MEMORANDUM

Missouri Department of Transportation
Design
District 4

TO: Jay Bestgen – de

FROM: Mary Miller
Transportation Project Manager

DATE: February 1, 2007

SUBJECT: Practical Design 2007 Awards for Excellence
I-70 & Noland Road Interchange, J4I140
MoDOT District 4

Please accept our application for the 2007 Awards for Excellence in Practical Design for the I-70 & Noland Road Interchange. This project is an excellent example of the application and spirit of the Practical Design philosophy. Because of the Practical Design efforts, MoDOT, its consultant, Delich, Roth & Goodwillie, and the rest of the core team have developed a design that is dramatically less costly than the 2006-2010 STIP while still meeting the purpose and need of the project.

Several iterations of practical design have been completed throughout the project, including a value engineering study. Two of the biggest challenges for implementing practical design at this interchange were the constraints based on full Federal oversight and compatibility with any future I-70 modifications/replacement based on the I-70 studies.

The original scope called for the reconstruction of the Noland Road interchange. MoDOT preliminarily selected a Single Point Urban Interchange (SPUI) that met the future I-70 template requirements as the likely design for the new interchange. This configuration was the basis for the estimated cost used in the pre-Practical Design STIP.

Traffic studies were completed on several alternatives. These studies determined that traffic conditions included unbalanced opposing left turn movements. These traffic conditions were better handled by a Tight Urban Diamond Interchange (TUDI) versus a SPUI.

When practical design was implemented, the core team looked at the true purpose and need of the project. We determined that the true purpose and need for the project was to replace or rehabilitate the bridge which was seriously deteriorated from the corrosion of the structural reinforcing of the voided slab deck. The possibility of rehabilitation was researched by performing deck tests on the structure. These tests indicated that the deck was so badly deteriorated that it could not be repaired. Cost analyses by DRG showed that a deck replacement was almost as costly as a total bridge replacement.

Due to its close proximity, an adjacent railroad bridge (L-975) west of the Noland Road interchange also required replacement. Standard ramp configurations with both the SPUI and the TUDI made the replacement necessary. The replacement of the railroad bridge was programmed under Job Number J4I1744 and was to be let in combination with the Noland Road Interchange project. One of the first practical design items implemented was to design the ramps of the TUDI to not require the replacement of the railroad bridge. The ramps would have standard acceleration/deceleration lanes and could be easily modified in the future when I-70 is rebuilt/reconstructed.

Two bridge traffic control options were available for this interchange, full closure or staged construction. Full closure would be three months with an additional three months of intermittent closures to tie in ramps, etc. The staged construction would have closed half of the interchange at a time, routed all traffic to one side of the bridge and then to the other, effectively doubling the traffic load and causing severe congestion for the entire construction period. A total closure is practical for this location, since all ramps will continue to provide right off and on movements between I-70 and Noland Road during the bridge closure. Additionally, good alternate routes east and west of the interchange are available for access. The closure option would save $2.5 to $3 million over the staged construction option. The public was initially resistant to the closure option but through extensive public outreach, the community has agreed that the closure option has less overall impact to the traveling public and the businesses along Noland Road.

Researching various bridge structure types, during the VE study, led to the innovative use of a precast, prestressed voided concrete box beams. The required depth of these non-traditional structural elements was the only practical way of minimizing the profile grade impacts to Noland Road, while still maintaining clearance over I-70. The box beams are fabricated off-site and can be quickly erected, which makes the shortened closure time requested by the public more cost effective. With the profile grade on Noland Road lowered by using the box beam bridge, it allowed a significant portion of the existing ramps to remain in place. This will be one of the first box beam bridges built in this region by MoDOT.

Practical Design also encouraged other cost saving design changes. A design exception allowed more spread flow on Noland Road and thus reduced the bridge width by five feet on each side. Bridge approaches were removed from the standard bridge design. Also, right-of-way was minimized because of the reduced interchange footprint and by using steeper slopes, rock backfilling, and the utilization of MSE retaining walls along I-70 and Noland Road. MSE retaining walls allow the future I-70 template width to be reduced, thus reducing the length of the proposed Noland Road Bridge. All of these factors attribute to decreasing the required interchange footprint and the significant construction cost savings.

The overall cost savings from the $33.4 million used in the 2006-2010 MoDOT STIP to the current estimate of $8 million is over $25 million. These costs include the necessary right of way acquisition. The new TUDI configuration will handle traffic better than the current configuration and better than the SPUI originally considered. The bridge will be compatible with future I-70 improvements and the ramps will adequately serve the interchange needs until design year 2027.

Attached to this letter is supporting documentation. Included are concept drawings of the SPUI, the TUDI configured with new ramps, and the TUDI as currently planned. Abbreviated cost estimates of all three configurations are also included.

The MoDOT core team for the I-70 & Noland Road interchange project is proud and pleased with the successful application of Practical Design. Through the use of Practical Design we have provided a product that meets the purpose and need of the project, uses innovative new methods of construction, minimizes the impacts to the traveling public and community and improves traffic flow and safety, all at tremendous cost savings to MoDOT and the taxpayers of Missouri.

Please contact me at (816) 622-6570 if you need any additional details on the practical design of this project.

ROUTE	STATE	DISTRICT	SHEET NO.
I-70	MO	4	

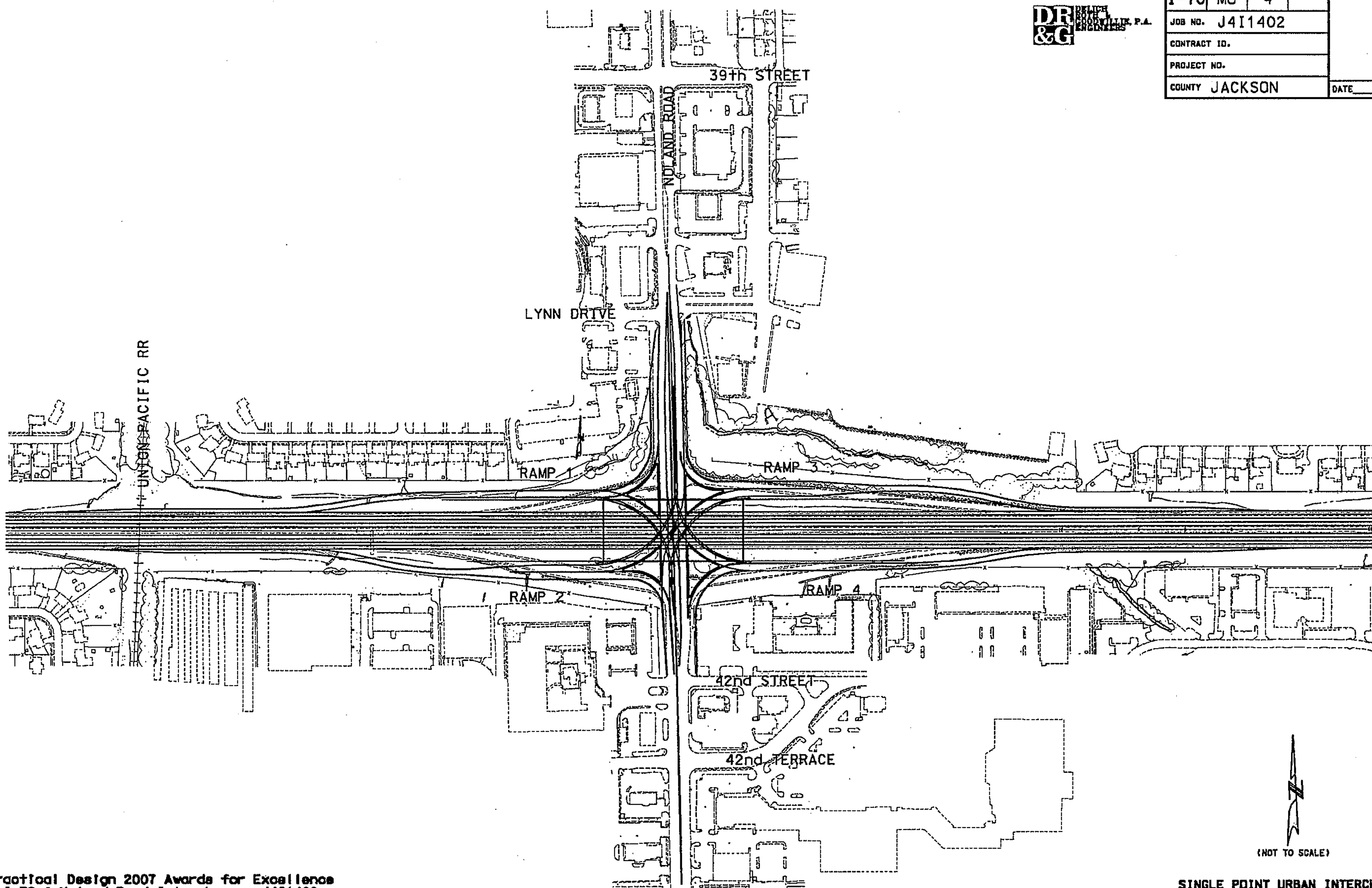
JOB NO. J4I1402

CONTRACT ID.

PROJECT NO.

COUNTY JACKSON

DATE



Practical Design 2007 Awards for Excellence
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MoDOT. District 4

SINGLE POINT URBAN INTERCHANGE
RAMP CONNECTIONS TO FUTURE I-70

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I-70	MO	4	
JOB NO. J4I1402			
CONTRACT ID.			
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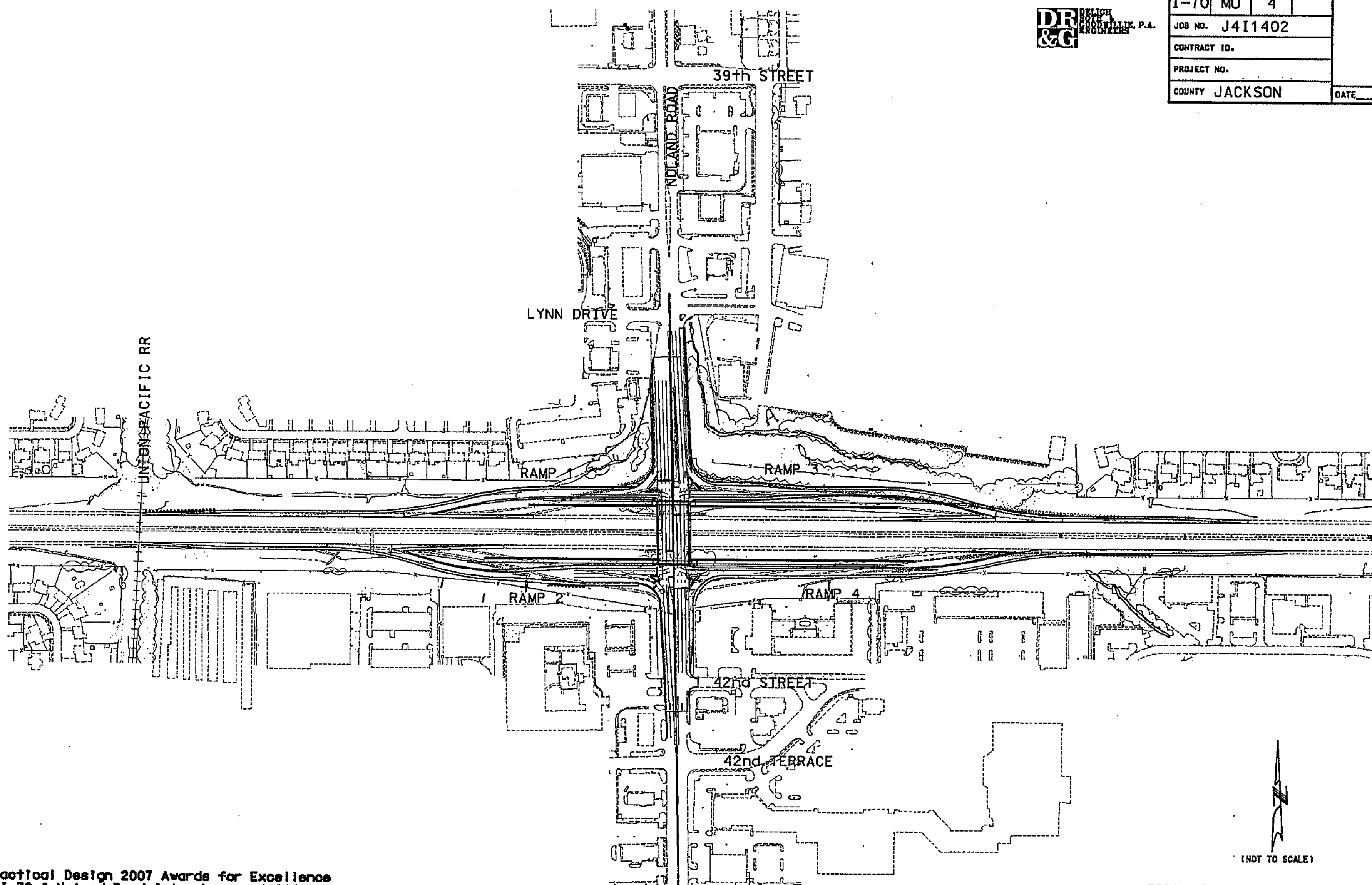
COUNTY JACKSON			DATE



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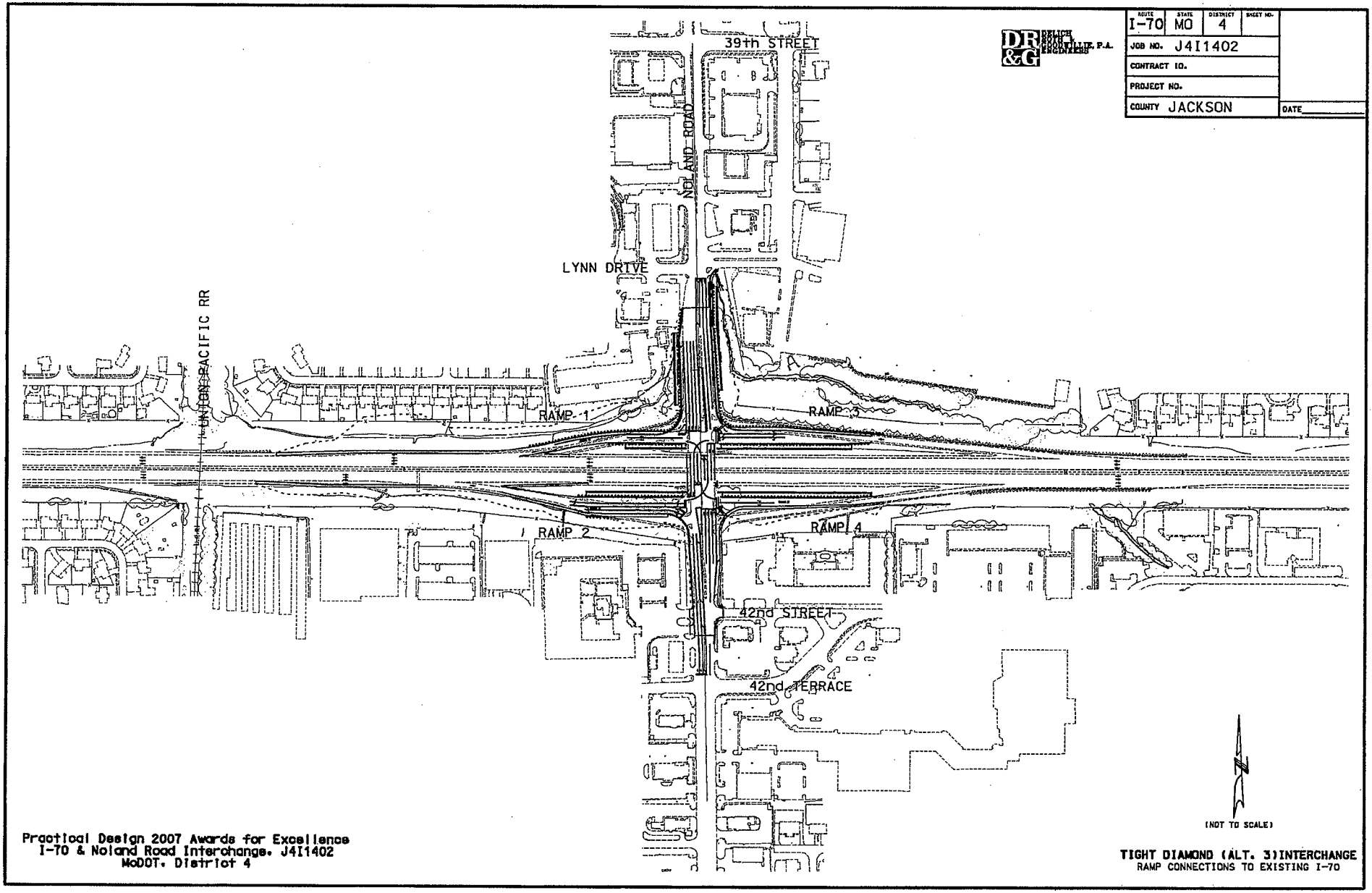
MoDOT, District 4

TIGHT DIAMOND (ALT. 1) INTERCHANGE
RAMP CONNECTIONS TO EXISTING I-70



DR&G BELICH JENSEN & ASSOCIATES P.A.

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TIGHT DIAMOND (ALT. 3) INTERCHANGE
RAMP CONNECTIONS TO EXISTING I-70

2007 APPLICATION FORM

(required for each entry)

Job No. J4I1402 **Route** I-70 **County** Jackson

STIP Description (Scoping or Construction, state which STIP) 05-09☐ 06-10☒ 07-11☐

Construction STIP:

J4I1402 - Replace bridge and reconstruct interchange with a tight urban diamond design at Noland Road in Independence. Project involves bridge L976R.

J4I1744 – Replace the Union Pacific Railroad bridge (I-975) over I-70

Project Manager (could have both)

MoDOT Mary Miller **Consultant** Earl Harrison Jr. - DRG

Active core team members as approved by the MoDOT PM (may include consultants)

Susan Nelson - TPD	Pat Moseley - 4mt	Dave MacDonald - 4tr
Kerri Lewis - 4pi	Laura Ruman - de	James Harcourt - de
Joe Donner - 4rw	Mark Sommerhauser - ITS	Ron Temme - br
Mike Stelzleni - de	Angelo Mannino - DRG	Joe Rishmany - DRG

Project Contacts (will have both for consultant entry)

District 4 **Consultant** $2,093,024

STIP budget $33,363,000 or **Award cost** $_____

Value Engineering study during design? yes☒ no☐ (if yes) **Project Stage** Conceptual

VE Contact person Tom Allen

Construction-stage VE (VECP)? yes☐ no☒ (if yes) **Explain** _____

Total VECP savings $_____ **VECP Contact Person** _____

Why is this entry the "poster" image for MoDOT's practical design philosophy?

(In layman's terms - 100 words or fewer – attach additional sheet if necessary) _____

Through the use of Practical Design we have provided a product that meets the purpose and need of the project, uses innovative new methods of construction, minimizes the impacts to the traveling public and community and improves traffic flow and safety, all at tremendous cost savings to MoDOT and the taxpayers of Missouri. The total cost of the project has been reduced from $33.4 million to $8 million.

Send entries to: MoDOT Design Division, ATTN: Jay Bestgen
1320 Creek Trail Dr.
Jefferson City, Missouri 65109

All entries must be received no later than close of business on February 1, 2007

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Project Costs:

Single Point Urban Interchange (SPUI) + UP Railroad Bridge:

	SPUI [1]	Union Pacific Railroad Bridge [1]
R/W ($M)	$3.48	-
Construction ($M)	$15.37	$14.51
Subtotal ($M)	$18.85	$14.51
Total Project ($M)	$33.36	

[1] Based on 2006-2010 MoDOT STIP

Tight Urban Diamond Interchange (Alt.1):

	Tight Urban Diamond
R/W ($M)	$3.48
Construction ($M)	$9.56
Total Project ($M)	$13.04

Tight Urban Diamond Interchange (Alt. 3):

	Tight Urban Diamond
R/W ($M)	$0.4
Construction ($M)	$7.55
Total Project ($M)	$7.95