

FEDERAL TRANSIT BUS TEST

Performed for the Federal Transit Administration U.S. DOT
In accordance with 49 CFR, Part 665

Altoona Bus Testing and Research Center Test Bus Procedure

5.7 STRUCTURAL DURABILITY TEST

Pass/Fail
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**LTI BUS RESEARCH
AND TESTING CENTER**

ABBREVIATIONS

ABTC	Altoona Bus Test Center
A/C	Air Conditioner
ADB	Advance design bus
CBD	Central business district
CI	Compression ignition
CNG	Compressed natural gas
CW	Curb weight (bus weight including maximum fuel, oil, and coolant; but without passengers or driver)
dB(A)	Decibels with reference to 0.0002 microbar as measured on the “A” scale
DIR	Test director
DR	Bus driver
EPA	Environmental Protection Agency
FFS	Free floor space (floor area available to standees, excluding ingress/egress areas, area under seats, area occupied by feet of seated passengers, and the vestibule area)
FTA	Federal Transit Administration
GAWR	Gross axle weight rating
GL	Gross load (150 lb. for every designed passenger seating position, for the driver, and for each 1.5 sq. ft. of free floor space)
GVW	Gross vehicle weight (curb weight plus gross vehicle load)
GVWR	Gross vehicle weight rating
hr.	Hour
LNG	Liquefied natural gas
LTI	Larson Transportation Institute
mpg	Miles per gallon
mph	Miles per hour
NBM	New bus models
PSTT	Penn State Test Track
rpm	Revolutions per minute
SAE	Society of Automotive Engineers
SCF	Standard cubic feet
SCFM	Standard cubic feet per minute
SCH	Test scheduler
SA	Staff Assistant
SI	Spark ignition
SLW	Seated load weight (curb weight plus 150 lb. for every designated passenger seating position and for the driver)
TD	Test driver
TM	Track manager
TP	Test personnel

5.7-I. TEST OBJECTIVE

The objective of this test is to perform an accelerated durability test that approximates up to 25 percent of the service-life of the vehicle.

5.7-II. TEST DESCRIPTION

The test article is driven a total of 3,800; 5,050; 7,500, 11,250 or 15,000 miles; approximately 2,500; 3,750; 5,000; 8,750 or 12,500 miles on the PSTT durability test track and approximately 1,300 or 2,500 miscellaneous other miles. The durability test track consists of seven different stress inducing elements that subject the bus to the types of events expected to be encountered during transit service. Figures 5.7-1 through 5.7-8 provide a detailed profile for each stress inducing element located on the durability test track. The test speed is posted in front of all durability elements. The bus speeds on the durability elements are as follows: 20 mph on the 1" random chuck holes, chatter bumps and high crown Intersection; 10 mph on 6" staggered bumps, frame twist and the end turnarounds; 8 mph on railroad crossing; and 5 mph on the 4" Chuck Hole. The test will be conducted with the bus operated under three different loading conditions. The first segment will consist of 1,000; 1,625; 2,000; 3,625 or 5,250 miles with the bus operated at GVWR. The second segment will consist of approximately 500; 1,000; 1,500 or 2,000 miles with the bus operated at SLW. The remainder of the test, 1,000; 1,625; 2,000; 3,625 or 5,250 miles, will be conducted with the bus loaded to CW.

If GVWR exceeds the axle design weights, then the load will be adjusted to the axle design weights and the change will be recorded. All subsystems are operated during these tests in their normal modes. All recommended manufacturers servicing is to be followed and noted on the vehicle maintainability log.

It is intended that this test accelerate the normal structural stresses encountered during transit service at a ratio of 10:1. Some components may experience a more accelerated stress cycling, while others may experience stress cycling at a rate of less than 10:1. Unscheduled maintenance, breakdowns and repairs are recorded on the same log as are any unusual occurrences as noted by the driver. The test article will be visually inspected at the change of each driving shift or if a problem is suspected. Once a week the test article shall be washed down, raised and thoroughly inspected for any signs of failure.

5.7-III. TEST ARTICLE

The test article is a transit bus with a minimum service life of 4, 5, 7, 10 or 12 years.

5.7-IV. TEST EQUIPMENT/FACILITIES/PERSONNEL

This test is run on the vehicle durability test track facility and bus test lane at the PSTT. Test personnel consist of the following:

1. Test track manager (TM)
2. Bus driver (DR)
3. Test personnel (TP)
4. Camera

5.7-V. TEST DATA

The test data consists of keeping the vehicle log for miles and hours driven on the durability test track or bus test lanes. In addition, the vehicle maintainability log is updated with Work Order Forms when any breakdowns or any unscheduled maintenance is required. All forms to be filled out with a pen. Data shall be forwarded to the ABTC manager on a weekly basis.

5.7-VI. TEST PREPARATION AND PROCEDURES

The detailed test preparation and procedures are listed in Procedure 5.7-1.

DETAILED TEST PROCEDURES		TITLE: 5. Structural Integrity
Procedure 5.7-1	NOMENCLATURE: 5.7 Structural Durability Test	
OPER STEP	ACTION BY	TEST PREPARATION
1	TP	Record the test bus number on the vehicle log.
2	TP	Record the bus mileage as delivered on the vehicle log.
3	TP	Load the bus with a distributed load appropriate for the particular test segment.
4	DR	Deliver the bus to the PSTT and record the mileage on the vehicle log.

DETAILED TEST PROCEDURES		TITLE: 5. Structural Integrity
Procedure 5.7-1	NOMENCLATURE: 5.7 Structural Durability Test	
OPER STEP	ACTION BY	TEST PROCEDURE
1	TP	Take photographs of the bus on the durability lane (both side view and head on view).
2	TM	Check bus logs each day. Determine whether the required mileage has been reached for the particular load, and if so, arrange to change load.
3	TM	Check bus logs to see if bus must be scheduled for servicing, and if so, fill out a Work Order Form and arrange for the bus to be taken to ABTC.
4	DR	Inspect the bus at the beginning of each shift or as necessary for safety, all subsystems operational, and signs of structural failure. Inspect ballast and adjust and reposition as necessary to ensure proper weight distribution. Record comments and descriptions on the vehicle log and any repairs on a Work Order Form.
5	DR	Operate the bus in accordance with the established driving schedule. The approximate speed of each element is painted on the Durability Test Track.
6	DR	In accordance with the established driving schedule, operate all subsystems; e.g., open and close all doors, operate all lights, windshield washer and wipers, chairlifts, etc., depending on the equipment on the bus. Check the structure and the suspension components. Photograph any damage that occurs.
7	DR	Repeat 3 through 5 for each driving segment.
8	DR	After turning the bus over to the next driver, complete your Driving Log, using pen, and note anything unusual.

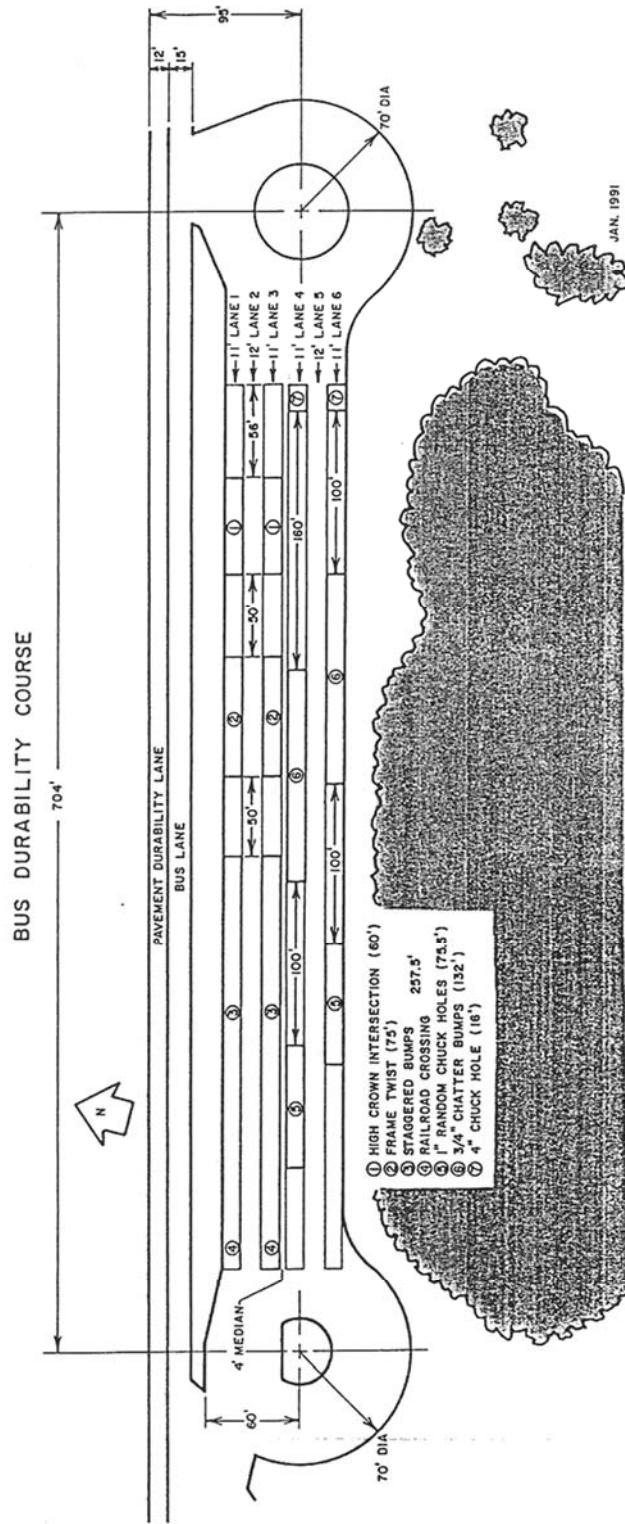


Figure 5.7-1. Plan view of the PSBRTF durability test track.

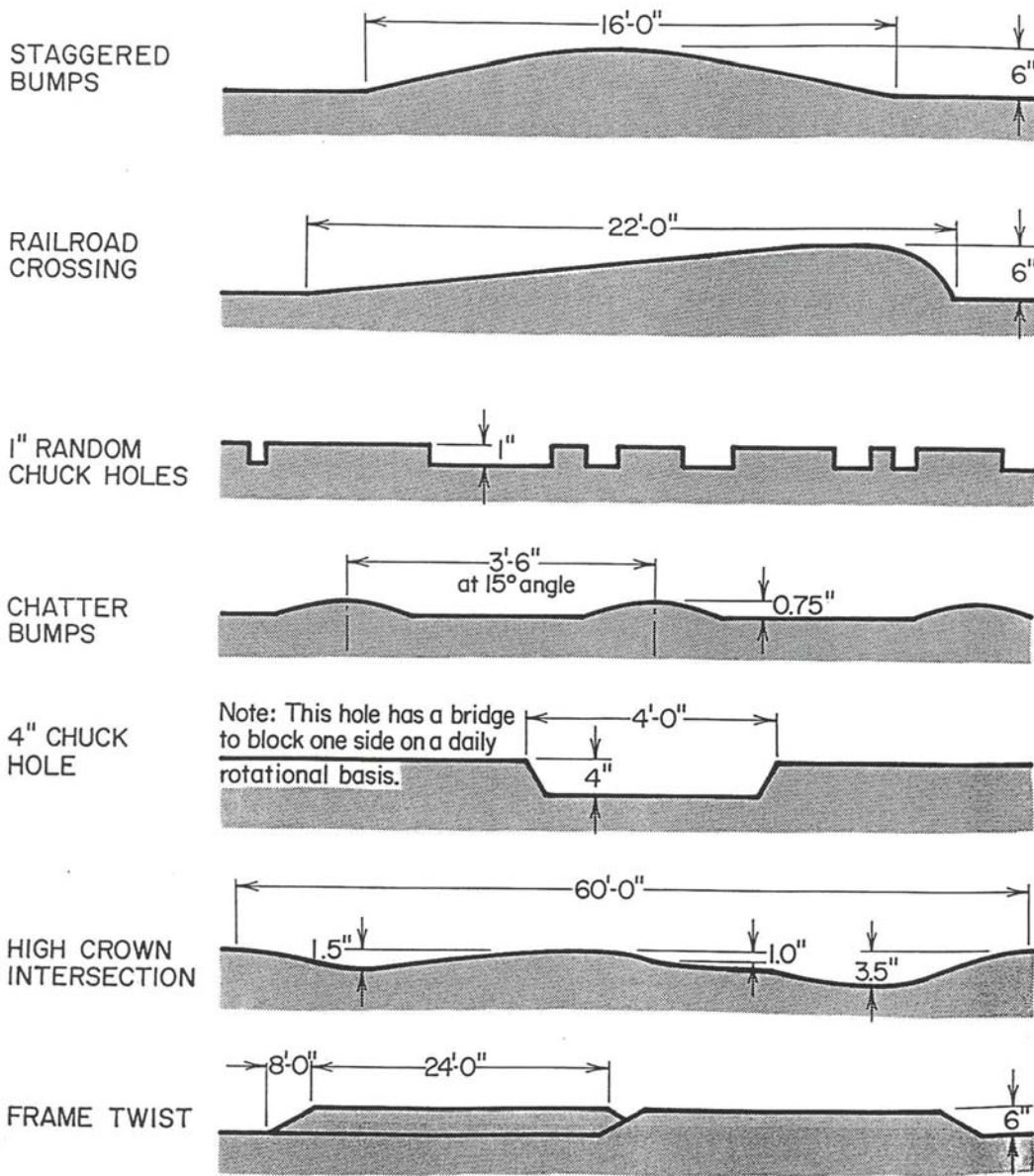
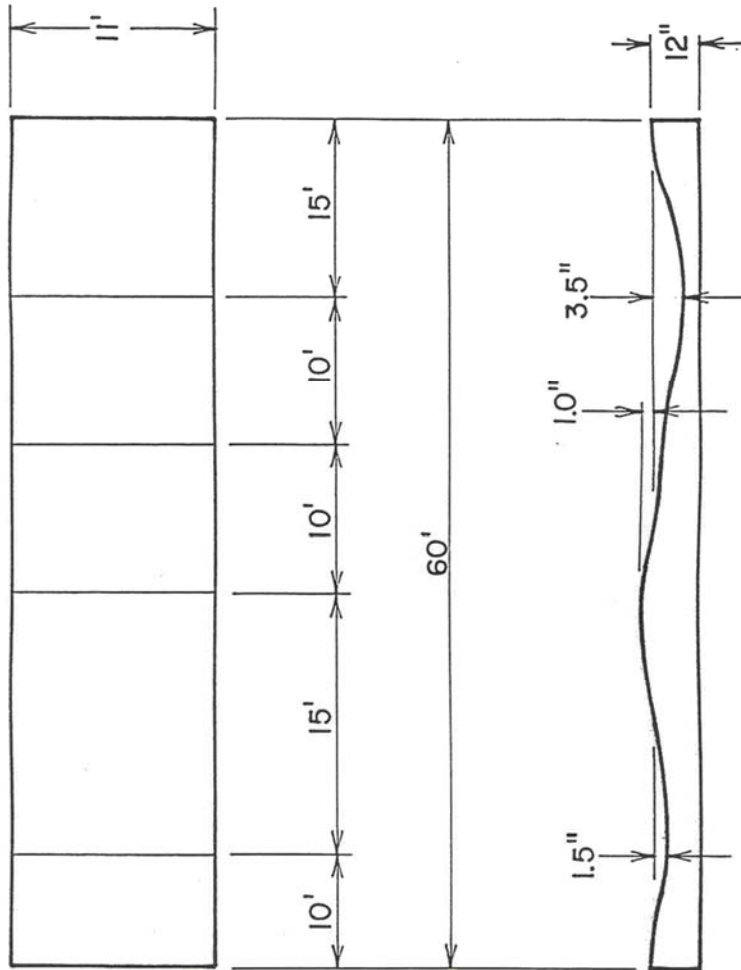
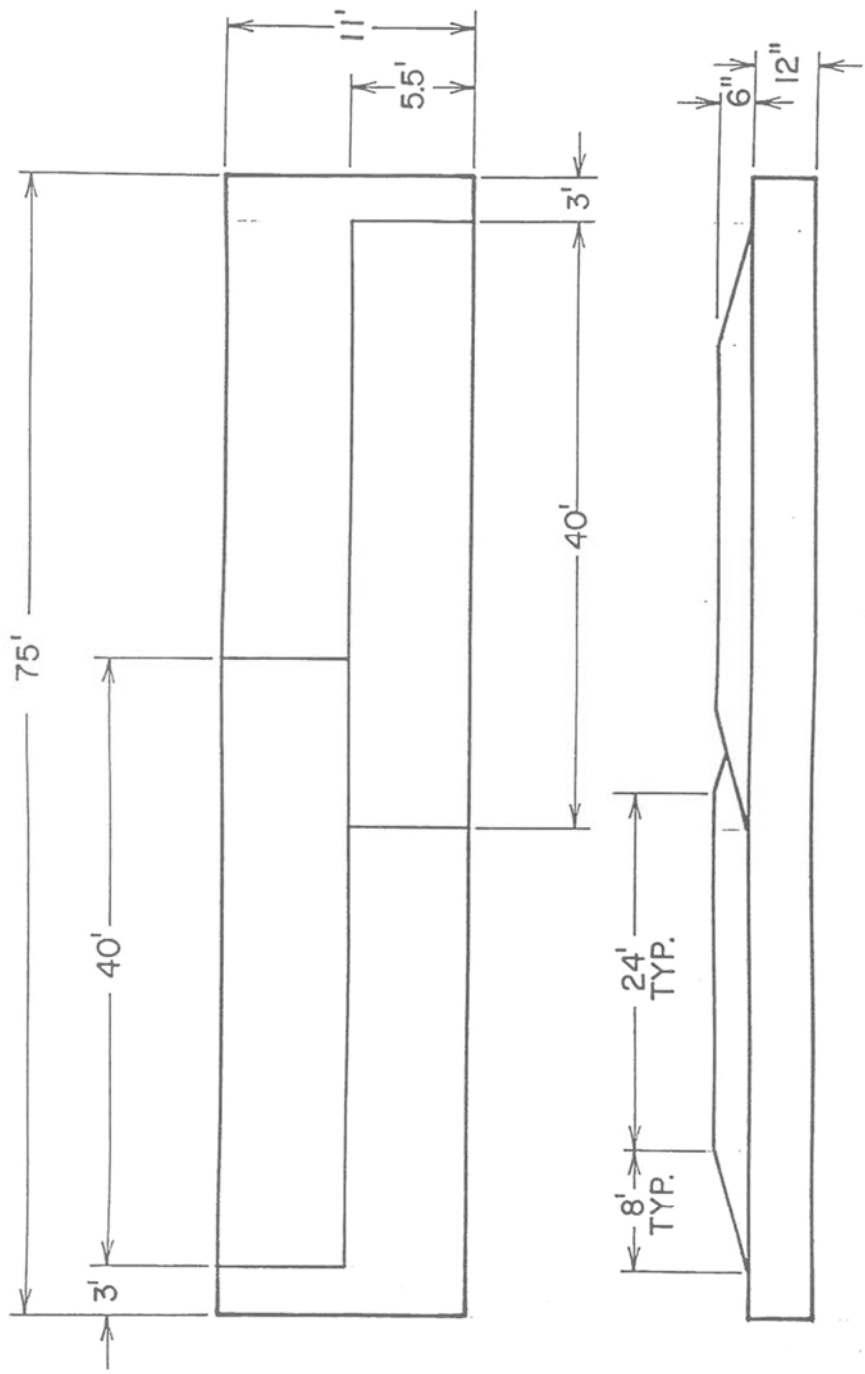


Figure 5.7-2. Side view of stress elements.



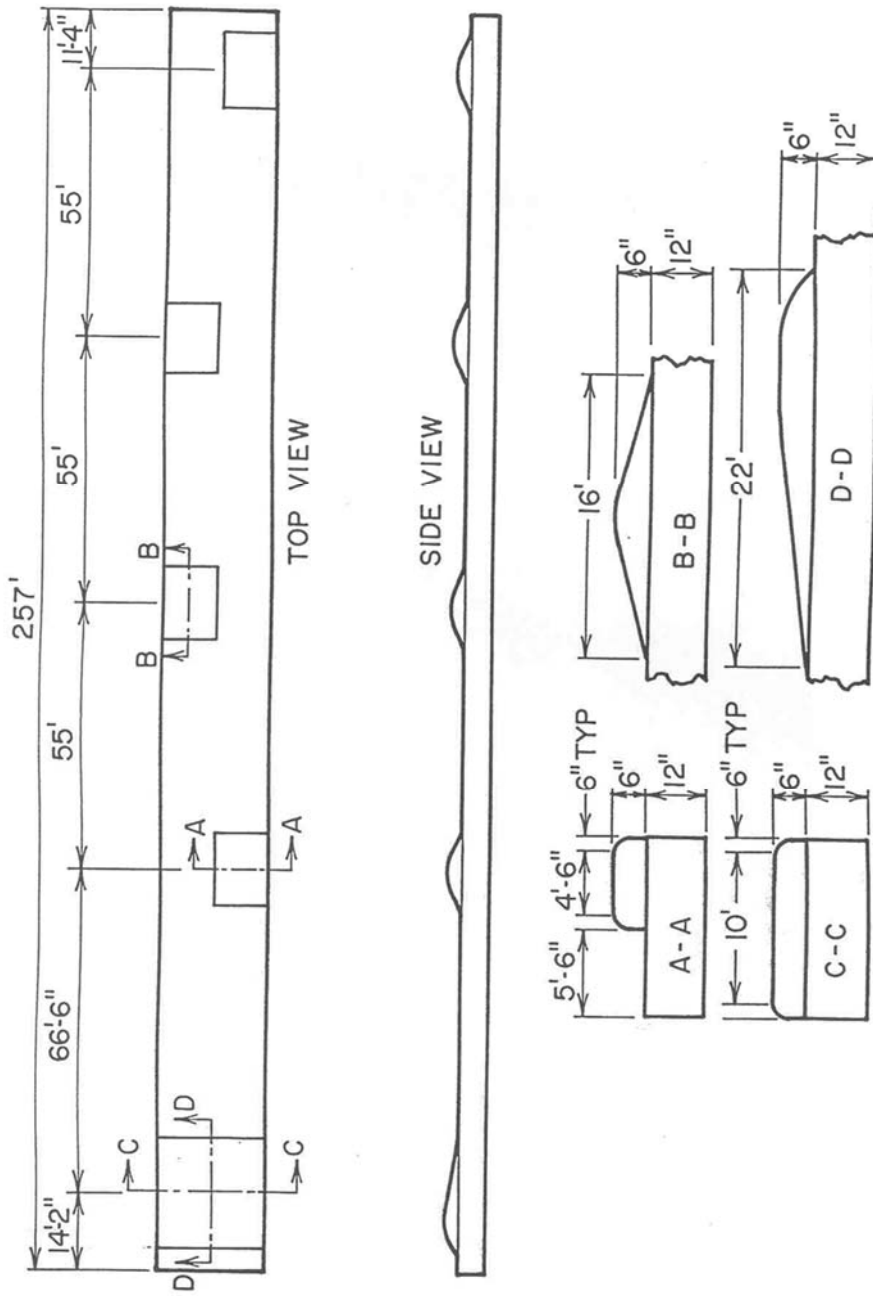
ELEMENT 1 -- HIGH CROWN INTERSECTION

Figure 5.7-3



ELEMENT 2 -- FRAME TWIST

Figure 5.7-4.



ELEMENT 3 -- STAGGERED BUMPS
ELEMENT 4 -- RAILROAD CROSSING

Figure 5.7-5.

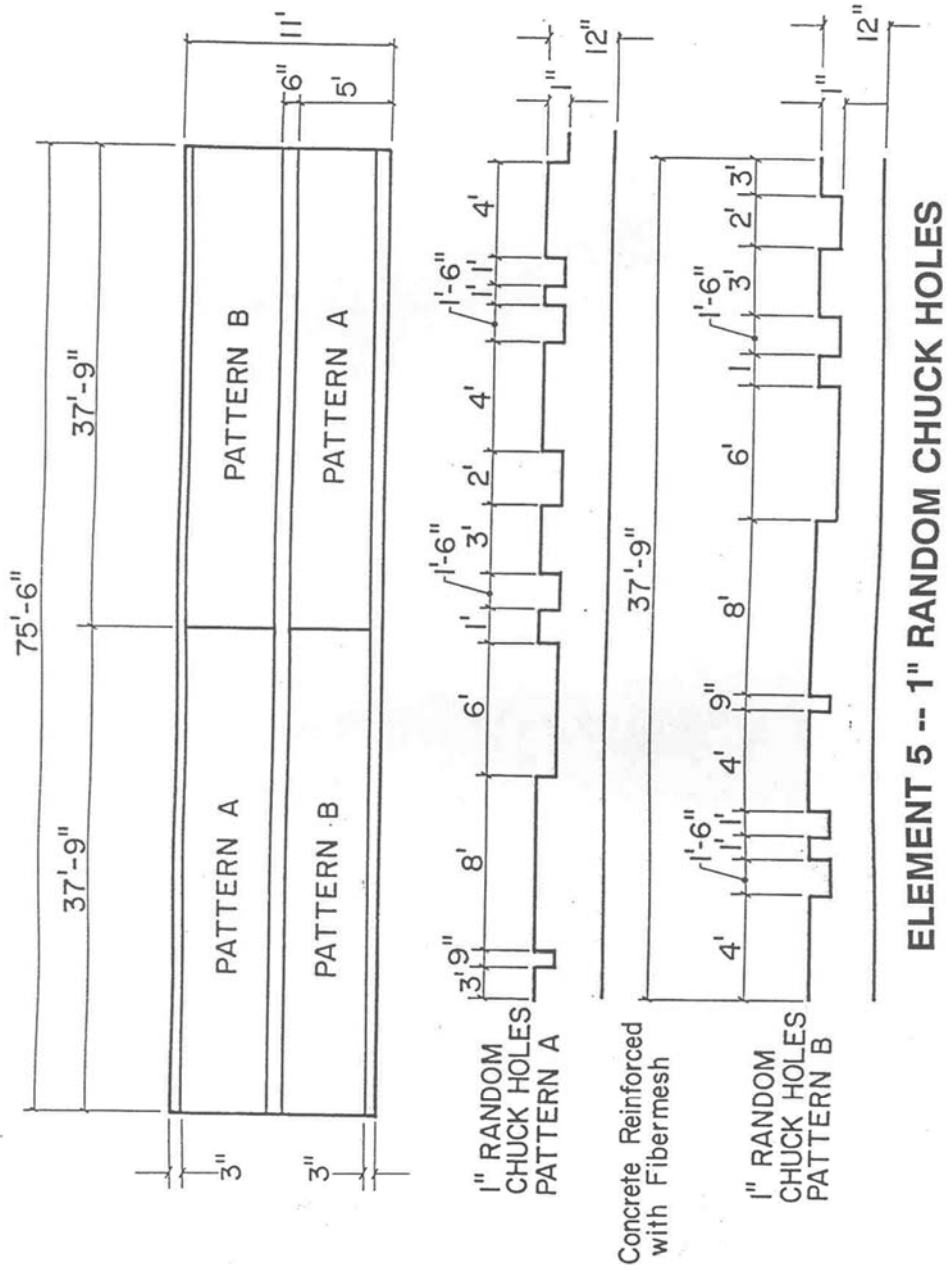
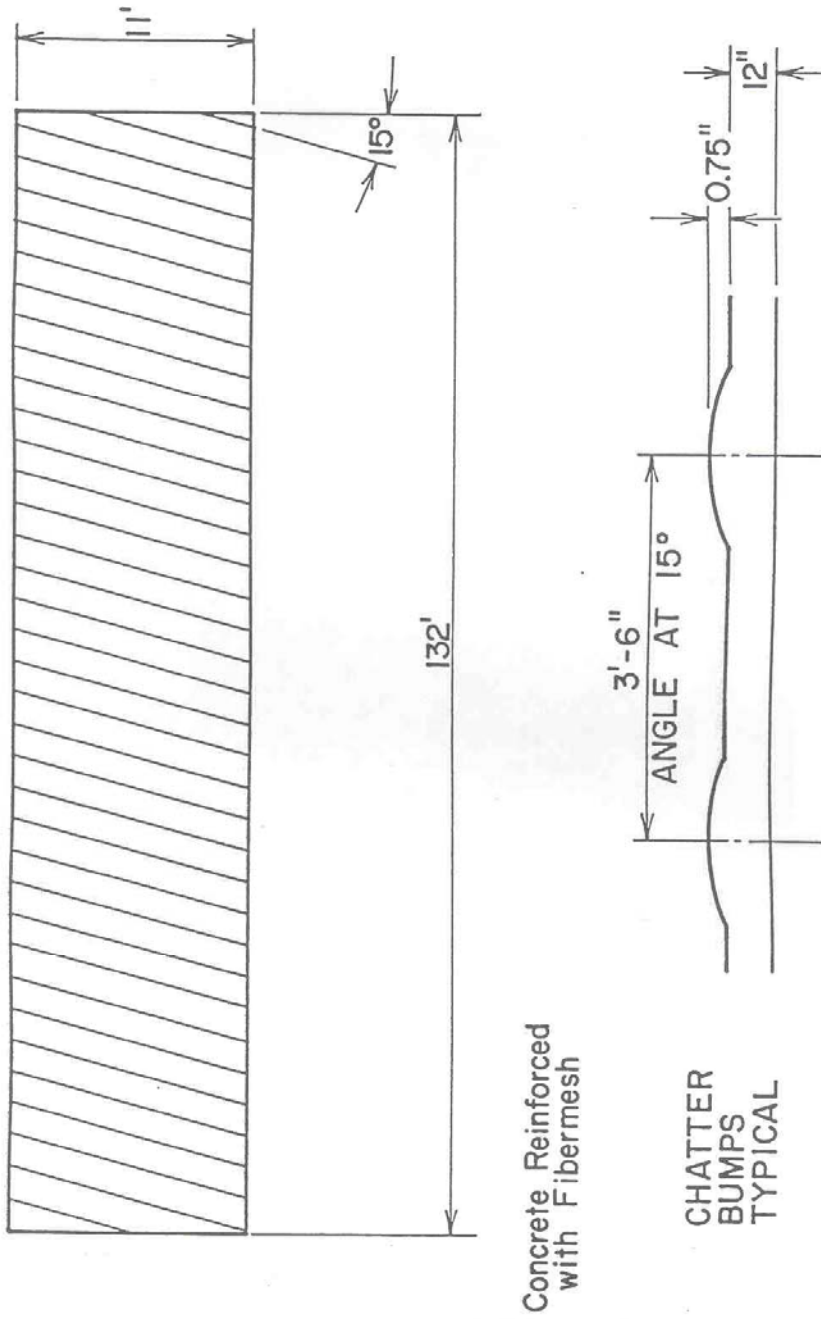
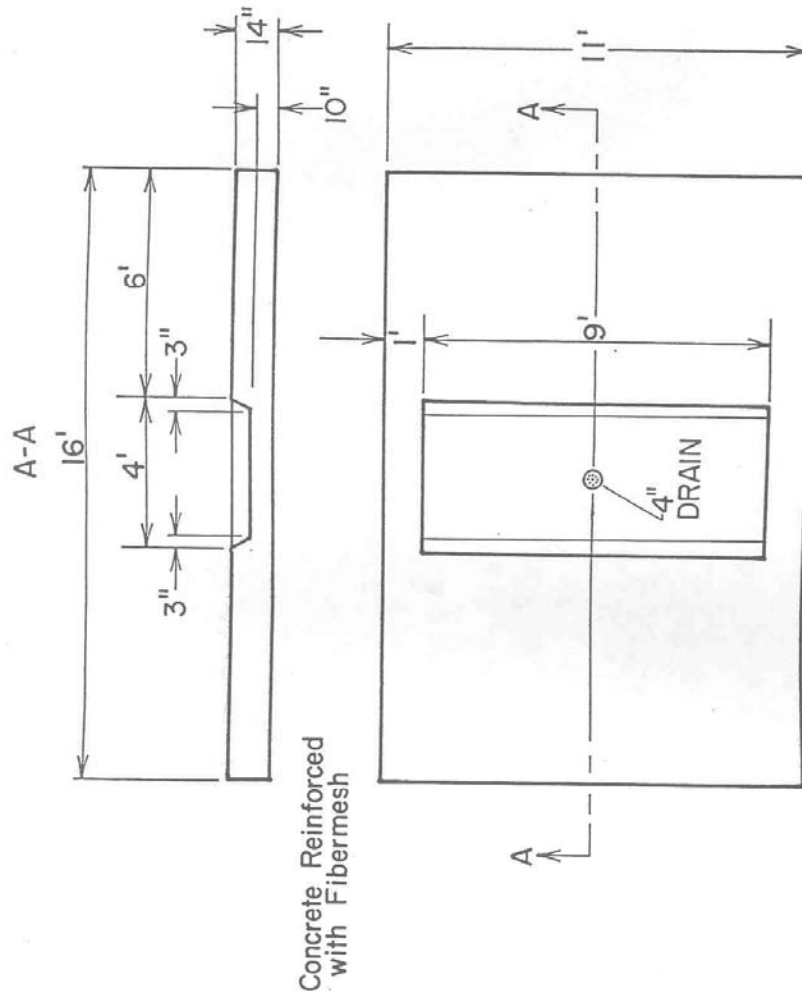


Figure 5.7-6.



ELEMENT 6 -- 3/4" CHATTER BUMPS

Figure 5.7-7.



ELEMENT 7 -- 4" CHUCK HOLE

Figure 5.7-8.