor	Grainger	
5. gear reducing box	Grainger	
6. digital indicator Mitutoyo Electronic	McMaster-Carr	20875A67
Rolling Compactor		
1. hydraulic System		
2. hydraulic cylinder 31/4" bore x 4"stroke	Rexroth	MF6HH
3. hydraulic cylinder 11/2" bore x 12"stroke	Rexroth	MS2HH
4. roller bearing (4)	McGill	FCF-3
5. limiting switch (3)	Grainger	3A096
6. hydraulic fluid		
7. hose		