LANCASTER COUNTY ADULT DETENTION FACILITY

Third Level Floor Infill Structural Analysis

June 19, 2012

BVH ARCHITECTS

SINCLAIR hille architects

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A. PROJECT DESIGN TEAM

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BVH ARCHITECTS

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B. BACKGROUND

A space planning study for the reuse of the existing Lancaster County Adult Detention Facility was conducted by the BVH Architects / Sinclair Hille Architects design team in the spring of 2012 that demonstrated how various Lancaster County agencies currently located throughout Lincoln could be consolidated to the central City/County governmental campus. The reuse study also addressed the anticipated growth of the County, District and Juvenile court systems well into the future.

One key issue with the existing building that was identified as part of the reuse study is the configuration of the Third Level Floor Plan. This level contains the cell room mezzanines adjacent the visitor areas, mechanical rooms, internal roof well and open upper volumes of the day rooms and exercise rooms. The resulting floor area is virtually unusable for office or future courtroom functions, however, one potential use for this floor in its current configuration would be Police Evidence Storage.

As such, the reuse study recommended three (3) options for the Third Floor Level as follows:

1. Infill all of the open upper volumes of the day rooms and exercise rooms with new floor structure. Convert the internal roof well to floor space by adding a new mechanical equipment penthouse and roof above. This would create a complete and flexible floor plate (except at the existing mechanical rooms) for office and future courtroom occupancy.

2. Infill the open upper volumes of the day rooms and exercise rooms with new floor structure on the north half of the building only. Convert all or part of the internal roof well to floor space by adding a new mechanical equipment penthouse and roof above. This option would create a usable floor plate for the long term future expansion of the District Court system at the north half of the floor. The remaining south half of the floor could be utilized for Police Evidence Storage (or similar light storage) if all of the concrete masonry unit partition walls are removed to increase the existing floor loading capacity.

3. Leave the existing floor as is with no new floor structure infill. Utilize the internal roof well for additional air-handling mechanical equipment. The entire floor could be utilized for Police Evidence Storage (or similar light storage) if all of the concrete masonry unit partition walls are removed to increase the existing floor loading capacity.

Because the reuse study space plan relied on these new floor areas in the scenario that maximized the occupancy of the building, it was recognized that further structural analysis was needed to verify the feasibility of the floor infills before moving forward with the implementation of the facility reuse.

An additional finding of the reuse study was the need to increase the HVAC capacity of the building for future office and courtroom occupancies. As noted above, one solution would be to add an air-handling equipment penthouse on the roof similar to what was done with the Justice and Law Enforcement Center project in 1996. This structural analysis includes the conversion of the internal roof well on the Third Floor Level to occupied floor space as well as the addition of a mechanical equipment penthouse above this area.

C. EXISTING BUILDING STRUCTURAL ANALYSIS

The existing building structure is comprised of a precast concrete post and beam frame supporting precast concrete twin-tee floor systems. One exception to this system is the use of a structural precast concrete floor slab with cast-in-place concrete topping at the perimeter mezzanine level cell rooms on the Third Floor Level. Additionally, this structural floor slab is cantilevered to form the mezzanine level walkway network that access the cell rooms. The building's structural frame is supported on a pile foundation system.

The following key findings were revealed after review of the existing structural design:

- The perimeter mezzanine level cell room cast-in-place concrete floor system has a design live load capacity of 40 psf which is inadequate for the live loads required for office or light storage occupancy. This floor system also supports a relatively high dead load in the form of the concrete masonry unit walls that form the cell rooms. The demolition and removal of these existing concrete masonry unit walls would remove a significant amount of dead load and increase the live load capacity to 100 psf. For comparison, the International Building Code currently requires new office buildings to have a minimum floor live load capacity of 65 psf.

- The perimeter mezzanine level floors cantilever beyond the existing beam line at the cell room walls to form the walkways that access the cell rooms. The live load capacity of these walkways is extremely low. This analysis recommends that these cantilevered floors be removed and replaced with the proposed new floor infills.

- The recessed roof well at the Third Floor Level is precast concrete twin tee construction and has a live load design capacity that exceeds 100 psf. As such, it is possible to enclose this roof well and convert it to occupied space.

- The typical precast concrete structural design approach would be to design the structural members to carry the actual design loads with little additional gravity load capacity. To that end no additional load is proposed to be placed on existing structural frame members including the beam members at the perimeter of the new floor infill areas. These new floors should be supported independently.

- The typical pile and pile cap foundation design approach would allow for some additional bearing capacity based on the following analysis. The existing 16" diameter piles were originally rated at 200 kips each which is approximately 25% of the concrete strength for end bearing capacity. Because piles can typically handle up to 30% of the concrete strength in end bearing this would increase the bearing capacity 20% to 240 kips each. The new loads are considerably less than a 20% increase to the pile. To that end, in some locations relatively light column loads from the new floor infills above are proposed to bear on existing pile caps adjacent existing column locations.

C. NEW FLOOR INFILL STRUCTURAL DESIGN APPROACH

Several structural floor systems were evaluated for the new floor infills. The recommended system is a composite steel floor system at the floor infills supported by new steel columns that extend down through the Second, First and Ground Floor Levels and bear on existing pile caps or new spread footings. This is the best approach when considering the construction logistics of erecting the new floor structures within the existing building. The new steel beams, columns and decking would be brought into the building through existing window openings or new temporary roof openings. Concrete for the floor slabs would be pumped into place through existing window openings.

The new floor structure design is based on the following criteria:

- The new floor infill structure has design load capacities of 10 psf superimposed dead load + 100 psf live load.

- As the new steel pipe columns extend from the new floor structure on the Third Level to foundations, they pass through the Ground Level parking area and future Prisoner Transfer Sally Port. In these locations the new columns will be encased in 16" diameter concrete shrouds for fire protection and protection from parking law enforcement vehicles.

- The new spread footings were designed for a 1500 psf allowable soil bearing pressure to minimize the differential settlement between the new footings and the existing structure.

- For the purposes of this structural analysis, the floor infill framing and column locations in the southeast quadrant are proposed to be similar to the framing and column locations in the northeast quadrant. However, note that the Ground Floor of the southeast quadrant houses existing major mechanical and electrical system equipment for the building. If the Third Level floor infill is pursued as part of the reuse plan, additional structure and/or equipment location adjustments may be necessary to accommodate the new footing locations.

The biggest challenge to the preliminary structural design was developing a framing plan that positioned the new columns such that they missed existing framing members and precast twin-tee web members and at the same time had minimal impact on the Ground Level parking layout and proposed Prisoner Transfer Sally Port plan. Refer to New Footing Plans on Sheets 1.0 and 1.1 which show the preliminary locations for new columns and footings. Note that while the locations never eliminate a parking stall, they do in many instances frame a parking stall with columns on both sides resulting in the need for additional care when parking law enforcement vehicles.

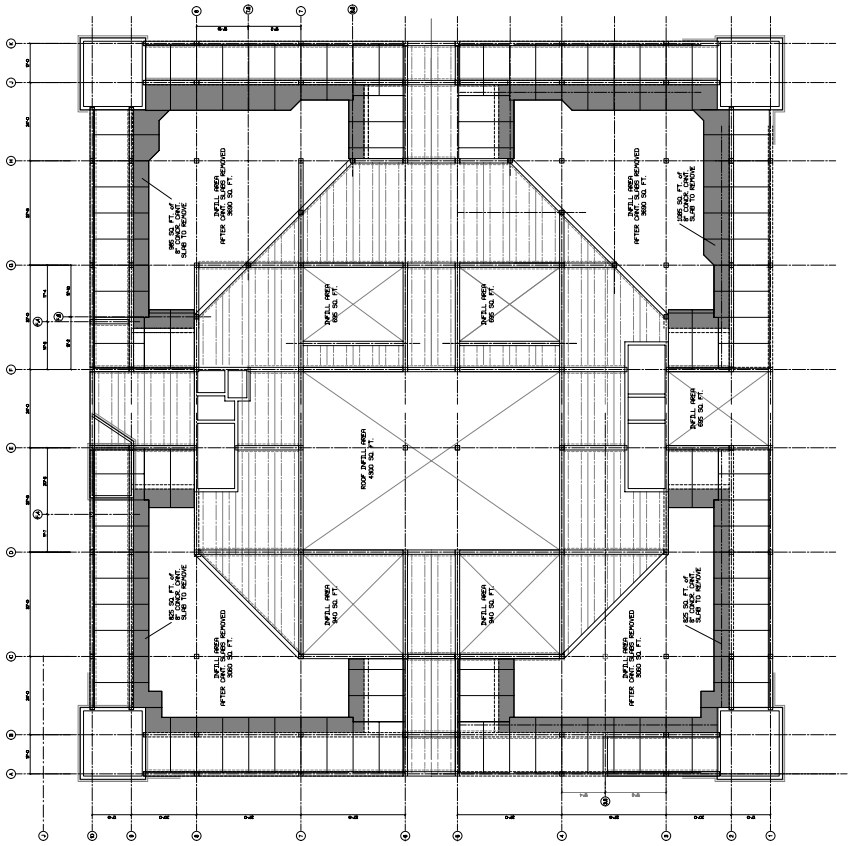
C. PRELIMINARY STRUCTURAL DESIGN DRAWINGS

The preliminary structural plans that follow were developed to illustrate the structural design approach to the Third Level floor infills and a new mechanical equipment penthouse. These drawings were also utilized to develop the Opinion of Probable Construction Cost. The drawings that follow are:

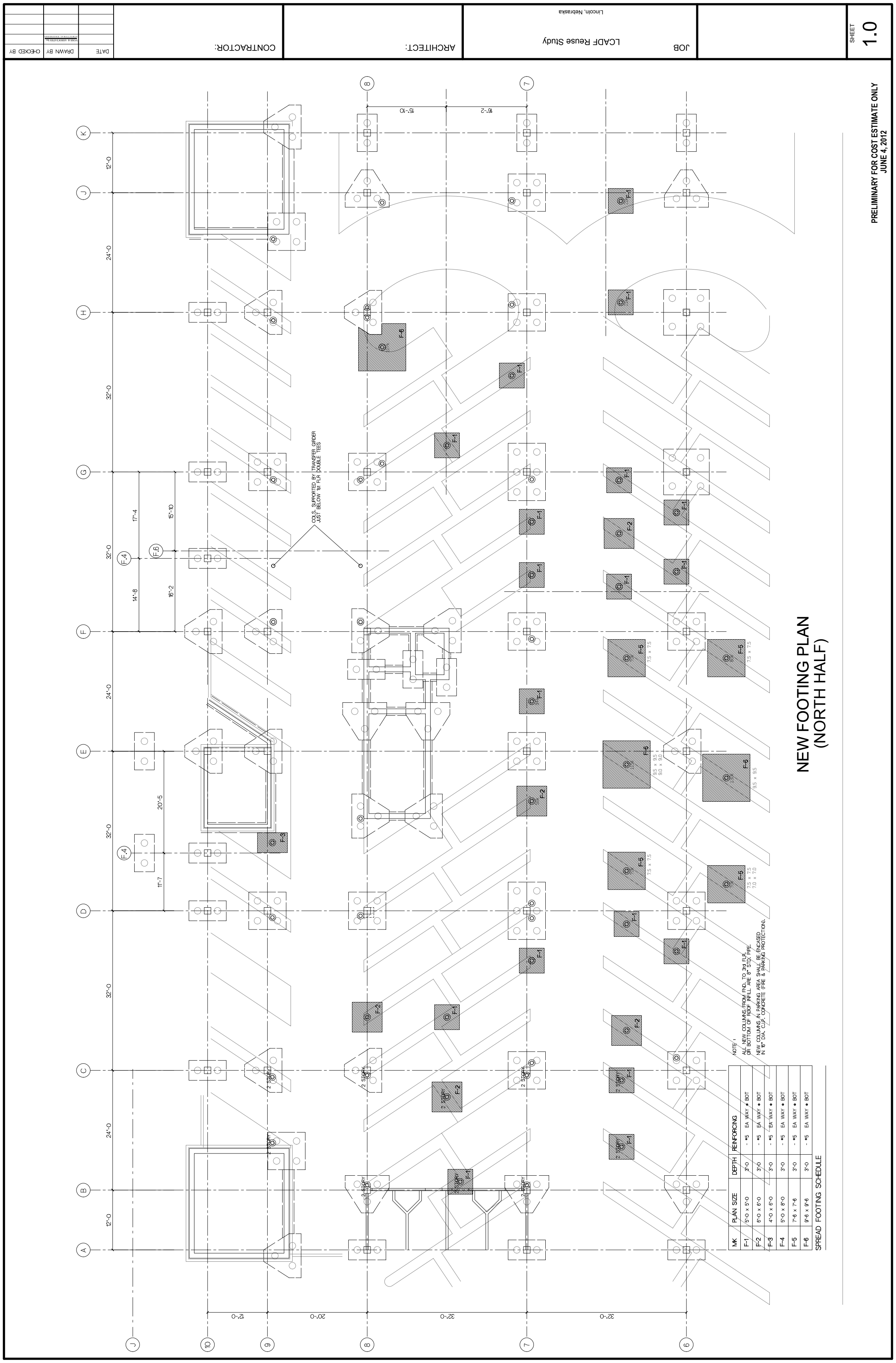
- Sheet 0.1, NEW INFILL AREAS – 3RD LEVEL & ROOF
- Sheet 1.0, NEW FOOTING PLAN (North Half)
- Sheet 1.1, NEW FOOTING PLAN (South Half)
- Sheet 2.0, NEW INFILL FRAMING – 3RD LEVEL (North Half)
- Sheet 2.0a, NEW INFILL FRAMING – 3RD LEVEL (North Half), This plan is identical to Sheet 2.0 with the addition of the precast concrete twin-tee and parking pattern layouts superimposed on the plan.
- Sheet 2.1, NEW INFILL FRAMING – 3RD LEVEL (South Half)
- Sheet 2.1a, NEW INFILL FRAMING – 3RD LEVEL (South Half), This plan is identical to Sheet 2.1 with the addition of the precast concrete twin-tee and parking pattern layouts superimposed on the plan.
- Sheet 2.2, NEW INFILL FRAMING – ROOF LEVEL & NEW PENTHOUSE ROOF FRAMING

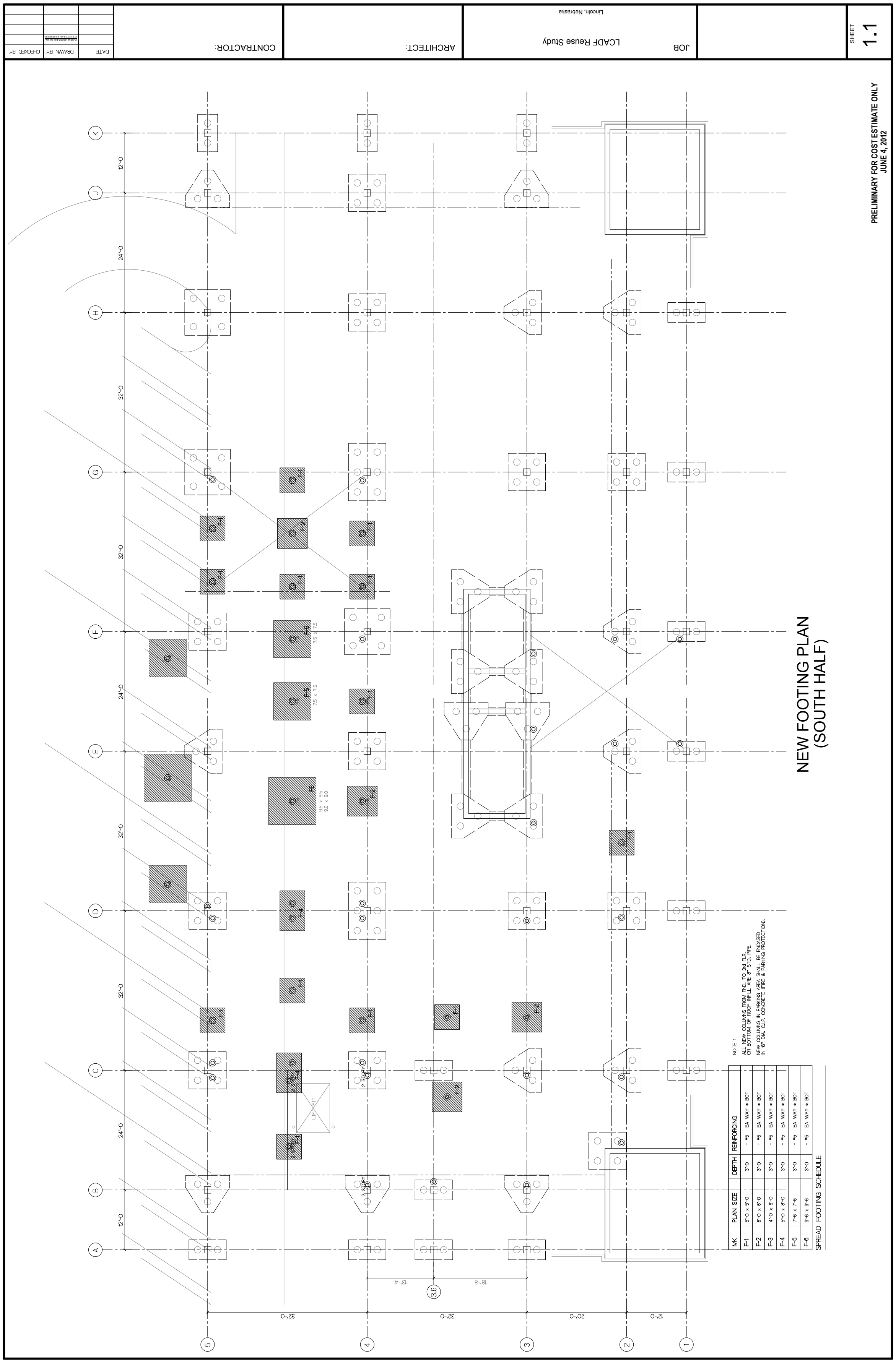
DATE	DRAWN BY	CHECKED BY	CONTRACTOR:	ARCHITECT:	JOB		SHEET
					LCADF Reuse Study Lincoln, Nebraska		0.1

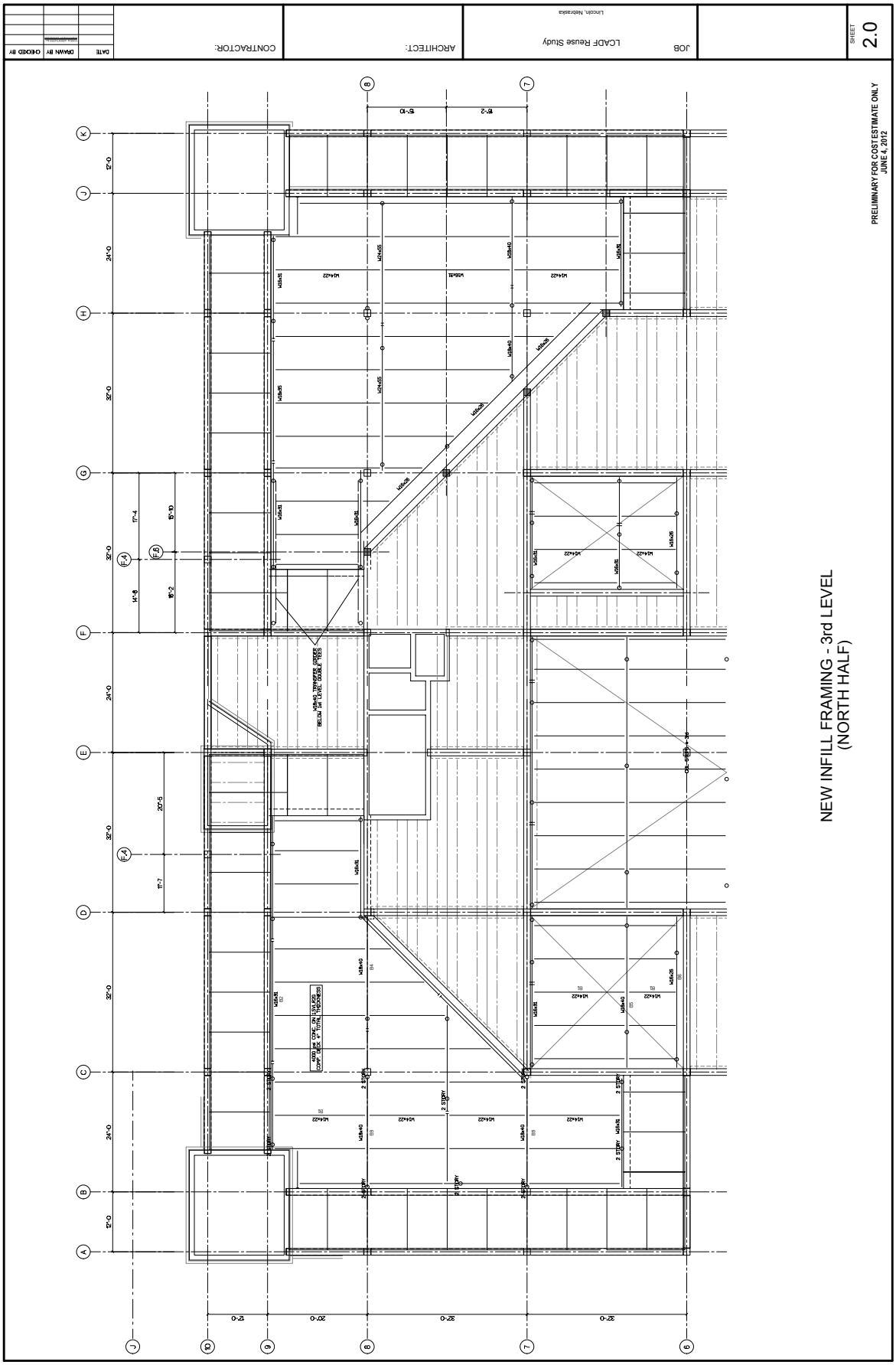
PRELIMINARY FOR COST ESTIMATE ONLY
JUNE 4, 2012



NEW INFILL AREAS - 3rd LEVEL & ROOF


NEW FOOTING PLAN
(NORTH HALF)
PRELIMINARY FOR COST ESTIMATE ONLY
JUNE 4, 2012
SHEET
1.0
JOB
LCADF Reuse Study
Lincoln, Nebraska
ARCHITECT:
CONTRACTOR:
DATE
DRAWN BY
CHECKED BY
COLS. SUPPORTED BY TRANSFER GIRDER
JUST BELOW 1st FLR DOUBLE TEES
NOTE :
ALL NEW COLUMNS FROM FND. TO 3rd FLR.
OR BOTTOM OF ROOF INFILL ARE 8" STD. PIPE.
NEW COLUMNS IN PARKING AREA SHALL BE ENCASED
IN 16" DIA. C.I.P. CONCRETE (FIRE & PARKING PROTECTION).
MK | PLAN SIZE | DEPTH | REINFORCING
F-1 | 5'-0 x 5'-0 | 3'-0 | - #5 EA WAY ● BOT
F-2 | 6'-0 x 6'-0 | 3'-0 | - #5 EA WAY ● BOT
F-3 | 4'-0 x 6'-0 | 3'-0 | - #5 EA WAY ● BOT
F-4 | 5'-0 x 8'-0 | 3'-0 | - #5 EA WAY ● BOT
F-5 | 7'-6 x 7'-6 | 3'-0 | - #5 EA WAY ● BOT
F-6 | 9'-6 x 9'-6 | 3'-0 | - #5 EA WAY ● BOT
SPREAD FOOTING SCHEDULE


NEW FOOTING PLAN
(SOUTH HALF)
PRELIMINARY FOR COST ESTIMATE ONLY
JUNE 4, 2012
SHEET
1.1
JOB
LCADF Reuse Study
Lincoln, Nebraska
ARCHITECT:
CONTRACTOR:
DATE
DRAWN BY
CHECKED BY
NOTE :
ALL NEW COLUMNS FROM FND. TO 3rd FLR. OR BOTTOM OF ROOF INFILL ARE 8" STD. PIPE.
NEW COLUMNS IN PARKING AREA SHALL BE ENCASED IN 16" DIA. C.I.P. CONCRETE (FIRE & PARKING PROTECTION).
SPREAD FOOTING SCHEDULE
MK | PLAN SIZE | DEPTH | REINFORCING
F-1 | 5'-0 x 5'-0 | 3'-0 | - #5 EA WAY @ BOT
F-2 | 6'-0 x 6'-0 | 3'-0 | - #5 EA WAY @ BOT
F-3 | 4'-0 x 6'-0 | 3'-0 | - #5 EA WAY @ BOT
F-4 | 5'-0 x 8'-0 | 3'-0 | - #5 EA WAY @ BOT
F-5 | 7'-6 x 7'-6 | 3'-0 | - #5 EA WAY @ BOT
F-6 | 9'-6 x 9'-6 | 3'-0 | - #5 EA WAY @ BOT


SHEET 2.0
JOB LCADF Reuse Study
Lincoln, Nebraska
ARCHITECT:
CONTRACTOR:
DATE
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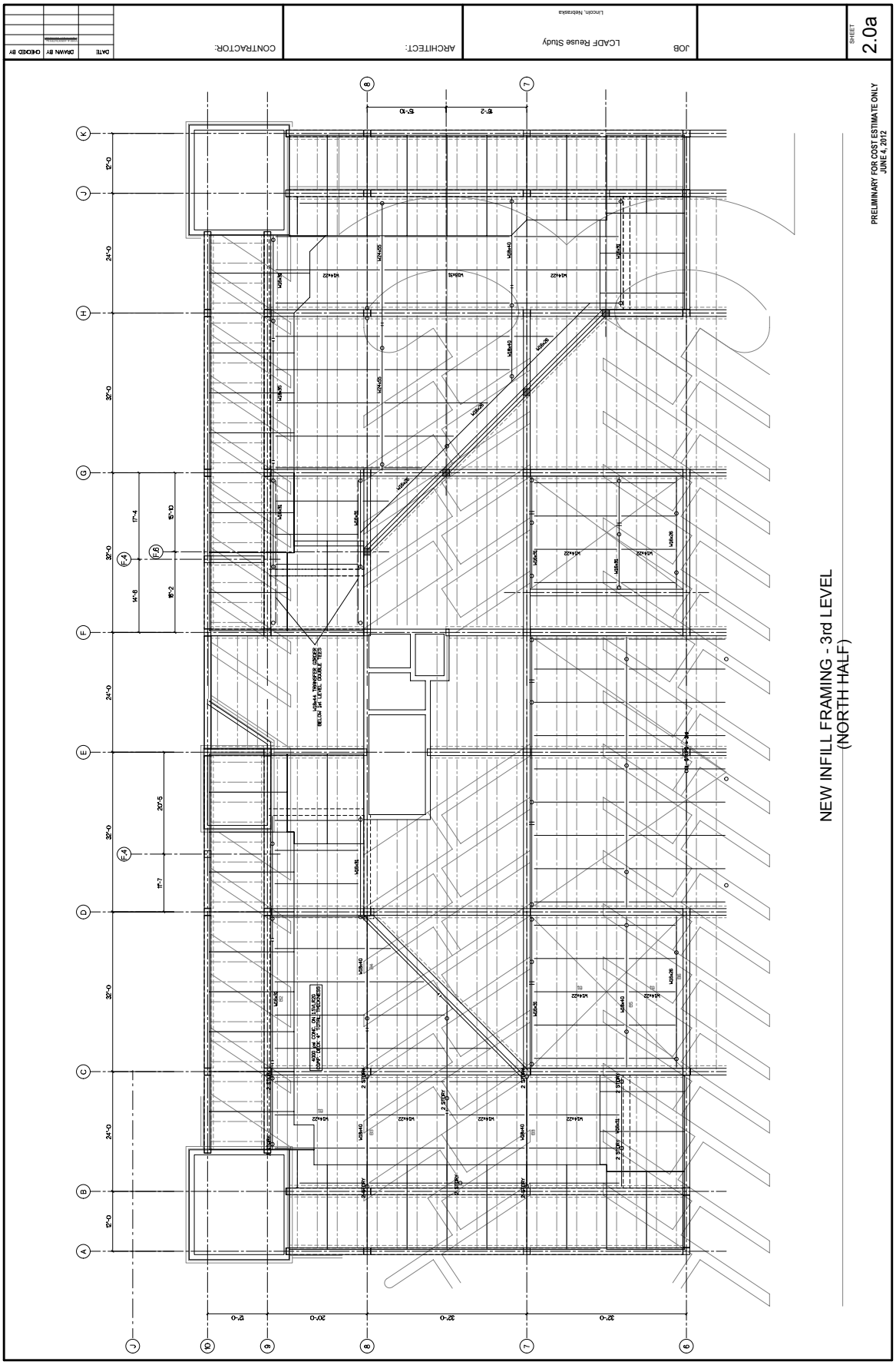
CHECKED BY
PRELIMINARY FOR COST ESTIMATE ONLY
JUNE 4, 2012
NEW INFILL FRAMING - 3rd LEVEL
(NORTH HALF)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Lincoln, Nebraska
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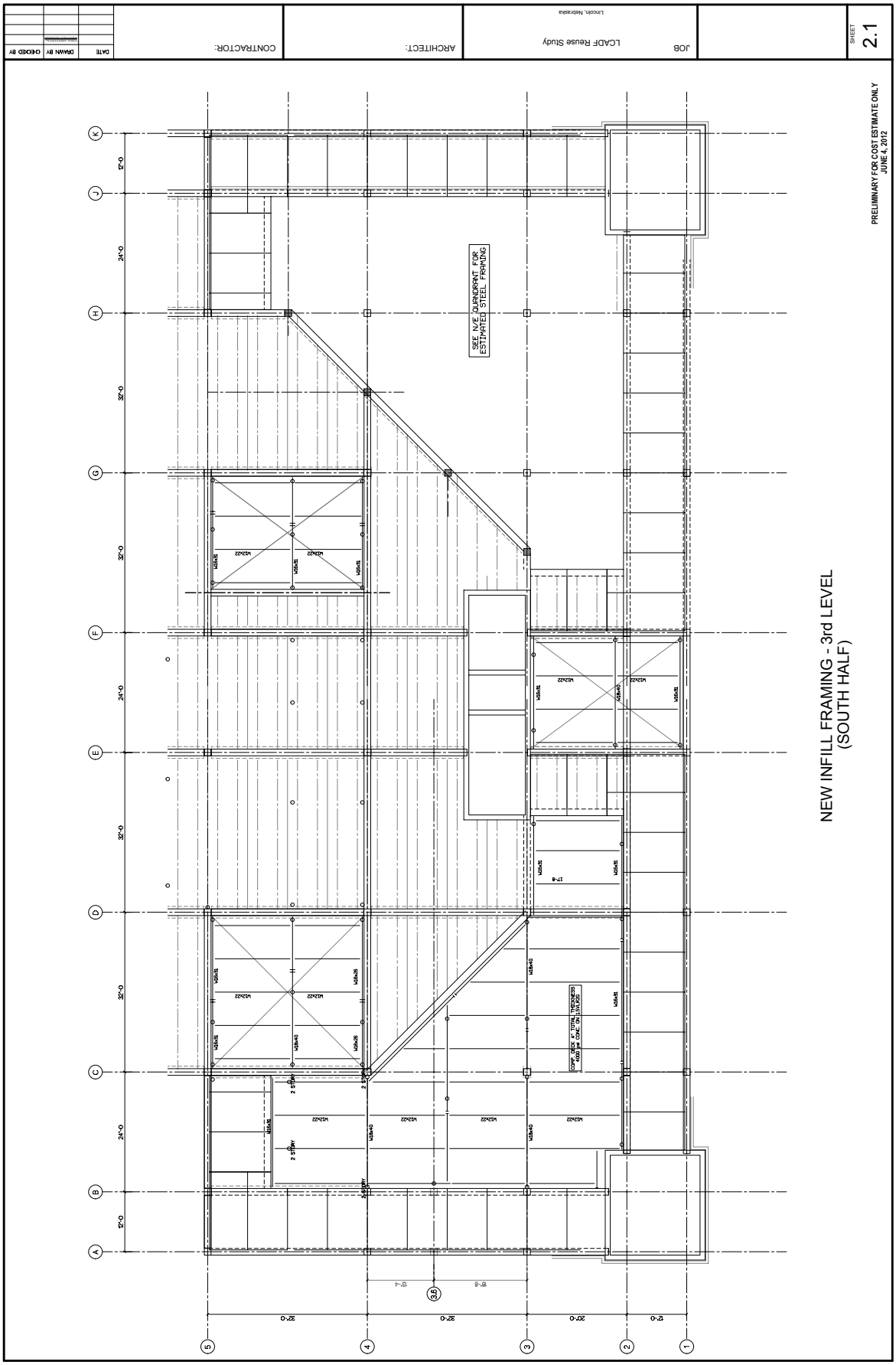
PRELIMINARY FOR COST ESTIMATE ONLY
JUNE 4, 2012
NEW INFILL FRAMING - 3rd LEVEL
(NORTH HALF)


SHEET
2.1
JOB
LCADF Reuse Study
Lincoln, Nebraska
ARCHITECT:
CONTRACTOR:
DATE
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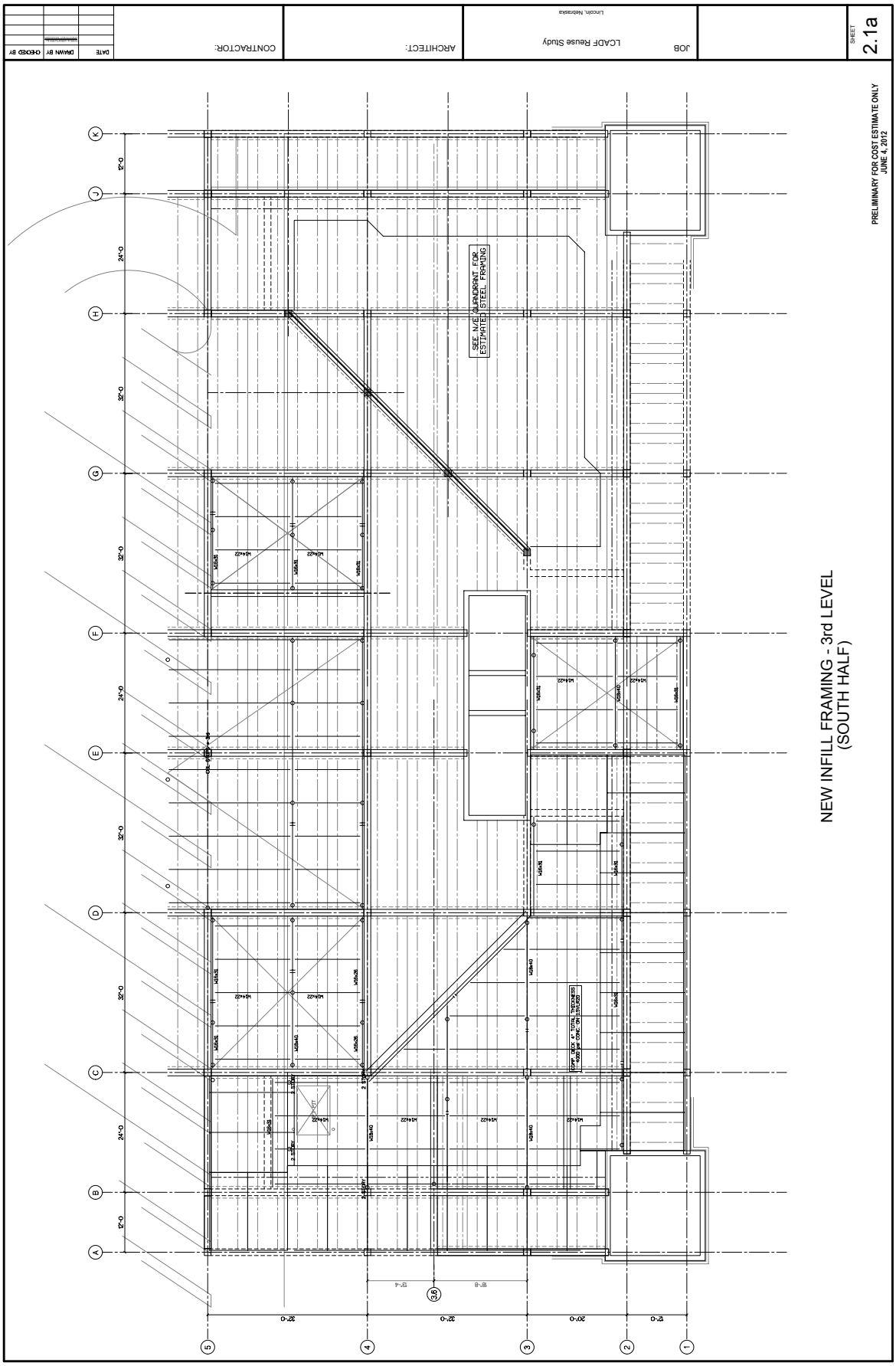
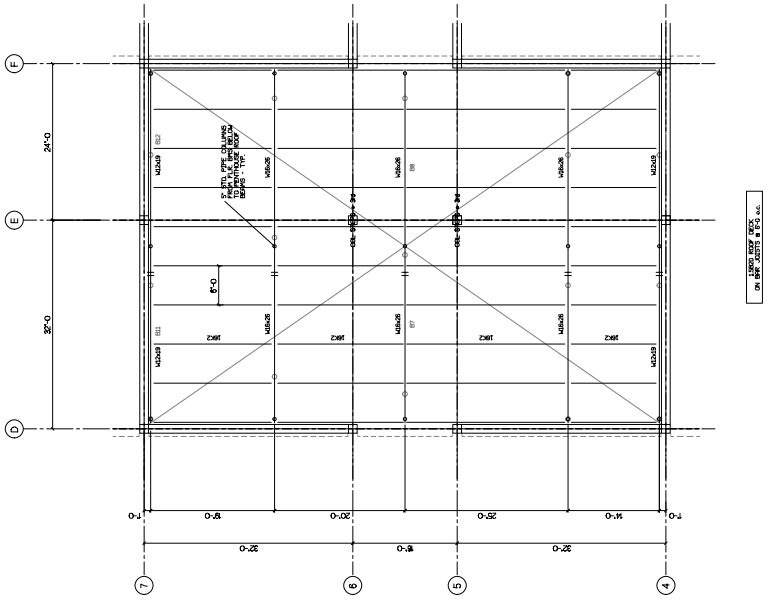
PRELIMINARY FOR COST ESTIMATE ONLY
JUNE 4, 2012
SEE N/E JOURNORANT FOR
ESTIMATED STEEL FRAMING
NEW INFILL FRAMING - 3rd LEVEL
(SOUTH HALF)

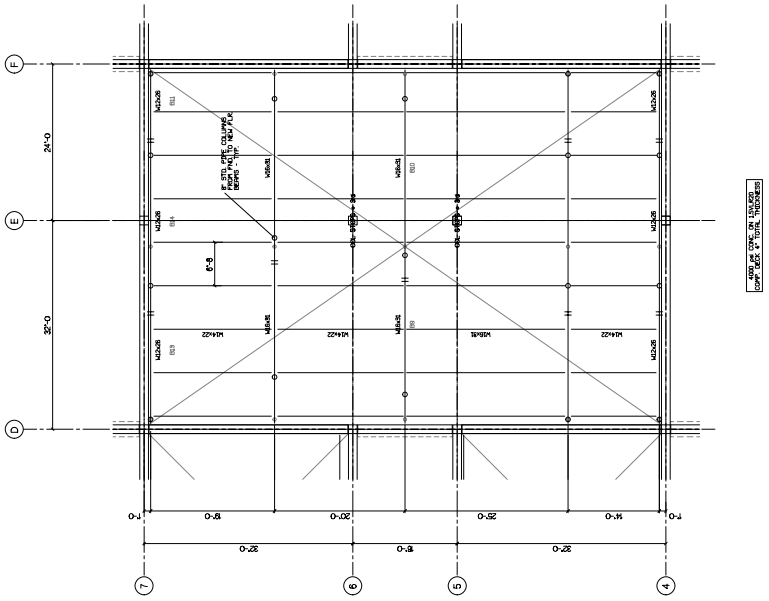

SHEET
2.1a
JOB
LOADF Reuse Study
Lincoln, Nebraska
ARCHITECT:
CONTRACTOR:
DATE
DRAWN BY
CHECKED BY
PRELIMINARY FOR COST ESTIMATE ONLY
JUNE 4, 2012
NEW INFILL FRAMING - 3rd LEVEL
(SOUTH HALF)
SEE N/E FOR HYDRANT ESTIMATED STEEL FRAMING

CONTRACTOR:	ARCHITECT:	JOB LCADF Reuse Study Lincoln, Nebraska		SHEET 2.2		
DATE	DRAWN BY	CHECKED BY				

PRELIMINARY FOR COST ESTIMATE ONLY
JUNE 4, 2012



NEW PENTHOUSE ROOF FRAMING



NEW INFILL FRAMING - ROOF LEVEL

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C. OPINION OF PROBABLE CONSTRUCTION COST

A professional construction cost estimator was consulted as part of this analysis to develop an Opinion of Probable Construction Cost. The total estimated construction cost is $1,803,935 and includes the new Third Level floor infills, the conversion of the existing internal roof well to tenant shell space and a new Fourth Floor Level mechanical equipment penthouse above the internal roof well. (For comparison, the previous Lancaster County Adult Detention Facility Reuse Study conservatively stated an Opinion of Probable Construction Cost of $3,393,060 for this scope of work.)

The total net gain of useable shell space is 21,765sf if the entire Third Level floor infill strategy is employed. This results in a construction cost of $82.88/sf for the new floor area.

The detailed breakdown of the Opinion of Probable Construction Cost is included below and on the following pages.

COST SUMMARY:

SCHEMATIC ESTIMATE- LADF STRUCTURAL INFILL	
**********	TOTAL
Interior/select demo	$110,097
Striping	$8,064
Resteel	$21,000
Paving & sidewalks	$10,263
Slabs	$87,981
Footings	$72,611
Column encasement	$30,359
Steel material	$375,000
Steel & precast erection	$300,000
Fireproofing	$70,612
Roofing/flashing	$49,280
Caulking	$2,912
Metal Studs/drywall	$56,112
Plaster patch	$11,712
Ceiling patch	$15,000
Floor patch	$30,000
Paint	$6,736
Fire sprinkler	$59,920
Plumbing	$12,000
HVAC	$9,000
Electrical	$15,000
General requirements, bond, fee	$293,245
Allowances	$0
**********	$0
Subtotal	$1,646,903
Sales tax - material	$0
Building permit	$7,032
Impact fees	$0
Builders risk	$0
Subtotal	$1,653,935
Contingency	$150,000
Total	$1,803,935

COST BREAKDOWNS:

MISC ITEMS

			Rate	Ext.	Total
**********					
Striping	40320	sf	$0.20	$8,064	$8,064
Rebar	21	tn	$1,000.00	$21,000	$21,000
Roofing/flashing	4480	sf	$11.00	$49,280	$49,280
Caulking	1456	lf	$2.00	$2,912	$2,912
Wrap columns w/ gyp	9352	sf	$6.00	$56,112	$56,112
Penthouse walls	0	sf	$0.00	$0	$0
Floor covering patch	3000	sf	$10.00	$30,000	$30,000
Ceiling patch	3000	sf	$5.00	$15,000	$15,000
Paint gyp walls	7481	sf	$0.75	$5,611	$5,611
Paint gyp ceilings	1500	sf	$0.75	$1,125	$1,125
Plaster patch	976	sf	$12.00	$11,712	$11,712
Fire sprinkler relocate	3000	sf	$5.00	$15,000	$15,000
New coverage area	22460	sf	$2.00	$44,920	$44,920
Plumbing relocate	3000	sf	$3.00	$9,000	$9,000
Penthouse roof drains	3	ea	$1,000.00	$3,000	$3,000
HVAC relocate	3000	sf	$3.00	$9,000	$9,000
Electrical relocate	3000	sf	$5.00	$15,000	$15,000
New lighting area	0	sf	$10.00	$0	$0

FOOTINGS

Layout pads	61	ea	$100.00	$6,100		$0	$6,100
Dig pads	61	ea	$86.00	$5,246	$130.00	$7,930	$13,176
Crumb pads	61	ea	$66.00	$4,026		$0	$4,026
Steel pads	61	ea	$66.00	$4,026		$0	$4,026
Pour pads	254.94	yd	$27.00	$6,884	$95.00	$24,220	$31,103
Waste	25.49	yd	$27.00	$688	$95.00	$2,422	$3,110
Remove Spoils	254.94	yd	$0.00	$0	$10.00	$2,549	$2,549
Grout base plates	61	ea	$40.00	$2,440	$15.00	$915	$3,355
Pump	5	ea	$0.00	$0	$850.00	$4,250	$4,250
R. Hdwr. pads	61	ea		$0	$15.00	$915	$915
TOTAL				$29,410		$43,201	$72,611

CIP COLUMNS

			Labor		Material			
			Rate	Ext.	Rate	Ext.		
**********								
Encase columns	56	ea	$353.00	$19,768	$175.00	$9,800	$29,568	
Equipment	1	ls	$0.00	$0	$790.72	$791	$791	
**********								
TOTAL				$19,768		$10,591	$30,359	

SLABS

			Labor		Marerial			
			Rate	Ext.	Rate	Ext.		
**********								
Labor	22460	sf	$1.06	$23,808	$0.00	$0	$23,808	
Concrete	311.94	yd	$0.00	$0	$95.00	$29,635	$29,635	
Waste	31.19	yd	$0.00	$0	$95.00	$2,963	$2,963	
Floor patches	167	sf	$35.00	$5,845	$10.00	$1,670	$7,515	
Mesh	22460	sf	$0.00	$0	$0.40	$8,984	$8,984	
R. Hardware	22460	sf	$0.00	$0	$0.08	$1,797	$1,797	
Pump	10	ea	$0.00	$0	$1,150.00	$11,500	$11,500	
Equipment	1	ls	$0.00	$0	$1,779.16	$1,779	$1,779	
**********								
TOTAL				$29,653		$58,328	$87,981	

PAVING SIDEWALKS

			Labor		Material			
			Rate	Ext	Rate	Ext	Total	
Labor	2268	sf	$1.40	3,175.20	$0.00	0.00	3,175.20	
Concrete	42.00	yd	$0.00	0.00	$95.00	3,990.00	3,990.00	
Waste	2.80	yd	$0.00	0.00	$95.00	266.13	266.13	
R. Hardware	2268	sf	$0.00	0.00	$0.04	90.72	90.72	
Pump/material hanc	3	ea	$0.00	0.00	$850.00	2,550.00	2,550.00	
Equipment	1	ls	$0.00	0.00	$190.51	190.51	190.51	
**********								
TOTAL				$3,175		$7,087	$10,263	

STEEL

Materials			Labor		Material		
			Rate	Ext.	Rate	Ext.	
**********							
Columns	423	ea	$107.00	$45,261		$0	$45,261
Beams	305	ea	$67.00	$20,435		$0	$20,435
Joists	40	ea	$53.00	$2,120		$0	$2,120
Deck	26760	sf	$0.54	$14,450		$0	$14,450
Moment connections	41	ea	$130.00	$5,330	$50.00	$2,050	$7,380
Misc. angles	200	ea	$27.00	$5,400		$0	$5,400
Contin. angle	750	lf	$7.00	$5,250		$0	$5,250
Crane	3	mo		$0	$20,000.00	$60,000	$60,000
Crane operator	3	mo	$9,300.00	$27,900	$0.00	$0	$27,900
Additional riggers (2 ea)	3	mo	$11,970.00	$35,910	$0.00	$0	$35,910
Crane mob/demod	1	ls		$0	$10,000.00	$10,000	$10,000
Secondary hoisting	3	mo		$0	$5,000.00	$15,000	$15,000
R. Hdwr/Rods	1	ls		$0	$4,861.69	$4,862	$4,862
Equipment	1	ls		$0	$20,257.05	$20,257	$20,257
**********							
TOTAL				$162,056		$112,169	$274,225
Davis Erection $320,000							

DEMOLITION

Materials							
			Labor		Material		
			Rate	Ext.	Rate	Ext	Total
**********							
Garage floor							
Sawcut slab	1456	lf	$0.00	$0	$8.00	$11,648	$11,648
Demo slab	2268	sf	$2.60	$5,897	$0.50	$1,134	$7,031
1st Floor							
TT penetration	74	ea	$0.00	$0	$134.00	$9,916	$9,916
X-ray penetration	0	ea	$0.00	$0	$65.00	$0	$0
2nd Floor							
TT penetration	74	ea	$0.00	$0	$134.00	$9,916	$9,916
X-ray penetration	0	ea	$0.00	$0	$65.00	$0	$0
Cantilever slab							
Sawcut into pieces	1860	lf	$0.00	$0	$12.00	$22,320	$22,320
Demo/remove pieces	3720	sf	$1.50	$5,580	$0.00	$0	$5,580
Material handling	190	hr	$27.00	$5,130	$0.00	$0	$5,130
Shoring	3720	sf	$0.00	$0	$1.50	$5,580	$5,580
3rd Floor Roof							
TT penetration	19	ea	$0.00	$0	$134.00	$2,546	$2,546
X-ray penetration	0	ea	$0.00	$0	$65.00	$0	$0
Roof demo	4480	sf	$2.00	$8,960	$0.25	$1,120	$10,080
Roof demo/pentrations	4	ea	$0.00	$0	$1,000.00	$4,000	$4,000
Remove existing ceiling	3000	sf	$1.05	$3,150	$0.25	$750	$3,900
Remove floor coverings	3000	sf	$2.00	$6,000	$0.25	$750	$6,750
	0		$0.00	$0	$0.00	$0	$0
Misc. item	0	ea	$0.00	$0	$0.00	$0	$0
Dumpsters	8	ea	$0.00	$0	$400.00	$3,200	$3,200
Equipment	1	ls	$0.00	$0	$2,500.00	$2,500	$2,500
**********							
TOTAL				$34,717		$75,380	$110,097