

# ADVANCE PLANNING RISK ANALYSIS

## *Managing Risk in the Project Development Process for Transportation Infrastructure Projects*

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# Outline

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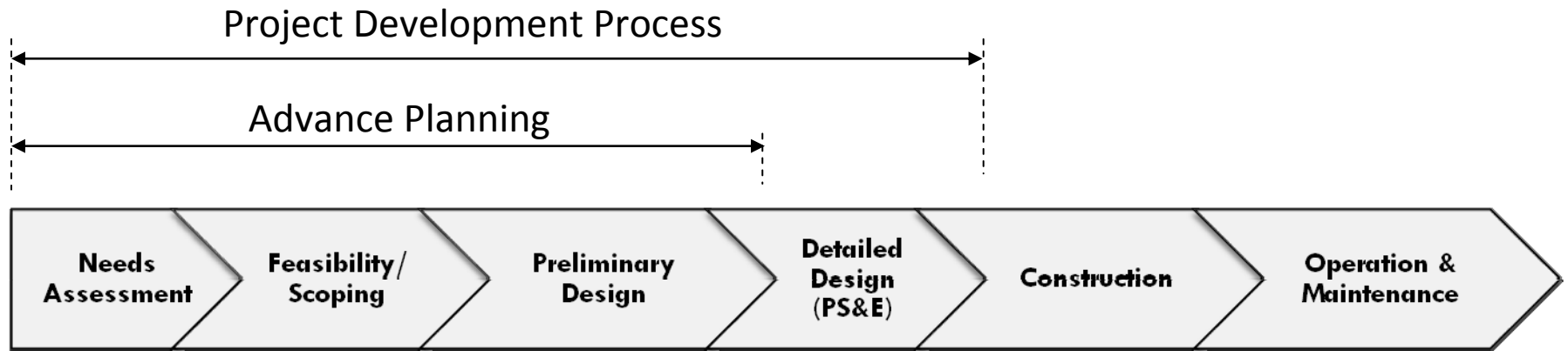
1. Background
2. How APRA was developed
3. How to use APRA
4. Conclusions

BACKGROUND



# Project Development Process

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Project Development Process (PDP) in project life cycle

(Adopted from TxDOT 2003)

# Project Development Process

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- A “long-lasting, comprehensive, and complex process” (Arts and Lamoen 2005)
- High level of uncertainty
- Functions are highly interrelated
- Need for a structured but flexible risk management

# Risk Management and Scope Definition

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- ❑ Risk management tends to focus on risk event
- ❑ Focusing on risk source is more proactive and effective
- ❑ Scope of work needs to be identified and organized early and appropriately
- ❑ Scope elements are sources of risk
- ❑ Managing risk using scope elements could be proactive and effective

# Previous Studies

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- Hackney (1965, 1992): industrial projects
  - CII (2006): Project Definition Rating Index for industrial and building projects
  - Shane (2006): design-build highway projects
- => Need one for the entire project development process of transportation infrastructure projects

# HOW APRA WAS DEVELOPED



# Identify & Categorize Elements

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- Reviewed literature
- Interviewed 11 transportation experts
- Reviewed by TxDOT Project Monitoring Committee

# APRA Elements

## I. BASIS OF PROJECT DECISION

### A. Project Strategy

- A1. Need & Purpose Documentation
- A2. Investment Studies & Alternatives Assessments
- A3. Programming & Funding Data
- A4. Key Team Member Coordination
- A5. Public Involvement

### B. Owner/Operator Philosophies

- B1. Design Philosophy
- B2. Operating Philosophy
- B3. Maintenance Philosophy
- B4. Future Expansion & Alteration Considerations

### C. Project Requirements

- C1. Functional Classification & Use
- C2. Evaluation of Compliance Requirements
- C3. Survey of Existing Environmental Conditions
- C4. Determination of Utility Impacts
- C5. Value Engineering

## II. BASIS OF DESIGN

### D. Site Information

- D1. Geotechnical Characteristics
- D2. Hydrological Characteristics
- D3. Surveys & Planimetrics
- D4. Permitting Requirements
- D5. Environmental Documentation
- D6. Property Descriptions
- D7. Ownership Determinations
- D8. Right-of-Way Mapping
- D9. Constraints Mapping
- D10. Right-of-Way Site Issues

### E. Location & Geometry

- E1. Horizontal & Vertical Alignment
- E2. Control of Access
- E3. Schematic Layouts
- E4. Cross-Sectional Elements

### F. Structures

- F1. Bridge Structure Elements
- F2. Hydraulic Structures
- F3. Miscellaneous Design Elements

### G. Design Parameters

- G1. Provisional Maintenance Requirements
- G2. Constructability

### H. Installed Equipment

- H1. Equipment List
- H2. Equipment Location Drawings
- H3. Equipment Utility Requirements

## III. EXECUTION APPROACH

### I. Acquisition Strategy

- I1. Long-Lead Parcel & Utility Adjustment Identification
- I2. Long-Lead/Critical Equipment & Materials Identification
- I3. Local Public Agencies Utilities Contracts & Agreements
- I4. Utility Agreement & Joint-Use Contracts
- I5. Project Delivery Method & Contracting Strategies
- I6. Design/Construction Plan & Approach
- I7. Procurement Procedures & Plans
- I8. Appraisal Requirements
- I9. Advance Acquisition Requirements

### J. Deliverables

- J1. CADD/Model Requirements
- J2. Documentation/Deliverables

### K. Project Control

- K1. Right-of-Way & Utilities Cost Estimates
- K2. Design & Construction Cost Estimates
- K3. Project Cost Control
- K4. Project Schedule Control
- K5. Project Quality Assurance & Control
- K6. Safety Procedures

### L. Project Execution Plan

- L1. Environmental Commitments & Mitigation
- L2. Interagency Coordination
- L3. Local Public Agency Contractual Agreements
- L4. Interagency Joint-Use Agreements
- L5. Preliminary Traffic Control Plan
- L6. Substantial Completion Requirements

# Element Description Example

## **C4. Determination of Utility Impacts**

Infrastructure projects often necessitate the adjustment of utilities to accommodate the design and construction of proposed transportation facilities. Failure to mitigate utility conflicts in the design process or to relocate facilities in a timely manner can result in unwarranted delays and increased project costs. Issues to consider include:

- Field verification of existing utilities facilities
- Field verification with proposed alignment
- Necessary utility facility repair and modernization
- Action plans for utility adjustments
- Physical constraints to utility placement
- Schedule impact of utility relocations and adjustments
- Determination of utility location in State right-of-way
- Local ordinances or industry standards
- Safety clearances requirements
- Other

# Element's Two Dimensions

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- Level of Importance:
  - Determined relatively by experts
  
- Levels of Definition:
  - Level 1 – Complete definition
  - Level 2 – Minor deficiencies
  - Level 3 – Some deficiencies
  - Level 4 – Major deficiencies
  - Level 5 – Incomplete or poor definition
  - “Level” 0 – Non-applicable

# Weight APRA Elements

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- 6 weighting workshops
- 51 participants (18 years of experience average)
- 39 completed questionnaires valid for analysis
- Elements' total weight is 1000 points

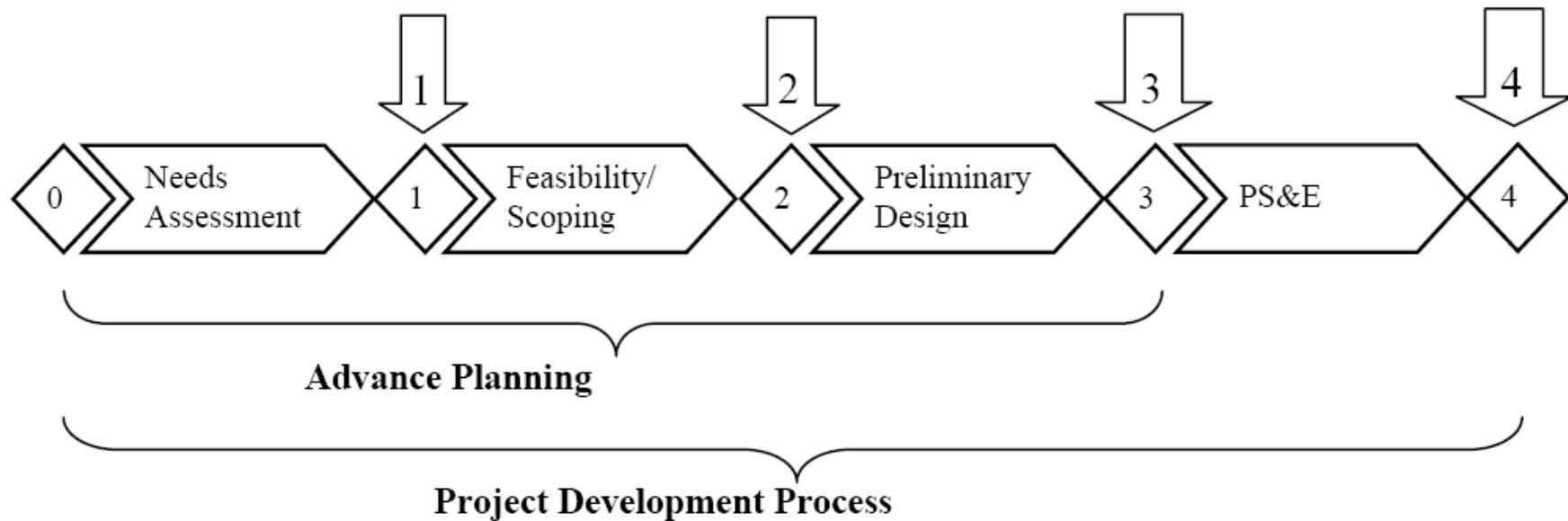
SECTION I - BASIS OF PROJECT DECISION								
CATEGORY Element	Definition Level						Score	
	0	1	2	3	4	5		
<b>A. PROJECT STRATEGY (Maximum = 122)</b>								
A1. Need & Purpose Documentation	0	1	7	12	18	23		
A2. Investment Studies & Alternatives Assessments	0	2	8	14	19	25		
A3. Programming & Funding Data	0	2	9	16	23	30		
A4. Key Team Member Coordination	0	1	6	11	16	21		
A5. Public Involvement	0	2	7	13	18	23		
<b>CATEGORY A TOTAL</b>								
<b>B. OWNER/OPERATOR PHILOSOPHIES (Maximum = 76)</b>								
B1. Design Philosophy	0	1	7	12	18	23		
B2. Operating Philosophy	0	1	5	10	14	18		
B3. Maintenance Philosophy	0	1	5	9	12	16		
B4. Future Expansion & Alteration Considerations	0	2	6	11	15	19		
<b>CATEGORY B TOTAL</b>								
<b>C. PROJECT REQUIREMENTS (Maximum = 102)</b>								
C1. Functional Classification & Use	0	1	5	8	12	15		
C2. Evaluation of Compliance Requirements	0	1	6	10	15	19		
C3. Survey of Existing Environmental Conditions	0	2	8	14	20	26		
C4. Determination of Utility Impacts	0	2	9	16	23	30		
C5. Value Engineering	0	1	4	7	9	12		
<b>CATEGORY C TOTAL</b>								
<b>Section I Maximum Score = 300</b>							<b>SECTION I TOTAL</b>	

# APRA Section and Category Weights

<b>SECTION and Category</b>	<b>Weight</b>
<b>SECTION I – BASIS OF PROJECT DECISION</b>	<b>300</b>
Category A - Project Strategy	122
Category B - Owner/Operator Philosophies	76
Category C - Project Requirements	102
<b>SECTION II – BASIS OF DESIGN</b>	<b>359</b>
Category D - Site Information	173
Category E - Location & Geometry	79
Category F - Structures	48
Category G - Design Parameters	29
Category H - Installed Equipment	30
<b>SECTION III – EXECUTION APPROACH</b>	<b>341</b>
Category I - Acquisition Strategy	137
Category J - Deliverables	23
Category K - Project Control	98
Category L - Project Execution Plan	83
<b>TOTAL</b>	<b>1000</b>

# Develop Tool and Method

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- ❑ Guidelines on: who, how, when to use APRA
- ❑ Computer tool

# Test APRA

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- On 16 real projects (9 completed and 7 ongoing)
- 32 people participated
- APRA helps identify critical elements in the PDP?
  - 32/32 people agreed
- APRA helps improve the PDP?
  - 27/32 people agreed; 4 neutral; 1 disagreed

# HOW TO USE APRA



# A Case Study

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## □ The Project:

- Freeway widening in Texas
- At the beginning of detailed design (PS&E)
- Estimated total cost >\$32 million (>\$2M detailed design, >\$10M right-of-way, >\$20M construction)

## □ Steps:

- Prepare for assessment
- Assess project using APRA
- Develop an action plan

# Prepare for Assessment

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- Assessment package sent to project team: agenda, presentation, element descriptions, forms, and questionnaire
- Project basic information sent to facilitator
- Team members familiarized with meeting materials
- Facilitated assessment meeting: 2-3 hours

# Assess Project Using APRA

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- 5 project team members participated
- Element by element:
  - Team discussed the level of work performed
  - Determined, by consensus, definition level
  - Facilitator took notes and recorded decisions
  - No solutions discussed (only assessment)
- Assessment form did not include element scores

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<b>CATEGORY C TOTAL</b>							
<b>Section I Maximum Score = 300</b>			<b>SECTION I TOTAL</b>				

# High Risk APRA Elements

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APRA Element	Level of Definition	APRA Score
A3. Programming & Funding Data	4	23
C5. Value Engineering	5	12
G1. Provisional Maintenance Requirements	4	9
G2. Constructability	4	14
H2. Equipment Location Drawings	5	8
I1. Long-Lead Parcel & Utility Adjustment Identification	4	19
K6. Safety Procedures	4	10
L5. Preliminary Traffic Control Plan	5	13

□ Total project score: 411 / 1000

# Hypothetical Action Plan

<i>Project Title:</i>					<i>Date: XX/XX/200X</i>	
<b>ID</b>	<b>APRA Element</b>	<b>Level of Definition</b>	<b>APRA Score</b>	<b>Action Description</b>	<b>Deadline/Frequency</b>	<b>Responsible</b>
1	A3	4	23	Obtain and/or keep updated of funding sources data for construction; promptly report to the project manager and inform the project area offices when data become available	At least monthly	C. Smith
2	G2	4	14	Request and encourage the frequent involvement of the construction consultants in providing input to the design	12/31/0X and every 3 months	T. Campbell
3	H2	5	8	Develop equipment location drawings and distribute them to the project area offices	6/31/0Y	L. Nelson
5	K6	4	10	Review and update the safety requirements and procedures; report to the project manager	12/31/0Y	K. Jones

# Benefits of APRA

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- ❑ Checklist of critical scope elements
- ❑ Means to monitor progress at various stages
- ❑ Tool to aid in communication and team alignment
- ❑ Training tool for organizations and individuals
- ❑ Benchmarking tool for organizations for evaluating and predicting project performance
- ❑ Can be integrated into formal project risk management

# CONCLUSIONS



# Conclusions

- ❑ Need for proactive risk management in PDP
- ❑ APRA developed: list of 59 scope elements with relative weights and assessment mechanism
- ❑ Well received by professionals
- ❑ Element descriptions and weights customizable
- ❑ More assessment data allow benchmarking
- ❑ Can be integrated into formal project risk management

THANK YOU!

