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Economic Analysis of Council Bluffs and Keg Creek ABC Projects

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APPLIED RESEARCH ASSOCIATES, INC.
An Employee Owned Company

Economic Analysis

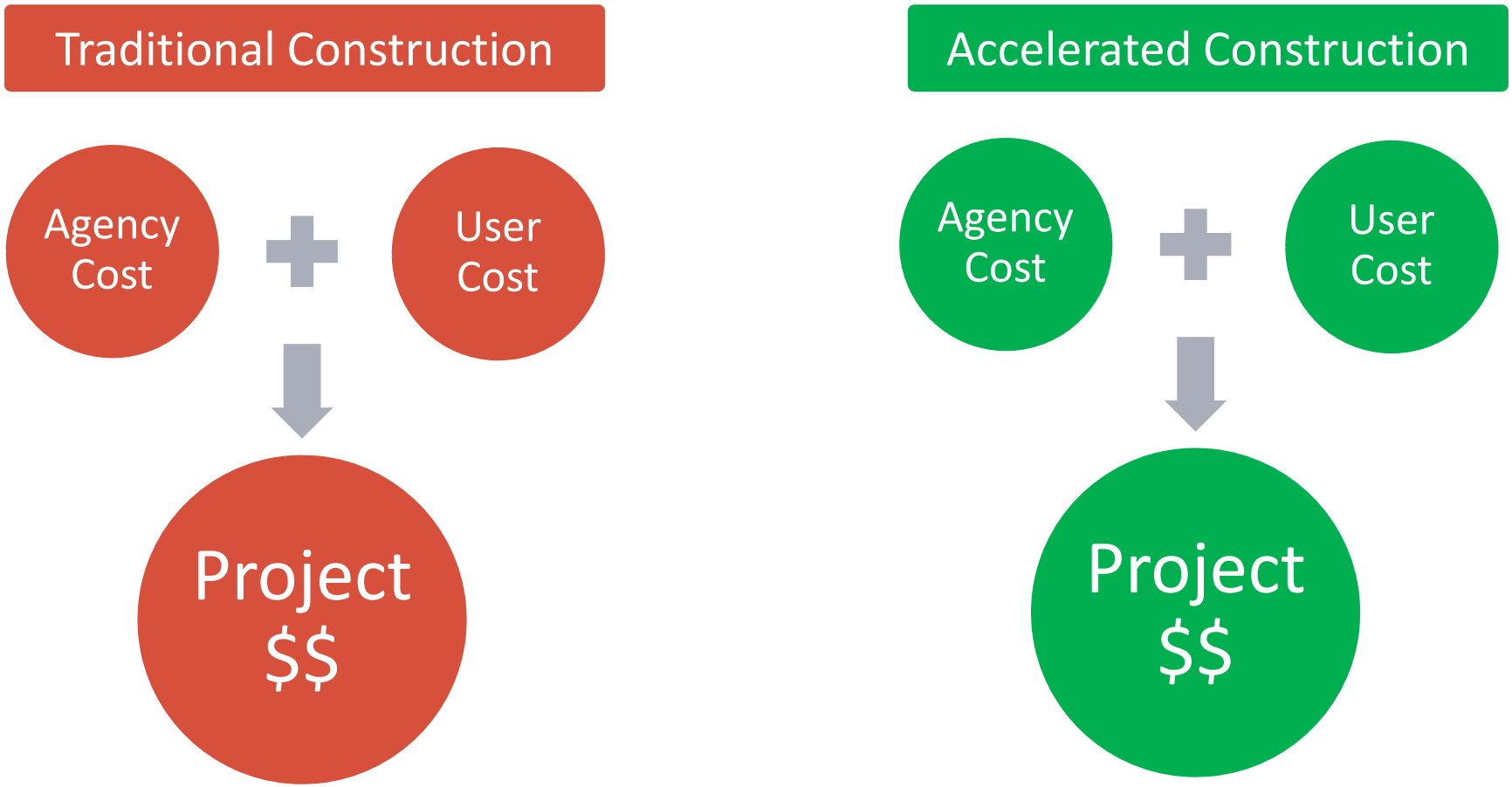
What is the economic efficiency of accelerated bridge and roadway construction ?

How does accelerated construction compare with traditional option in terms of economic value?

The Concept…

Compare Costs vs Benefits for Traditional and Accelerated Construction Options

The Steps…



The Inputs…

Agency Costs

- Preliminary Design and Engineering
- Construction Costs
  - Equipment
  - Material
  - Construction labor
  - Mobilization
  - Incentives/disincentives
- Construction Engineering
- Traffic control
- Law Enforcement

Road User Costs

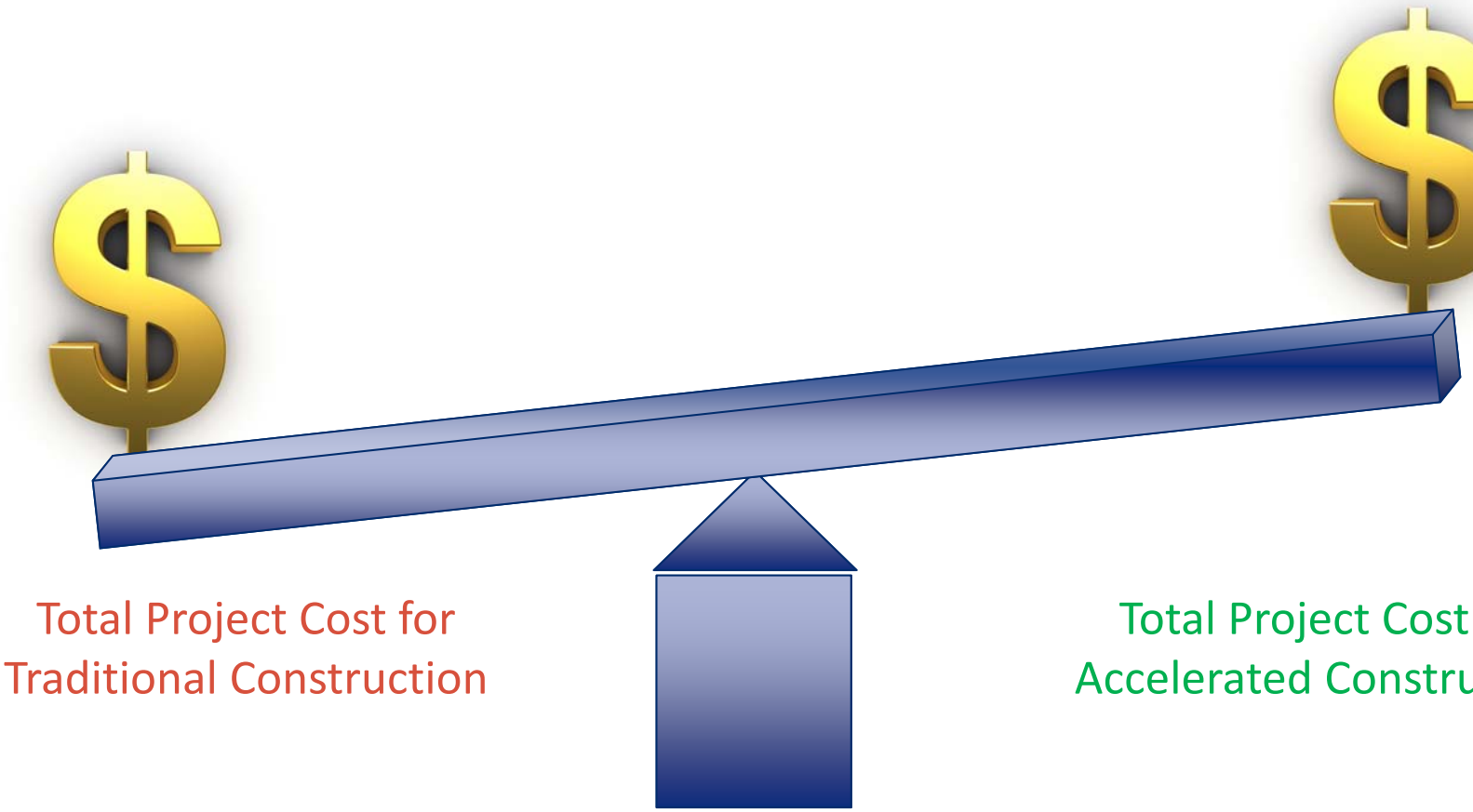
- Delay costs
- Vehicle operating costs
- Crash costs
- Emission costs

& Project duration

Compare the Alternatives

Traditional Construction

Accelerated Construction



Total Project Cost for Traditional Construction

Total Project Cost for Accelerated Construction

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IMPROVEMENTS TO THE 24TH STREET–I-29/80 INTERCHANGE IN COUNCIL BLUFFS, IOWA

Economic Analysis

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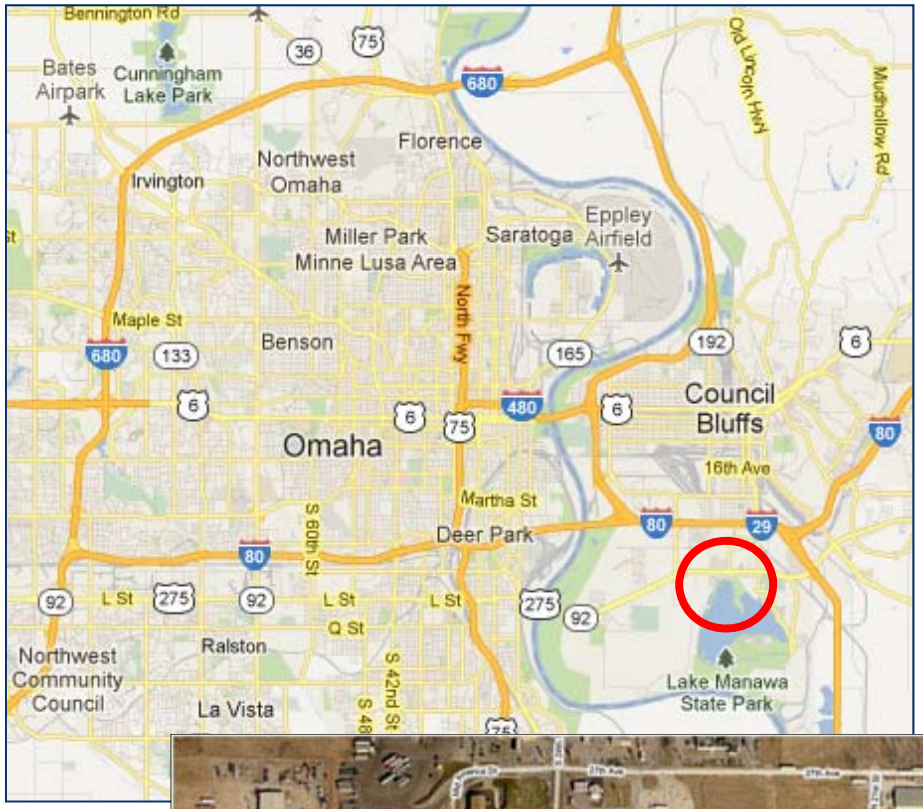
24th Street–I-29/80 Interchange (Council Bluffs, IA)



KEY INNOVATION

- Use of full-depth, precast bridge deck panels made with self-consolidating, high- performance concrete
- Estimated construction duration
  - Cast in-place → 426 days (two seasons)
  - Precast → 175 days (less than one season)

24th Street–I-29/80 Interchange (Council Bluffs, IA) Agency Costs

Category	Cast in place	Precast	% Increase
Preliminary design and engineering	$304,380	$516,032	70%
Bridge construction	$5,073,000	$6,450,398	27%
Roadway improvements	$4,807,721	$4,807,721	
Traffic control	$272,521	$272,521	
Construction inspection	$50,730	$70,954	40%
Miscellaneous	$620,512	$388,636	-37%
Total	$11,128,864	$12,506,262	**12.4%**

Increase in agency cost with precast option was $ 1.4 Million

24th Street–I-29/80 Interchange (Council Bluffs, IA)
Road User Costs – Delay Costs

Total delay time due to work zone = 607 vehicle-hours / day
Iowa DOT estimates = $8/hr for cars and $ 24/hr for trucks
Daily RUC due to work zone = $ 6,215.68

Category	Cast in place	Precast
Delay time due to work zone	No difference	
Number of Construction Days	426 (2 seasons)	175 (< 1 season)
Total Delay Costs	**$ 2,647,880**	**$ 1,087,744**

24th Street–I-29/80 Interchange (Council Bluffs, IA)
Road User Costs – Data for Safety Costs

Crash Rate (per 1000 vehicles)	
Personal injury	69
Non personal injury	146

Million Veh. Miles	Cast in-place	Precast
I-29/80	5.96	2.45
24th street	37.64	15.46
Traffic Over Construction Period	**43.60 M**	**17.91 M**

24th Street–I-29/80 Interchange (Council Bluffs, IA)
Road User Costs – Safety Costs

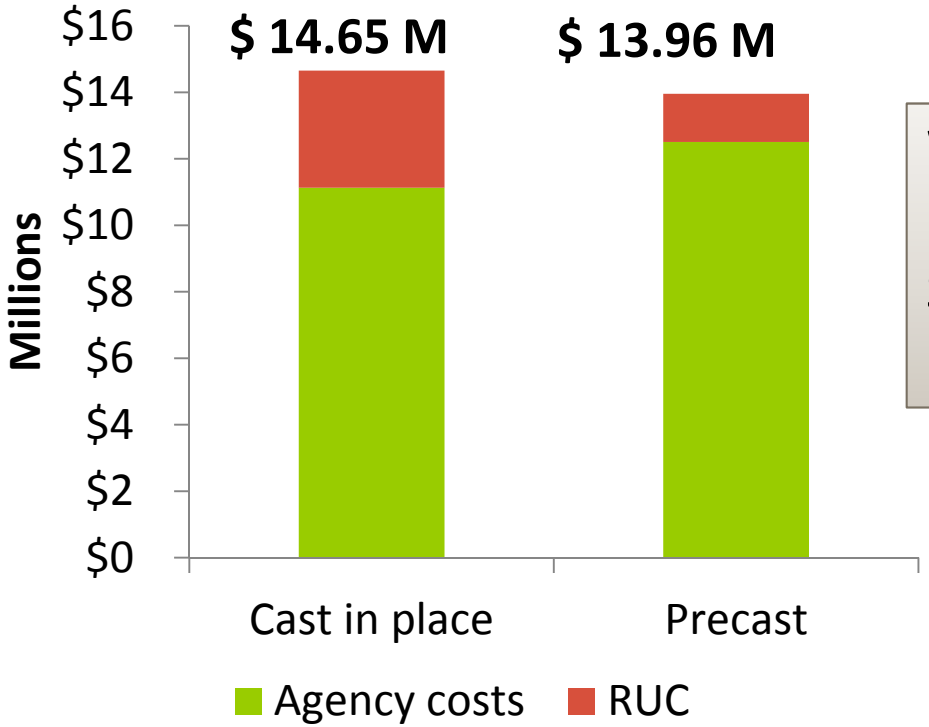
Category	Cast in place		Precast	
	I–29/80	24th Street	I–29/80	24th Street
Injury–causing crash	$494,883	$59,143	$203,265	$24,312
Non-injury crash	$283,005	$41,795	$116,240	$17,181
Total	$878,826		$360,998	

24th Street–I-29/80 Interchange (Council Bluffs, IA) Road User Costs

Category	Cast in-place	Precast
Delay Costs	$ 2,647,880	$ 1,087,744
Veh Operating Cost	No difference	
Crash Cost	$878,826	$360,998
Total RUC	**$3,526,706**	**$1,448,742**

RUC savings with precast option were about $2 million

24th Street–I-29/80 Interchange (Council Bluffs, IA) Total Cost Comparison



With Precast option,
Increase in agency costs = $1.38 M
Savings in RUC = $ 2.08 M
Net savings = $ 700,000

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RECONSTRUCTION OF US 6 BRIDGE OVER KEG CREEK, IOWA

Economic Analysis

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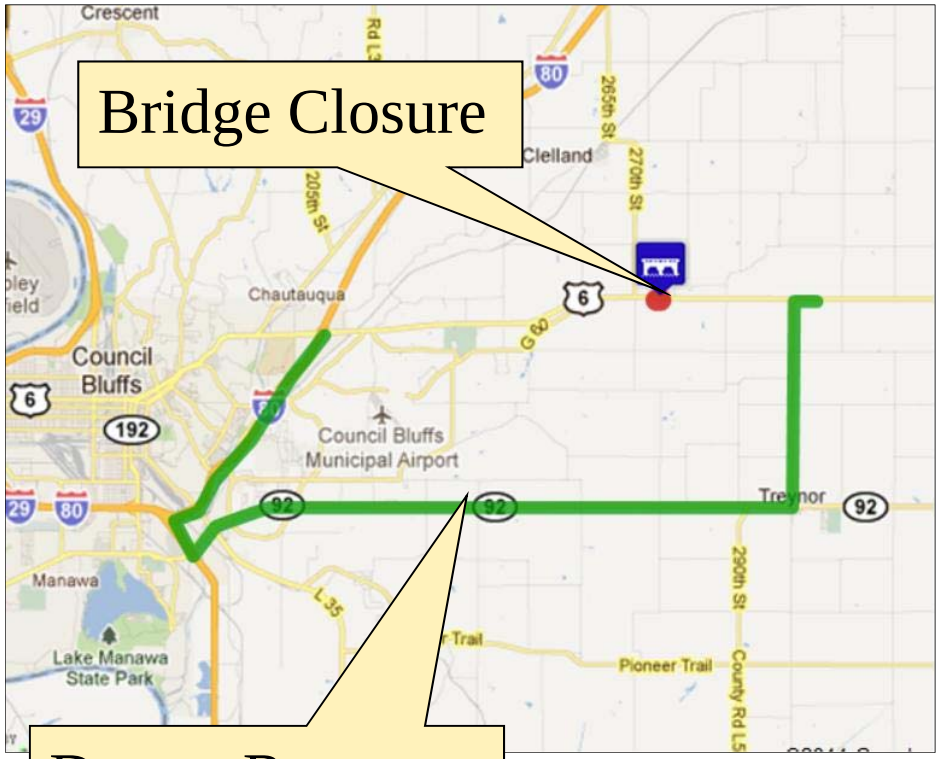
Reconstruction of US 6 Bridge over Keg Creek



KEY INNOVATION

- Use of Prefabricated substructure and modular superstructure elements
- Estimated construction duration
  - Cast in-place → 183 days (6 months)
  - Precast → 14 days

Reconstruction of US 6 Bridge over Keg Creek Agency Costs

Item	Baseline Case	As-built Case
Bridge	$1,147,178	$2,294,472
Road Improvements	$ 305,967	$ 305,967
Traffic Control	$ 3,200	$ 3,200
Concrete Flume	$ 55,185	$ 55,185
Total Project	**$1,511,530**	**$2,658,823**

Increase in agency costs with precast option was $ 1.15 Million

Reconstruction of US 6 Bridge over Keg Creek
Road User Costs – Vehicle Operating Costs

Trucks only (9% of AADT) ~ 350 trucks
21 mile detour
Mileage costs for trucks = $ 0.81 /mile
Daily RUC due to work zone = $ 5955.20

Category	Cast in place	Precast
Detour Length	No difference	
Number of Construction Days	183	14
Total VOC	**$1,089,802**	**$83,373**

Reconstruction of US 6 Bridge over Keg Creek
Road User Costs – Delay Costs

21 mile detour for trucks only (9% of AADT)
Additional travel time due to detour = 24.67 min /truck
Value of delay time = $ 25.67/hr for trucks
Daily RUC due to work zone = $ 3,684.70

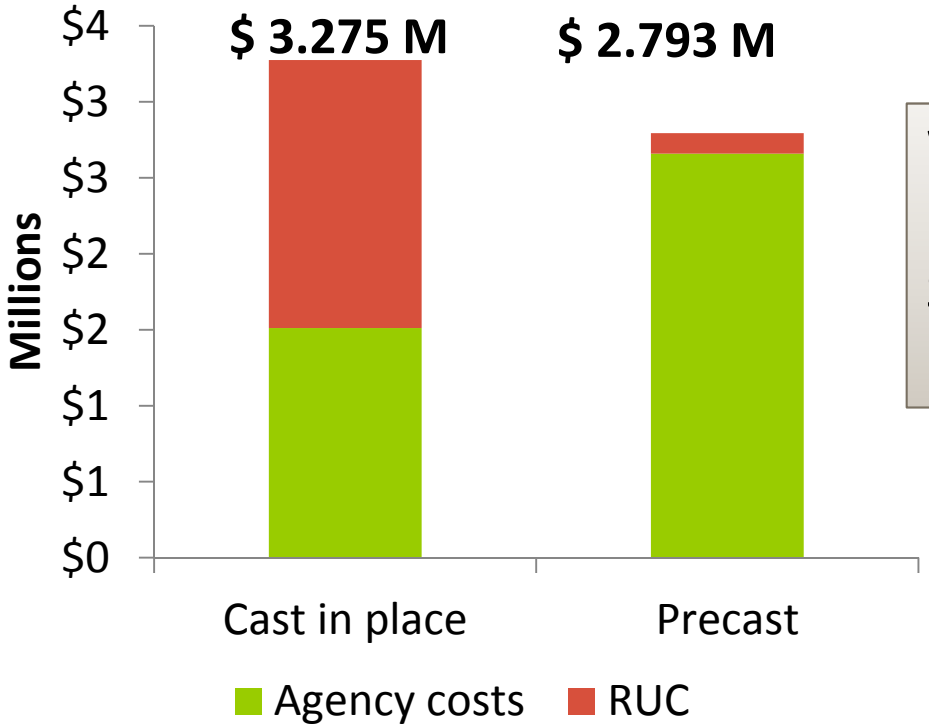
Category	Cast in place	Precast
Delay time due to work zone	No difference	
Number of Construction Days	183	14
Total Delay Costs	**$ 674,300**	**$ 51,586**

Reconstruction of US 6 Bridge over Keg Creek Road User Costs

Category	Cast in-place	Precast
Delay Costs	$674,300	$ 51,586
Vehicle Operating Costs	$1,089,802	$83,373
Crash Cost	No difference	
Total RUC	$1,764,102	$134,959

RUC savings with precast option were about $1.63 million

Reconstruction of US 6 Bridge over Keg Creek Total Cost Comparison



With Precast option,
Increase in agency costs = $1.147 M
Savings in RUC = $ 1.629 M
Net savings = $ 481,850