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## Research reports

### Title

Asphalt Compaction Mold: Four-Inch Thick Ingot Mold: Basic Mold Assembly and Operating Instructions

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### Publication Date

2007-10-01

# Asphalt Compaction Mold Four-Inch Thick Ingot Mold

## Basic Mold Assembly and Operating Instructions

Principal Investigators: J. T. Harvey and C. L. Monismith  
Design: M. Troxler

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**PREPARED FOR:**

California Department of Transportation  
Division of Research and Innovation  
Office of Roadway Research

**PREPARED BY:**

University of California  
Pavement Research Center  
UC Davis, UC Berkeley

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All measurements in inches unless otherwise noted.

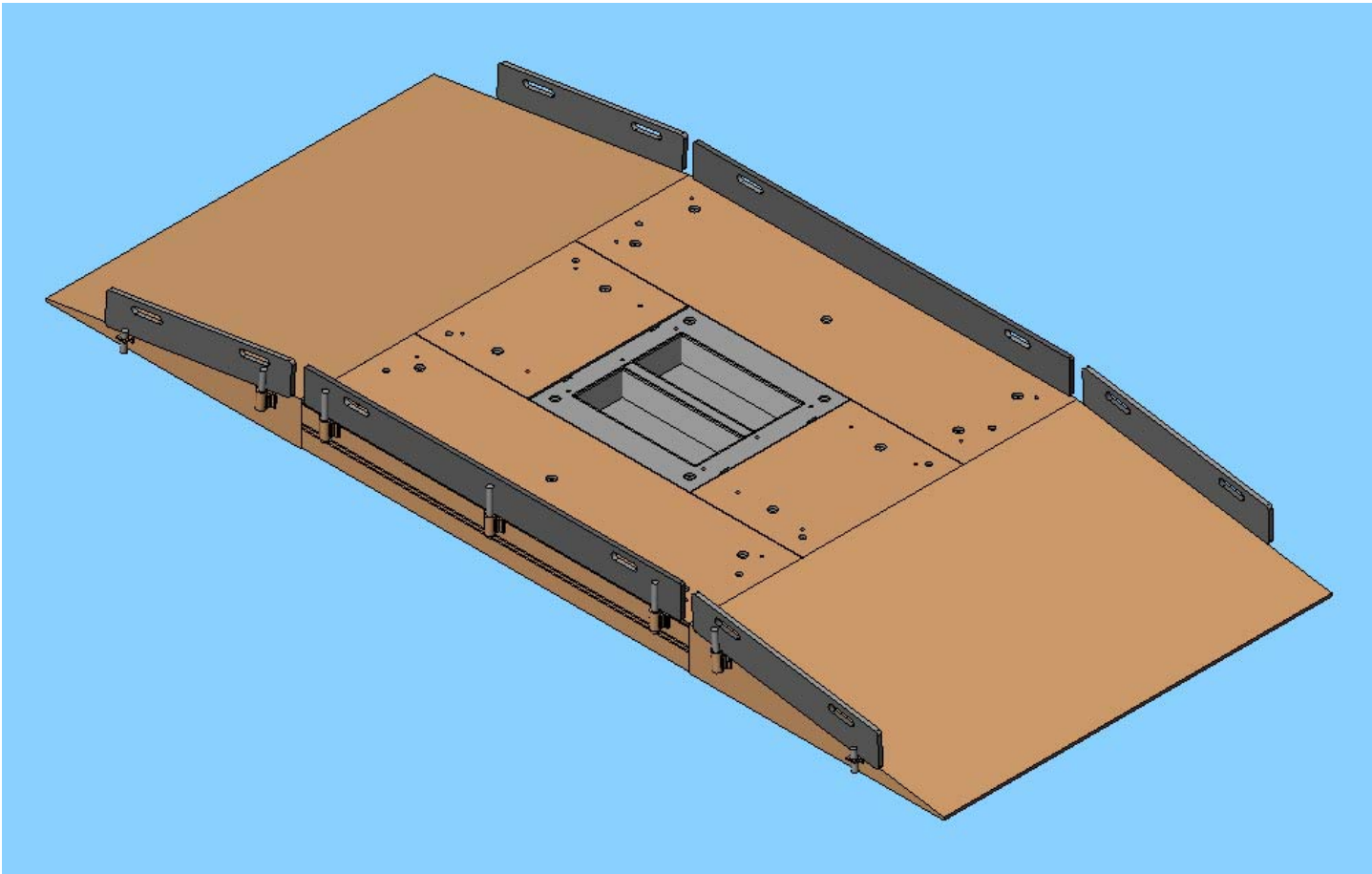
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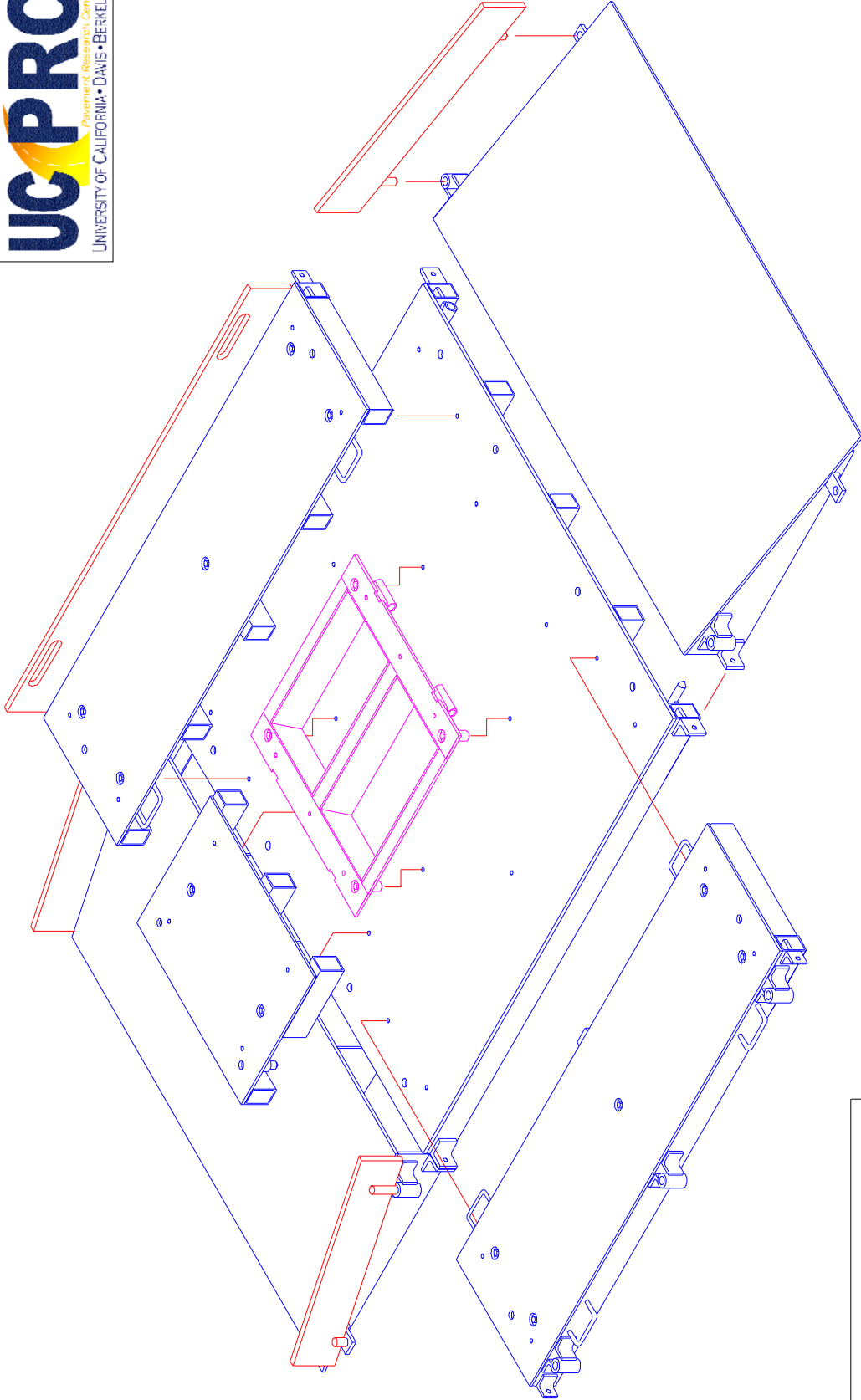
 Parts and components

 Dimension lines & text

 Hidden lines

# Section 1: Description and General Overviews





**UNLESS OTHERWISE SPECIFIED**

FINISH SPECIFICATIONS:

MACHINED SURFACES 1/25" MAX

GROUND SURFACES 3/2" MAX

DECIMAL TOL. .XX±.010 XXX±.005 XXXX±.0005

FRACTIONAL TOL. ±.010

ANGLE TOL. ±1°

REMOVE BURRS AND SHARP EDGES TO .015 MAX

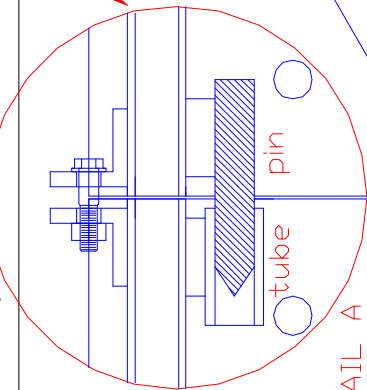
**DO NOT SCALE**

PART NAME		EXPLODED VIEW	SCALE	N/A
MATERIAL	NUMBER	DESCRIPTION	DATE	1-23-03
PART NUMBER			DRAWN BY	MPT
			CHECKED BY	
				CHANGE
				ECO DATE

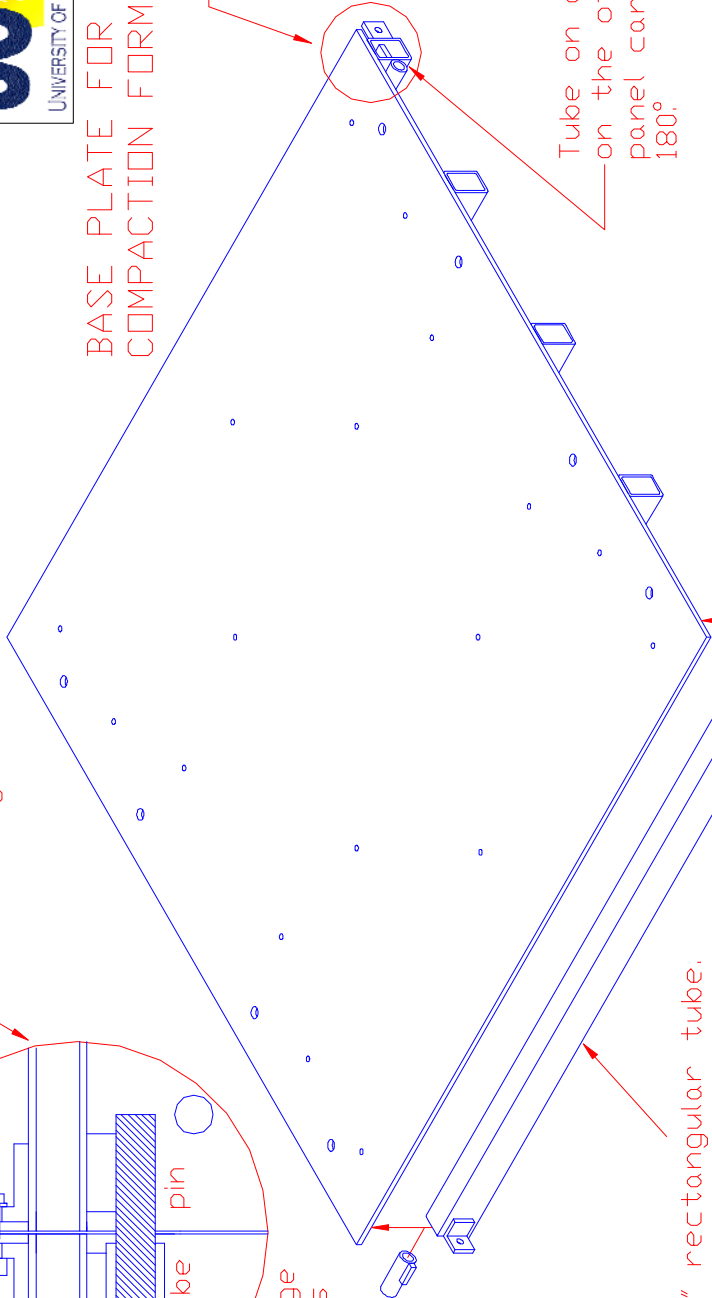


BASE PLATE FOR ASPHALT COMPACTION FORM.

2 Base sections bolted together.



DETAIL A showing edge connections



3.5" X 1.5" rectangular tube. .1875" wall, 72" long.

Angle iron bracket, to attach base panel sections together.

Hardened steel alignment pin. fits into adjoining tube socket.

Detail "A"

Tube on one side, pin on the other, the base panel can be rotated 180°.

UNLESS OTHERWISE SPECIFIED

- FINISH SPECIFICATIONS
- MACHINED SURFACES 125 ✓/MAX.
- GROUND SURFACES 32 ✓/MAX.
- DECIMAL TOL. .XX ± .010 .XXX ± .005 .XXXX ± .0005
- FRACTIONAL TOL. ± .010
- ANGLE TOL. ± 1°
- REMOVE BURRS AND SHARP EDGES TO .015 MAX.
- DO NOT SCALE

PART NAME		BASE PANEL		SCALE	NONE	F
MATERIAL		NUMBER	A-36	DATE	9-22	E
PART NUMBER		DESCRIPTION	STEEL	DRAWN BY	MPT	D
		CHECKED BY				C
						B
						A
		CHANGE				
		ECO				
		DATE				



2.5" X 3.5" square tube supports.

Alignment pin & socket see detail "A".

4 Each, 1/2-13NC holes for lifting eyes.

Bolt down point. See detail "B".

3 Each, guardrail mounts.

Ramp attachment, 2 each.

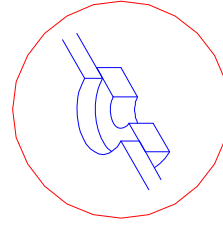
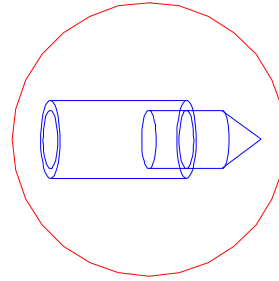
1/2-13NC threaded holes for lifting eyes. 4 Each.

Tubes protrude from panel to form mold supports.

4 Each, handles.

**DETAIL A**

Panel alignment points are a combination of pin & socket. An unlimited number of panels can be stacked one on top of another.



**DETAIL B**

Panel bolt down points are 1" thru holes, with 1/2" thick backing plates. Bolt heads are recessed below top of panel.

**ASPHALT COMPACTION MOLD PANELS**

**UNLESS OTHERWISE SPECIFIED**

**FINISH SPECIFICATIONS**

MACHINED SURFACES 125/Max.

GROUND SURFACES 32/Max.

DECIMAL TOL. .XX ± .010 .XXX ± .005 .XXXX ± .0005

FRACTIONAL TOL. ± .010

ANGLE TOL. ± 1°

REMOVE BURRS AND SHARP EDGES TO .015 MAX.

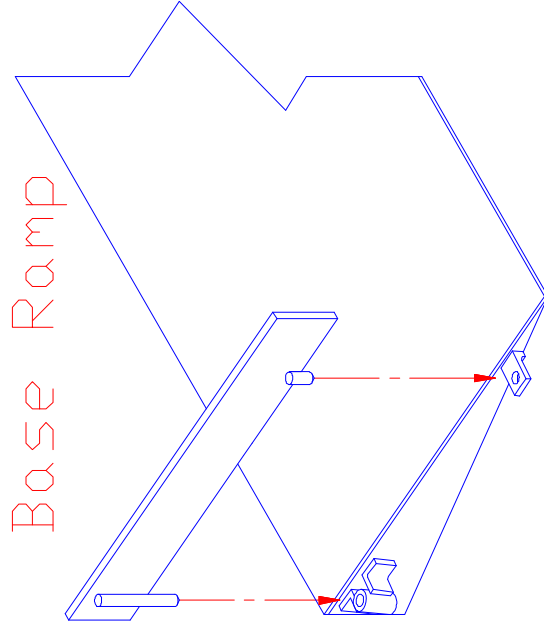
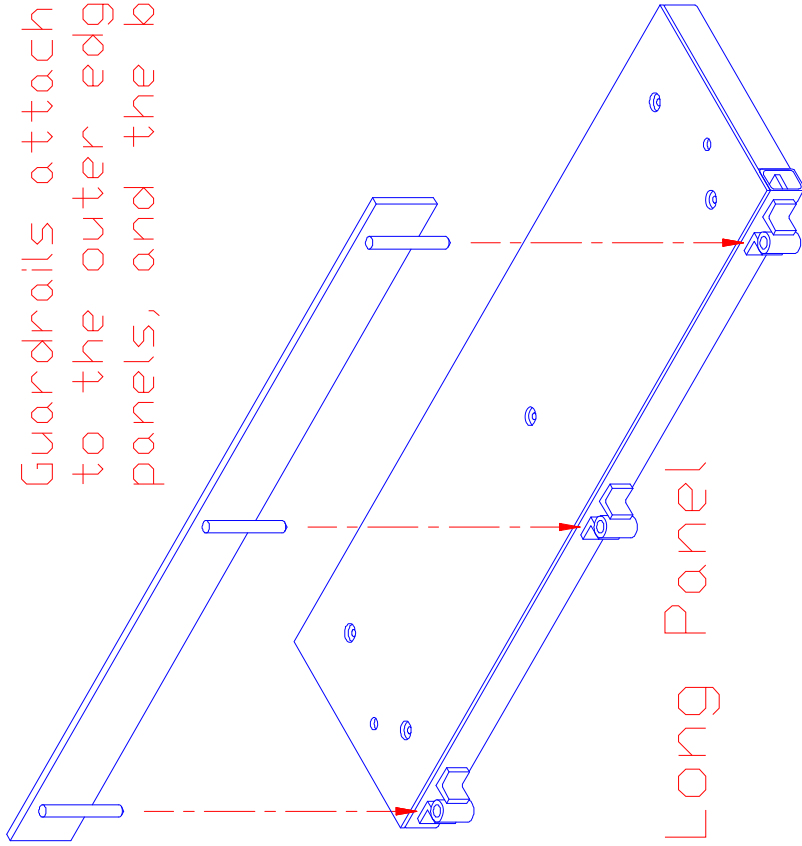
DO NOT SCALE

PART NAME		ASPHALT COMPACTION PANELS		SCALE	N/A	F
MATERIAL		NUMBER	A-36 STEEL PLATE	DATE	9-23-02	E
PART NUMBER		DESCRIPTION		DRAWN BY	MPT	D
		CHECKED BY				C
						B
						A
		CHANGE				
		ECO				
		DATE				





Guardrails attach by pin and socket joints to the outer edges of both the long panels, and the base ramps.

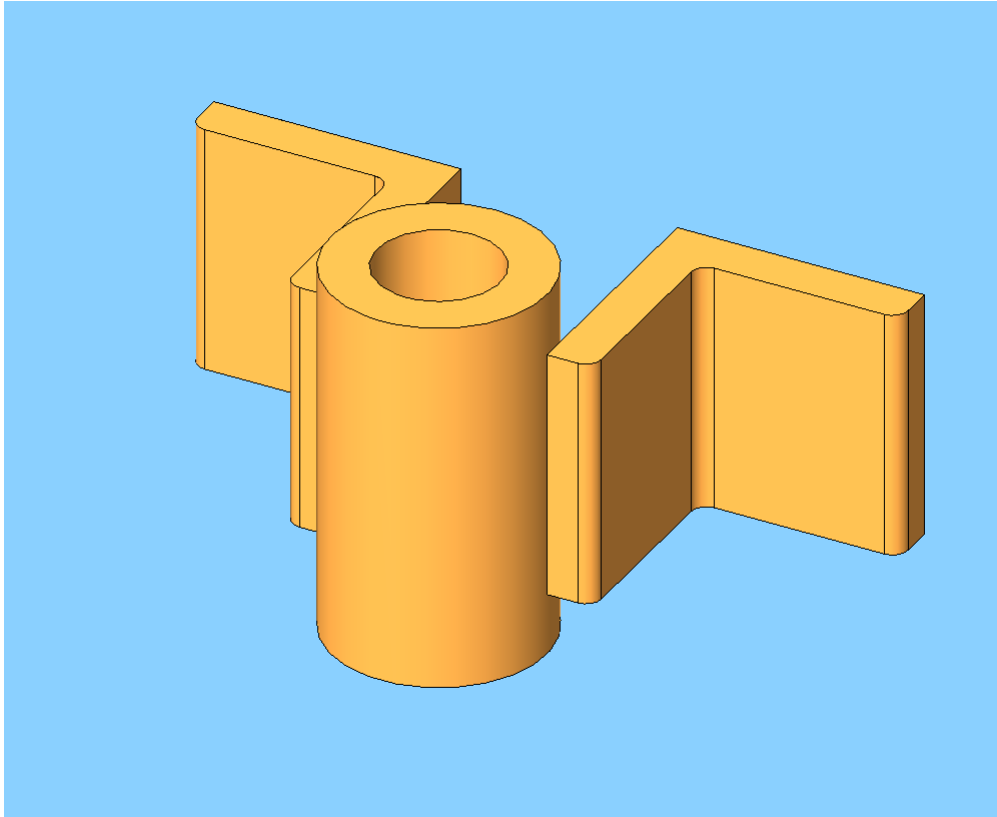


UNLESS OTHERWISE SPECIFIED  
 FINISH SPECIFICATIONS  
 MACHINED SURFACES 125  $\sqrt{\text{MAX.}}$   
 GROUND SURFACES 32  $\sqrt{\text{MAX.}}$   
 DECIMAL TOL. .XX .010 .XXX .005 .XXXX .0005  
 FRACTIONAL TOL. .010  
 ANGLE TOL. 1  
 REMOVE BURRS AND SHARP EDGES TO .015 MAX.  
 DO NOT SCALE

PART NAME		Guard rail Assembly	
SCALE		n/a	
DATE		12-23-02	
DRAWN BY		MPT	
CHECKED BY			
MATERIAL	NUMBER		
DESCRIPTION			
PART NUMBER			

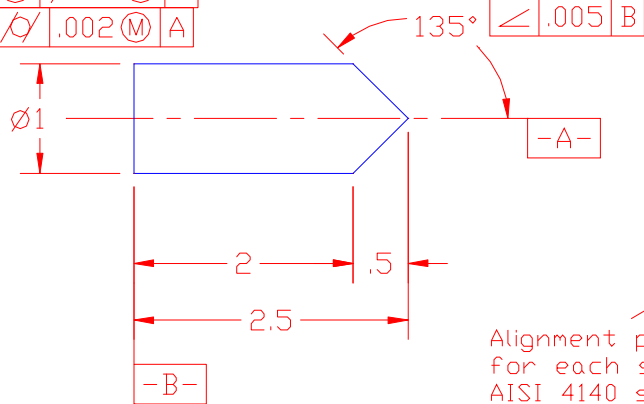
F			
E			
D			
C			
B			
A			
CHANGE			ECD DATE

## Section 2: Components and Sub-Assemblies





○	∅001	M	A
∅	.002	M	A

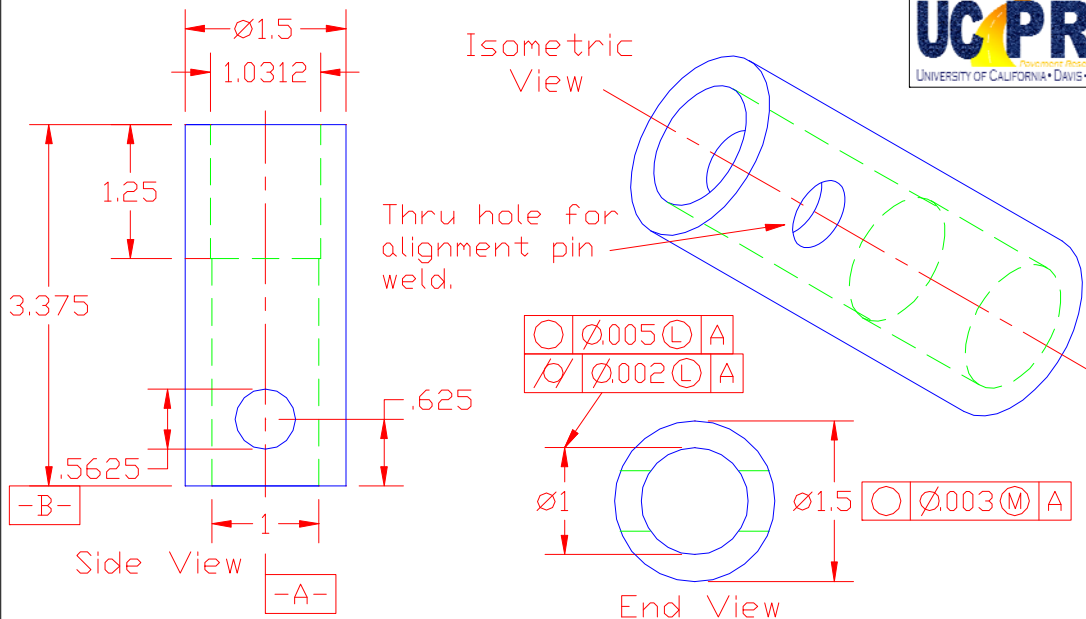


Alignment pin. 8 each are required for each section of mold assembly. AISI 4140 steel, welded into part #02, and then hardened through heat treatment.

Unless Otherwise Specified

Finish Specifications  
Machined Surfaces 125  $\sqrt{\text{MAX}}$   
Ground Surfaces 32  $\sqrt{\text{MAX}}$   
Decimal Tol. XX ± .010 XXX ± .005 XXXX ± .0005  
Fractional Tol. ± .010  
Angle Tol. ± 1°  
Remove Burrs And Sharp Edges to .015 Max.  
DD NOT SCALE

Part Name		Alignment Pin	Scale	N/A	F		
Material	Number	4140	Date	11-10	E		
	Description	Chrome-Moly Steel	Drawn By	MPT	D		
Part Number		#01	Checked By		C		
					B		
					A		
						Change	ECD Date

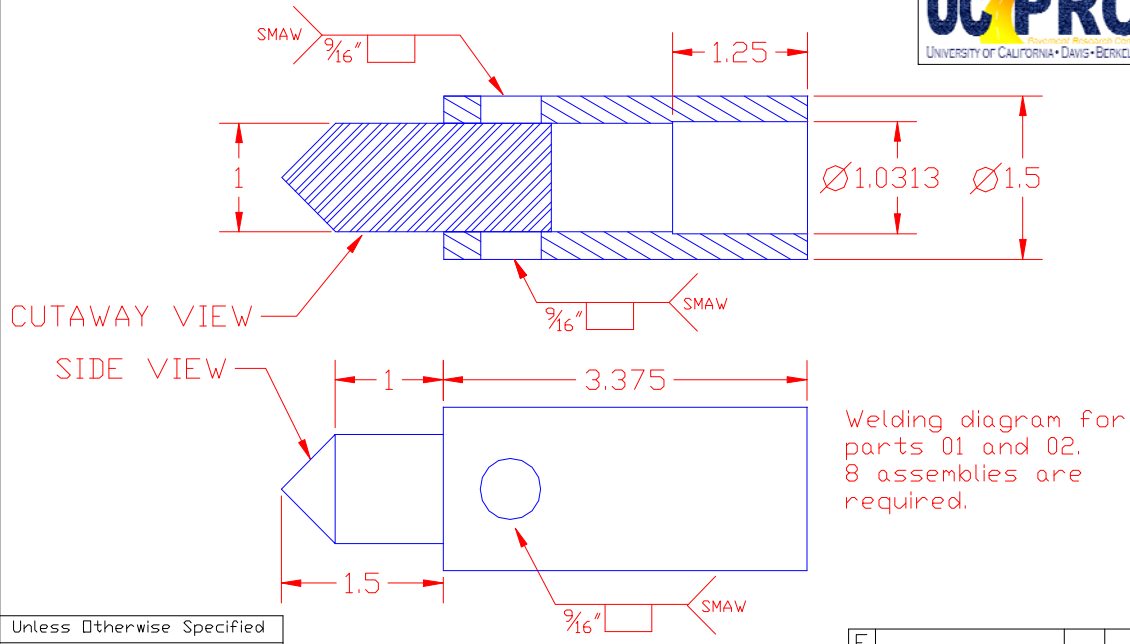


8 each are required for each section of mold.

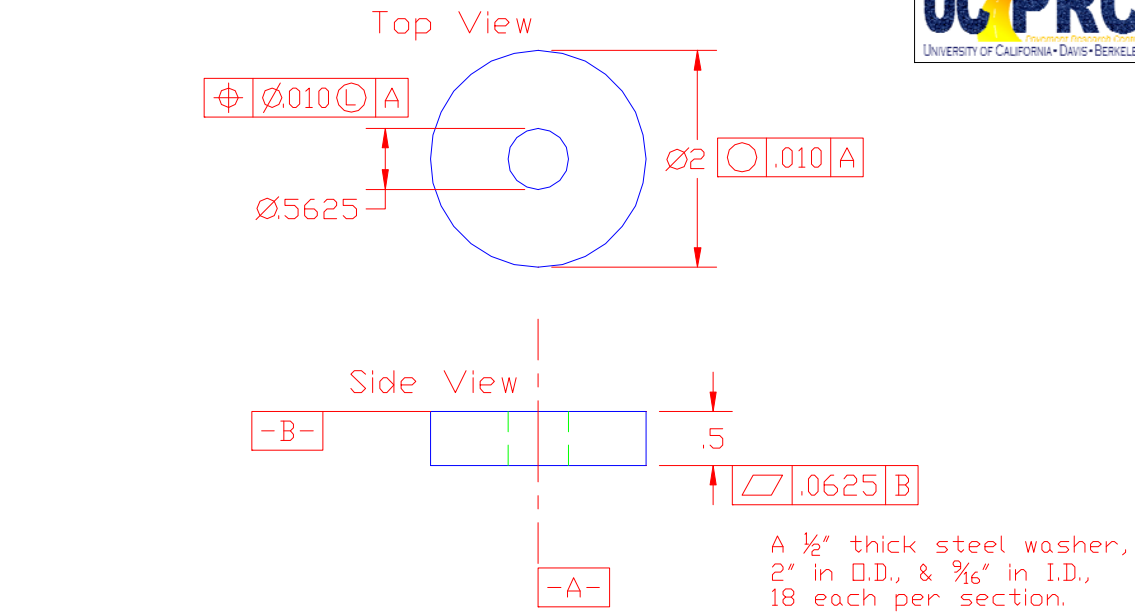
Unless Otherwise Specified

Finish Specifications  
Machined Surfaces 125  $\sqrt{\text{MAX}}$   
Ground Surfaces 32  $\sqrt{\text{MAX}}$   
Decimal Tol. XX ± .010 XXX ± .005 XXXX ± .0005  
Fractional Tol. ± .010  
Angle Tol. ± 1°  
Remove Burrs And Sharp Edges to .015 Max.  
DD NOT SCALE

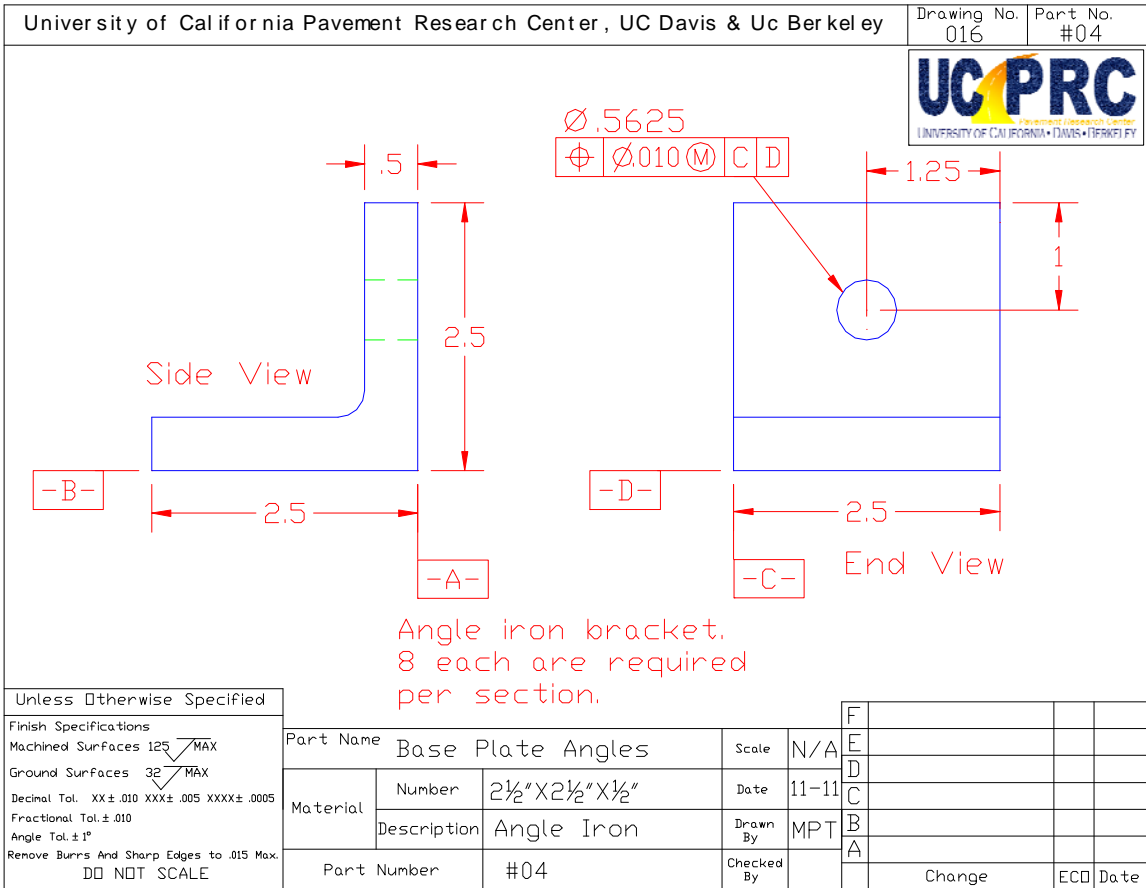
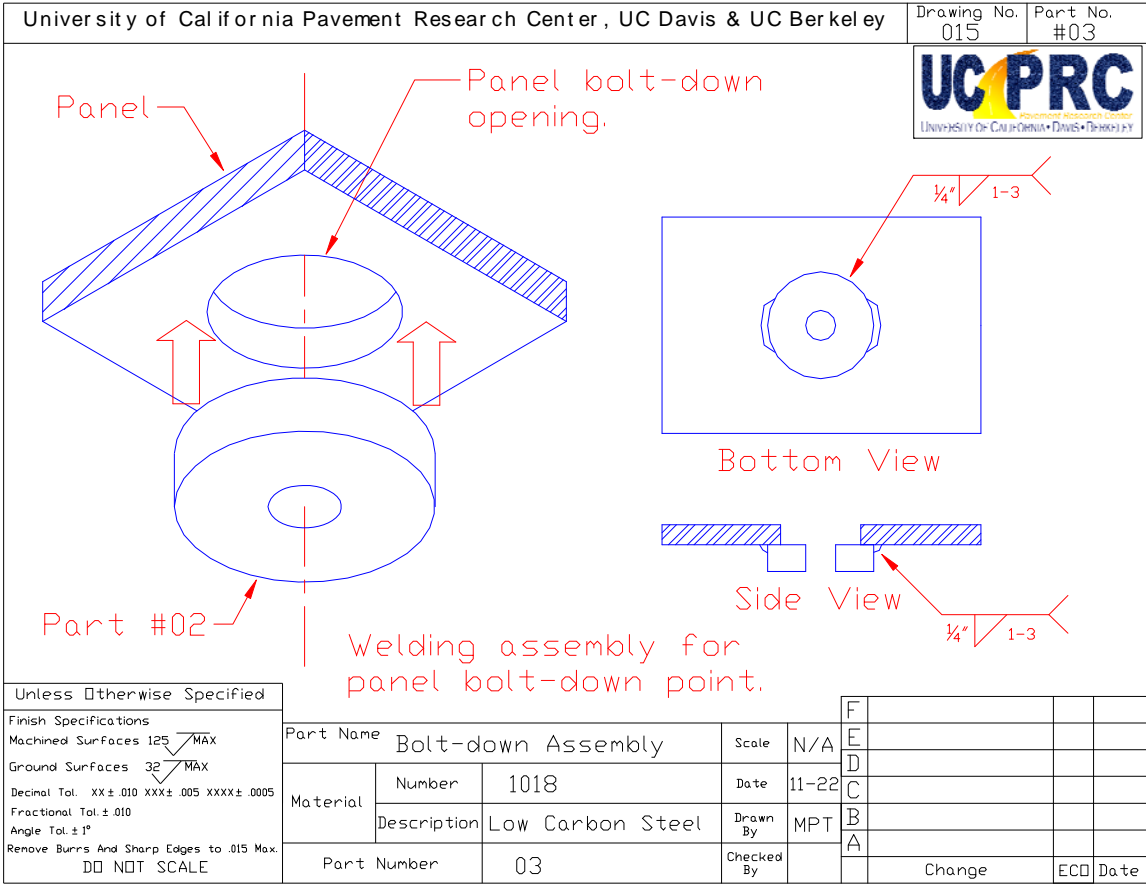
Part Name		Alignment Tube	Scale	N/A	F		
Material	Number	DOM steel tubing	Date	11-11-03	E		
	Description		Drawn By	MPT	D		
Part Number		#02	Checked By		C		
					B		
					A	Enlarge alignment hole	1 12-31-05
						Change	ECD Date

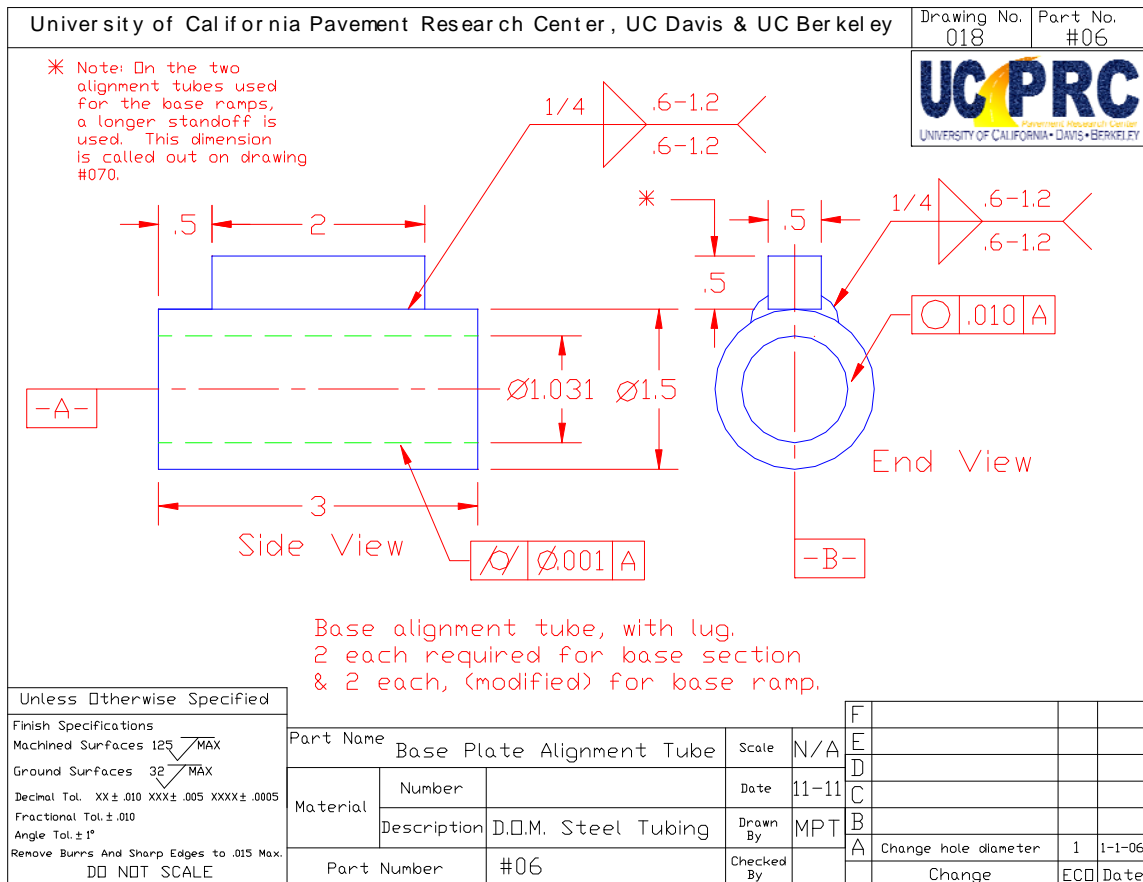
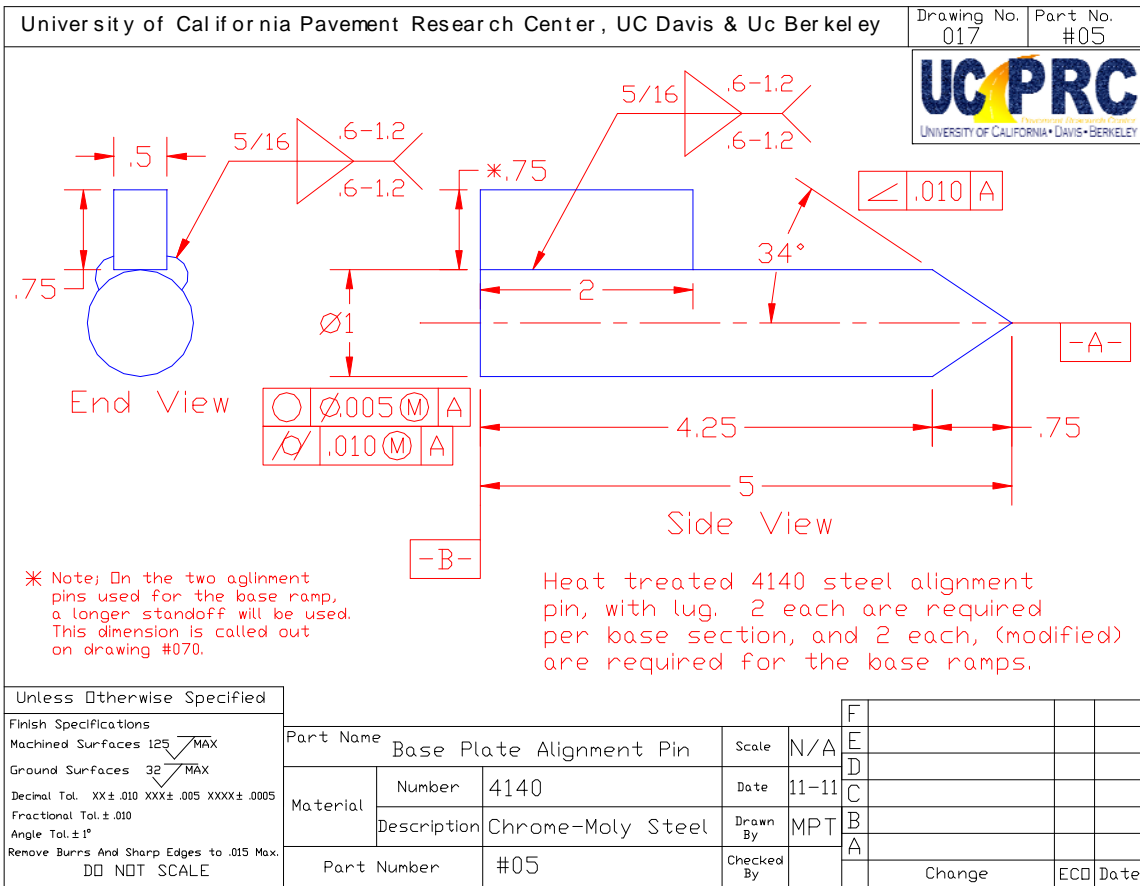


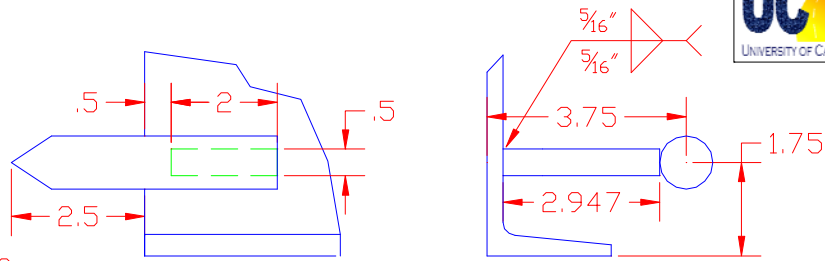
Unless Otherwise Specified		Part Name		Scale	N/A	F		
Finish Specifications		WELDING DIAGRAM #1		Date	12-3	E		
Machined Surfaces 125 MAX		Material	Number	Drawn By	MPT	D		
Ground Surfaces 32 MAX		Description		Checked By		C		
Decimal Tol. XX±.010 XXX±.005 XXXX±.0005		Parts 01 & 03				B		
Fractional Tol. ±.010						A		
Angle Tol. ±1°								
Remove Burrs And Sharp Edges to .015 Max.								
DO NOT SCALE							Change	ECD Date



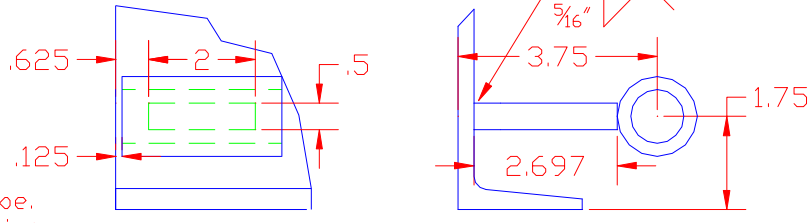
Unless Otherwise Specified		Part Name		Scale	N/A	F		
Finish Specifications		Panel Bolt-down Disc		Date	11-10	E		
Machined Surfaces 125 MAX		Material	Number	Drawn By	MPT	D		
Ground Surfaces 32 MAX		Description		Checked By		C		
Decimal Tol. XX±.010 XXX±.005 XXXX±.0005		Low Carbon Steel				B		
Fractional Tol. ±.010		#03				A		
Angle Tol. ±1°								
Remove Burrs And Sharp Edges to .015 Max.							Change	ECD Date
DO NOT SCALE								







Base ramp alignment pin. Side & end views.

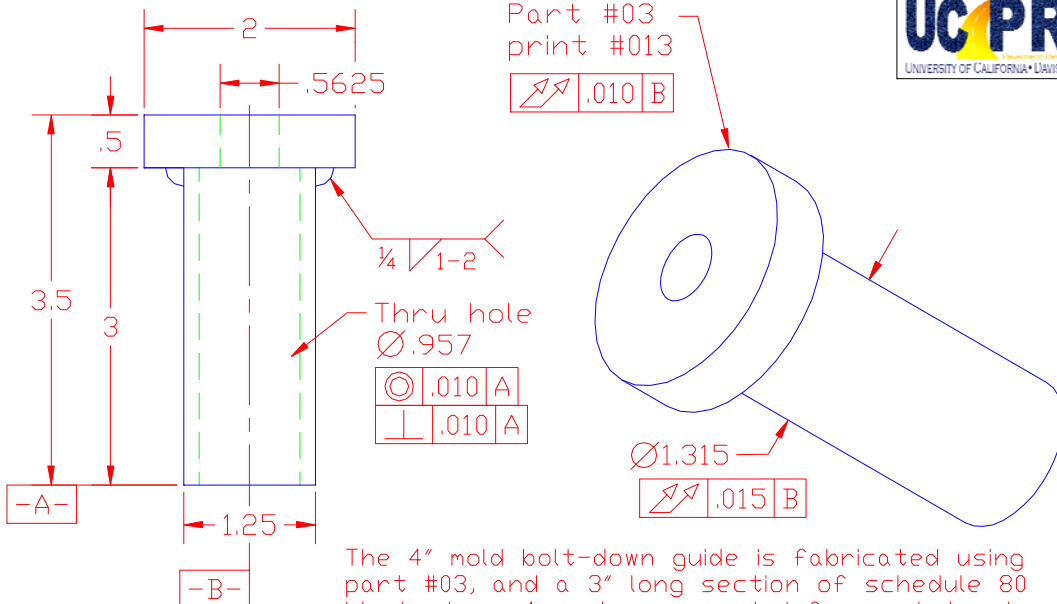


Base ramp alignment tube. Side & end views.

Side View

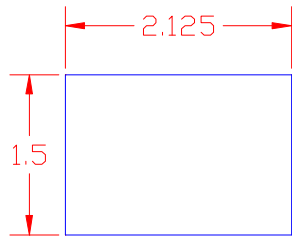
End View

Unless Otherwise Specified		Part Name		Scale	F		
Finish Specifications		Base Ramp Alignment Detail		1/2	E		
Machined Surfaces 125	MAX	Number		Date	D		
Ground Surfaces 32	MAX	Description		1-25	C		
Decimal Tol. XX ± .010 XXX ± .005 XXXX ± .0005		Material		Drawn By	B		
Fractional Tol. ± .010		Part Number		MPT	A		
Angle Tol. ± 1°		#05 & #06		Checked By		Change	ECD Date
Remove Burrs And Sharp Edges to .015 Max.							
DO NOT SCALE							



The 4" mold bolt-down guide is fabricated using part #03, and a 3" long section of schedule 80 black pipe. 4 each are needed for each ingot mold.

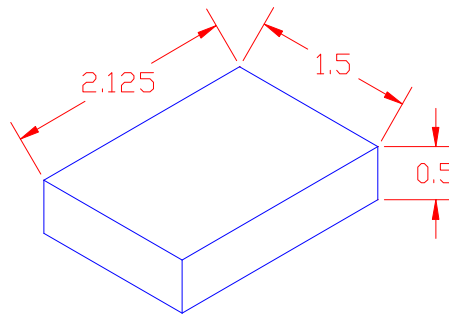
Unless Otherwise Specified		Part Name		Scale	F		
Finish Specifications		4" Mold Bolt-down Guide		N/A	E		
Machined Surfaces 125	MAX	Number		Date	D		
Ground Surfaces 32	MAX	Description		12-9	C		
Decimal Tol. XX ± .010 XXX ± .005 XXXX ± .0005		Material		Drawn By	B		
Fractional Tol. ± .010		Low Carbon Steel		MPT	A	Hole enlarged	1 11-17-05
Angle Tol. ± 1°		Part Number		Checked By		Change	ECD Date
Remove Burrs And Sharp Edges to .015 Max.		07					
DO NOT SCALE							



Top View



Side View

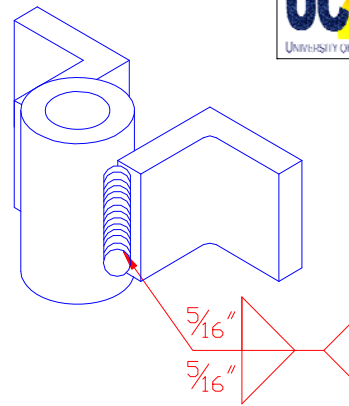
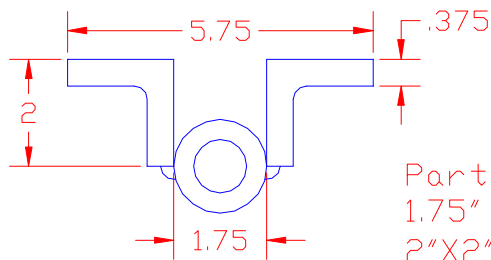
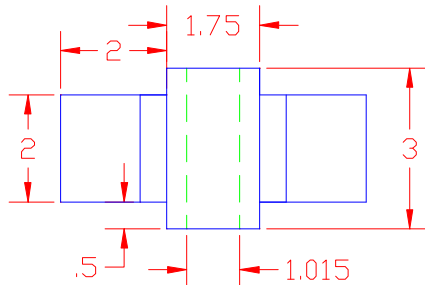


Steel stiffeners for rectangular tube, at base plate corners. 4 Each are required per section.

Unless Otherwise Specified

Finish Specifications	
Machined Surfaces	125 $\nabla$ MAX
Ground Surfaces	32 $\nabla$ MAX
Decimal Tol.	XX ± .010 XXX ± .005 XXXX ± .0005
Fractional Tol.	± .010
Angle Tol.	± 1°
Remove Burrs And Sharp Edges to .015 Max.	
DO NOT SCALE	

Part Name		Stiffener Plate	Scale	N/A	F			
Material	Number	A-36	Date	12-22	E			
	Description	Hot Roll Steel	Drawn By	MPT	D			
Part Number		08	Checked By		C			
					B			
					A			
						Change	ECD	Date



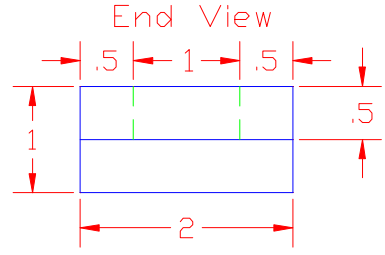
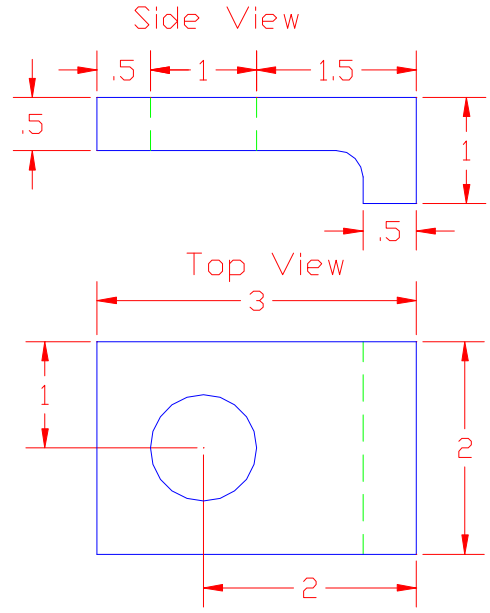
Part #010 is a fabrication of 1.75" O.D. X 1" I.D. steel tubing, and 2" X 2" X 3/8" angle iron. 10 each are required per section.

Unless Otherwise Specified

Finish Specifications	
Machined Surfaces	125 $\nabla$ MAX
Ground Surfaces	32 $\nabla$ MAX
Decimal Tol.	XX ± .010 XXX ± .005 XXXX ± .0005
Fractional Tol.	± .010
Angle Tol.	± 1°
Remove Burrs And Sharp Edges to .015 Max.	
DO NOT SCALE	

Part Name		Guard Mount	Scale	1/2	F			
Material	Number		Date	12-23	E			
	Description	Angle iron & steel tube	Drawn By	MPT	D			
Part Number		010	Checked By		C			
					B			
					A			
						Change	ECD	Date

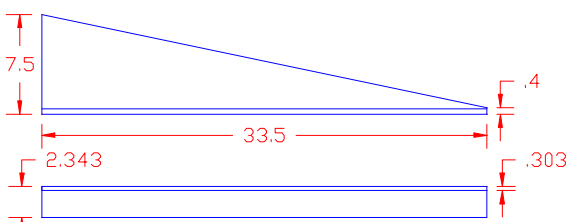
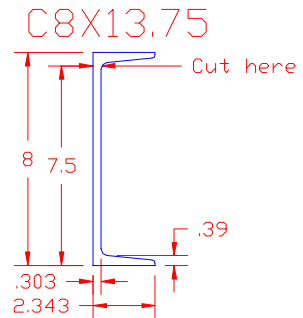




Ramp guardrail mounts. Used on the base ramp only. Machined from 1/2" thick angle iron. 4 each are required.

Unless Otherwise Specified  
 Finish Specifications  
 Machined Surfaces 125 MAX  
 Ground Surfaces 32 MAX  
 Decimal Tol. XX ± .010 XXX ± .005 XXXX ± .0005  
 Fractional Tol. ± .010  
 Angle Tol. ± 1°  
 Remove Burrs And Sharp Edges to .015 Max.  
 DO NOT SCALE

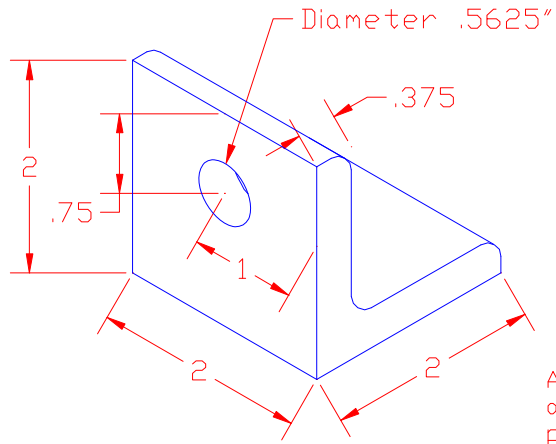
Part Name		Ramp Guardrail Mount	Scale	N/A	F		
Material	Number	1"X3"x1/2"	Date	12-25	E		
	Description	Angle Iron	Drawn By	MPT	D		
Part Number		011	Checked By		C		
						B	
						A	
						CHANGE	ECD DATE



Base Ramp Rib  
 10 each are required

UNLESS OTHERWISE SPECIFIED  
 FINISH SPECIFICATIONS  
 MACHINED SURFACES 125 MAX.  
 GROUND SURFACES 32 MAX.  
 DECIMAL TOL. XX .010 XXX .005 XXXX .0005  
 FRACTIONAL TOL. .010  
 ANGLE TOL. 1  
 REMOVE BURRS AND SHARP EDGES TO .015 MAX.  
 DO NOT SCALE

PART NAME		Ramp Under-ribs	SCALE	2:1	F		
MATERIAL	NUMBER	C4X7.25 & C8X13.75	DATE	12-26	E		
	DESCRIPTION	Channel Iron	DRAWN BY	MPT	D		
PART NUMBER		012	CHECKED BY		C		
						B	
						A	
						CHANGE	ECD DATE



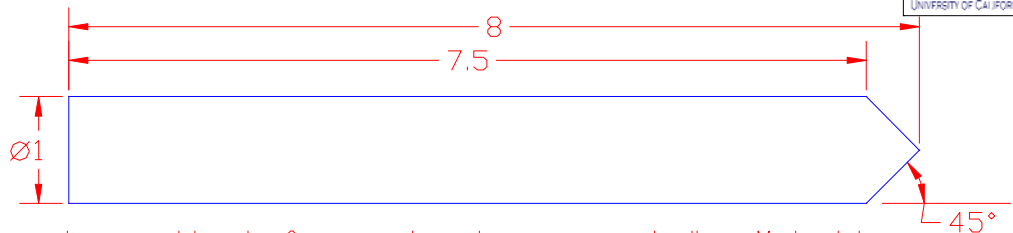
Angle iron bracket used to attach short ramps to long panels, for making 8" & 12" deep specimens. 4 each are required for each section.

Unless Otherwise Specified

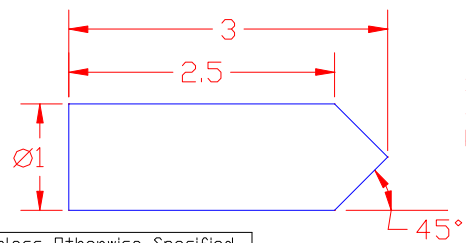
Finish Specifications  
 Machined Surfaces 125  $\sqrt{\text{MAX}}$   
 Ground Surfaces 32  $\sqrt{\text{MAX}}$   
 Decimal Tol. XX ± .010 XXX ± .005 XXXX ± .0005  
 Fractional Tol. ± .010  
 Angle Tol. ± 1°  
 Remove Burrs And Sharp Edges to .015 Max.  
 DO NOT SCALE

Part Name		Panel Ramp Angle	Scale	N/A
Material	Number	2"X2"X3/8"	Date	12-27
	Description	Angle Iron	Drawn By	MPT
Part Number		013	Checked By	

F			
E			
D			
C			
B			
A			
Change	ECD	Date	



Long guide pin for panel and ramp guardrails. Material: carbon steel. 10 each are required for first section, 6 each are required for each additional section.



Short guide pin, for base ramp only. 4 each are required, irregardless of how many sections are constructed.

Unless Otherwise Specified

Finish Specifications  
 Machined Surfaces 125  $\sqrt{\text{MAX}}$   
 Ground Surfaces 32  $\sqrt{\text{MAX}}$   
 Decimal Tol. XX ± .010 XXX ± .005 XXXX ± .0005  
 Fractional Tol. ± .010  
 Angle Tol. ± 1°  
 Remove Burrs And Sharp Edges to .015 Max.  
 DO NOT SCALE

Part Name		Guardrail Pin	Scale	N/A
Material	Number	1018	Date	12-27
	Description	Carbon Steel	Drawn By	MPT
Part Number		014	Checked By	

F			
E			
D			
C			
B			
A			
Change	ECD	Date	

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Drawing No. 063 Part No. 018

Short handle is for the outside of the long panel.  
The long handle is for the inside, (facing the molds).  
4 of each type are required per section.

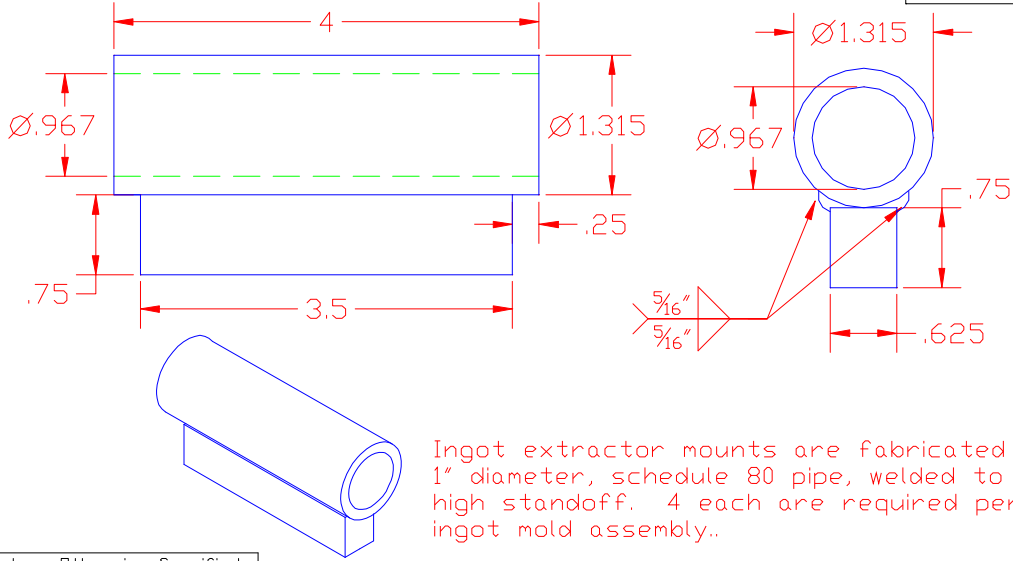
Unless Otherwise Specified		Part Name Long Panel Handles		Scale	1/2	F		
Finish Specifications		Material		Date	1-14	E		
Machined Surfaces 125 $\sqrt{\text{MAX}}$		Number		Drawn By	MPT	D		
Ground Surfaces 32 $\sqrt{\text{MAX}}$		Description		Checked By		C		
Decimal Tol. XX $\pm$ .010 XXX $\pm$ .005 XXXX $\pm$ .0005		1/2" dia. steel bar				B		
Fractional Tol. $\pm$ .010		Part Number				A		
Angle Tol. $\pm$ 1°		018					Change	ECD Date
Remove Burrs And Sharp Edges to .015 Max. DO NOT SCALE								

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Drawing No. 065 Part No. 019

Standard 1/2-13NC eyebolt.  
A minimum of 8 are recommended for each base/panel section.

Unless Otherwise Specified		Part Name Lifting Eyes		Scale	N/A	F		
Finish Specifications		Material		Date	1-19	E		
Machined Surfaces 125 $\sqrt{\text{MAX}}$		Number		Drawn By	MPT	D		
Ground Surfaces 32 $\sqrt{\text{MAX}}$		Description		Checked By		C		
Decimal Tol. XX $\pm$ .010 XXX $\pm$ .005 XXXX $\pm$ .0005		1/2-13 Eyebolt				B		
Fractional Tol. $\pm$ .010		Part Number				A	Change to standard eyebolt	1 5-9-05
Angle Tol. $\pm$ 1°		019					Change	ECD Date
Remove Burrs And Sharp Edges to .015 Max. DO NOT SCALE								

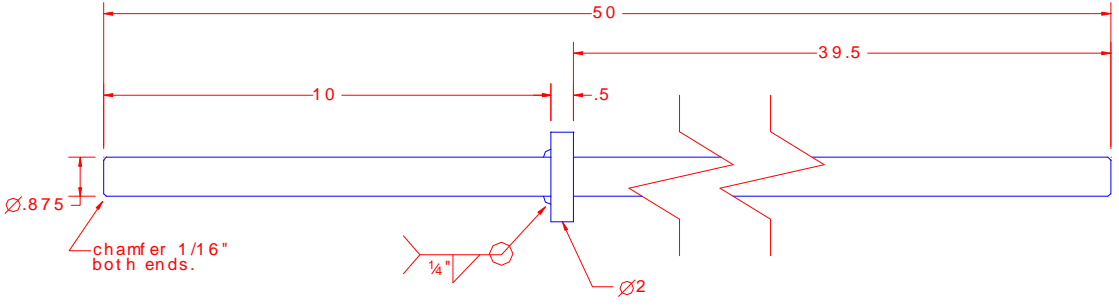


Ingot extractor mounts are fabricated from 1" diameter, schedule 80 pipe, welded to a .75" high standoff. 4 each are required per ingot mold assembly..

Unless Otherwise Specified

Finish Specifications
Machined Surfaces 125 $\sqrt{\text{MAX}}$
Ground Surfaces 32 $\sqrt{\text{MAX}}$
Decimal Tol. XX ± .010 XXX ± .005 XXXX ± .0005
Fractional Tol. ± .010
Angle Tol. ± 1°
Remove Burrs And Sharp Edges to .015 Max.
DO NOT SCALE

Part Name	Ingot Extractor Mount		Scale	N/A	F		
Material	Number		Date	1-20	E		
	Description	1" SCH 80 PIPE	Drawn By	MPT	D		
Part Number	020	Checked By			C		
					B		
					A	Change size of lug	1 12-13-05
						Change	ECD Date

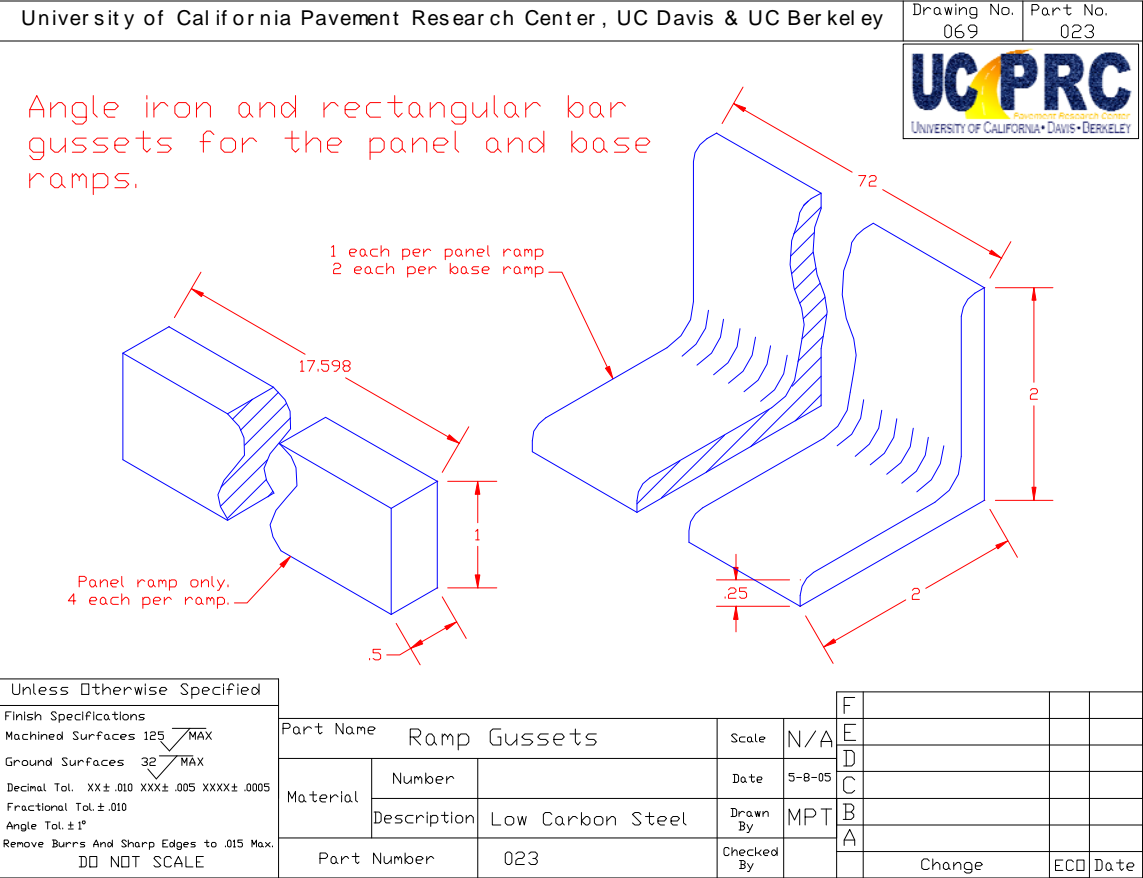
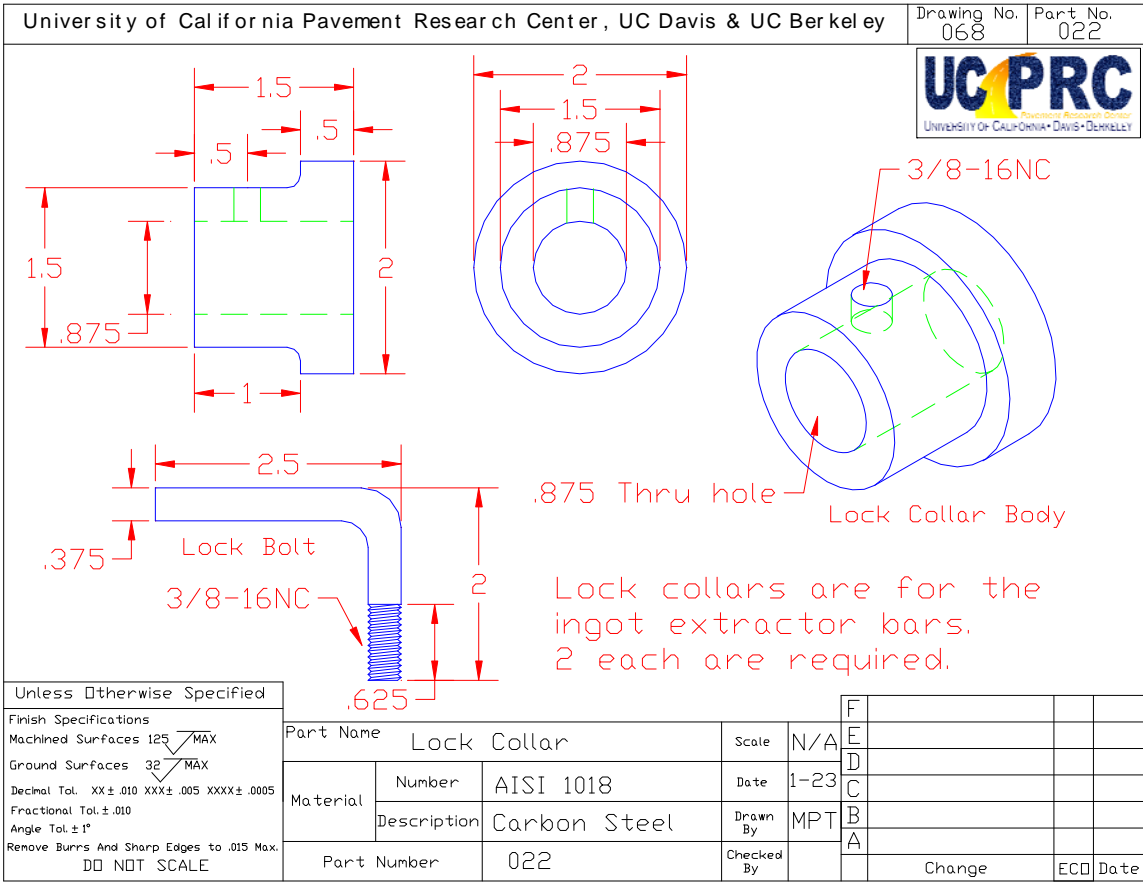


The ingot extracting bar is made from .875 diameter, hardened alloy 4140 steel. There is a welded collar on one end, and a lock collar, (part #022) attaches to the other end. Two each are required.

Unless Otherwise Specified

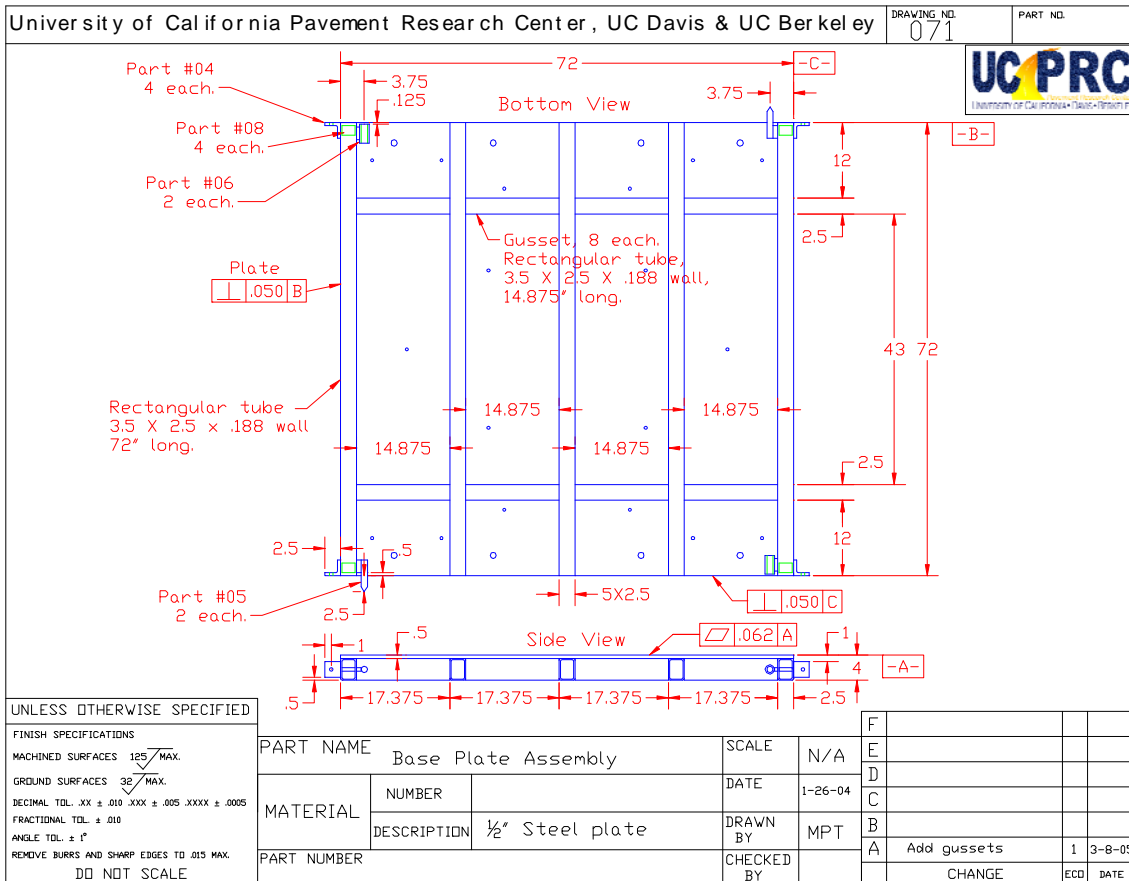
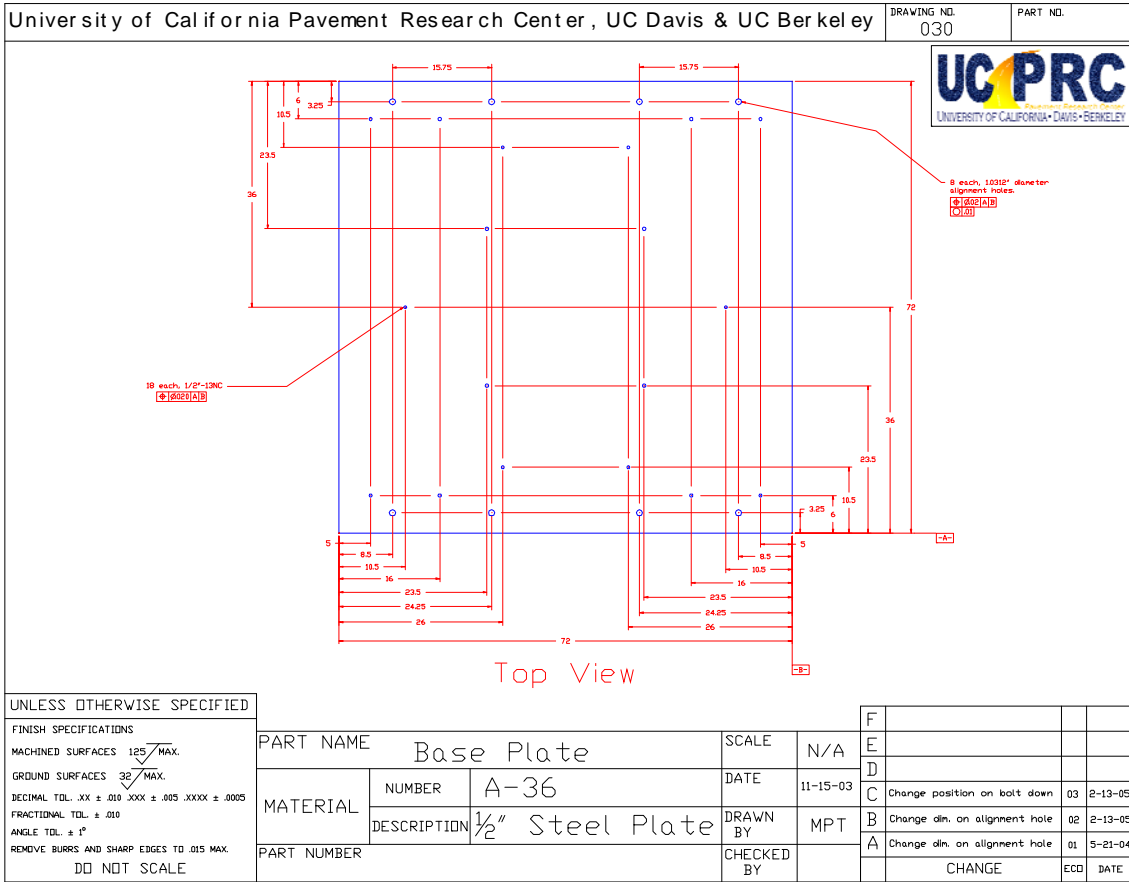
finish specifications
machined surfaces 125 $\sqrt{\text{MAX}}$ .
ground surfaces 32 $\sqrt{\text{MAX}}$ .
decimal tol. .xxx .010 .xxxx .005 .xxxx #0005
fractional tol. ± .010
angle tol. ± 1°
remove burrs and sharp edges to .015 max.
do not scale

Part Name	Ingot Extractor Bar		scale	n/a	F		
material	number	AISI 4140	date	12-31	E		
	description	Hardened Alloy Steel Rod	drawn by	MPT	D		
part number	021	checked by			C		
					B		
					A	change	eco date



## Section 3: Assembly and Fabrication Prints







Base plate under-ribs. To facilitate the attachment of the ramps, the under-ribs below the base plate run parallel with the long panels above.

Detail CC Drawing #074

Detail BB Drawing #033

Detail DD, Drawing # 075  
4 Each, 1/2-13NC nuts.

Detail AA Drawing #032

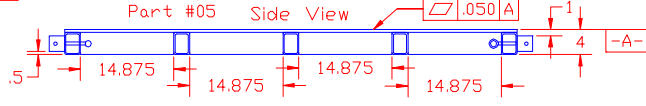
Note: Welds are AW, 5/32" dia. 7018 electrode. Set amperage as required.

4 Each, Part #04

4 Each, Part #08

2 Each, Part #05

2 Each, Part #06



UNLESS OTHERWISE SPECIFIED

FINISH SPECIFICATIONS

MACHINED SURFACES 125 MAX.

GROUND SURFACES 32 MAX.

DECIMAL TOL. .XX ± .010 XXX ± .005 XXXX ± .0005

FRACTIONAL TOL. ± .010

ANGLE TOL. ± °

REMOVE BURRS AND SHARP EDGES TO .015 MAX.

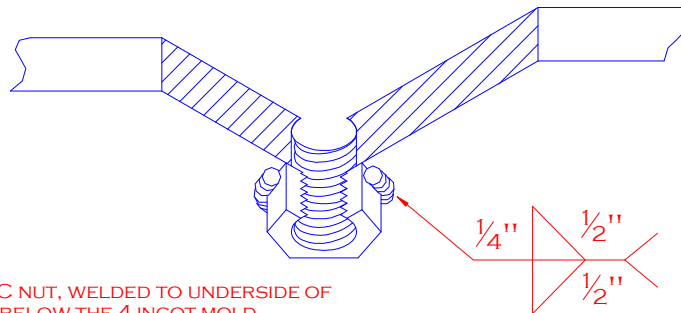
DO NOT SCALE

PART NAME		Base Plate Fabrication	SCALE	N/A
MATERIAL	NUMBER		DATE	12-21
	DESCRIPTION	1/2" Steel plate	DRAWN BY	MPT
PART NUMBER			CHECKED BY	

F			
E			
D			
C			
B	Add gussets	2	3-8-05
A	Change weld spacing	1	3-2-05
CHANGE		ECO	DATE



## DETAIL DD BASE PLATE NUT



THIS IS A 1/2-13NC NUT, WELDED TO UNDERSIDE OF THE BASE PLATE BELOW THE 4 INGOT MOLD BOLT-DOWN POINTS, TO ACT AS A REINFORCEMENT FOR THE THREADS. SCREW A 1" LONG, 1/2-13NC BOLT THROUGH THE BASE PLATE. ATTACH A 1/2-13 NUT FINGER TIGHT. WELD THE NUT TO THE UNDERSIDE OF THE BASE PLATE, AND THEN REMOVE THE BOLT.

UNLESS OTHERWISE SPECIFIED

FINISH SPECIFICATIONS

MACHINED SURFACES 125 MAX.

GROUND SURFACES 32 MAX.

DECIMAL TOL. .XX ± 0.10 XXX ± .005 XXXX ± .0005

FRACTIONAL TOL. ± .010

ANGLE TOL. ± °

REMOVE BURRS AND SHARP EDGES TO .015 MAX.

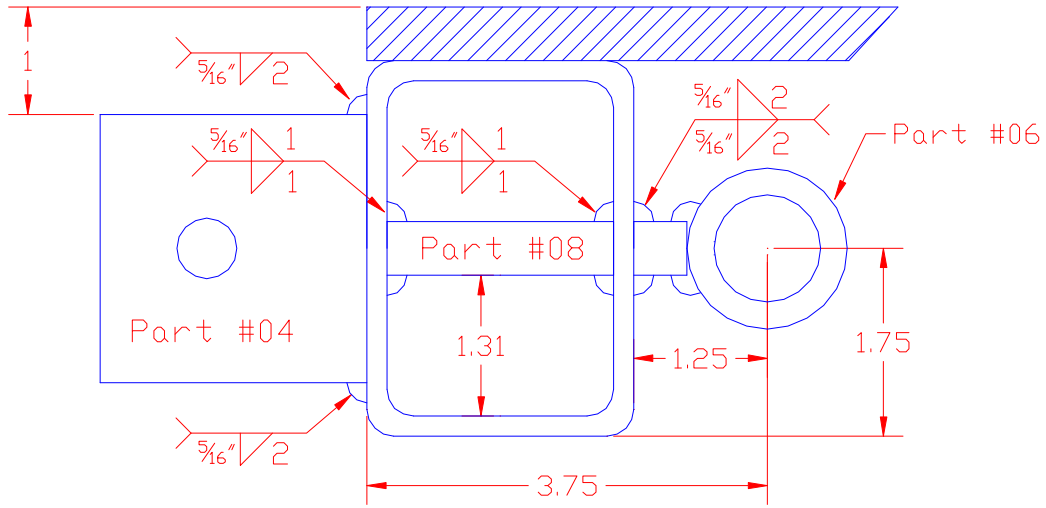
DO NOT SCALE

PART NAME		BASE PLATE NUTS	SCALE	N/A
MATERIAL	NUMBER		DATE	10-1-07
	DESCRIPTION	1/2-13NC NUTS	DRAWN BY	MPT
PART NUMBER			CHECKED BY	

F			
E			
D			
C			
B			
A			
CHANGE		ECO	DATE

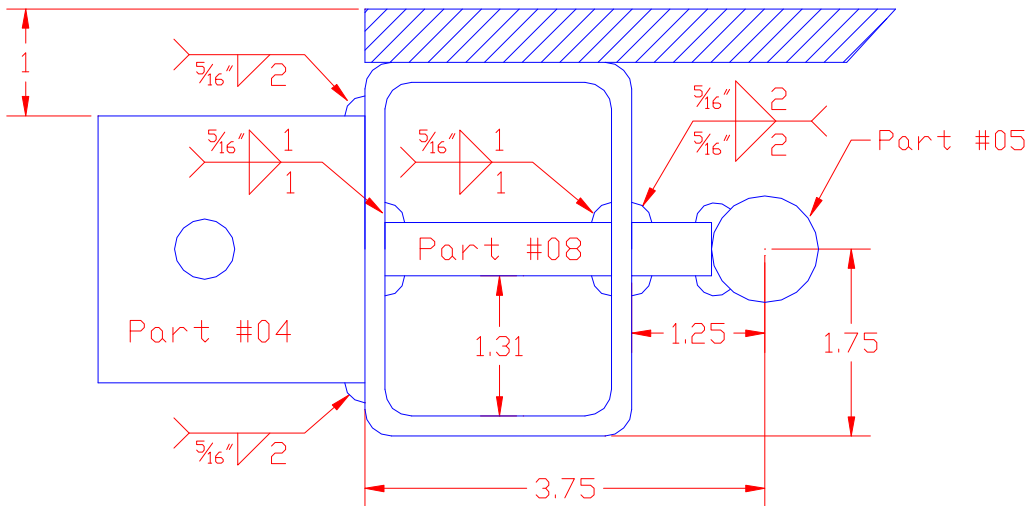


End View; Base Plate Attachment  
Angle And Alignment Tube.

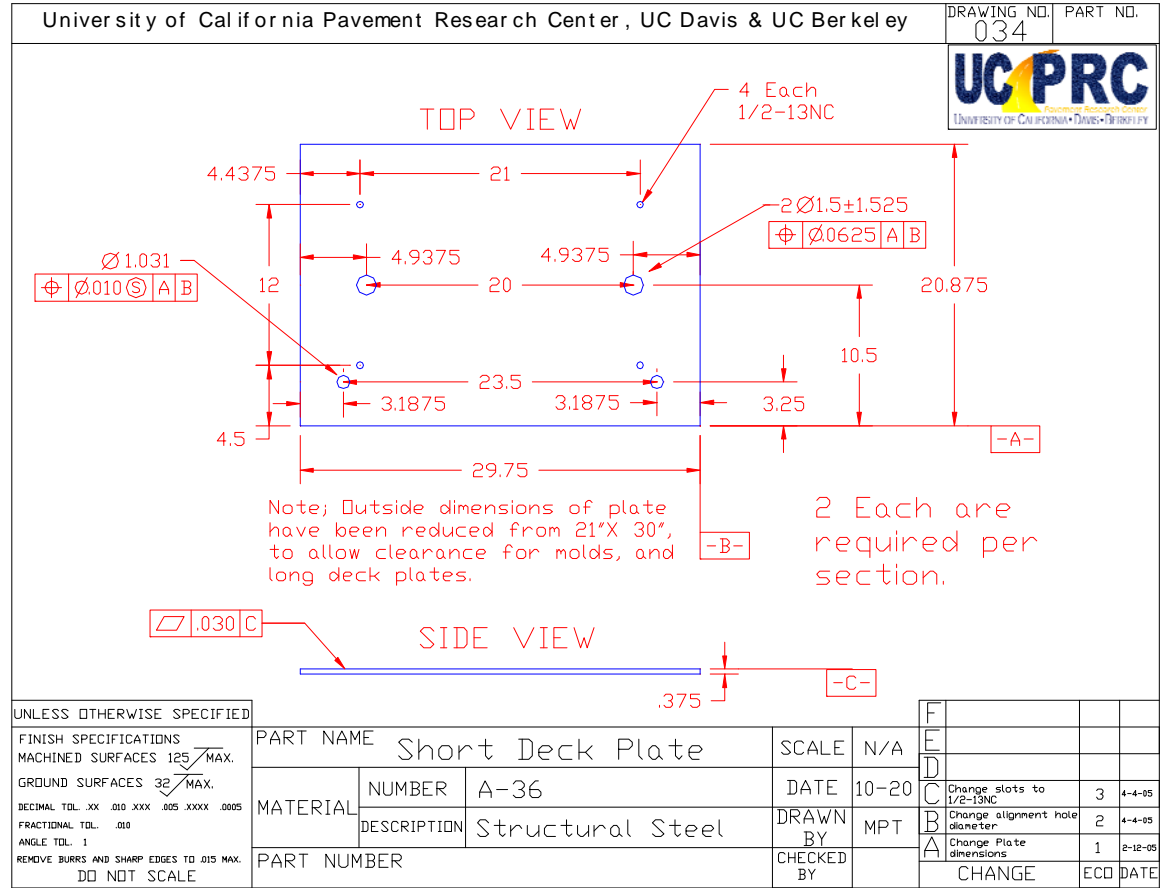
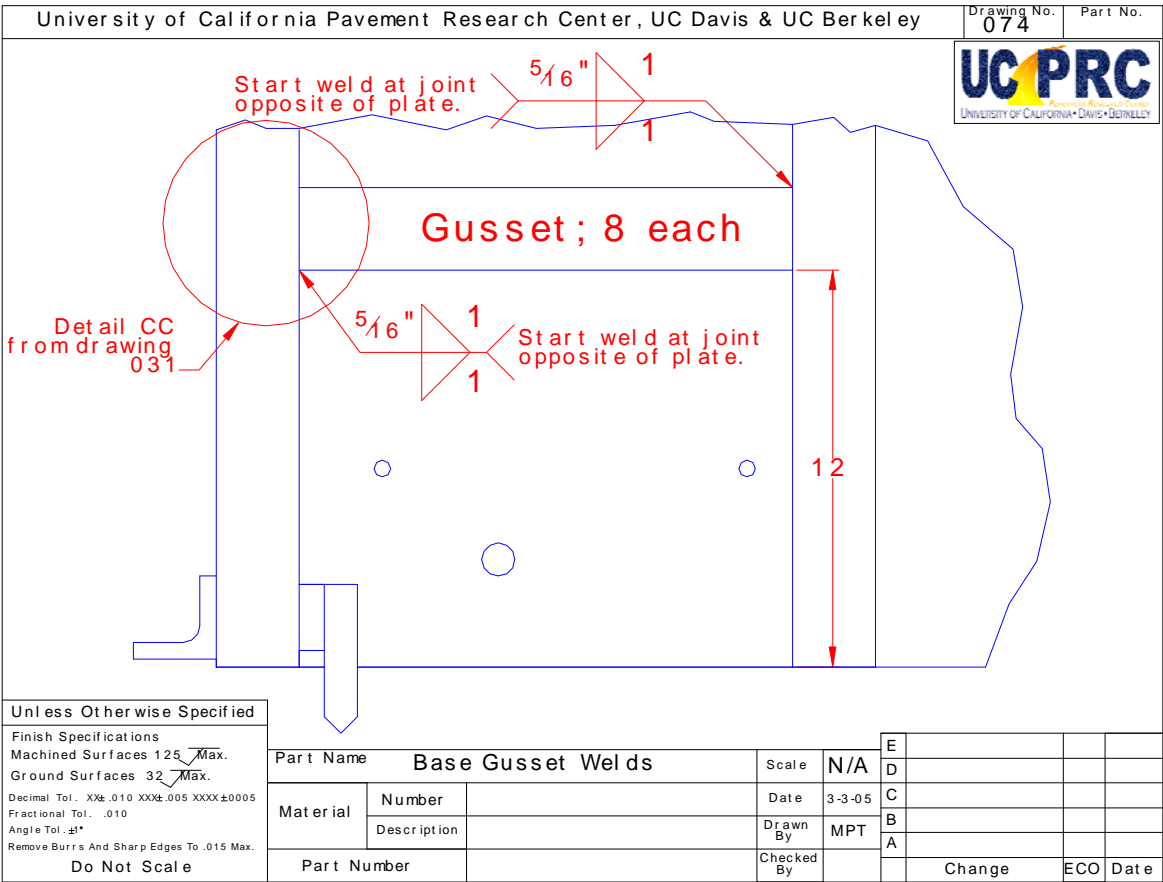


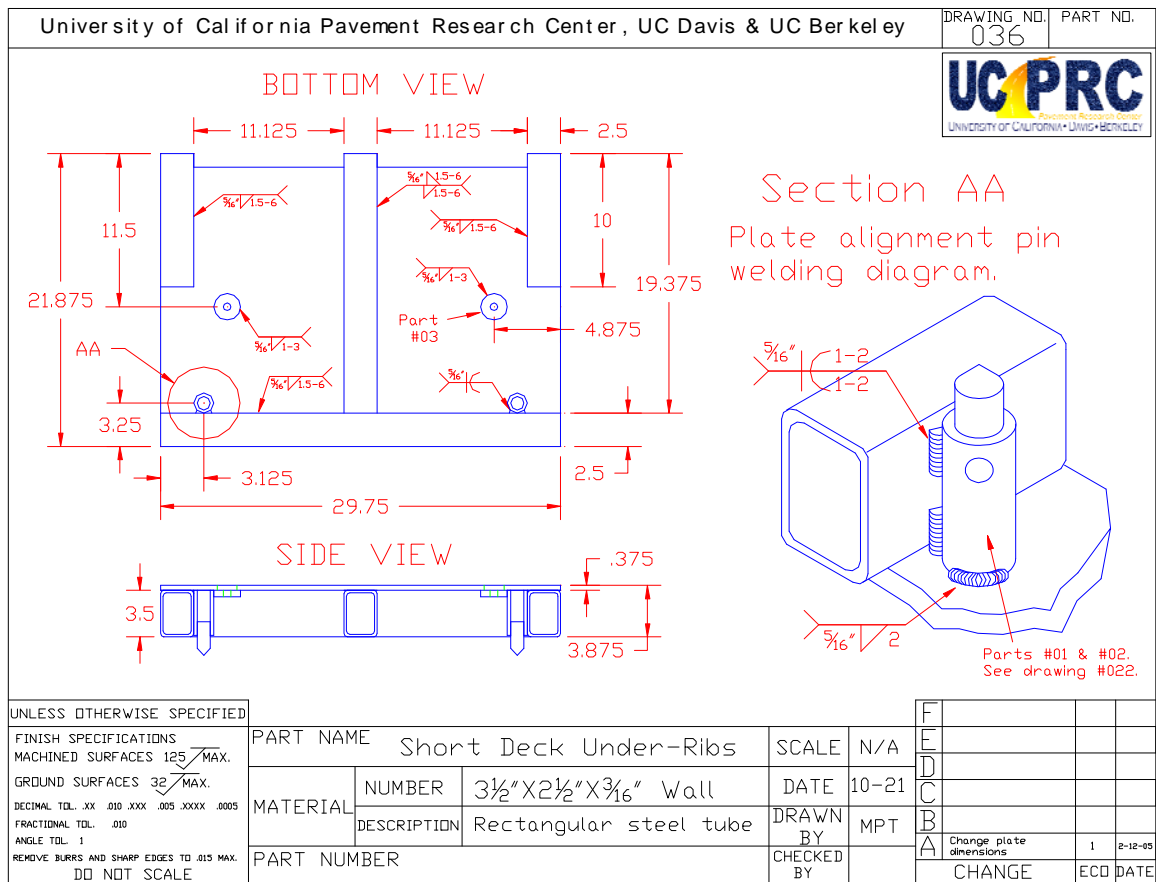
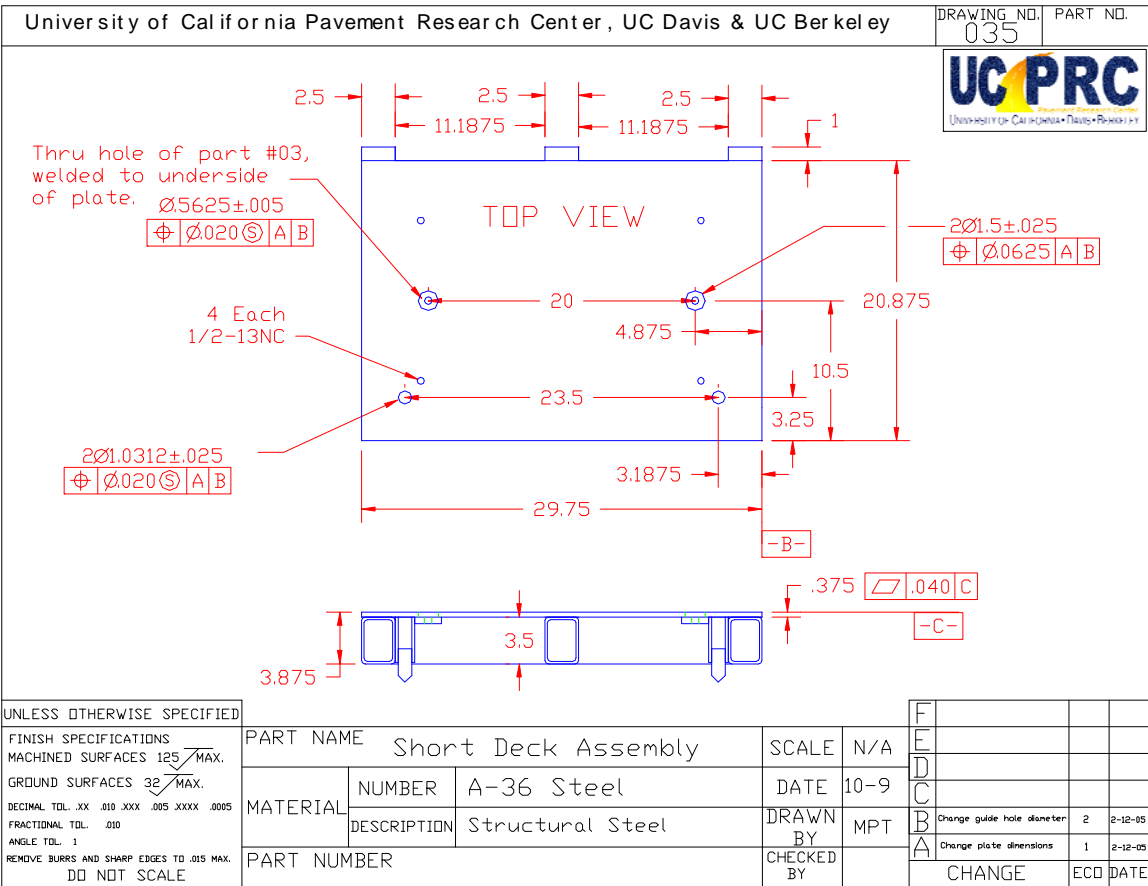
Unless Otherwise Specified		Part Name		Scale	F		
Finish Specifications		Detail "AA"		N/A	E		
Machined Surfaces	125 $\sqrt{\text{MAX}}$	Number		Date	12-29	D	
Ground Surfaces	32 $\sqrt{\text{MAX}}$	Description	Base Alignment Parts	Drawn By	MPT	C	
Decimal Tol.	XX ± .010 XXX ± .005 XXXX ± .0005	Part Number		Checked By		B	
Fractional Tol.	± .010					A	
Angle Tol.	± 1°						
Remove Burrs And Sharp Edges to .015 Max.							
DD NOT SCALE							
						Change	ECD Date

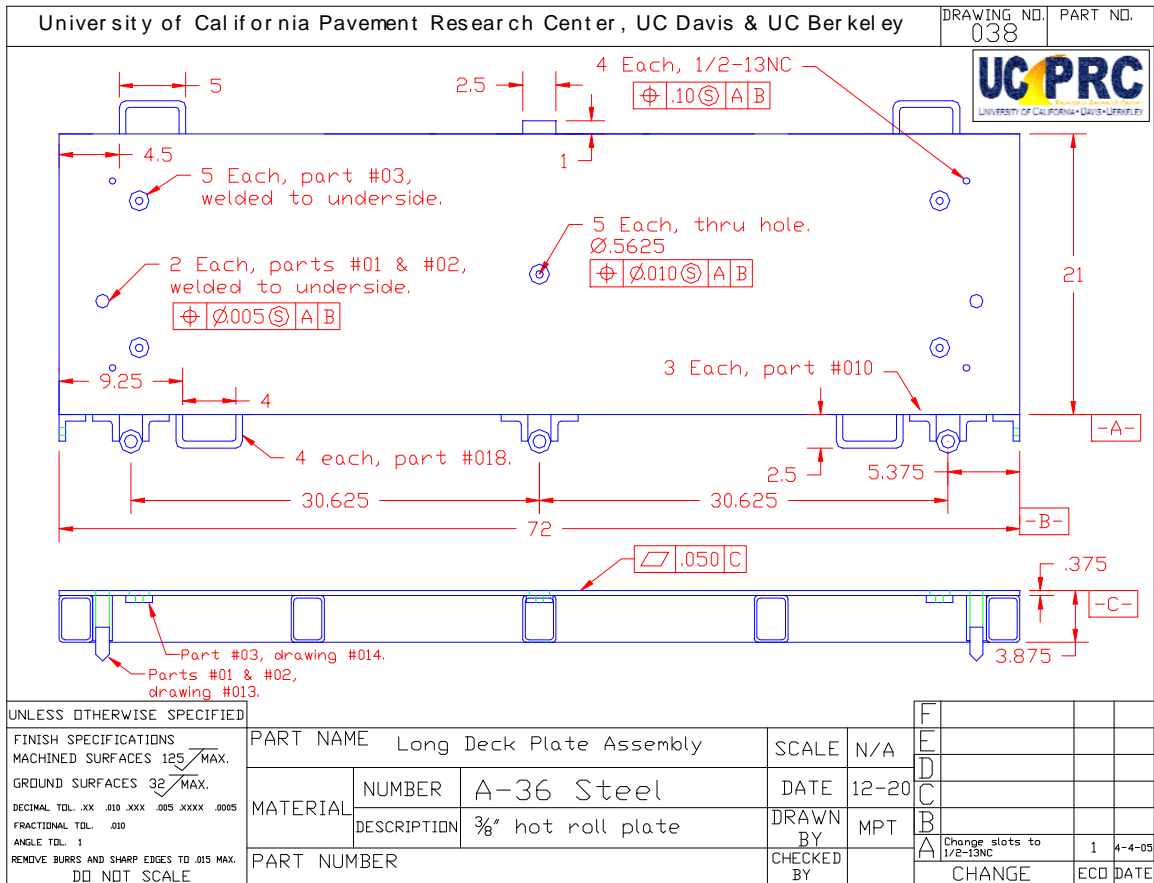
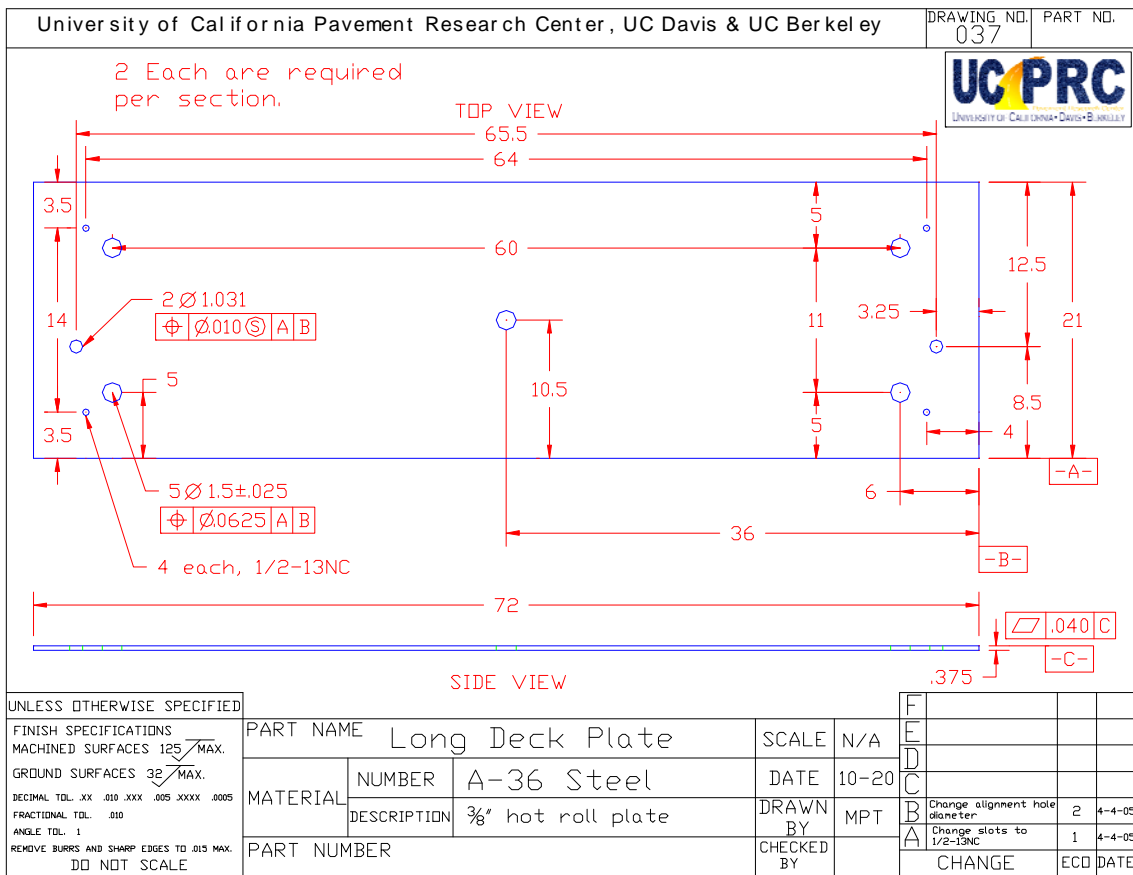
End View; Base Plate Attachment  
Angle And Alignment Pin.

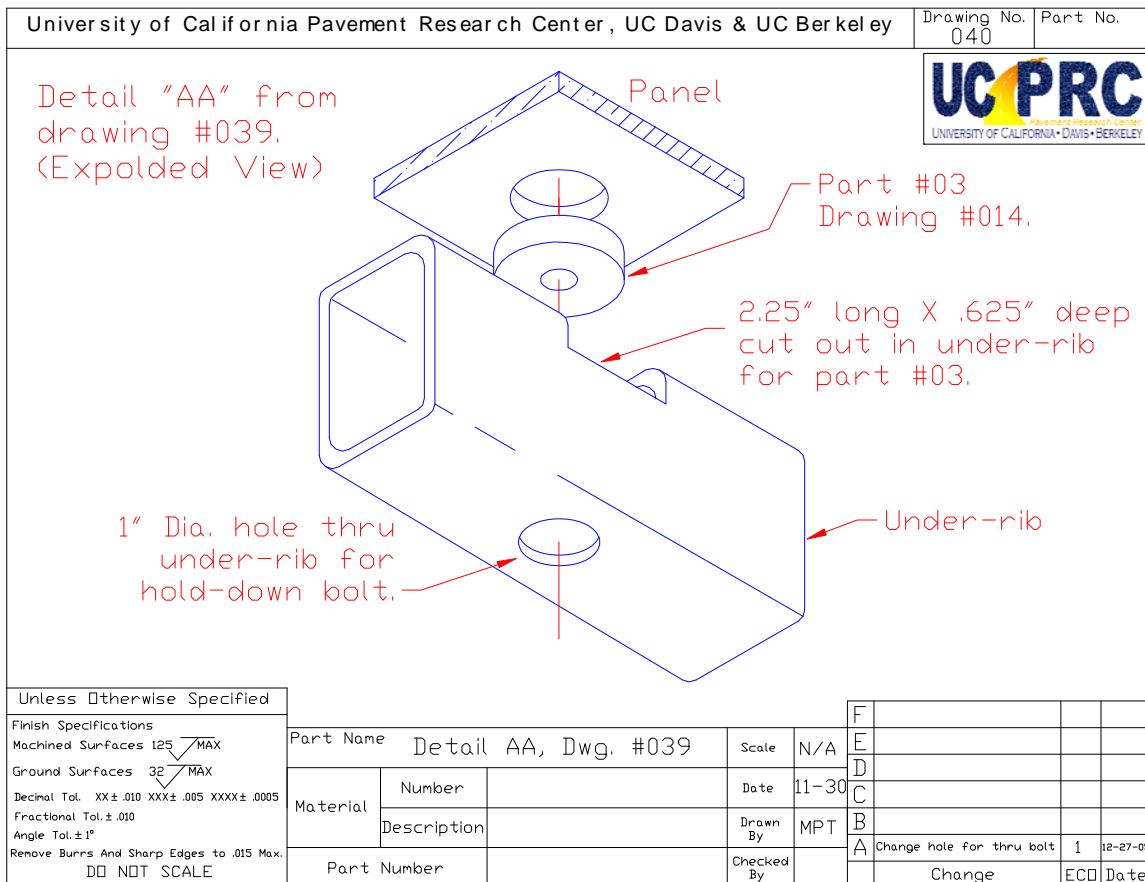
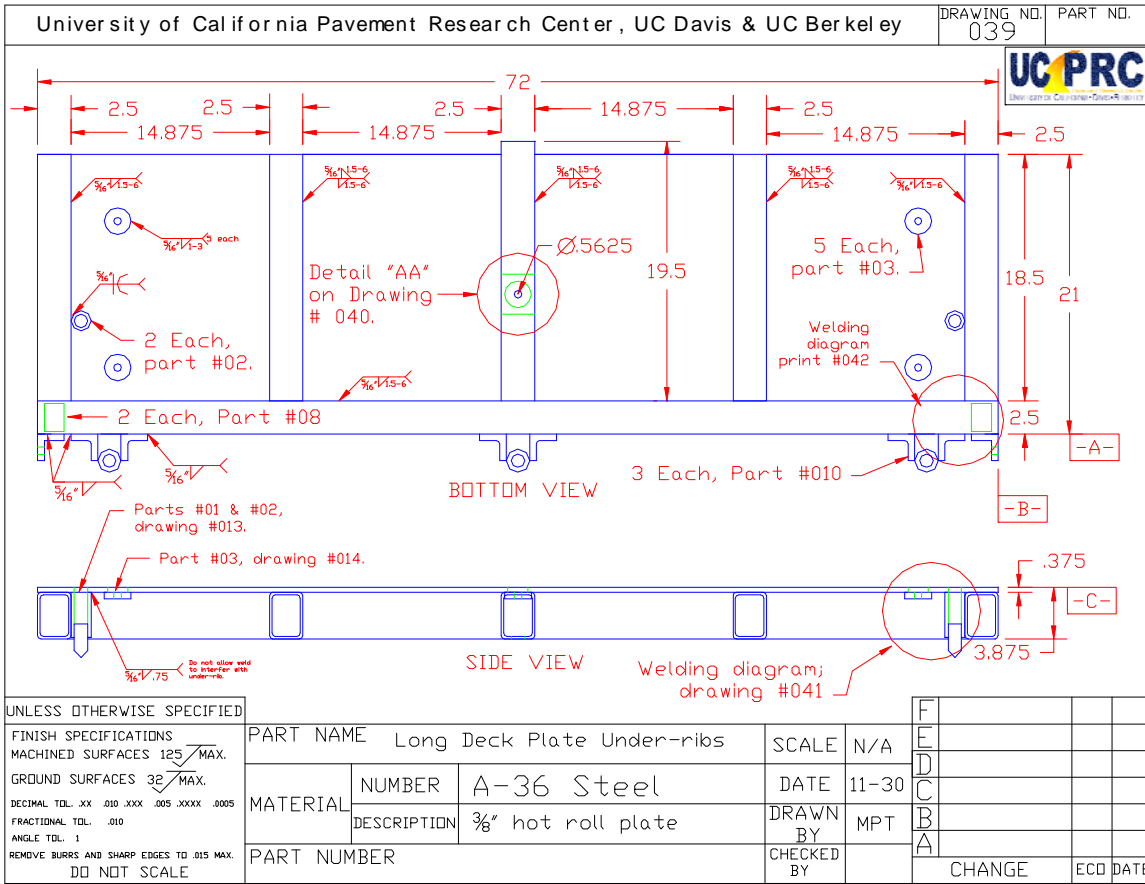


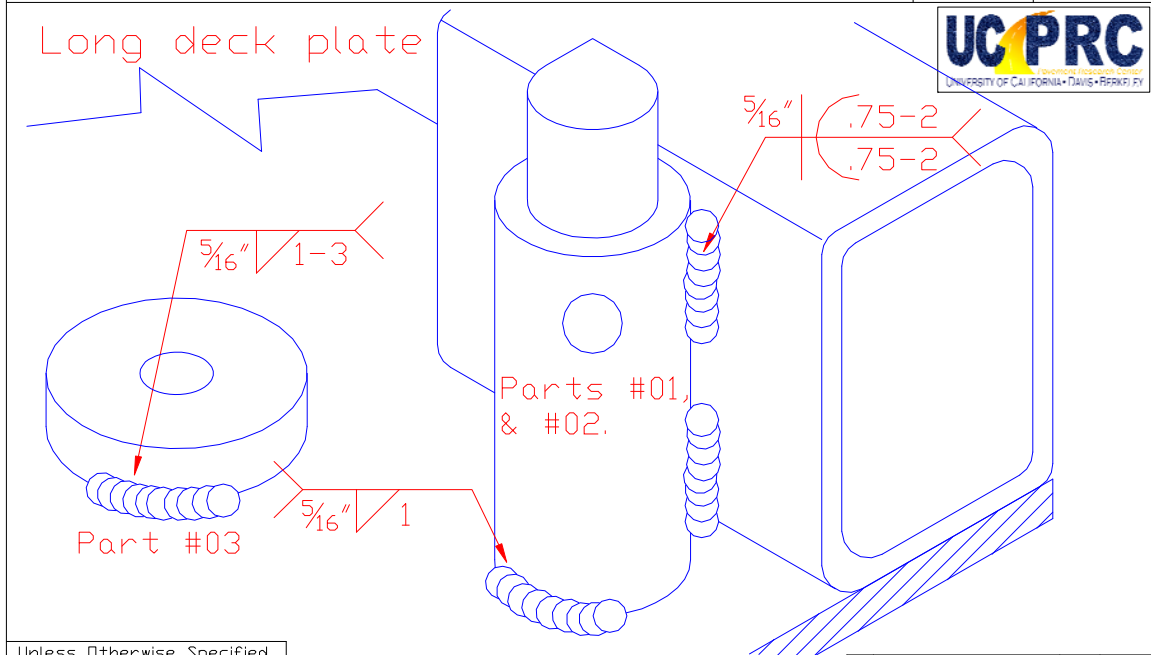
Unless Otherwise Specified		Part Name		Scale	F		
Finish Specifications		Detail "BB"		N/A	E		
Machined Surfaces	125 $\sqrt{\text{MAX}}$	Number		Date	12-29	D	
Ground Surfaces	32 $\sqrt{\text{MAX}}$	Description	Base Alignment Parts	Drawn By	MPT	C	
Decimal Tol.	XX ± .010 XXX ± .005 XXXX ± .0005	Part Number		Checked By		B	
Fractional Tol.	± .010					A	
Angle Tol.	± 1°						
Remove Burrs And Sharp Edges to .015 Max.							
DD NOT SCALE							
						Change	ECD Date







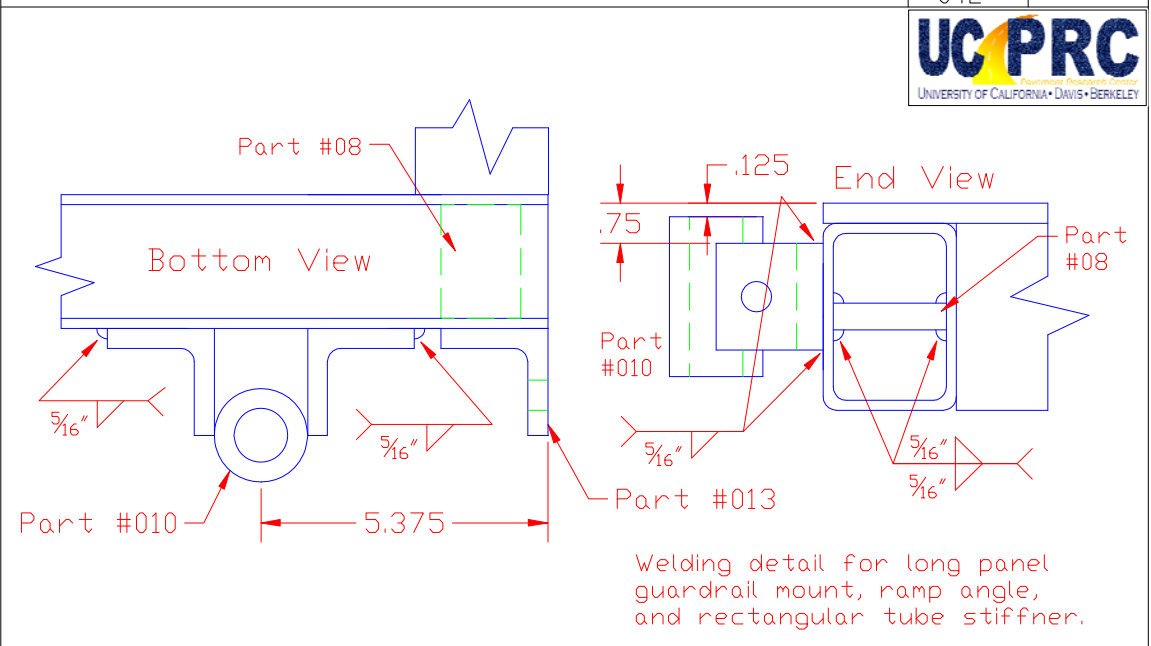




Unless Otherwise Specified

Finish Specifications  
 Machined Surfaces 125  $\sqrt{\text{MAX}}$   
 Ground Surfaces 32  $\sqrt{\text{MAX}}$   
 Decimal Tol. XX ± .010 XXX ± .005 XXXX ± .0005  
 Fractional Tol. ± .010  
 Angle Tol. ± 1°  
 Remove Burrs And Sharp Edges to .015 Max.  
 DO NOT SCALE

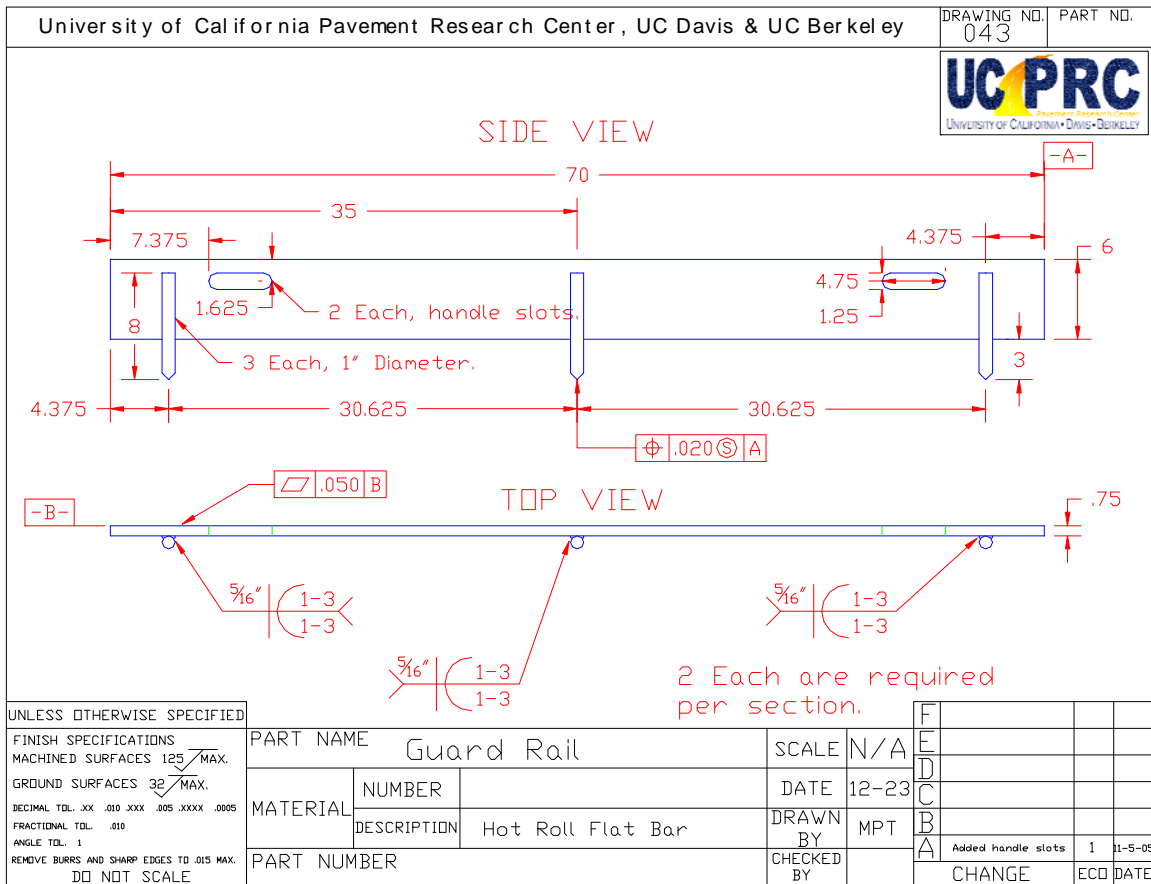
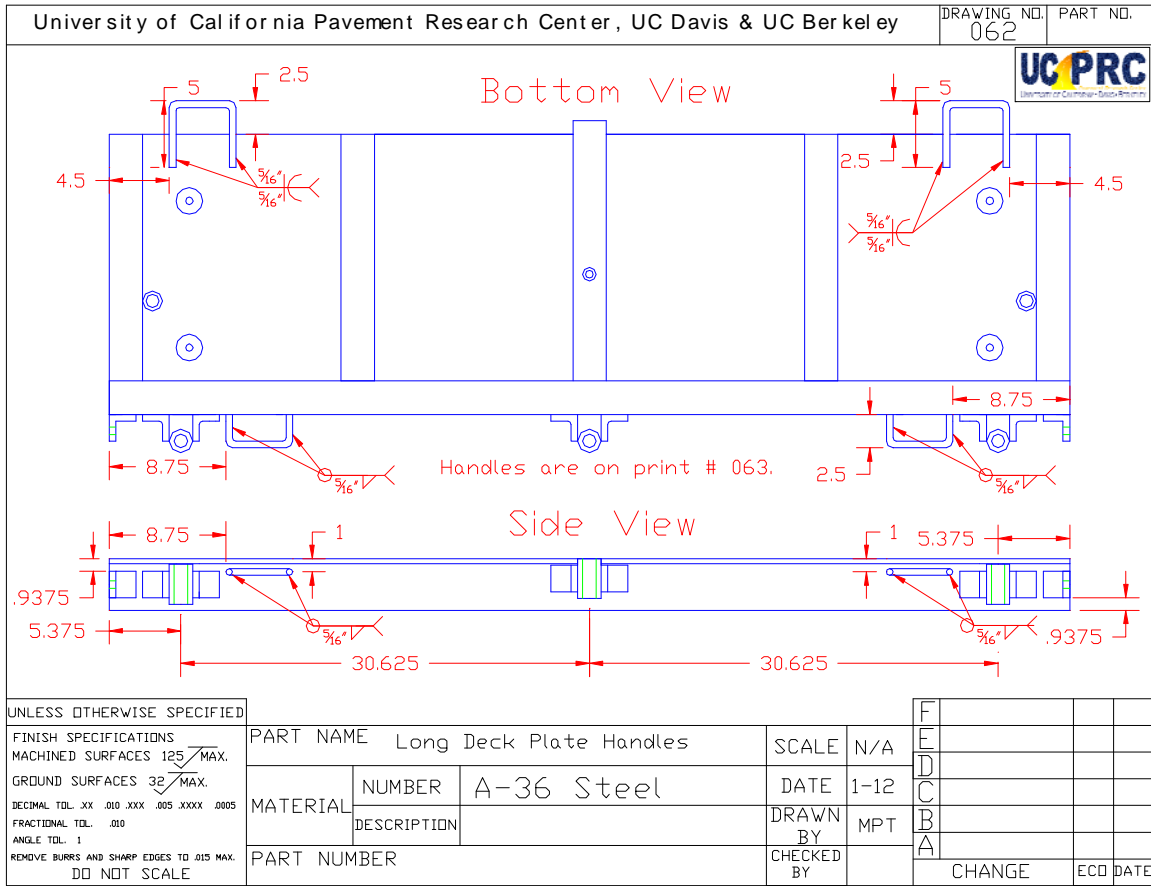
Part Name		Welding Diagram #2	Scale	N/A	F		
Material			Date	12-21	E		
Description			Drawn By	MPT	D		
Part Number		01, 02 & 03	Checked By		C		
						Change	ECD Date



Unless Otherwise Specified

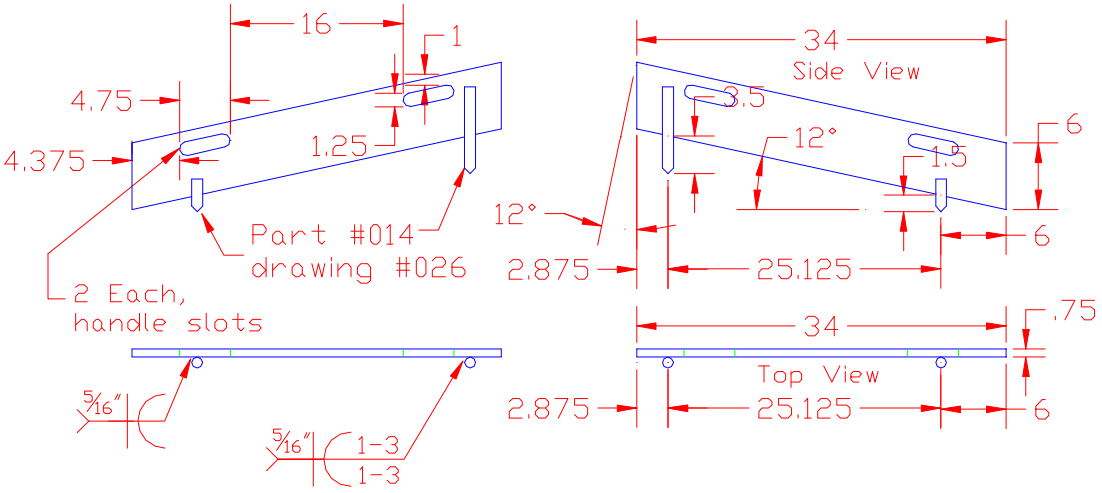
Finish Specifications  
 Machined Surfaces 125  $\sqrt{\text{MAX}}$   
 Ground Surfaces 32  $\sqrt{\text{MAX}}$   
 Decimal Tol. XX ± .010 XXX ± .005 XXXX ± .0005  
 Fractional Tol. ± .010  
 Angle Tol. ± 1°  
 Remove Burrs And Sharp Edges to .015 Max.  
 DO NOT SCALE

Part Name		Welding Diagram	Scale	1/2	F		
Material			Date	12-24	E		
Description			Drawn By	MPT	D		
Part Number			Checked By		C		
						Change	ECD Date



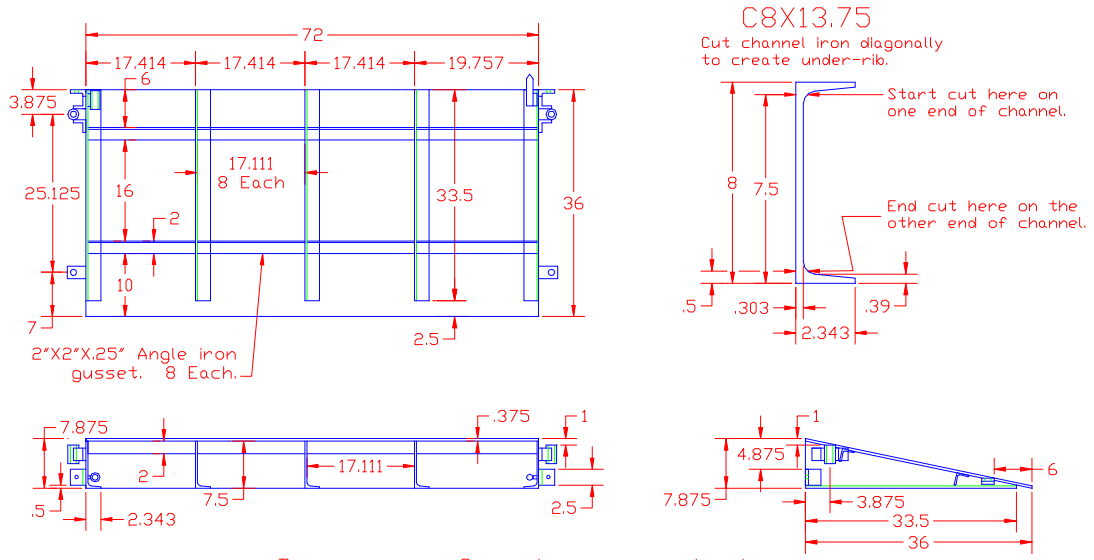


Left and right short guardrails are identical, mirror images of each other. They attach to the base ramps. Two of each side are required.



UNLESS OTHERWISE SPECIFIED  
 FINISH SPECIFICATIONS  
 MACHINED SURFACES 125 MAX.  
 GROUND SURFACES 32 MAX.  
 DECIMAL TOL. XX ± .010 XXX ± .005 XXXX ± .0005  
 FRACTION TOL. ± .010  
 ANGLE TOL. ± 1°  
 REMOVE BURRS AND SHARP EDGES TO .015 MAX.  
 DO NOT SCALE

PART NAME		Short Guardrail	SCALE	N/A	F		
MATERIAL	NUMBER		DATE	1-6-04	E		
	DESCRIPTION	Steel Flat Bar	DRAWN BY	MPT	D		
PART NUMBER			CHECKED BY		C		
					B		
					A	Added handle slots	1 11-5-05
						CHANGE	ECO DATE

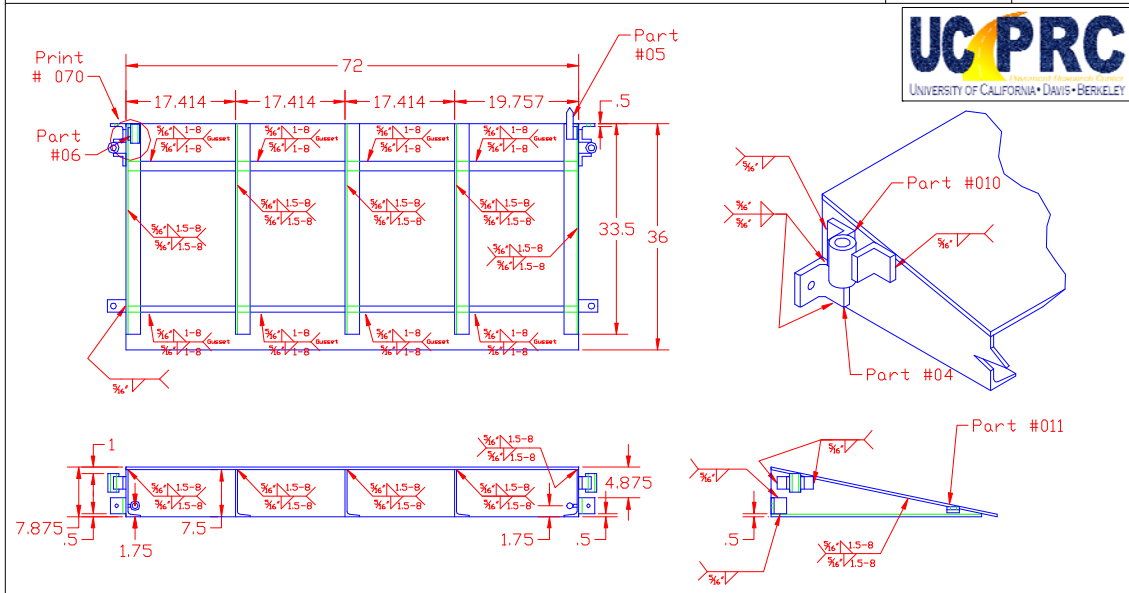


UNLESS OTHERWISE SPECIFIED  
 FINISH SPECIFICATIONS  
 MACHINED SURFACES 125 MAX.  
 GROUND SURFACES 32 MAX.  
 DECIMAL TOL. XX ± .010 XXX ± .005 XXXX ± .0005  
 FRACTIONAL TOL. ± .010  
 ANGLE TOL. ± 1°  
 REMOVE BURRS AND SHARP EDGES TO .015 MAX.  
 DO NOT SCALE

Base ramps, 2 each are required.

PART NAME		Base Ramp Assembly	SCALE	N/A	F		
MATERIAL	NUMBER		DATE	12-29	E		
	DESCRIPTION	A-36 & Channel Iron	DRAWN BY	MPT	D		
PART NUMBER			CHECKED BY		C		
					B		
					A	Add Gussets	1 4-16-05
						CHANGE	ECO DATE





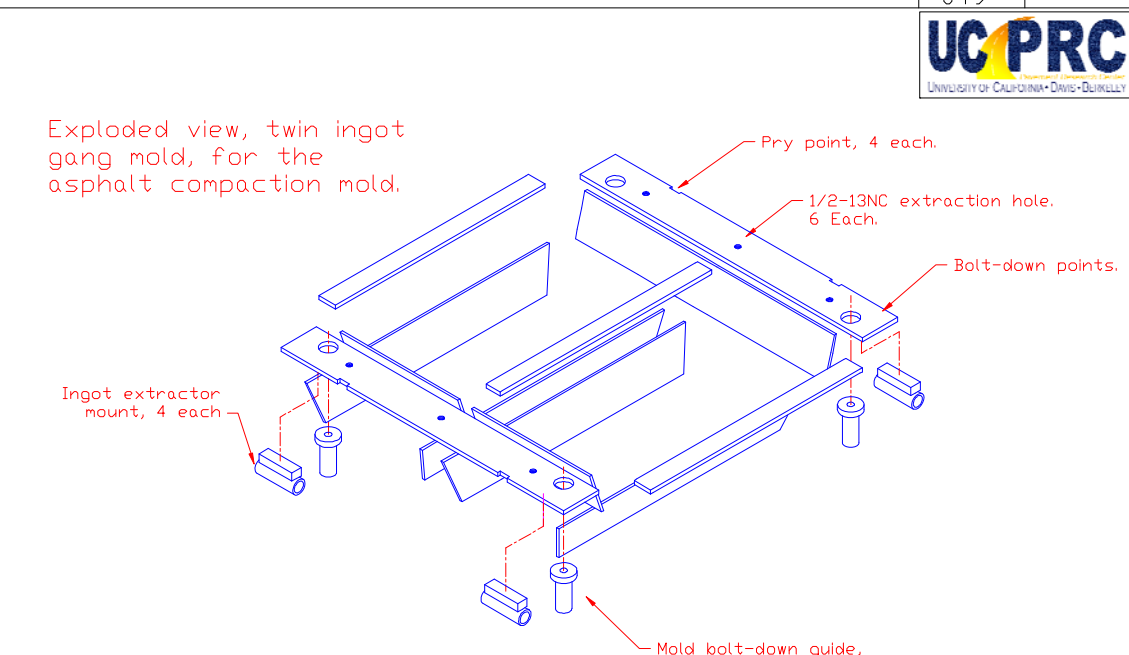
Note; Alignment pin and tube fabrication detail is located on print #070. Base ramp uses parts #05 & #06, with modified height standoffs.

UNLESS OTHERWISE SPECIFIED

FINISH SPECIFICATIONS  
 MACHINED SURFACES 125 MAX.  
 GROUND SURFACES 32 MAX.  
 DECIMAL TOL. XX ± .010 XXX ± .005 XXXX ± .0005  
 FRACTIONAL TOL. ± .010  
 ANGLE TOL. ± 1°  
 REMOVE BURRS AND SHARP EDGES TO .015 MAX.  
 DO NOT SCALE

PART NAME		Base Ramp Fabrication	SCALE	N/A
MATERIAL		A-36 & Channel Iron	DATE	12-29
PART NUMBER			DRAWN BY	MPT
			CHECKED BY	

F			
E			
D			
C			
B			
A	Added Gussets	1	4-16-05
	CHANGE	ECD	DATE



UNLESS OTHERWISE SPECIFIED

FINISH SPECIFICATIONS  
 MACHINED SURFACES 125 MAX.  
 GROUND SURFACES 32 MAX.  
 DECIMAL TOL. XX ± .010 XXX ± .005 XXXX ± .0005  
 FRACTIONAL TOL. ± .010  
 ANGLE TOL. ± 1°  
 REMOVE BURRS AND SHARP EDGES TO .015 MAX.  
 DO NOT SCALE

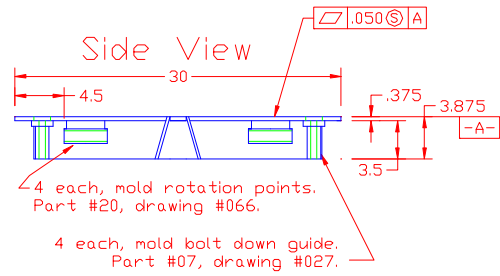
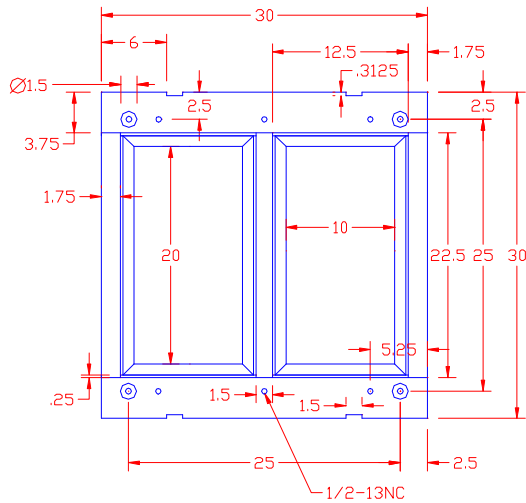
PART NAME		EXPLODED VIEW, 4" MOLD	SCALE	N/A
MATERIAL		HOT ROLL STEEL	DATE	12-6
PART NUMBER			DRAWN BY	MPT
			CHECKED BY	

F			
E			
D			
C			
B			
A			
	CHANGE	ECD	DATE



Note; This size ingot mold no longer used at UCPRC.

Top View



Basic twin gang mold insert for 4" deep compacted asphalt concrete ingots. Mold sits flush with panels, and mounts with 4 each, 1/2-13NC bolts, 4 1/2" long.

UNLESS OTHERWISE SPECIFIED

FINISH SPECIFICATIONS  
MACHINED SURFACES 125  $\sqrt{\text{MAX.}}$   
GROUND SURFACES 32  $\sqrt{\text{MAX.}}$

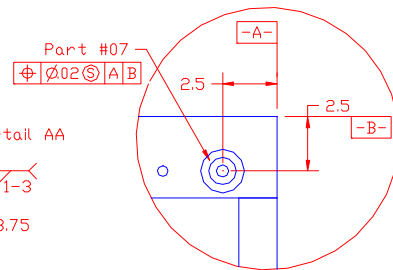
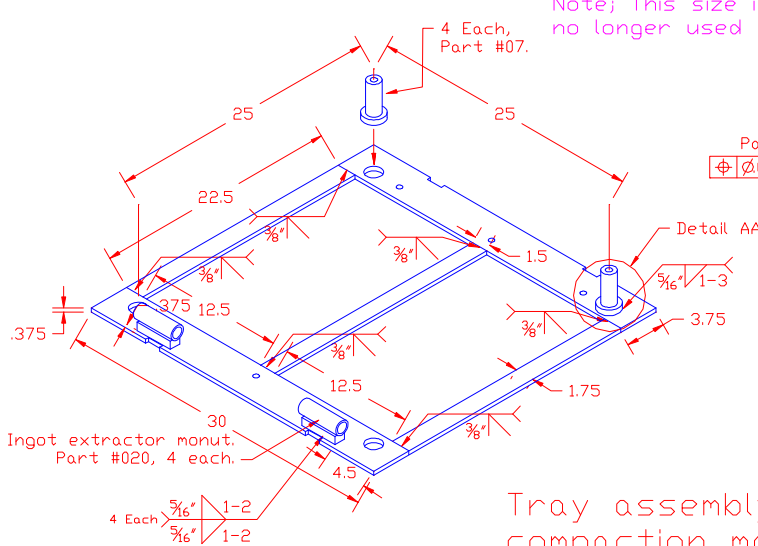
DECIMAL TOL. XX  $\pm$  .010 XXX  $\pm$  .005 XXXX  $\pm$  .0005  
FRACTION TOL.  $\pm$  .010  
ANGLE TOL.  $\pm$  1°  
REMOVE BURRS AND SHARP EDGES TO .015 MAX.  
DO NOT SCALE

PART NAME		4" MOLD ASSEMBLY	SCALE	N/A
MATERIAL	NUMBER		DATE	12-6
	DESCRIPTION	HOT ROLL STEEL	DRAWN BY	MPT
PART NUMBER			CHECKED BY	

F			
E			
D			
C	Move threaded lifting holes.	3	5-27-05
B	Enlarge prying points	2	5-27-05
A	Change Slots into threaded holes.	1	5-27-05
	CHANGE	ECD	DATE



Note; This size ingot mold no longer used at UCPRC.



Tray assembly for 4" asphalt compaction molds. 1 Each is required per section.

UNLESS OTHERWISE SPECIFIED

FINISH SPECIFICATIONS  
MACHINED SURFACES 125  $\sqrt{\text{MAX.}}$   
GROUND SURFACES 32  $\sqrt{\text{MAX.}}$

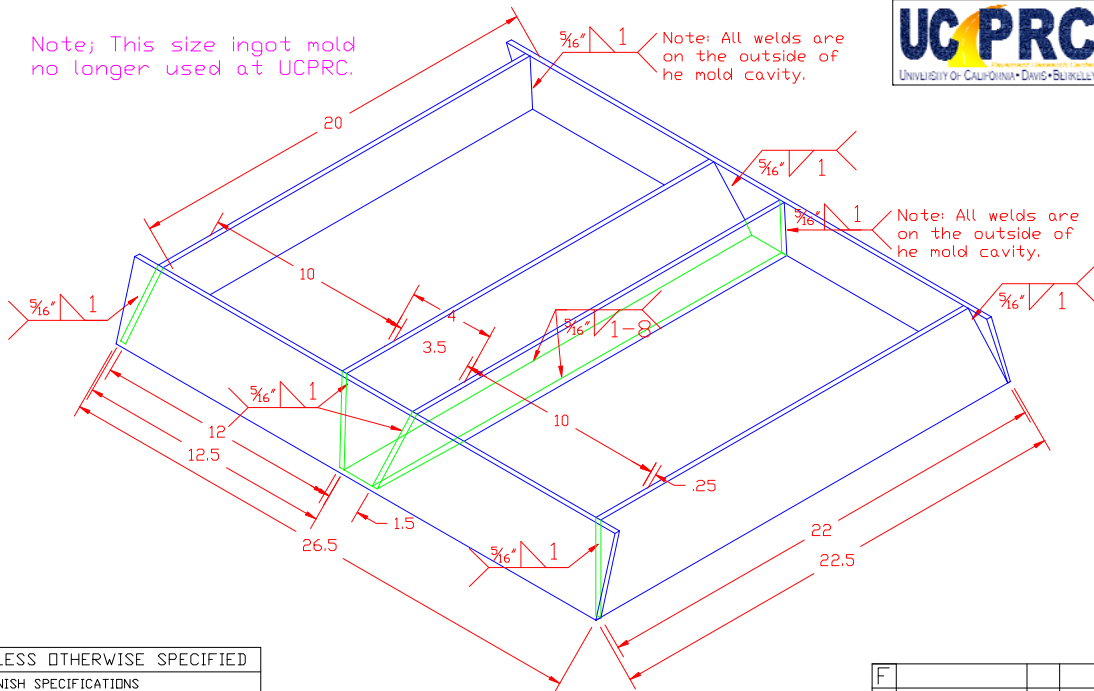
DECIMAL TOL. XX  $\pm$  .010 XXX  $\pm$  .005 XXXX  $\pm$  .0005  
FRACTION TOL.  $\pm$  .010  
ANGLE TOL.  $\pm$  1°  
REMOVE BURRS AND SHARP EDGES TO .015 MAX.  
DO NOT SCALE

PART NAME		4" Mold Fabrication #1	SCALE	N/A
MATERIAL	NUMBER		DATE	12-30
	DESCRIPTION	HOT ROLL STEEL	DRAWN BY	MPT
PART NUMBER			CHECKED BY	

F			
E			
D			
C	Move extractor mounts	3	5-29-05
B	Enlarge Prying slots.	2	5-27-05
A	Change slots to threaded holes.	1	5-27-05
	CHANGE	ECD	DATE



Note; This size ingot mold no longer used at UCPRC.



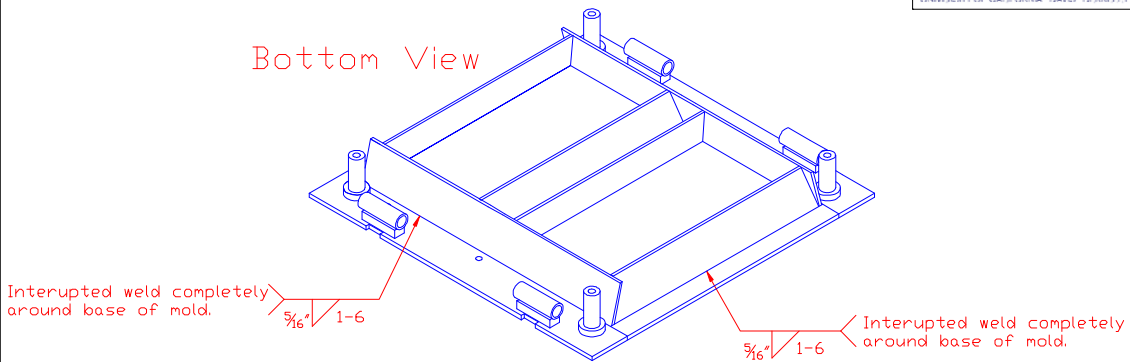
UNLESS OTHERWISE SPECIFIED

FINISH SPECIFICATIONS  
 MACHINED SURFACES 125 MAX.  
 GROUND SURFACES 32 MAX.  
 DECIMAL TOL. XX ± .010 XXX ± .005 XXXX ± .0005  
 FRACTION TOL. ± .010  
 ANGLE TOL. ± 1°  
 REMOVE BURRS AND SHARP EDGES TO .015 MAX.  
 DO NOT SCALE

PART NAME		4" Mold Fabrication #2	SCALE	N/A
MATERIAL	NUMBER		DATE	12-30
	DESCRIPTION	HOT ROLL STEEL	DRAWN BY	MPT
PART NUMBER			CHECKED BY	
			CHANGE	ECD DATE



Bottom View



Completed mold and tray assemblies are welded together to form a single 4" deep gang mold.

Each compacted ingot has a design weight of 80 lbs. The compaction mold weighs 84 lbs.

UNLESS OTHERWISE SPECIFIED

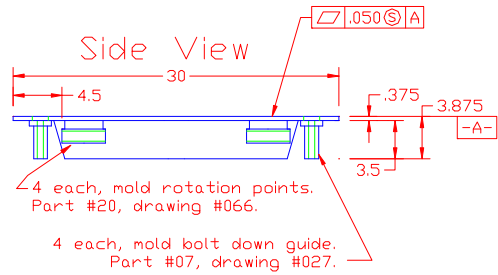
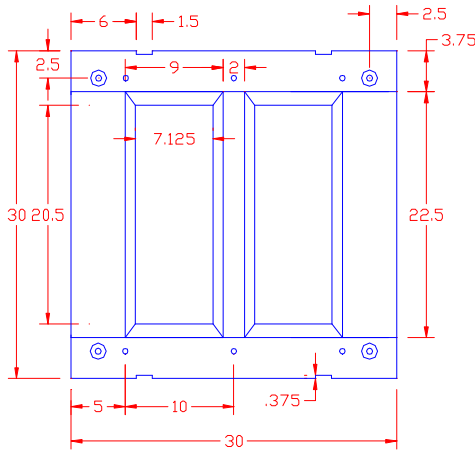
FINISH SPECIFICATIONS  
 MACHINED SURFACES 125 MAX.  
 GROUND SURFACES 32 MAX.  
 DECIMAL TOL. XX ± .010 XXX ± .005 XXXX ± .0005  
 FRACTION TOL. ± .010  
 ANGLE TOL. ± 1°  
 REMOVE BURRS AND SHARP EDGES TO .015 MAX.  
 DO NOT SCALE

PART NAME		4" Mold Fabrication #3	SCALE	N/A
MATERIAL	NUMBER		DATE	12-30
	DESCRIPTION	HOT ROLL STEEL	DRAWN BY	MPT
PART NUMBER			CHECKED BY	
			CHANGE	ECD DATE

F			
E	Continuous mold edge	5	12-13-05
D	Move rotation tubes	4	12-13-05
C	Enlarge prying slots.	3	5-30-05
B	Move rotation tubes	2	5-30-05
A	Change lifting slots to threaded holes.	1	5-30-05



Top View

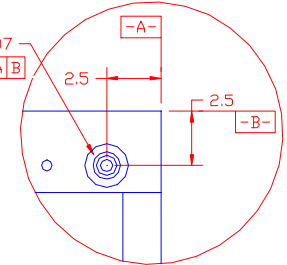
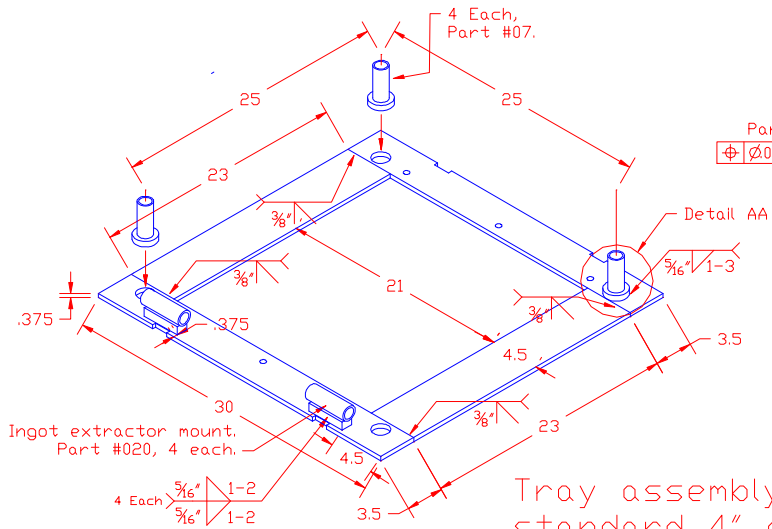


This ingot mold has been adopted as the standard size for both shear and fatigue specimens at the UCPRC.

UNLESS OTHERWISE SPECIFIED

FINISH SPECIFICATIONS	
MACHINED SURFACES	125 MAX.
GROUND SURFACES	32 MAX.
DECIMAL TOL.	XX ± .010 XXX ± .005 XXXX ± .0005
FRACTION TOL.	± .010
ANGLE TOL.	± 1°
REMOVE BURRS AND SHARP EDGES TO .015 MAX.	
DO NOT SCALE	

PART NAME		4" Narrow Mold Assembly	SCALE	N/A
MATERIAL	NUMBER		DATE	12-6
	DESCRIPTION	HOT ROLL STEEL	DRAWN BY	MPT
PART NUMBER			CHECKED BY	
F				
E				
D	Change ingot size	4	12-06-05	
C	Move threaded lifting holes.	3	5-27-05	
B	Enlarge prying points	2	5-27-05	
A	Change slots into threaded holes.	1	5-27-05	
	CHANGE	ECD	DATE	



Detail AA

Tray assembly for UCPRC standard 4" deep compaction molds. 1 Each is required per section.

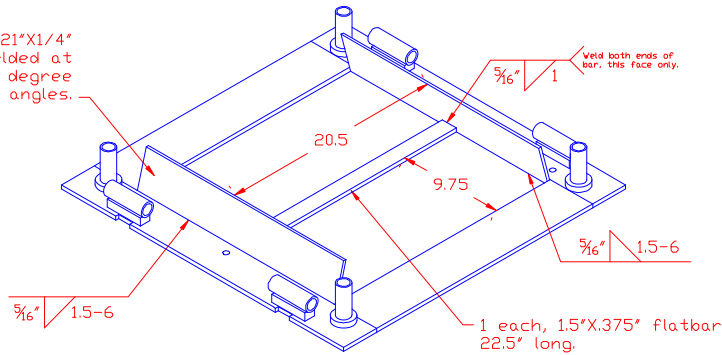
UNLESS OTHERWISE SPECIFIED

FINISH SPECIFICATIONS	
MACHINED SURFACES	125 MAX.
GROUND SURFACES	32 MAX.
DECIMAL TOL.	XX ± .010 XXX ± .005 XXXX ± .0005
FRACTION TOL.	± .010
ANGLE TOL.	± 1°
REMOVE BURRS AND SHARP EDGES TO .015 MAX.	
DO NOT SCALE	

PART NAME		UCPRC Mold Tray	SCALE	N/A
MATERIAL	NUMBER		DATE	10-6-07
	DESCRIPTION	HOT ROLL STEEL	DRAWN BY	MPT
PART NUMBER			CHECKED BY	
F				
E				
D				
C	Move extractor mounts.	3	5-29-05	
B	Enlarge prying slots.	2	5-27-05	
A	Change slots to threaded holes.	1	5-27-05	
	CHANGE	ECD	DATE	



2 Each, 4"x21"x1/4" flatbars, welded at identical 14 degree angles.

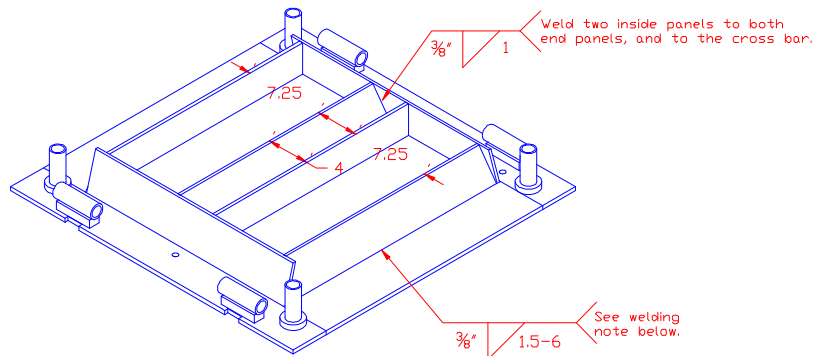


UNLESS OTHERWISE SPECIFIED  
 FINISH SPECIFICATIONS  
 MACHINED SURFACES 125  $\sqrt{\text{MAX.}}$   
 GROUND SURFACES 32  $\sqrt{\text{MAX.}}$   
 DECIMAL TOL. XX  $\pm .010$  XXX  $\pm .005$  XXXX  $\pm .0005$   
 FRACTION TOL.  $\pm .010$   
 ANGLE TOL.  $\pm 1^\circ$   
 REMOVE BURRS AND SHARP EDGES TO .015 MAX.  
 DO NOT SCALE

Standard size UCPRC ingot mold

PART NAME		UCPRC Mold Fabrication	SCALE	N/A
MATERIAL	NUMBER		DATE	10-7-07
	DESCRIPTION	HOT ROLL STEEL	DRAWN BY	MPT
PART NUMBER			CHECKED BY	

F		
E		
D		
C	Move extractor mounts.	3 5-29-05
B	Enlarge Prying slots.	2 5-27-05
A	Change slots to threaded holes.	1 5-27-05
	CHANGE	ECD DATE



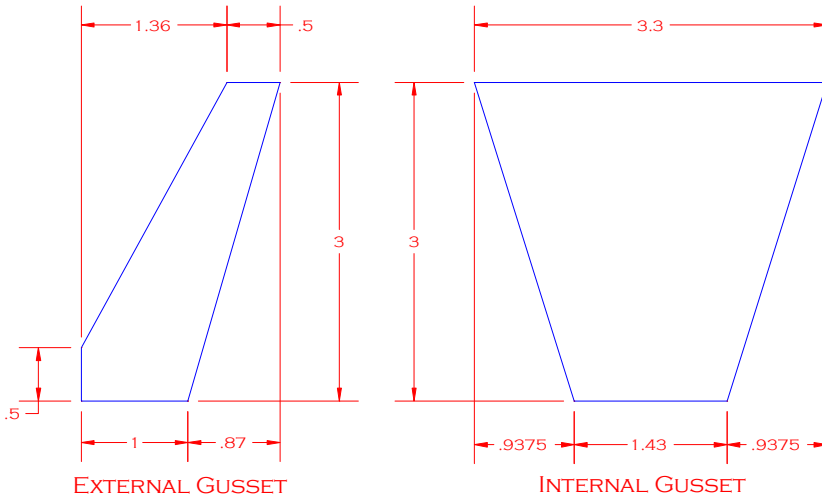
Welding note: Hand fit mold side panels, and weld on the outside of the mold cavity only. Do not allow any welds inside the area where the asphalt will be compacted.

UNLESS OTHERWISE SPECIFIED  
 FINISH SPECIFICATIONS  
 MACHINED SURFACES 125  $\sqrt{\text{MAX.}}$   
 GROUND SURFACES 32  $\sqrt{\text{MAX.}}$   
 DECIMAL TOL. XX  $\pm .010$  XXX  $\pm .005$  XXXX  $\pm .0005$   
 FRACTION TOL.  $\pm .010$   
 ANGLE TOL.  $\pm 1^\circ$   
 REMOVE BURRS AND SHARP EDGES TO .015 MAX.  
 DO NOT SCALE

Standard size UCPRC ingot mold

PART NAME		UCPRC Mold Fabrication	SCALE	N/A
MATERIAL	NUMBER		DATE	10-7-07
	DESCRIPTION	HOT ROLL STEEL	DRAWN BY	MPT
PART NUMBER			CHECKED BY	

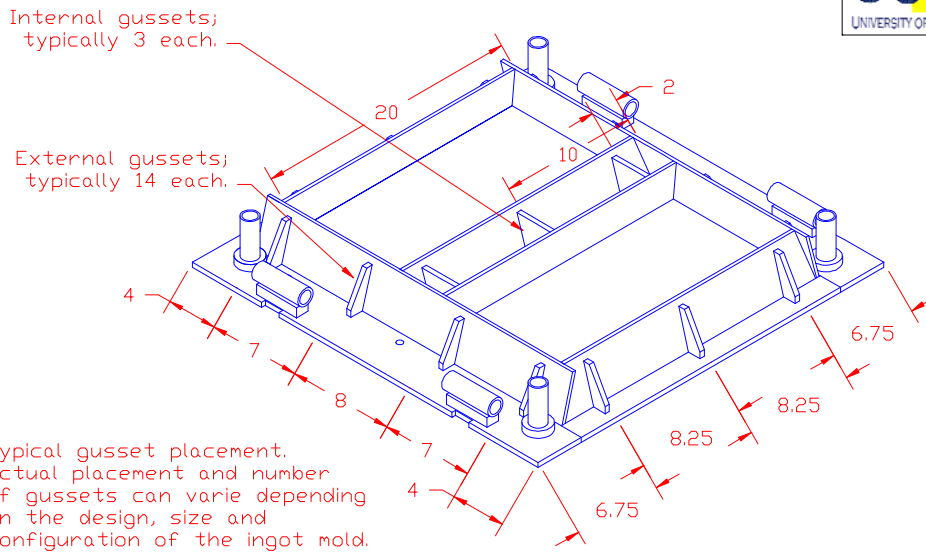
F		
E		
D		
C	Move extractor mounts.	3 5-29-05
B	Enlarge Prying slots.	2 5-27-05
A	Change slots to threaded holes.	1 5-27-05
	CHANGE	ECD DATE



REPEATED LABORATORY USE HAS SHOWN THAT REINFORCING GUSSETS ARE NECESSARY ON THE INGOT MOLD, TO PREVENT FAILURE OF THE MOLD FLANGE WELDS WHEN EXTRACTING ASPHALT SPECIMENS WITHOUT THE USE OF RELEASE AGENTS. TYPICALLY 14 EXTERNAL, AND 3 INTERNAL GUSSETS ARE USED ON EACH INGOT MOLD. THE GUSSETS ON THIS PRINT ARE FOR THE UCPRC STANDARD SIZED MOLD. THESE GUSSETS WERE CUT FROM 3" WIDE X 3/8" THICK HOTROLLED STEEL FLATBAR.

UNLESS OTHERWISE SPECIFIED  
 FINISH SPECIFICATIONS  
 MACHINED SURFACES 125 MAX  
 GROUND SURFACES 32 MAX  
 DECIMAL TOL. XX ± 0 TO XXX ± 005 XXXX ± 0005  
 FRACTIONAL TOL. ± 010  
 ANGLE TOL. ± 1°  
 REMOVE BURRS AND SHARP EDGES TO .015 MAX.  
**DO NOT SCALE**

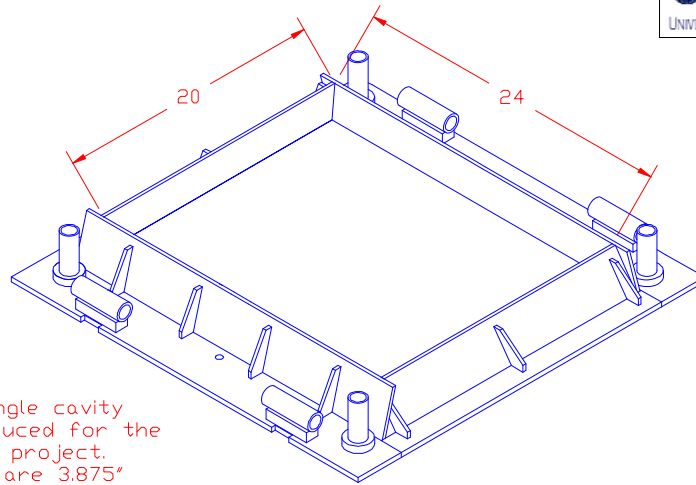
PART NAME		MOLD GUSSET	SCALE	N/A	F		
MATERIAL		HOT ROLL STEEL FLATBAR	DATE	10-6-07	E		
DESCRIPTION			DRAWN BY	MPT	D		
PART NUMBER			CHECKED BY		C		
					B		
					A		
						CHANGE	ECO DATE



Typical gusset placement. Actual placement and number of gussets can vary depending on the design, size and configuration of the ingot mold.

UNLESS OTHERWISE SPECIFIED  
 FINISH SPECIFICATIONS  
 MACHINED SURFACES 125 MAX.  
 GROUND SURFACES 32 MAX.  
 DECIMAL TOL. .XX .010 .XXX .005 .XXXX .0005  
 FRACTIONAL TOL. .010  
 ANGLE TOL. 1°  
 REMOVE BURRS AND SHARP EDGES TO .015 MAX.  
**DO NOT SCALE**

PART NAME		Mold Gusset Placement	SCALE	N/A	F		
MATERIAL			DATE	10-6-07	E		
DESCRIPTION			DRAWN BY	MPT	D		
PART NUMBER			CHECKED BY		C		
					B		
					A		
						CHANGE	ECO DATE



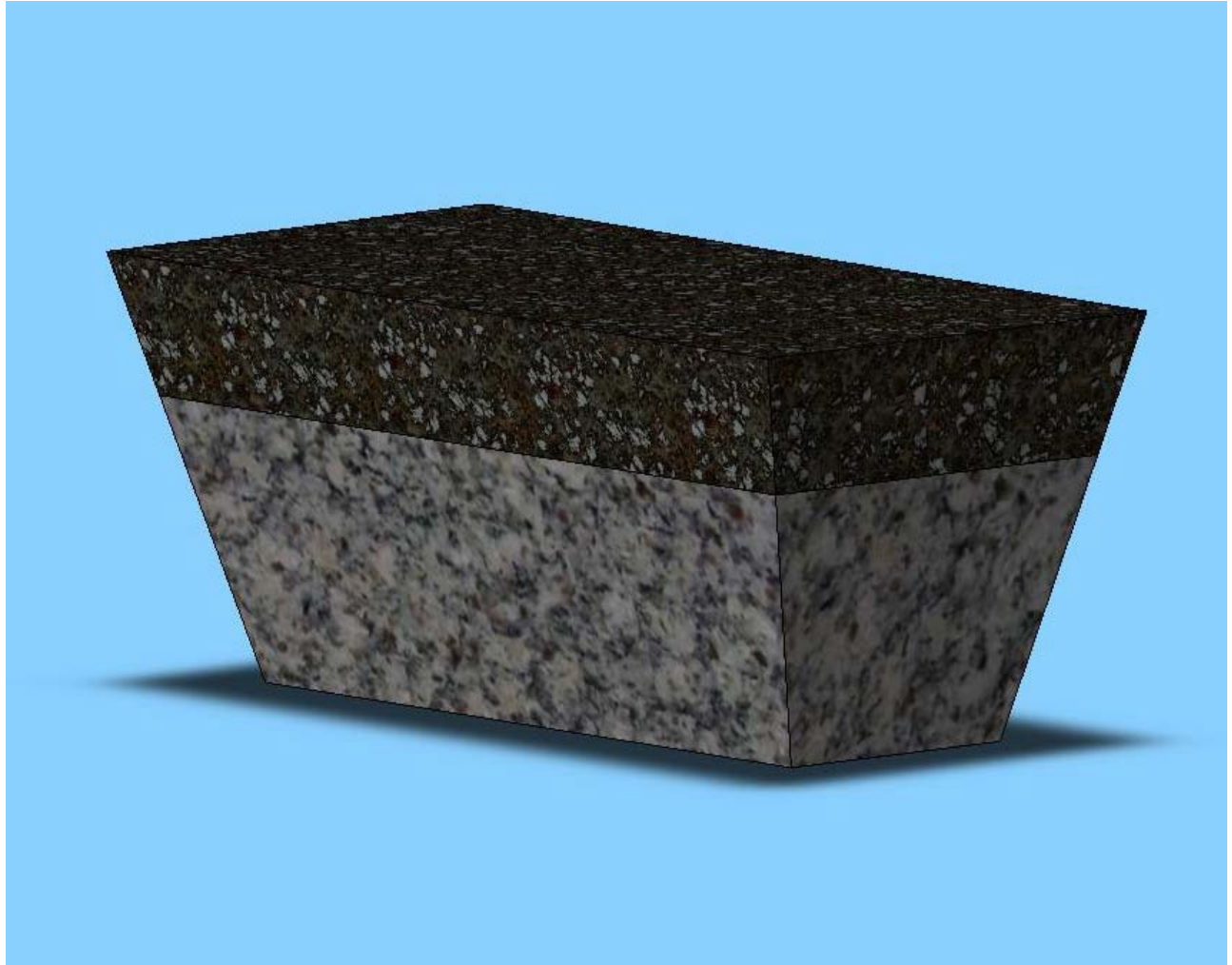
Maximum sized, single cavity  
ingot mold. Produced for the  
warm mix asphalt project.  
Ingot dimensions are 3.875"  
deep, 26" X 22" at the top,  
and 24" X 20" at the base.

UNLESS OTHERWISE SPECIFIED

FINISH SPECIFICATIONS  
MACHINED SURFACES 125 MAX.  
GROUND SURFACES 32 MAX.  
DECIMAL TOL. .XX .010 .XXX .005 .XXXX .0005  
FRACTIONAL TOL. .010  
ANGLE TOL. 1  
REMOVE BURRS AND SHARP EDGES TO .015 MAX.  
DO NOT SCALE

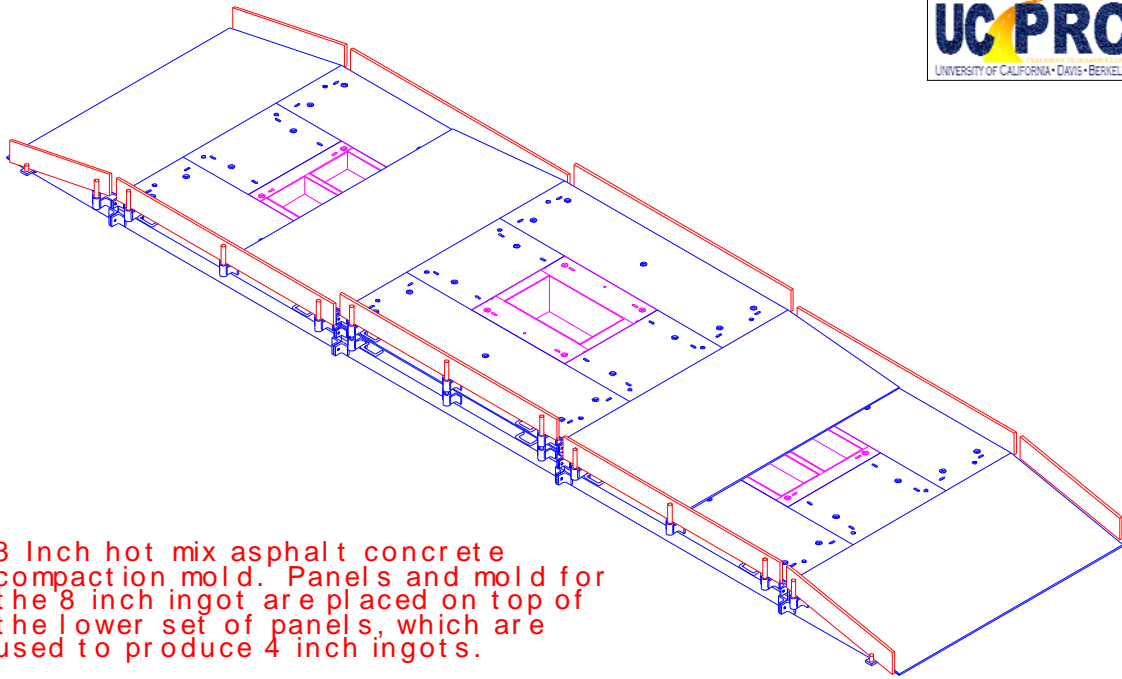
PART NAME		Maximum Sized Ingot Mold	SCALE		F		
MATERIAL		NUMBER	DATE	10-4-07	E		
DESCRIPTION			DRAWN BY	MPT	D		
PART NUMBER			CHECKED BY		C		
					B		
					A		
					CHANGE	ECD	DATE

## Section 4: Multiple Section Operations for 8-Inch- and 12-Inch Thick Specimens



8" Portland concrete cement specimen with 4" asphalt overlay.





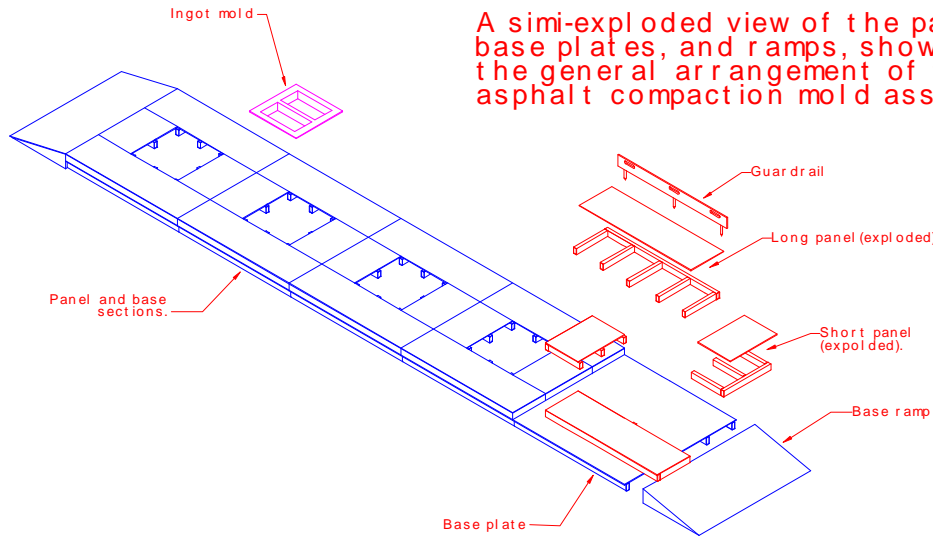
8 Inch hot mix asphalt concrete compaction mold. Panels and mold for the 8 inch ingot are placed on top of the lower set of panels, which are used to produce 4 inch ingots.

unless otherwise specified

Finish Specifications:  
 Machined Surfaces 125  $\sqrt{\text{MAX}}$ .  
 Ground Surfaces 32  $\sqrt{\text{MAX}}$ .  
 decimal tol. xx .010 xxx .005 xxxx .0005  
 fractional tol.  $\pm$ .010  
 angle tol.  $\pm$ °  
 remove burrs and sharp edges to .015 max.  
**do not scale**

Part Name		8" asphalt compaction mold		Scale	N/A
Material	Number			Date	2-16-04
	Description			Drawn by	MPT
Part Number				Checked by	

F			
E			
D			
C			
B			
A			
	change	eco	date



A semi-exploded view of the panels, base plates, and ramps, showing the general arrangement of the asphalt compaction mold assembly.

UNLESS OTHERWISE SPECIFIED

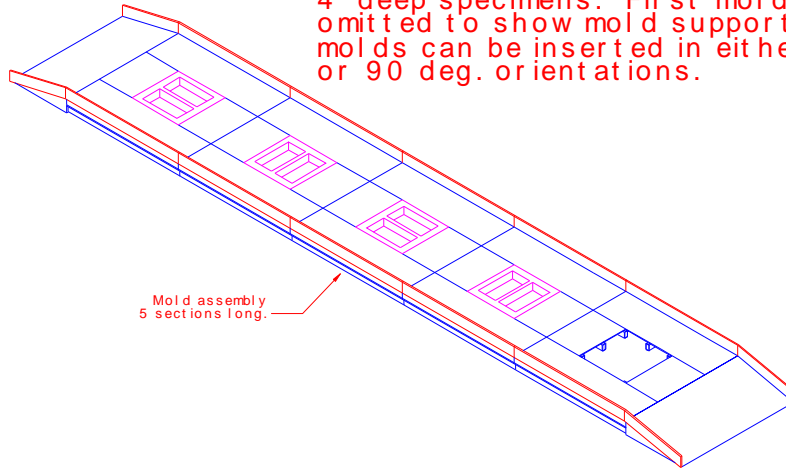
FINISH SPECIFICATIONS  
 MACHINED SURFACES 125  $\sqrt{\text{MAX}}$ .  
 GROUND SURFACES 32  $\sqrt{\text{MAX}}$ .  
 DECIMAL TOL. xx  $\pm$ .010 xxx  $\pm$ .005 xxxx  $\pm$ .0005  
 FRACTIONAL TOL.  $\pm$ .010  
 ANGLE TOL.  $\pm$ 1°  
 REMOVE BURRS AND SHARP EDGES TO .015 MAX.  
**DO NOT SCALE**

PART NAME		ASPHALT COMPACTION MOLD		SCALE	NONE
MATERIAL	NUMBER			DATE	12 SEP 03
	DESCRIPTION			DRAWN BY	MPT
PART NUMBER		N/A		CHECKED BY	

G			
F			
E			
D			
C			
B			
A			
	CHANGE	ECO	DATE



Asphalt compaction mold configured for 4" deep specimens. First mold has been omitted to show mold supports. Ingot molds can be inserted in either straight, or 90 deg. orientations.



Mold assembly  
5 sections long.

UNLESS OTHERWISE SPECIFIED

FINISH SPECIFICATIONS

MACHINED SURFACES 125  $\sqrt{\text{MAX.}}$

GROUND SURFACES 32  $\sqrt{\text{MAX.}}$

DECIMAL TOL. XX  $\pm$ .010 .XXX  $\pm$ .005 .XXXX  $\pm$ .0005

FRACTIONAL TOL.  $\pm$ .010

ANGLE TOL.  $\pm$ 1°

REMOVE BURRS AND SHARP EDGES TO .015 MAX.

DO NOT SCALE

PART NAME ASPHALT COMPACTION FORM

SCALE NONE

DATE 18 SEP 03

MATERIAL NUMBER

DRAWN BY MPT

DESCRIPTION TYPE A-36 STEEL

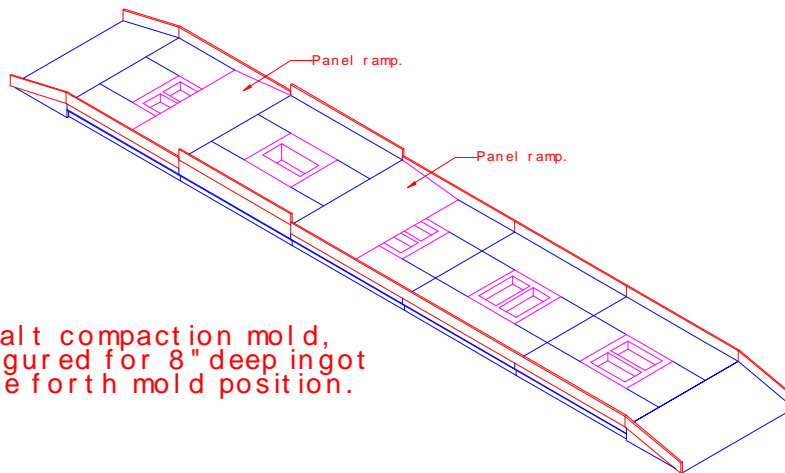
CHECKED BY

PART NUMBER N/A

G			
F			
E			
D			
C			
B			
A			
	CHANGE	ECO	DATE



Asphalt compaction mold, configured for 8" deep ingot at the fourth mold position.



Panel ramp.

Panel ramp.

UNLESS OTHERWISE SPECIFIED

FINISH SPECIFICATIONS

MACHINED SURFACES 125  $\sqrt{\text{MAX.}}$

GROUND SURFACES 32  $\sqrt{\text{MAX.}}$

DECIMAL TOL. XX  $\pm$ .010 .XXX  $\pm$ .005 .XXXX  $\pm$ .0005

FRACTIONAL TOL.  $\pm$ .010

ANGLE TOL.  $\pm$ 1°

REMOVE BURRS AND SHARP EDGES TO .015 MAX.

DO NOT SCALE

PART NAME 8" ASPHALT COMPACTION FORM

SCALE NONE

DATE 21 SEP 03

MATERIAL NUMBER

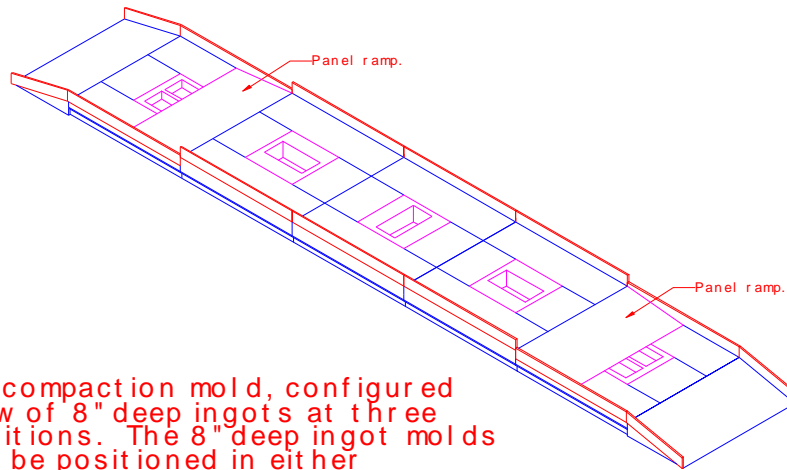
DRAWN BY MPT

DESCRIPTION TYPE A-36 STEEL

CHECKED BY

PART NUMBER N/A

G			
F			
E			
D			
C			
B			
A			
	CHANGE	ECO	DATE

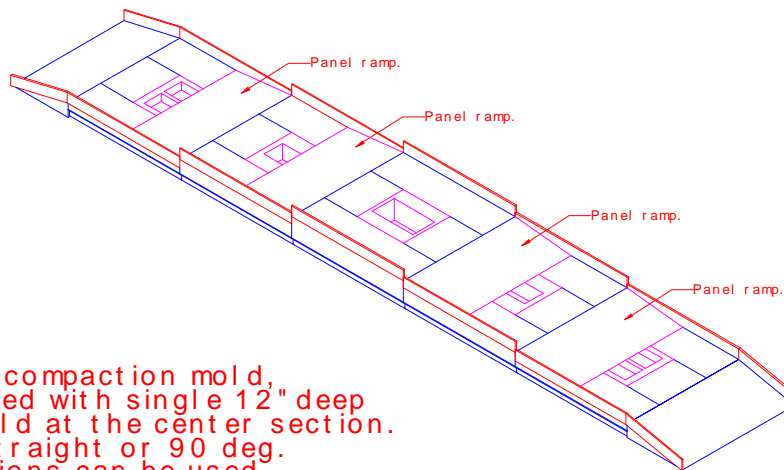


Asphalt compaction mold, configured for a row of 8" deep ingots at three mold positions. The 8" deep ingot molds can also be positioned in either straight or 90 deg. orientations.

UNLESS OTHERWISE SPECIFIED

FINISH SPECIFICATIONS  
 MACHINED SURFACES 125  $\sqrt{\text{MAX.}}$   
 GROUND SURFACES 32  $\sqrt{\text{MAX.}}$   
 DECIMAL TOL. XX  $\pm$  .010 .XXX  $\pm$  .005 .XXXX  $\pm$  .0005  
 FRACTIONAL TOL.  $\pm$  .010  
 ANGLE TOL.  $\pm$  1°  
 REMOVE BURRS AND SHARP EDGES TO .015 MAX.  
**DO NOT SCALE**

PART NAME		GANG MOLD 8" COMPACTION FORMS		SCALE	NONE	G		
MATERIAL	NUMBER			DATE	21 SEP 03	F		
	DESCRIPTION	TYPE A-36 STEEL		DRAWN BY	MPT	E		
PART NUMBER		N/A		CHECKED BY		D		
						C		
						B		
						A		
							CHANGE	ECO DATE

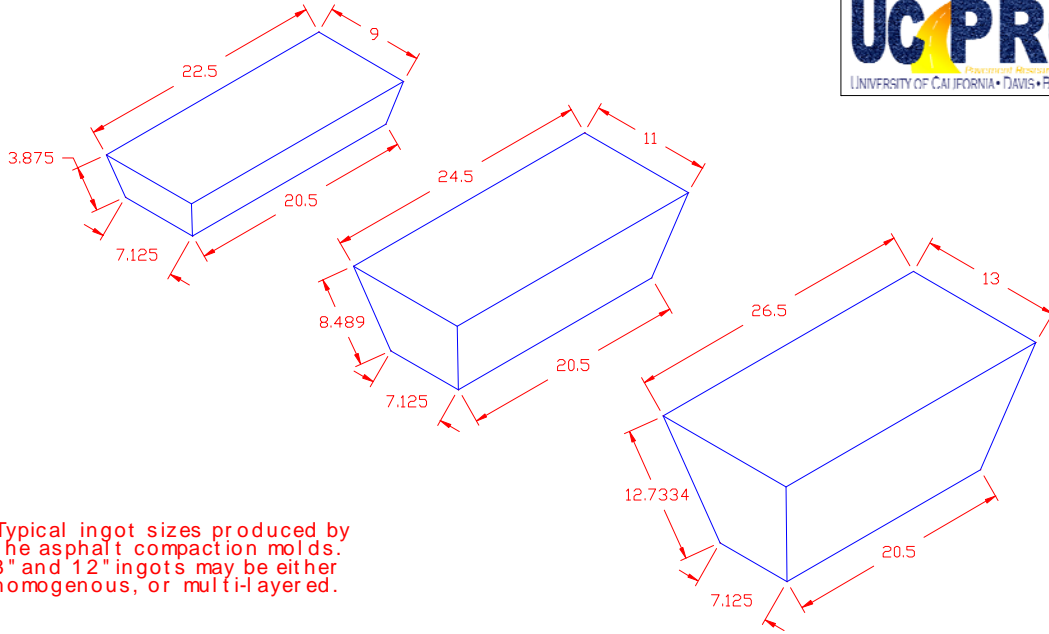


Asphalt compaction mold, configured with single 12" deep ingot mold at the center section. Either straight or 90 deg. orientations can be used.

UNLESS OTHERWISE SPECIFIED

FINISH SPECIFICATIONS  
 MACHINED SURFACES 125  $\sqrt{\text{MAX.}}$   
 GROUND SURFACES 32  $\sqrt{\text{MAX.}}$   
 DECIMAL TOL. XX  $\pm$  .010 .XXX  $\pm$  .005 .XXXX  $\pm$  .0005  
 FRACTIONAL TOL.  $\pm$  .010  
 ANGLE TOL.  $\pm$  1°  
 REMOVE BURRS AND SHARP EDGES TO .015 MAX.  
**DO NOT SCALE**

PART NAME		12" ASPHALT COMPACTION FORM		SCALE	NONE	G		
MATERIAL	NUMBER			DATE	22 SEP 03	F		
	DESCRIPTION	TYPE A-36 STEEL		DRAWN BY	MPT	E		
PART NUMBER		N/A		CHECKED BY		D		
						C		
						B		
						A		
							CHANGE	ECO DATE

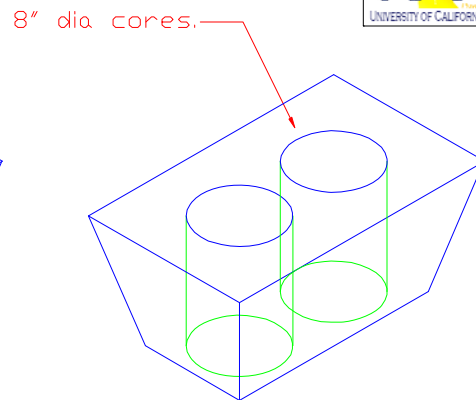
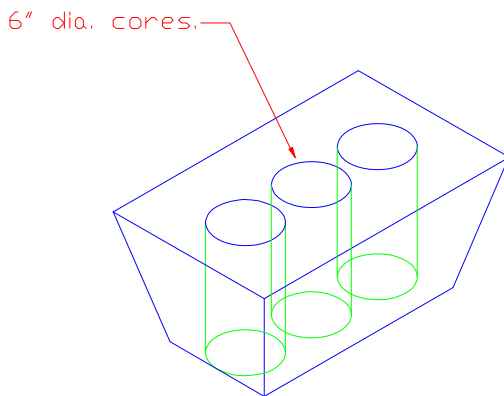


Typical ingot sizes produced by the asphalt compaction molds. 8" and 12" ingots may be either homogenous, or multi-layered.

UNLESS OTHERWISE SPECIFIED  
 FINISH SPECIFICATIONS  
 MACHINED SURFACES 125  $\sqrt{\text{MAX.}}$   
 GROUND SURFACES 32  $\sqrt{\text{MAX.}}$   
 DECIMAL TOL. XX  $\pm .010$  XXX  $\pm .005$  XXXX  $\pm .0005$   
 FRACTION TOL.  $\pm .010$   
 ANGLE TOL.  $\pm 1^\circ$   
 REMOVE BURRS AND SHARP EDGES TO .015 MAX.  
 DO NOT SCALE

PART NAME		Typical UCPRC Ingots		SCALE	N/A
MATERIAL	NUMBER	DATE	12-7-04		
	DESCRIPTION	DRAWN BY	MPT		
PART NUMBER		CHECKED BY			

F			
E			
D			
C			
B			
A			
	CHANGE	ECD	DATE

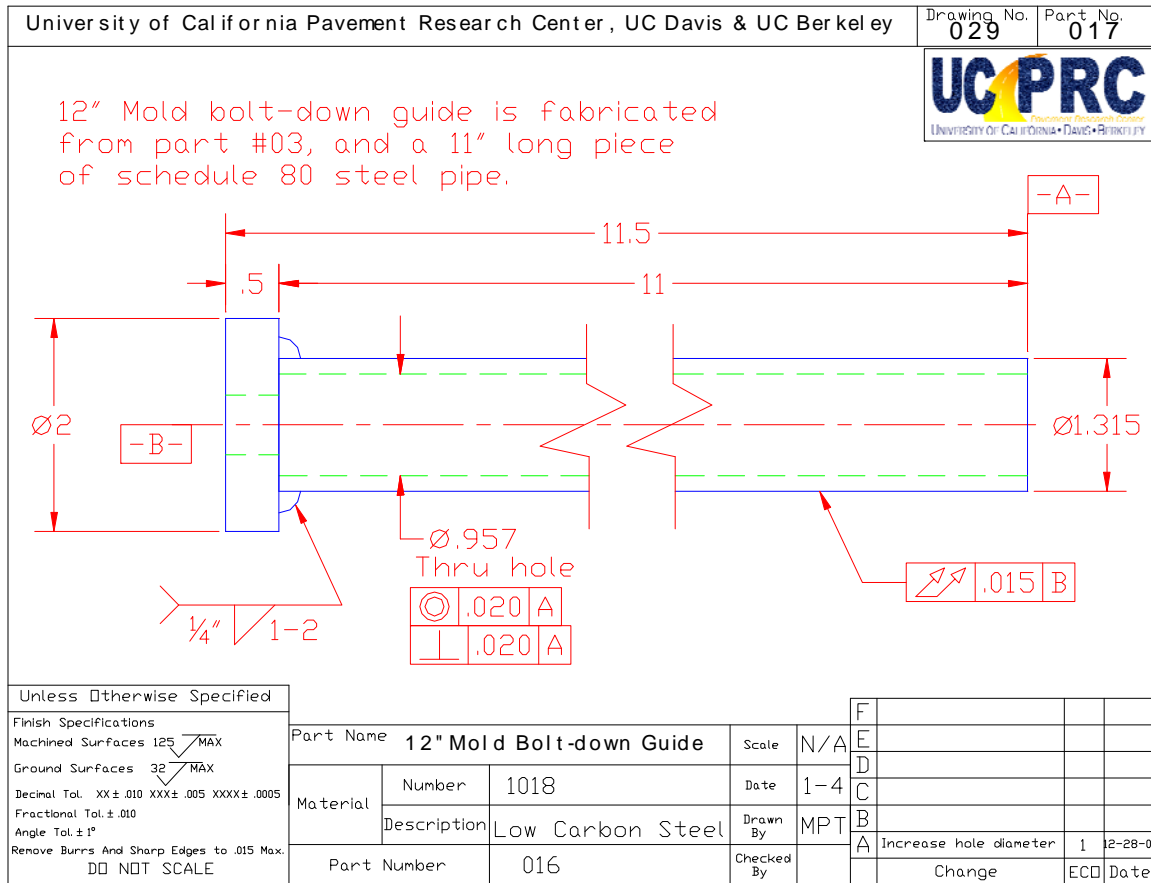
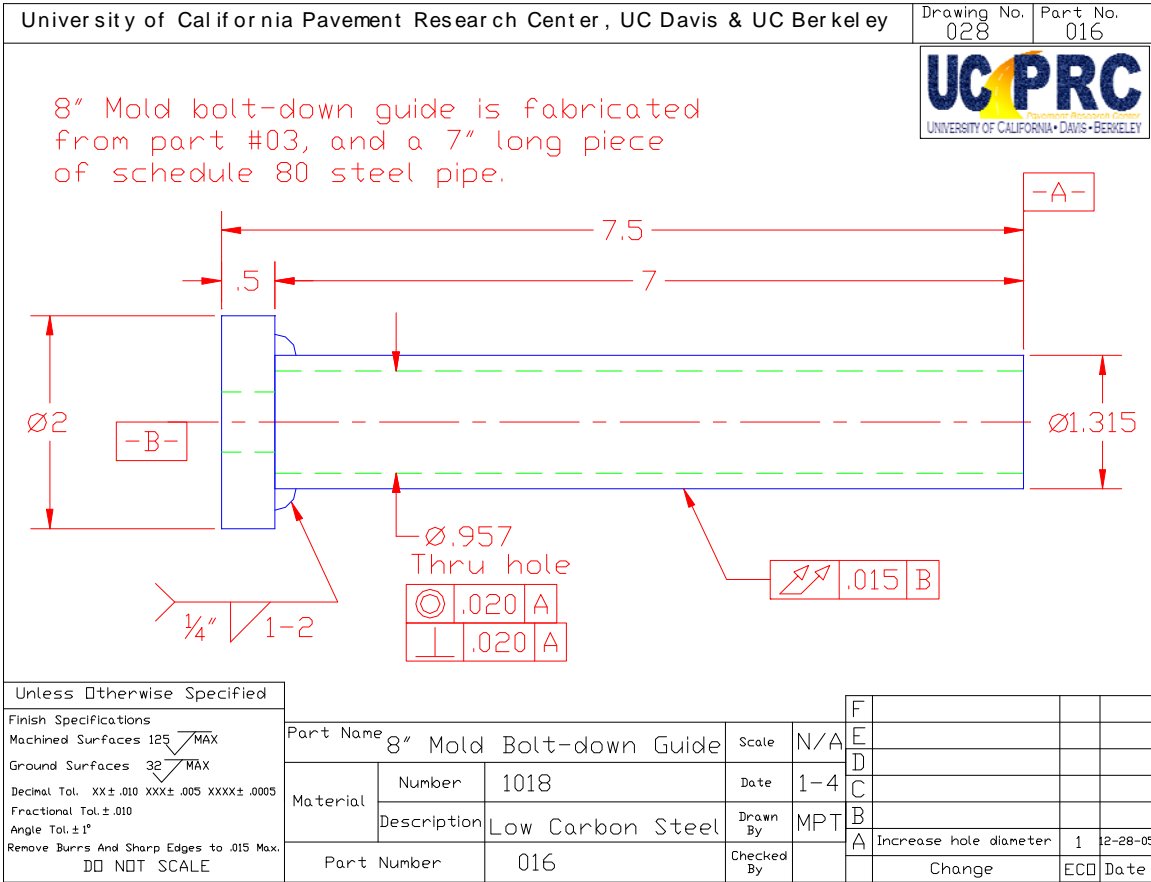



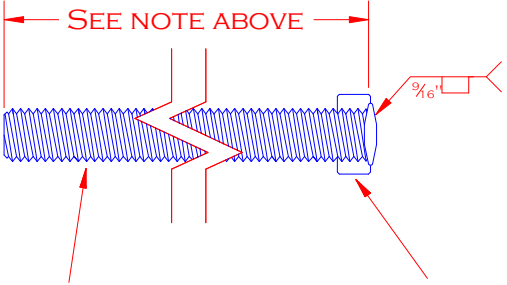
6" and 8" shear and triaxle specimens, cut from 12" thick compacted hot mix asphalt ingots. Ingots can be either homogeneous blocks, or can be built up by paving and compacting on top of 4" or 8" ingots. Composite, or three layer ingots can be built up by taking a 4" ingot, placing it in a 8" mold and paving over it. This ingot can then be placed in a 12" mold, and given a final lift, to make three layers.


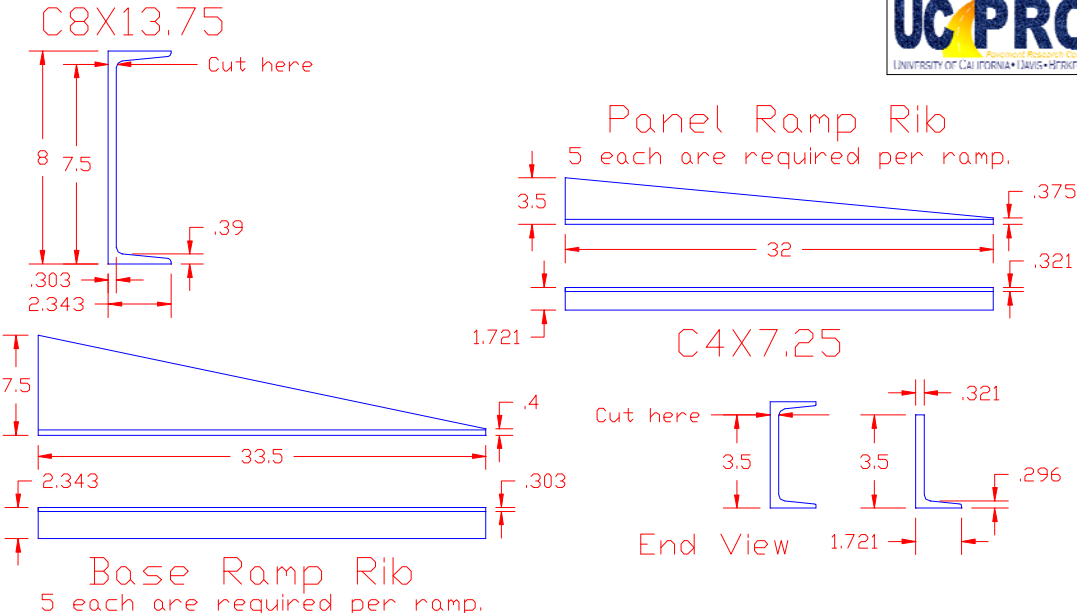
UNLESS OTHERWISE SPECIFIED  
 FINISH SPECIFICATIONS  
 MACHINED SURFACES 125  $\sqrt{\text{MAX.}}$   
 GROUND SURFACES 32  $\sqrt{\text{MAX.}}$   
 DECIMAL TOL. XX  $\pm .010$  XXX  $\pm .005$  XXXX  $\pm .0005$   
 FRACTION TOL.  $\pm .010$   
 ANGLE TOL.  $\pm 1^\circ$   
 REMOVE BURRS AND SHARP EDGES TO .015 MAX.  
 DO NOT SCALE

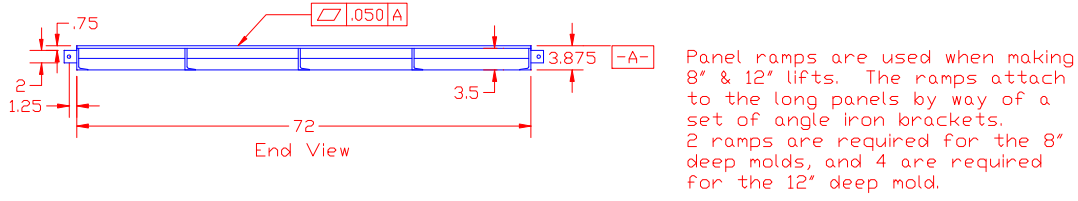
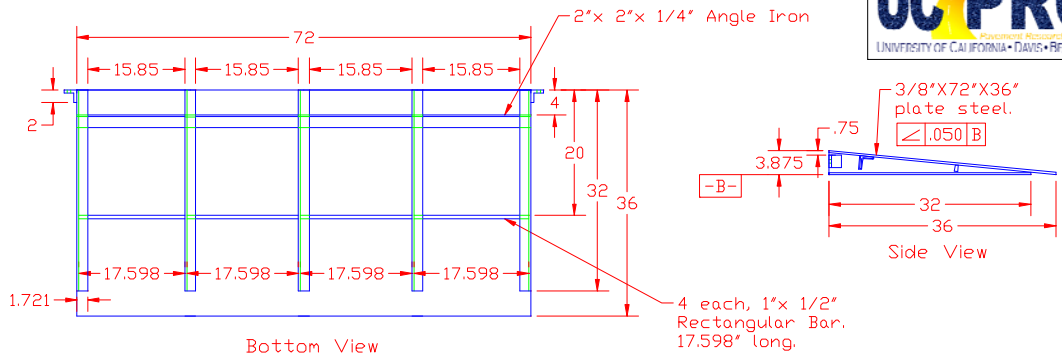
PART NAME		TYPICAL ASPHALT CORES		SCALE	N/A
MATERIAL	NUMBER	DATE	12-7-04		
	DESCRIPTION	DRAWN BY	MPT		
PART NUMBER		CHECKED BY			

F			
E			
D			
C			
B			
A			
	CHANGE	ECD	DATE



UNIVERSITY OF CALIFORNIA PAVEMENT RESEARCH CENTER, UC DAVIS & UC BERKELEY		DRAWING NO. 080	PART NO.																				
<p>MOLD HOLD-DOWN BOLTS FOR THE 8" DEEP &amp; 12" DEEP INGOT MOLDS ARE FABRICATED FROM GRADE B7 ALLTHREAD, AND 1/2-13NC NUTS. THE BOLTS FOR THE 8" DEEP MOLDS SHOULD HAVE AN OAL OF 9.5". THE BOLTS FOR THE 12" DEEP MOLDS SHOULD HAVE AN OAL OF 13.5".</p>																							
																							
<p>1/2-13NC ALLOY STEEL THREADED ROD. ASTM A193 GRADE B7, AISI 4140. MINIMUM TENSILE STRENGTH: 125,000 PSI.</p>		<p>SIZE 1/2-13NC HEX THIN (JAM) NUT. GRADE 8 ANSI/ASME B18.2.2 WIDTH 3/4", HEIGHT 5/16"</p>																					
<p>UNLESS OTHERWISE SPECIFIED</p> <p>FINISH SPECIFICATIONS MACHINED SURFACES 125 MAX GROUND SURFACES 32 MAX DECIMAL TOL. XX ±0.10 XXX ±0.05 XXXX ±0.005 FRACTIONAL TOL. ±0.10 ANGLE TOL. ±1° REMOVE BURRS AND SHARP EDGES TO .015 MAX. DO NOT SCALE</p>		<table border="1" style="width:100%; border-collapse: collapse;"> <tr> <td colspan="2">PART NAME</td> <td>SCALE</td> <td>N/A</td> </tr> <tr> <td colspan="2">MATERIAL</td> <td>DATE</td> <td>10-11-07</td> </tr> <tr> <td colspan="2">DESCRIPTION</td> <td>DRAWN BY</td> <td>MPT</td> </tr> <tr> <td colspan="2">PART NUMBER</td> <td>CHECKED BY</td> <td></td> </tr> <tr> <td colspan="2"></td> <td>CHANGE</td> <td>ECO DATE</td> </tr> </table>		PART NAME		SCALE	N/A	MATERIAL		DATE	10-11-07	DESCRIPTION		DRAWN BY	MPT	PART NUMBER		CHECKED BY				CHANGE	ECO DATE
PART NAME		SCALE	N/A																				
MATERIAL		DATE	10-11-07																				
DESCRIPTION		DRAWN BY	MPT																				
PART NUMBER		CHECKED BY																					
		CHANGE	ECO DATE																				

University of California Pavement Research Center, UC Davis & UC Berkeley		DRAWING NO. 024	PART NO. 012																				
																							
																							
<p>UNLESS OTHERWISE SPECIFIED</p> <p>FINISH SPECIFICATIONS MACHINED SURFACES 125 MAX. GROUND SURFACES 32 MAX. DECIMAL TOL. XX .010 XXX .005 XXXX .0005 FRACTIONAL TOL. .010 ANGLE TOL. 1 REMOVE BURRS AND SHARP EDGES TO .015 MAX. DO NOT SCALE</p>		<table border="1" style="width:100%; border-collapse: collapse;"> <tr> <td colspan="2">PART NAME</td> <td>SCALE</td> <td>2:1</td> </tr> <tr> <td colspan="2">MATERIAL</td> <td>DATE</td> <td>12-26</td> </tr> <tr> <td colspan="2">DESCRIPTION</td> <td>DRAWN BY</td> <td>MPT</td> </tr> <tr> <td colspan="2">PART NUMBER</td> <td>CHECKED BY</td> <td></td> </tr> <tr> <td colspan="2"></td> <td>CHANGE</td> <td>ECO DATE</td> </tr> </table>		PART NAME		SCALE	2:1	MATERIAL		DATE	12-26	DESCRIPTION		DRAWN BY	MPT	PART NUMBER		CHECKED BY				CHANGE	ECO DATE
PART NAME		SCALE	2:1																				
MATERIAL		DATE	12-26																				
DESCRIPTION		DRAWN BY	MPT																				
PART NUMBER		CHECKED BY																					
		CHANGE	ECO DATE																				



UNLESS OTHERWISE SPECIFIED

FINISH SPECIFICATIONS

MACHINED SURFACES 125 MAX.

GROUND SURFACES 32 MAX.

DECIMAL TOL. .XX ± .010 .XXX ± .005 .XXXX ± .0005

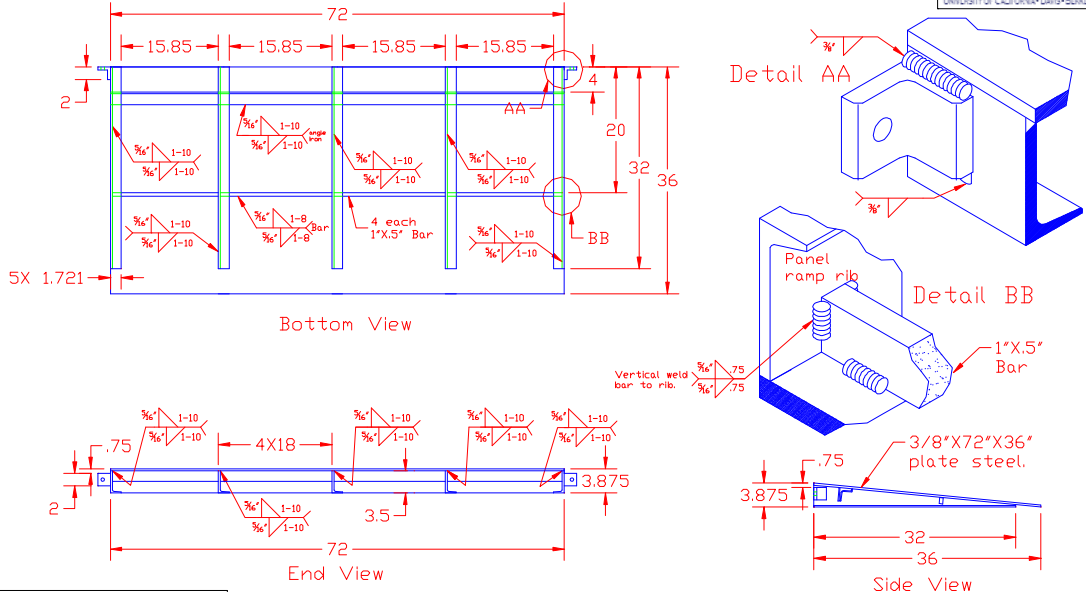
FRACTIONAL TOL. ± .010

ANGLE TOL. ± 1°

REMOVE BURRS AND SHARP EDGES TO .015 MAX.

DO NOT SCALE

PART NAME		Panel Ramp Assembly	SCALE	N/A	F		
MATERIAL		A-36 & Channel Iron	DATE	1-5	E		
PART NUMBER			DRAWN BY	MPT	D		
			CHECKED BY		C		
					B	Add 1"x .5" Bar	2 5-8-05
					A	Add angle iron	1 5-8-05
					CHANGE		ECD DATE



UNLESS OTHERWISE SPECIFIED

FINISH SPECIFICATIONS

MACHINED SURFACES 125 MAX.

GROUND SURFACES 32 MAX.

DECIMAL TOL. .XX ± .010 .XXX ± .005 .XXXX ± .0005

FRACTIONAL TOL. ± .010

ANGLE TOL. ± 1°

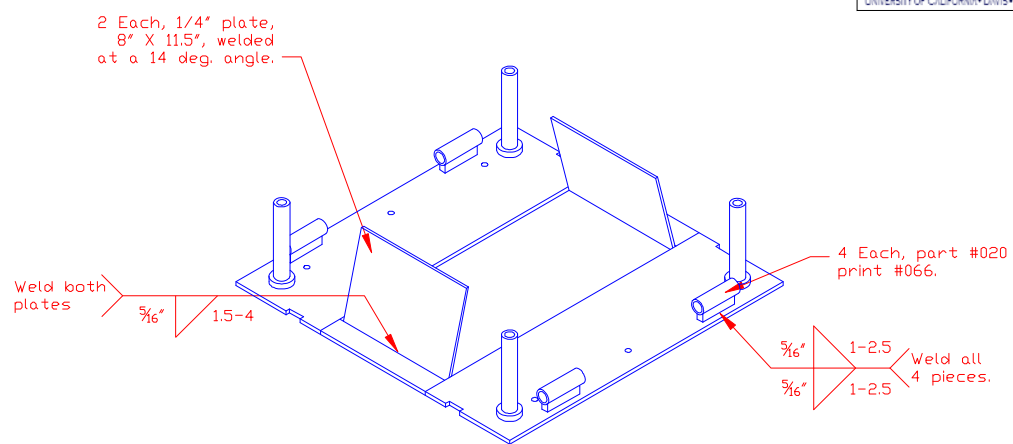
REMOVE BURRS AND SHARP EDGES TO .015 MAX.

DO NOT SCALE

PART NAME		Panel Ramp Fabrication	SCALE	N/A	F		
MATERIAL		A-36 & Channel Iron	DATE	12-25-04	E		
PART NUMBER			DRAWN BY	MPT	D		
			CHECKED BY		C	Add 1"x.5" Bar	3 5-7-05
					B	Change welds	2 5-7-05
					A	Add angle iron	1 5-7-05
					CHANGE		ECD DATE



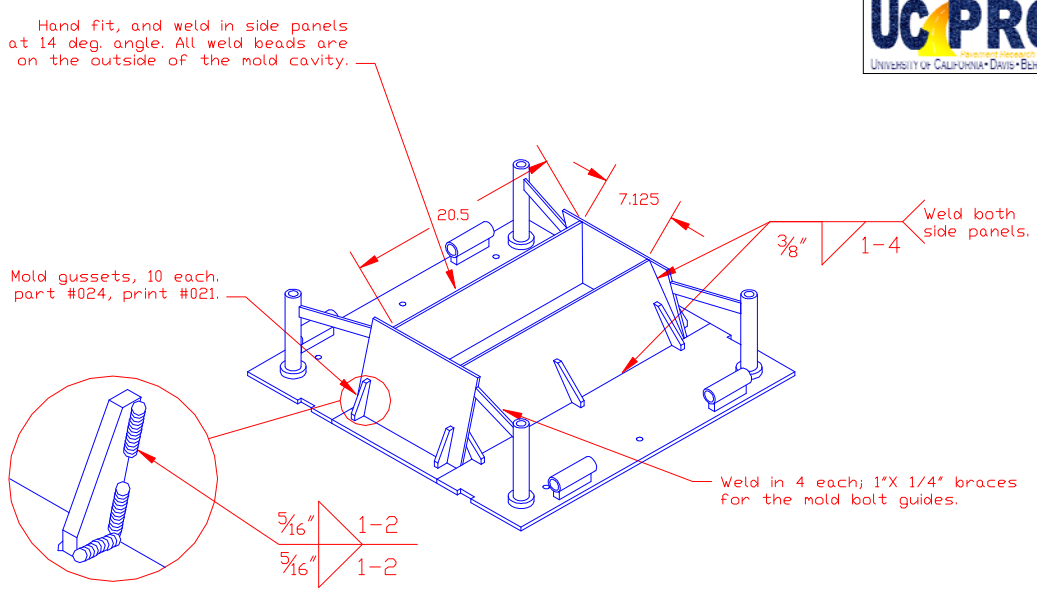




Tray for 8" asphalt compaction mold.

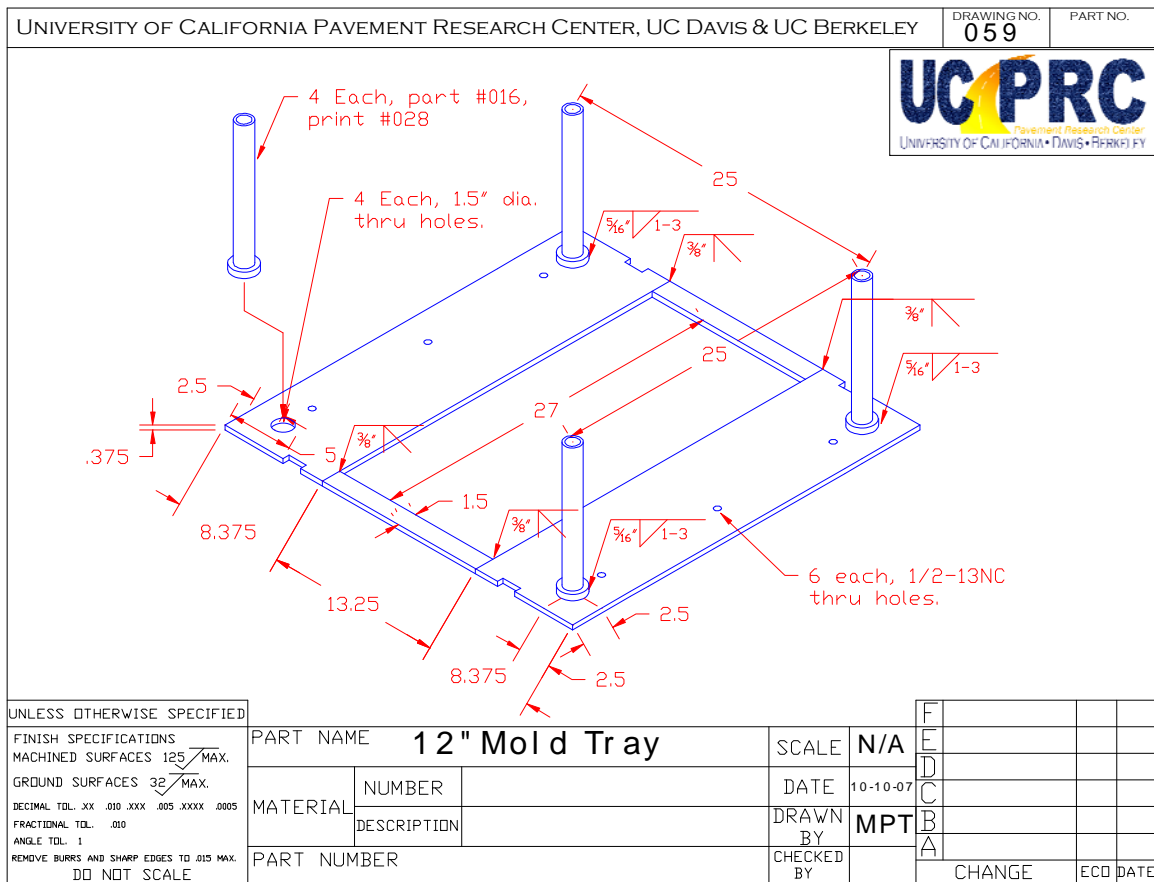
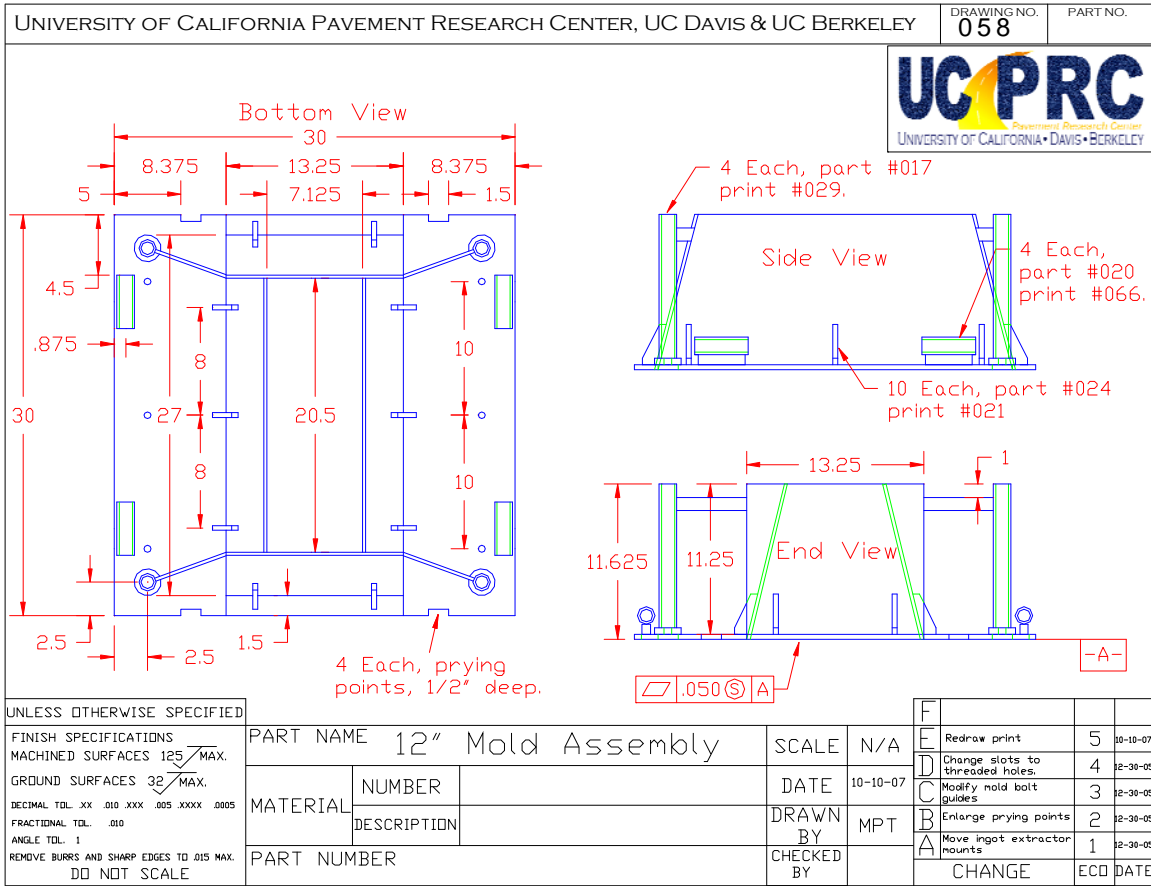
UNLESS OTHERWISE SPECIFIED  
 FINISH SPECIFICATIONS  
 MACHINED SURFACES 125  $\sqrt{\text{MAX.}}$   
 GROUND SURFACES 32  $\sqrt{\text{MAX.}}$   
 DECIMAL TOL. XX  $\pm .010$  XXX  $\pm .005$  XXXX  $\pm .0005$   
 FRACTION TOL.  $\pm .010$   
 ANGLE TOL.  $\pm 1^\circ$   
 REMOVE BURRS AND SHARP EDGES TO .015 MAX.  
 DO NOT SCALE

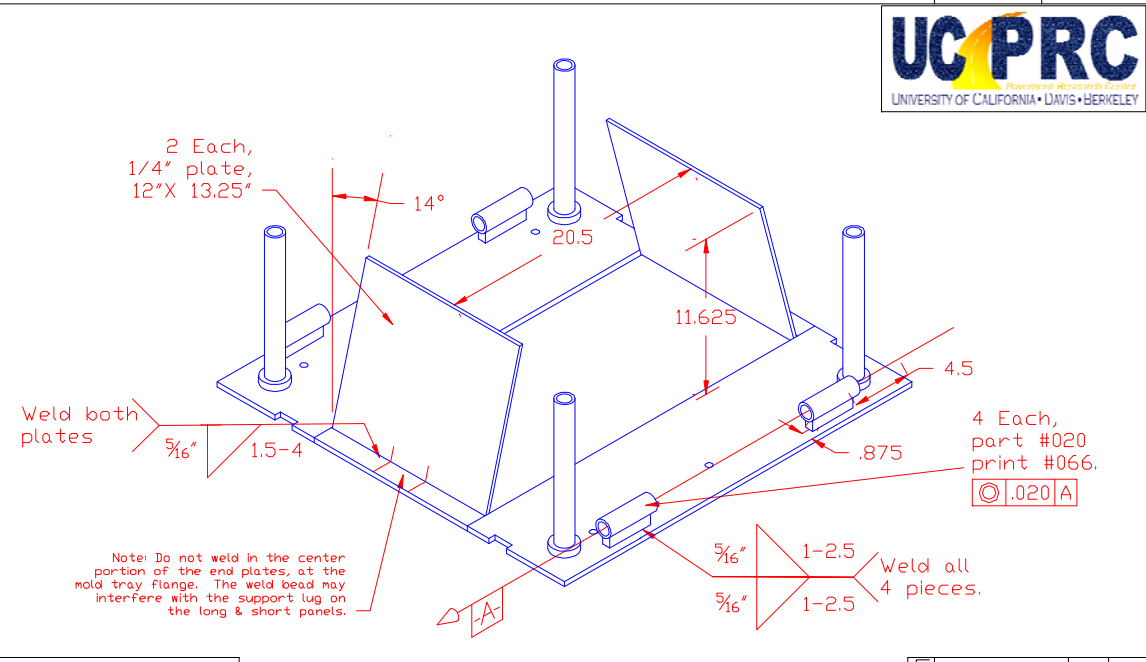
PART NAME		8" Mold Fabrication #1	SCALE	N/A	F		
MATERIAL		NUMBER	DATE	1-1-04	E		
		DESCRIPTION	DRAWN BY	MPT	D		
PART NUMBER			CHECKED BY		C		
					B		
					A	Convert slots to holes	1 12-28-05
						CHANGE	ECD DATE



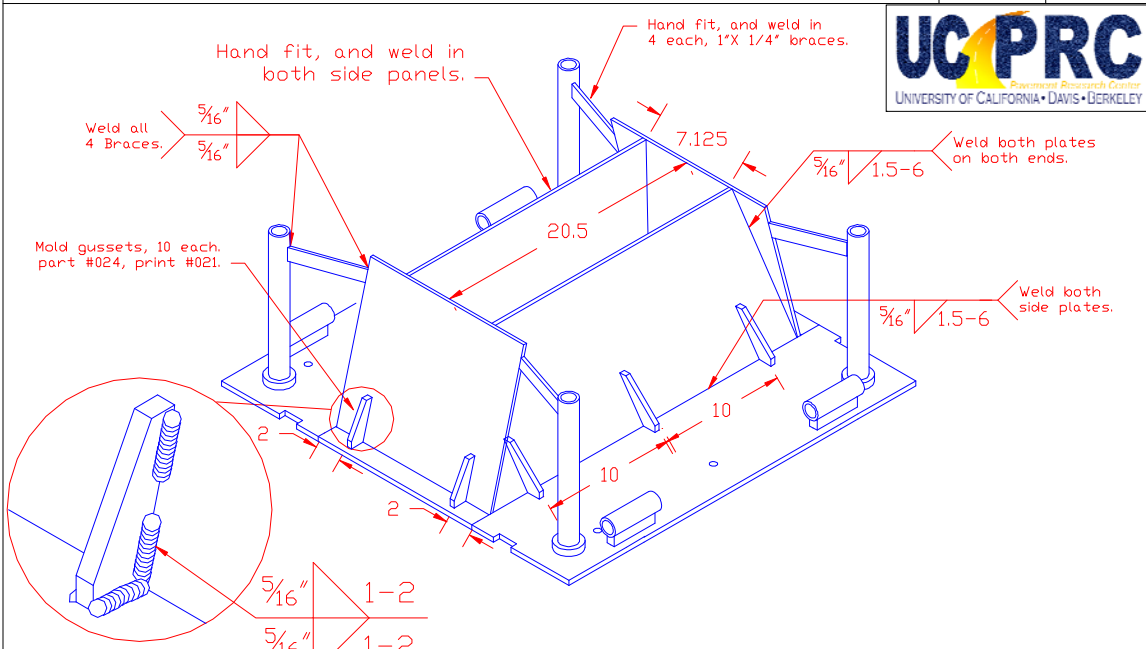
UNLESS OTHERWISE SPECIFIED  
 FINISH SPECIFICATIONS  
 MACHINED SURFACES 125  $\sqrt{\text{MAX.}}$   
 GROUND SURFACES 32  $\sqrt{\text{MAX.}}$   
 DECIMAL TOL. XX  $\pm .010$  XXX  $\pm .005$  XXXX  $\pm .0005$   
 FRACTION TOL.  $\pm .010$   
 ANGLE TOL.  $\pm 1^\circ$   
 REMOVE BURRS AND SHARP EDGES TO .015 MAX.  
 DO NOT SCALE

PART NAME		8" Mold Fabrication	SCALE	N/A	F		
MATERIAL		NUMBER	DATE	1-1-04	E		
		DESCRIPTION	DRAWN BY	MPT	D		
PART NUMBER			CHECKED BY		C		
					B	Add mold gussets	2 10-12-07
					A	Convert slots to holes	1 12-28-05
						CHANGE	ECD DATE





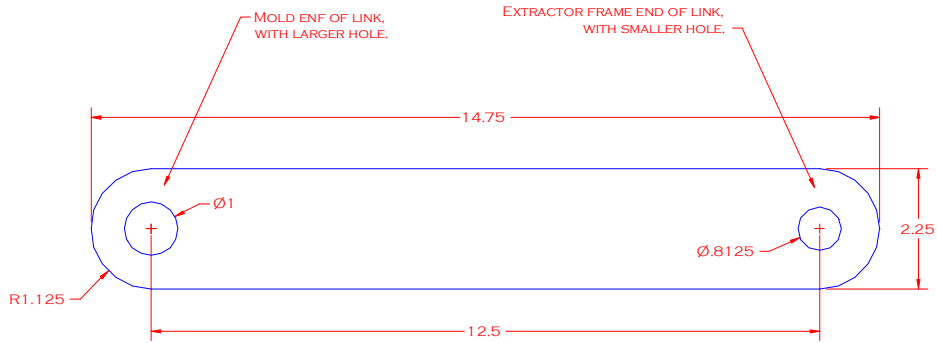
UNLESS OTHERWISE SPECIFIED		PART NAME <b>12" Ingot Mold</b>		SCALE	N/A	F		
FINISH SPECIFICATIONS MACHINED SURFACES 125 MAX.		MATERIAL		DATE	10-11-07	E		
GROUND SURFACES 32 MAX.		NUMBER		DRAWN BY	MPT	D		
DECIMAL TOL. .XX .010 .XXX .005 .XXXX .0005		DESCRIPTION		CHECKED BY		C		
FRACTIONAL TOL. .010		PART NUMBER				B		
ANGLE TOL. 1						A		
REMOVE BURRS AND SHARP EDGES TO .015 MAX. DO NOT SCALE							CHANGE	ECD DATE



UNLESS OTHERWISE SPECIFIED		PART NAME <b>12" Ingot Mold</b>		SCALE	N/A	F		
FINISH SPECIFICATIONS MACHINED SURFACES 125 MAX.		MATERIAL		DATE	10-11-07	E		
GROUND SURFACES 32 MAX.		NUMBER		DRAWN BY	MPT	D		
DECIMAL TOL. .XX .010 .XXX .005 .XXXX .0005		DESCRIPTION		CHECKED BY		C		
FRACTIONAL TOL. .010		PART NUMBER				B		
ANGLE TOL. 1						A		
REMOVE BURRS AND SHARP EDGES TO .015 MAX. DO NOT SCALE							CHANGE	ECD DATE

## Section 5: Accessory Equipment and Parts Lists



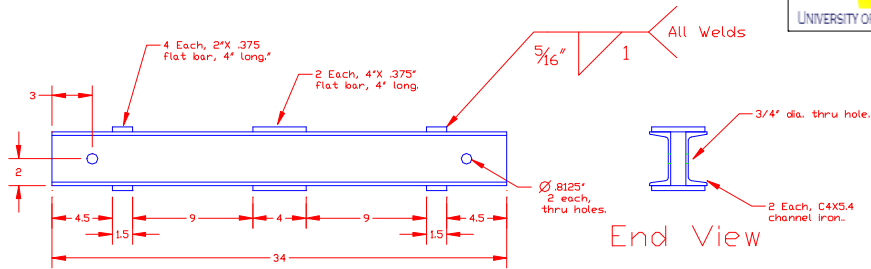


INGOT EXTRACTOR LINK. MADE FROM 1" THICK ALUMINUM PLATE. 2 EACH ARE REQUIRED.

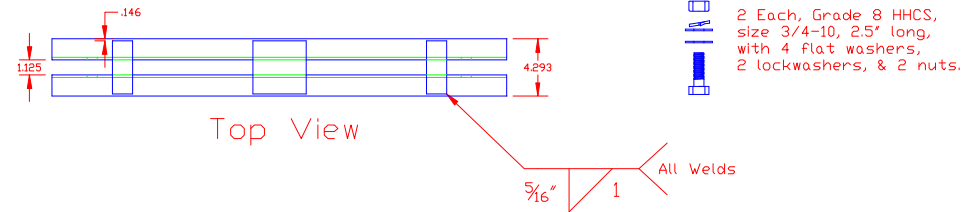
UNLESS OTHERWISE SPECIFIED

FINISH SPECIFICATIONS  
 MACHINED SURFACES 125 MAX.  
 GROUND SURFACES 32 MAX.  
 DECIMAL TOL. .XX .010 .XXX .005 .XXXX .0005  
 FRACTIONAL TOL. 1/10  
 ANGLE TOL. 2°  
 REMOVE BURRS AND SHARP EDGES TO .015 MAX.  
 DO NOT SCALE

PART NAME		INGOT EXTRACTOR LINK		SCALE	N/A	G		
MATERIAL	NUMBER	6160-T6	DATE	10-11-07		F		
DESCRIPTION		ALUMINUM	DRAWN BY	MPT		E		
PART NUMBER		025	CHECKED BY			D		
						C		
						B		
						A		
							CHANGE	CHK DATE



End View



2 Each, Grade 8 HHCS, size 3/4-10, 2.5" long, with 4 flat washers, 2 lockwashers, & 2 nuts.

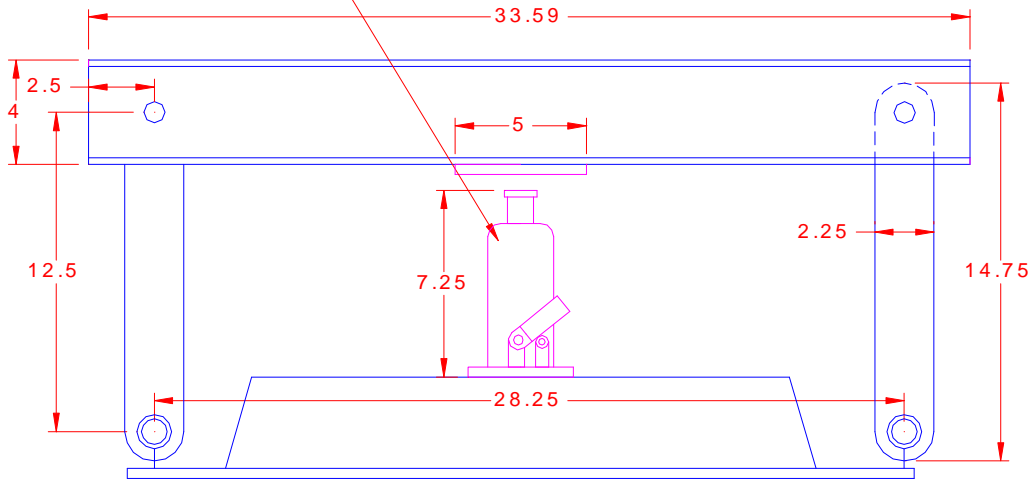
UNLESS OTHERWISE SPECIFIED

FINISH SPECIFICATIONS  
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 GROUND SURFACES 32 MAX.  
 DECIMAL TOL. .XX .010 .XXX .005 .XXXX .0005  
 FRACTIONAL TOL. 1/10  
 ANGLE TOL. 1°  
 REMOVE BURRS AND SHARP EDGES TO .015 MAX.  
 DO NOT SCALE

PART NAME		Ingot Extraction Rail		SCALE	N/A	F		
MATERIAL	NUMBER	C4X5.4	DATE	6-17-06		E		
DESCRIPTION		A-36 Steel Channel	DRAWN BY	MPT		D		
PART NUMBER			CHECKED BY			C		
						B		
						A		
							CHANGE	ECO DATE



10 ton hand operated hydraulic bottle jack.

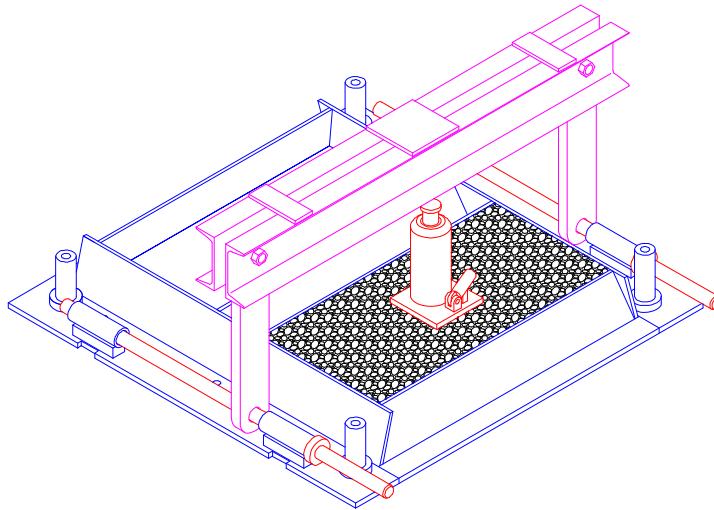


Side View; Ingot Extraction Tool

Unless Otherwise Specified

Finish Specifications  
 Machined Surfaces 125  $\sqrt{\text{MAX}}$ .  
 Ground Surfaces 32  $\sqrt{\text{MAX}}$ .  
 Decimal Tol. .XX  $\pm$ 0.10 XXX  $\pm$ 0.05 XXXX  $\pm$ 0.005  
 Fractional Tol. .010  
 Angle Tol. .5°  
 Remove Burrs And Sharp Edges To .015 Max.  
**Do Not Scale**

Part Name		Ingot Extracting tool		Scale	N/A	E			
Material	Number	Description	Part Number	Date	0-12-07	D			
				Drawn By	MPT	C			
				Checked By		B			
						A			
							Change	ECO	Date



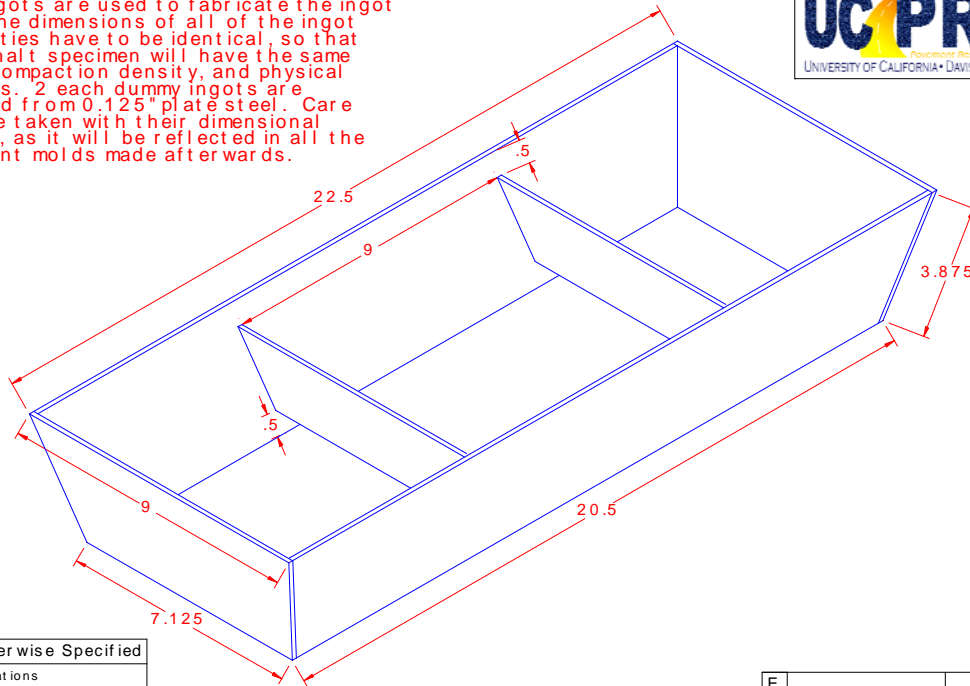
UNLESS OTHERWISE SPECIFIED

FINISH SPECIFICATIONS  
 MACHINED SURFACES 125  $\sqrt{\text{MAX}}$ .  
 GROUND SURFACES 32  $\sqrt{\text{MAX}}$ .  
 DECIMAL TOL. .XX  $\pm$ 0.10 XXX  $\pm$ 0.05 XXXX  $\pm$ 0.005  
 FRACTIONAL TOL. .010  
 ANGLE TOL. .5°  
 REMOVE BURRS AND SHARP EDGES TO .015 MAX.  
**DO NOT SCALE**

Part Name		Ingot Extraction Tool		Scale	N/A	F			
Material	Number	Description	Part Number	Date	6-14-06	E			
				Drawn By	MPT	D			
				Checked By		C			
						B			
						A			
							Change	ECO	Date



Dummy ingots are used to fabricate the ingot molds. The dimensions of all of the ingot mold cavities have to be identical, so that each asphalt specimen will have the same volume, compaction density, and physical properties. 2 each dummy ingots are fabricated from 0.125" plate steel. Care should be taken with their dimensional accuracy, as it will be reflected in all the subsequent molds made afterwards.



Unless Otherwise Specified  
 Finish Specifications  
 Machined Surfaces 125  $\sqrt{\text{Max.}}$   
 Ground Surfaces 32  $\sqrt{\text{Max.}}$   
 Decimal Tol. XX±.010 XXX±.005 XXXX±0.0005  
 Fractional Tol. .010  
 Angle Tol. ±1°  
 Remove Burrs And Sharp Edges To .015 Max.  
**Do Not Scale**

Part Name		Dummy Ingot	Scale	N/A	E		
Material	Number		Date	10-12-07	D		
	Description	1/8" Plate Steel	Drawn By	MPT	C		
Part Number			Checked By		B		
					A		
					Change	ECO	Date

# asphalt compaction mold

## 4 Inch HMA Gang Mold

### List of Materials

- 1 each,  $\frac{1}{2}$ " thick A-36 steel plate, 72" X 72".
- 2 each,  $\frac{3}{8}$ " thick A-36 steel plate, 72" X 36".
- 2 each,  $\frac{3}{8}$ " thick A-36 steel plate, 72" X 21".
- 2 each,  $\frac{3}{8}$ " thick A-36 steel plate, 30" X 21".
- 24 feet of  $\frac{3}{4}$ " X 6" hot rolled steel flat bar.
- 10 feet of  $\frac{1}{4}$ " X 4" hot rolled steel flat bar.
- 3 feet of  $\frac{3}{8}$ " X  $1\frac{1}{2}$ " hot rolled steel flat bar.
- 6 feet of  $\frac{3}{8}$ " X  $1\frac{3}{4}$ " hot rolled steel flat bar.
- 6 feet of  $\frac{3}{8}$ " X 4" hot rolled steel flat bar.
- 1 foot of  $\frac{1}{2}$ " X  $\frac{1}{2}$ " cold rolled steel square bar.
- 1 foot of  $\frac{1}{2}$ " X  $\frac{3}{4}$ " cold rolled steel flat bar.
- 1 foot of  $\frac{1}{2}$ " X  $1\frac{1}{2}$ " hot rolled steel flat bar.
- 1 foot of  $\frac{3}{4}$ " X 1" cold rolled steel flat bar.
- 5 feet of 2" X 2" X  $\frac{3}{8}$ " angle iron.
- 2 feet of  $2\frac{1}{2}$ " X  $2\frac{1}{2}$ " X  $\frac{1}{2}$ " angle iron.
- 1 foot of 3" X 3" X  $\frac{1}{2}$ " angle iron.
- 10 feet of  $\frac{1}{2}$ " diameter 1018 steel round stock.
- 6 feet of 1" diameter 1018 steel round stock.
- 1 foot of 2" diameter 1018 steel round stock.
- 6 feet of 1" diameter 4140 steel round stock.
- 4 feet of  $1\frac{1}{2}$ " O.D. X 1" I.D. steel D.O.M. tubing.
- 2 feet of  $1\frac{1}{4}$ " O.D. X .5625" I.D. steel D.O.M. tubing.
- 6 feet of  $1\frac{3}{4}$ " O.D. X 1" I.D. steel D.O.M. tubing.
- 20 feet of C8X13.75 channel iron.
- 70 feet of  $3\frac{1}{2}$ " X  $2\frac{1}{2}$ " rectangular steel tube, .188" wall.
- 20 each,  $\frac{1}{2}$ "-13NC bolts,  $4\frac{1}{2}$ " long, grade 5 or higher.
- 4 each,  $\frac{1}{2}$ "-13NC bolts, 2" long, grade 8, with locknuts.



# asphalt compaction mold

## 8 inch HMA Mold List of Materials

3 each,  $\frac{1}{2}$ " thick A-36 steel plate, 72" X 72".  
4 each,  $\frac{3}{8}$ " thick A-36 steel plate, 72" X 36".  
8 each,  $\frac{3}{8}$ " thick A-36 steel plate, 72" X 21".  
8 each,  $\frac{3}{8}$ " thick A-36 steel plate, 30" X 21".  
30 feet of  $\frac{3}{4}$ " X 6" hot rolled steel flat bar.  
50 feet of  $\frac{1}{4}$ " X 4" hot rolled steel flat bar.  
6 feet of  $\frac{3}{8}$ " X  $1\frac{1}{2}$ " hot rolled steel flat bar.  
12 feet of  $\frac{3}{8}$ " X  $1\frac{3}{4}$ " hot rolled steel flat bar.  
3 feet of  $\frac{3}{8}$ " X 3" hot rolled steel flat bar.  
16 feet of  $\frac{3}{8}$ " X 4" hot rolled steel flat bar.  
2 feet of  $\frac{1}{2}$ " X  $\frac{1}{2}$ " cold rolled steel square bar.  
2 feet of  $\frac{1}{2}$ " X  $\frac{3}{4}$ " cold rolled steel flat bar.  
10 feet of  $\frac{1}{2}$ " X  $1\frac{1}{2}$ " hot rolled steel flat bar.  
5 feet of  $\frac{3}{4}$ " X 1" cold rolled steel flat bar.  
14 feet of 2" X 2" X  $\frac{3}{8}$ " angle iron.  
4 feet of  $2\frac{1}{2}$ " X  $2\frac{1}{2}$ " X  $\frac{1}{2}$ " angle iron.  
2 feet of 3" X 3" X  $\frac{1}{2}$ " angle iron.  
35 feet of  $\frac{1}{2}$ " diameter 1018 steel round stock.  
16 feet of 1" diameter 1018 steel round stock.  
4 feet of 2" diameter 1018 steel round stock.  
10 feet of 1" diameter 4140 steel round stock.  
10 feet of  $1\frac{1}{2}$ " O.D. X 1" I.D. steel D.O.M. tubing.  
6 feet of  $1\frac{1}{4}$ " O.D. X .5625" I.D. steel D.O.M. tubing.  
8 feet of  $1\frac{3}{4}$ " O.D. X 1" I.D. steel D.O.M. tubing.  
16 feet of C4 X 7.25 channel iron.  
16 feet of C8 X 13.75 channel iron.  
14 feet of 1/2"-13NC alloy 4140 threaded rod.  
8 feet of  $\frac{1}{4}$ " X 8" hot rolled steel plate.  
6 feet of  $\frac{3}{8}$ " X 8" hot rolled steel plate.  
6 feet of 1" diameter, schedule 80 pipe.  
1 foot of  $1\frac{1}{2}$ " diameter, schedule 80 pipe.  
250 feet of  $3\frac{1}{2}$ " X  $2\frac{1}{2}$ " rectangular steel tube, .188" wall.  
54 each,  $\frac{1}{2}$ "-13NC bolts,  $4\frac{1}{2}$ " long, grade 5 or higher.  
8 each,  $\frac{1}{2}$ "-13NC bolts, 2" long, grade 8, with locknuts.

# asphalt compaction mold

## 12 inch HMA Compaction Mold List of Materials

5 each,  $\frac{1}{2}$ " thick A-36 steel plate, 72" X 72".  
18 each,  $\frac{3}{8}$ " thick A-36 steel plate, 72" X 36".  
18 each,  $\frac{3}{8}$ " thick A-36 steel plate, 72" X 21".  
6 each,  $\frac{3}{8}$ " thick A-36 steel plate, 30" X 21".  
80 feet of  $\frac{3}{4}$ " X 6" hot rolled steel flat bar.  
85 feet of  $\frac{1}{4}$ " X 4" hot rolled steel flat bar.  
12 feet of  $\frac{3}{8}$ " X  $1\frac{1}{2}$ " hot rolled steel flat bar.  
25 feet of  $\frac{3}{8}$ " X  $1\frac{3}{4}$ " hot rolled steel flat bar.  
10 feet of  $\frac{3}{8}$ " X 3" hot rolled steel flat bar.  
26 feet of  $\frac{3}{8}$ " X 4" hot rolled steel flat bar.  
2 foot of  $\frac{1}{2}$ " X  $\frac{1}{2}$ " cold rolled steel square bar.  
2 foot of  $\frac{1}{2}$ " X  $\frac{3}{4}$ " cold rolled steel flat bar.  
10 feet of  $\frac{1}{2}$ " X  $1\frac{1}{2}$ " hot rolled steel flat bar.  
12 feet of  $\frac{3}{4}$ " X 1" cold rolled steel flat bar.  
30 feet of 2" X 2" X  $\frac{3}{8}$ " angle iron.  
10 feet of  $2\frac{1}{2}$ " X  $2\frac{1}{2}$ " X  $\frac{1}{2}$ " angle iron.  
2 foot of 3" X 3" X  $\frac{1}{2}$ " angle iron.  
75 feet of  $\frac{1}{2}$ " diameter 1018 steel round stock.  
22 feet of 1" diameter 1018 steel round stock.  
10 feet of 2" diameter 1018 steel round stock.  
20 feet of 1" diameter 4140 steel round stock.  
30 feet of  $1\frac{1}{2}$ " O.D. X 1" I.D. steel D.O.M. tubing.  
20 feet of  $1\frac{1}{4}$ " O.D. X .5625" I.D. steel D.O.M. tubing.  
20 feet of  $1\frac{3}{4}$ " O.D. X 1" I.D. steel D.O.M. tubing.  
30 feet of C4X7.25 channel iron.  
20 feet of C8X13.75 channel iron.  
60 feet of 1/2-13NC alloy 4140 threaded rod.  
20 feet of  $\frac{1}{4}$ " X 8" hot rolled steel plate.  
10 feet of  $\frac{1}{4}$ " X 12" hot rolled steel plate.  
20 feet of  $\frac{3}{8}$ " X 8" hot rolled steel plate.  
30 feet of 1" diameter, schedule 80 pipe.  
1 foot of  $1\frac{1}{2}$ " diameter, schedule 80 pipe.  
510 feet of  $3\frac{1}{2}$ " X  $2\frac{1}{2}$ " rectangular steel tube, .188" wall.  
100 each,  $\frac{1}{2}$ "-13NC bolts,  $4\frac{1}{2}$ " long, grade 5 or higher.  
10 each,  $\frac{1}{2}$ "-13NC bolts, 2" long, grade 8, with locknuts.

## Section 6: Operating Instructions for Asphalt Compaction Mold

1. Foreword
2. Overview
3. The Base Plate
4. Short Deck Plate
5. Long Deck Plate
6. Ramps
7. Safety Guard Rails
8. Ingot Molds
9. Ingot Extraction Tool
10. Additional Equipment for Making 8-inch Thick, and 12-inch Thick Specimens.

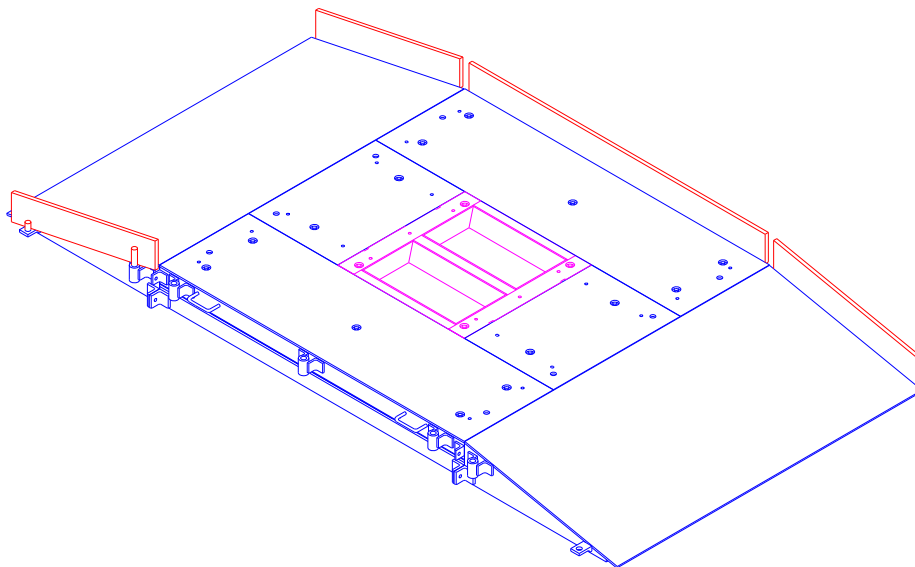


Figure 1. Basic 4" asphalt compaction mold assembly. Forward panel safety guard, and ramp guard, removed for clarity.

## 1. Foreword

The Asphalt Compaction Mold is designed to be user friendly, safe, and have maximum versatility. Many of its components are modular, and interchangeable. The ingot molds themselves are designed to be used in multiple orientations, and multiple styles of molds can be used to make many different sizes of specimens. The overall system has many redundant features, to provide for the safest level of operation, and ease of use.

Even though the mold was designed to be used with a smaller riding compactor, the strength of the assembly allows it to accommodate weights of up to 22,000 pounds safely. The safety guards allow the use of a rolling wheel up to 36” wide to make edge of wheel to center of mold passes, with 2” clearance on either side.

The operating instructions for the Asphalt Compaction Mold, (ACM), are presented along three main topics: a discussion about the function of each of the major components, the assembly procedures for each of the components, and a description of the use or operation of the components. These instructions are written to describe the basic, single unit, 4” lift mold. The last chapter discusses the additional equipment used when expanding the mold to accommodate ingot molds for both 8” and 12” lifts.



## 2. Overview

In use, the operation of the ACM is quite simple. The mold is preheated prior to compacting an ingot. In standard practice this is usually accomplished through the use of heat lamps affixed inside a wooden box placed over the mold. Once the mold has been preheated, a sample of hot mixed asphalt concrete is placed into the ingot mold. Then a power driven, or manual rolling compactor is used to compress the sample into the ingot mold. The rolling compactor may be allowed to travel back and forth the full length of the ACM without danger.

Once the asphalt sample has cooled, the ingot mold assembly can be unbolted from the rest of the ACM, and lifted free by use of a set of eyebolts. Once the mold has been removed, it can be inverted by use of a steel bar, inserted through tubes under the mold assembly. When the ingot mold is turned upside down, the asphalt specimens usually fall free of the mold. If the ingots stick in the mold, then an ingot extractor tool can be used to free them.



### 3. Base Plate

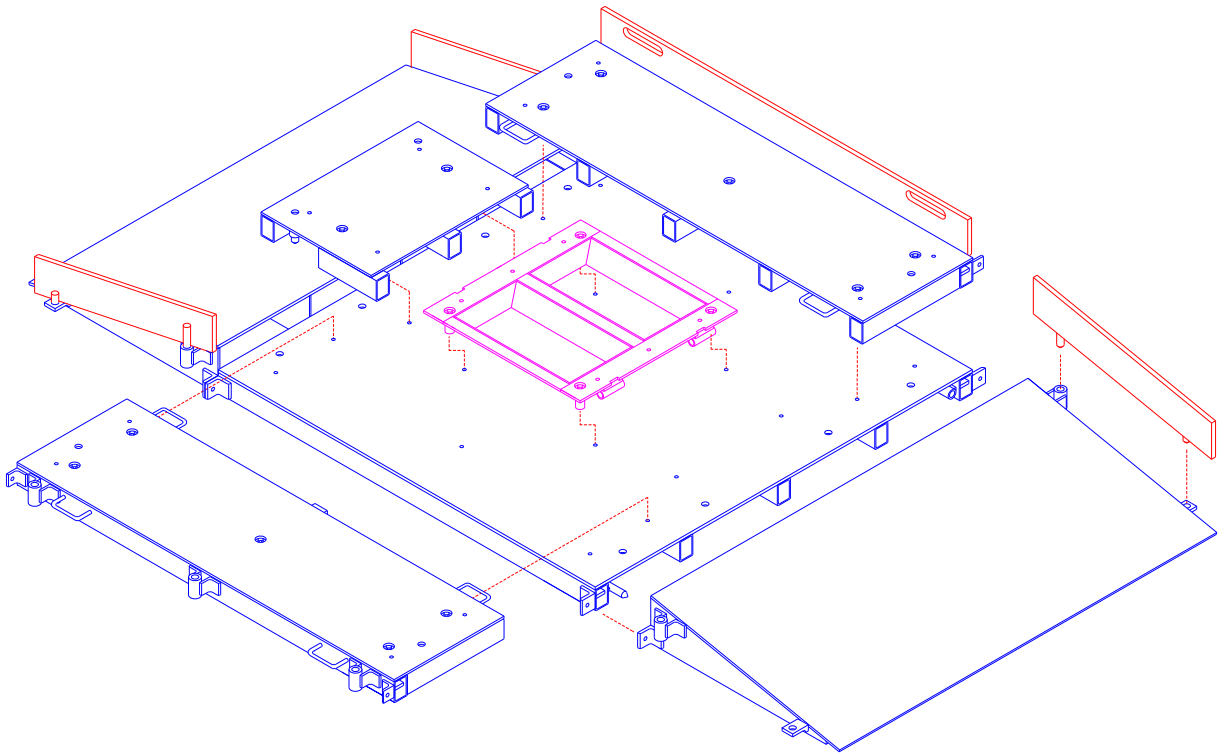
The base plate forms the foundation of the entire compaction mold. Made from ½” thick steel plate, it performs multiple functions. A tube and socket connection underneath the base plate allows a row of base plates to be linked up in series. This is useful, either when producing multiple simultaneous specimens, or when making lifts of 8” or 12” depth. Each base plate is secured to the next by ½” bolts, passed through angle iron flanges at the corners. If needed, the correct spacing between base plates can be maintained by thick spacer washers placed in-between the flanges on each of these bolts.

A pattern of threaded holes provides the attachment points for all of the deck plates, and the mold assembly, which are fastened by long bolts from above the base plate. A series of through holes act as alignment guides for positioning pins on the long and short deck plates. The combination of guide holes and bolt holes makes it easy to assemble the panels in the correct orientation. All of the holes are mirrored on each half of the base plate, so even when the base plates are rotated 180 degrees, these hole patterns are designed remain the same. All the base plates are identical, and interchangeable.

For proper operation, the base plate should be placed on a level concrete surface, of sufficient strength to support the rolling compactor which will be used. It is not absolutely necessary that the floor be perfectly level, but it is always most desirable to have the ACM set directly upon smooth concrete, to attain proper surface contact. If the support surface is slightly uneven, then ¾” thick plywood sheets may be placed together to form a continuous flooring surface between the concrete and the base plate. The weight of the rolling compactor should settle the ACM into the wooden flooring with repeated use.

You should never attempt to level individual base plates with wedges, shims or small pads. These will not provide full surface contact, and may cause localized loading and stress concentrations which may cause bending of the ACM under high loads.

If it is anticipated that additional base plate segments will be attached to facilitate a set of gang molds, then the original base plate should be positioned in a location which will accommodate further expansion. Once the base plate has been placed in position, it will be time to install the deck plates.



#### **4. Short Deck Plate**

The deck plates form the surface upon which the rolling compactor will travel. Both the long and short deck panels surround the ingot mold, and support the rolling compactor as it compresses the asphalt into the mold.

The short deck plates have a set of alignment pins which fit into corresponding holes in the base plate. This assures proper alignment. Each short deck plate has a set of sockets directly above the alignment pins, which are designed to accept the alignment pins of yet another short deck plate. In this way, several short deck plates may be stacked upon each other, and will still retain the correct alignment.

The short deck plates are fastened to the base plate via a pair of ½” diameter bolts. The heads of these bolts rest in a recess, below the top surface of the short deck plate. This allows the rolling compactor to travel over the panel surface, without contacting the bolt heads. All of the short deck plates are identical, and interchangeable. Though they can be placed on either end of the base plate, their attachment hole and alignment pin configuration prevents them from being installed incorrectly.

Three of the under ribs of the short deck plate extend 1” beyond the edge of the panel surface. These act as supports for the flange around the top of the ingot mold.



## **5. Long Deck Plate**

The long deck plates function much the same as the short deck plates, but have several additional features. Like the short deck plates, the long deck plates have a set of alignment pins and sockets. This allows up to three deck plates to be stacked atop each other, to accommodate the mold for a 12” lift ingot.

The long deck plates have the same type of recessed-head bolt attachment as the short deck plates, but with five bolt holes instead of two. Only the one central under-rib of the long deck plate extends beyond the panel. This extended rib also acts as a support for the ingot mold flange.

Because it is longer, and heavier, the long deck plate has four lifting handles to make installation and removal easier. On the outer edge of the long deck plate are three mounting sockets for the safety guard rail. The angle iron flanges on the outside corners of the long deck plates are to facilitate the mounting of the ramps that are used as approaches by the rolling compactor. If several ACM segments are joined in series, and the greatest possible rigidity is desired, then these angle iron flanges may be used to secure the long panels on one segment to those on the next. (This is not generally required.)

Both the long and short deck plates may be removed or installed individually, and in no particular order. To remove, the plates are simply unbolted, and lifted off of the base plate.

## 6. Ramps

There are two types of ramps employed with the ACM. A higher ramp is used as an approach on both ends of the ACM, or on both ends of a series of ACM segments. Ramps which are half as high are used when additional layers of deck plates have been stacked up to facilitate either 8" or 12" lift ingots. The shorter ramps are not used with the 4" lift ingot mold configuration.

The higher ramps have the same type of pin and socket alignment equipment as the base plates, and will interconnect with them. An angle iron flange on the higher ramps will mate with the flange on the corner of the base plates, and the two will be joined using ½" bolts.

The higher ramps have socket mounts to accept ramp safety guard rails. These higher ramps are used at either end of the ACM, to drive the rolling compactor up off the floor, and onto the ACM.

The shorter ramps do not have alignment pins or sockets, and have no provision for mounting safety guards. The angle iron flanges on the short ramps mate with the flanges on the ends of the long deck plates. The short ramps are secured to the long deck plates with ½" bolts. The short ramps are used when several layers of deck plates are employed. The short ramps are placed on one level of deck plate, and allow the rolling compactor to move up to the next level of plates. When using an 8" lift ingot mold, the deck plates are stacked two high, and two short ramps are used. When using a 12" lift ingot mold, the deck panels are stacked three high, and four of the short ramps are employed to allow the rolling compactor access to the mold.

## 7. Safety Guards Rails

When using the ACM, especially when making 8” and 12” lifts, great care must be taken not to allow the rolling compactor to fall off the side of the compaction mold assembly, as the rolling compactor may tip over, causing great mechanical damage, and danger to the operator and bystanders.

The ACM is equipped with a robust safety guard rail on either side of the assembly. This guard rail is made of ¾” thick steel, 6” high, and is held in position by 1” diameter steel pins.

There are two types of safety guard rails used on the ACM; panel guards, and ramp guards. The panel guard rails are straight, have three attachment pins, and are 70” long. They attach to the mounting sockets on the outside edge of the long deck plates. The panel guards are identical, and are interchangeable.

The ramp guard rails are shorter, and trapezoid in shape. They have two attachment pins; one of standard length, and one stub pin. The ramp guard rails mount to the higher “end” ramps only, and are not interchangeable. One ramp guard will fit on the left side of the ramp, and the other will fit on the right.

(Though they offer a degree of safety, no safety feature is full proof. It would be very difficult to do, but a large industrial rolling compactor can be driven over the top of these guards! The Asphalt Compaction Mold should only be used by competent personnel, trained in the proper use of a rolling compactor.)

## 8. Ingot Molds

The ingot molds are the heart of the ACM. There are three different configurations. The basic mold has two cavities, and will produce two 4" deep ingots at a time. The molds which produce 8" and 12" deep ingots are both single cavity. All of the ingot molds have a symmetrical mounting bolt pattern, and can be rotated at 90 degree intervals in the ACM.

Even though the three sizes of ingot molds have different size ingot trays, and different width mold flanges, there are many features which all the molds have in common. All of the ingot molds bolt down to the base plate using ½" bolts, in a square pattern 25" on a side. All of the ingot molds feature six ½" threaded holes, which may be used for either attaching lifting eyes, or for use with jacking bolts.

All of the ingot molds have four slots arranged along their perimeter, to be used as prying points when lifting the mold assembly out of the ACM. All of the ingot molds have four tubes, positioned beneath the flange, to facilitate both inverting the mold assembly, and attaching the ingot extracting tool.

Once the deck plates are bolted to the base plate, the ingot mold assembly can be inserted into the recess this creates in the center of the compaction mold. Four ½" bolts are inserted into the bolt guides on the ingot mold assembly. These guide tubes also act as standoffs, providing additional support for the ingot mold. The heads of the bolts are in recesses, below the level of the surface of the ingot mold. Once the bolts are tightened, the ingot mold is in place, and ready to be used.

The ingot molds are preheated, and hot asphalt concrete is placed into the mold cavities. The asphalt is compacted while hot, and is then allowed to cool. Once the asphalt ingots have cooled, it is time to remove the ingot mold from the base and deck plates.

The four bolts which retain the ingot mold are loosened, and removed. It is recommended that four ½" eyebolts be screwed into the threaded holes near the corners of the ingot mold flange. The ingot

mold, with the asphalt specimens still inside, can then be lifted free from the rest of the assembly using a crane, forklift, hoist, lifting bar, or some other contrivance.

Once clear of its recess, the ingot mold may be placed upon the surface of the deck plates. The lifting eyes are now removed, and a steel bar passed through a set of the tubes under the ingot mold flange, on one side of the mold only. A sling, chain or hoist is attached to both ends of this bar. By lifting the ingot mold using this bar, the entire assembly will travel over center as soon as the ingot molds are lifted clear of the deck plates. The ingot molds may now be lowered, and will settle in a position upside-down from the one from which they were lifted.

The ingots should come free from the mold as it is being lowered into the upside-down position. To form a cushion to prevent possible damage to the ingots as they come out of the ingot mold, the mold may be lowered onto layers of burlap, a thick sheet of foam, or some other suitable material. If the ingots do not come free from the mold, the bottom of the mold, which will now be facing up, is open, exposing the bottom of the asphalt ingot. Because of its tapered configuration, a pressure applied to the bottom of the asphalt ingot should force it from the mold assembly.

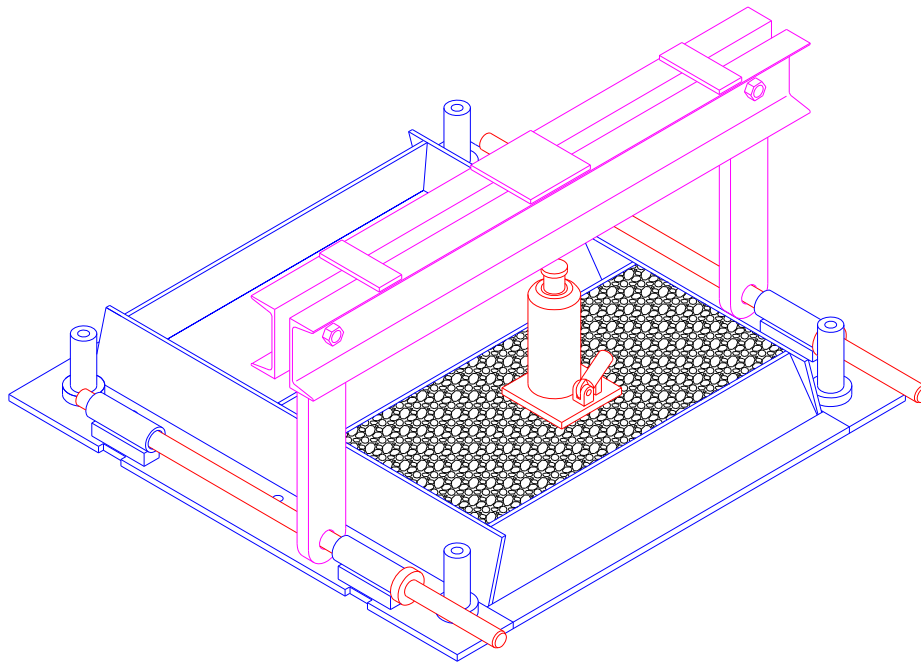
Should the ingots become stuck in the mold cavities, an ingot extraction tool can be used to remove them. This consists of a strong back with two links, two steel bars, and a hydraulic jack.

## 9. Using the Ingot Extraction Tool

The mold, with the stuck ingots in it, is inverted and placed on a raised surface so that the ingots will have room to fall free of the mold. Usually the mold is placed upside-down on a pair of wood two by four.

Next a flat piece of metal plate is placed on the bottom of the asphalt ingot, to spread out the force of the extracting tool. A 10 ton hand operated hydraulic jack is then placed on top of the metal plate. The strong back with links is positioned over the hydraulic jack, and the links are attached to the mold body by passing steel bars through both the extraction tool mounts on the mold, and the holes on the end of the links.

With the ingot extraction tool now installed, the jack is cranked by hand until enough force is exerted on the asphalt ingot to extract it from the mold cavity.





## **10. Additional Equipment to be Used for Making 8-Inch Thick, and 12-Inch Thick Specimens**

The modular design of the ACM allows several base plate & deck plate assemblies to be linked together. If only one or two of these assemblies are linked in a row, they can only be used to make the 4” deep asphalt ingot molds. However, when three sets of plates are linked together, a second layer of deck plates can be stacked on top of the center panel. This configuration will permit the use of an 8” deep ingot mold. When five sets of plates are linked together, the three center panels can be stacked two high, and the centermost panel can be stacked with a third set of deck plates to accommodate the use of a 12” deep ingot mold.

To set up an 8” deep ingot mold, first bolt together three, (or more), base plate assemblies. The long and short deck plates for these may be set in place, but only the deck plates on the first and last set are bolted down. Do not place any bolts into the deck plates on the center section. A set of the higher base ramps is bolted to both ends of this series of plates.

Either 4” deep asphalt ingot molds may be bolted into position on the first and third set of plates, or these positions may be left empty. A second set of deck plates is stacked up on the center panel. This double high stack of deck plates is bolted down with special 9½” long, high strength bolts, which will pass through both layers of panels. A set of the shorter panel ramps is bolted to each end of this second set of deck plates on the center panel. Now there should be ramps allowing the rolling compactor access on and off the ACM, and also up to the second layer of deck plates.

The single cavity, 8” deep asphalt ingot mold may now be inserted into its recess in the center panel. The mold is also bolted down with the same 9½” long high strength bolts.

Once the mold is bolted down, the guards are ready to be installed. Simply line up the steel pins in the guards with the socket mounts on the sides of the long deck plates, and set the guards into position. The ramp



guards install in the same manner into socket mounts on the base ramps, but there are left hand and right hand guards. The left hand guards will only insert into the left side of the ramp and the right hand guards into the right. No guards are needed on the panel ramps.

The ACM with the 8" deep ingot mold is now ready to use. The mold may either be preheated, and asphalt placed into the mold to be compacted into an 8" deep specimen, or a dual layer specimen may be produced. To make an 8" specimen using two different types or layers of asphalt, place a 4" deep asphalt ingot into the bottom of the 8" mold, and compact an additional lift on top of it. Once the ingot has cooled, the mold is unbolted, lifted out and inverted with the same process as the 4" ingot mold.

To produce 12" ingots, at least five base plate and deck plate assemblies need to be linked together. All five sections will have a layer of long and short deck plates installed, but the center three sections are not to be bolted down. Installing ingot molds is optional. As always, a set of base ramps is placed at either end of the mold segments.

A second layer of deck plates is installed on top of the center three plate assemblies. The 9½" long high strength bolts are used to fasten down the second layer of deck plates on the second and forth in the series of plates, but the center plate, (the third in the series of plate assemblies), is left unbolted. Then a third layer of deck plated is placed on the center plate assembly, and is bolted down using 13½" long high strength bolts.

Four of the panel ramps are now used. Two of the panel ramps are places at either end of the third level of deck plates on the center plate assembly. Another set of panel ramps are attached to the ends of the second set of deck plates, on the second and forth set of plates. A total of six ramps are now employed to lift the rolling compactor from floor level up to the 12" ingot mold, and back again.

Now the ramp and panel guard rails are inserted, the same as they were on the 8" mold ACM. Finally the 12" deep single cavity asphalt ingot mold is inserted into the recess in the center panel assembly. The

mold is bolted down using the 13½” high strength bolts. The 12” ACM is now ready to be used.

A single homogenous ingot, 12” deep may be produced, or different combinations of multiple layer ingots can be made. An 8” deep ingot may be placed in the 12” mold, and a 4” lift added. Or, a double layer ingot, produced by placing a 4” ingot into an 8” mold, may be placed into the 12” mold and given a third lift. If a concrete mold is made to simulate an 8” deep ingot, then this specimen can be placed in the 12” deep mold, and a 4” asphalt overlay can be added.

Once the ingot cools, it may be unbolted, lifted and inverted in the customary manner. Caution is advised when handling the 12” ingots and mold, as the 12” deep specimens are very heavy.