

## **Risk management in the implementation of Levan-Vlore motorway project**

Gentjan Rexhaj<sup>1</sup>, Ahmet Öztaş<sup>2</sup>

<sup>1</sup>*Civil Engineering Department, Epoka University, Albania*

<sup>2</sup>*Department of Civil Engineering, North Iraq University, Iraq*

### **Abstract**

Levan-Vlore motorway, is one of the most important segments of a 24 km road section from Levan to Vlore, part of the north-south corridor. The works comprise the construction of a 4 line road in generally flat/semi-hilly rural areas.

A successful implementation of the project is closely dependent of a good risk management process. It can make a successful implementation of the project within a shorter timeframe, within the quality control standards and with fewer expenses. In this paper, risk identification, classification and assessment for Levan-Vlore motorway segment is conducted. The methodology used in this study consists of examination of project description, work breakdown structure, cost estimate, design and construction schedule etc. The risk events were quantified and documented and then analyzed.

As a result, according to the risk breakdown events, it can be stated that implementation of the project was moderate to risky in terms of project's major objectives cost, time, scope and quality.

### **INTRODUCTION**

Levan-Vlore motorway, is one of the most important segments of a 24 km road section from Levan to Vlore, part of the north-south corridor. The works comprise the construction of a 4 line road in generally flat/semi-hilly rural areas.

The risk assessment process for the Levan-Vlora project can be divided into the following five phases [1-5]:

#### **Phase 1 - Project Description**

The proposed project will support the construction of a 24 km road section from Levan to Vlore, part of the north-south corridor, and Trans-European Corridor VIII. The works comprise the construction of approximately 24.2 km of 4 line road in a generally flat/semi-hilly rural areas. The section to be constructed from Levan to Vlora is 24.4 km long and begins approximately 150 m before junction of Levani. South of Levani the road moves again near to the railway and existing road until reaching a new connection to the Levan-Tepelena road. The section Levan-Mifoli crosses the plan of Vjosa River, partly on viaduct because of the floods levels. The section Mifoli-Vlora borders railroad utilizing its corridor. The railway is finally crossed before Narta and intersects the hill and its olive groves, in order to pass adjacent to an industrial zone and an energy plant. The new road joins existing one with a roundabout, and from it's enter the city of Vlora.

## **Phase 2 – Risks identification**

### **Design Risks**

- Unexpected geotechnical or groundwater issues,
- Surveys incomplete,
- Bridge site data incomplete to DES(is missing method of statement ),
- Unforeseen design exceptions required (connections between two areas village and cemetery),
- Incomplete quantity estimates (quantity of piles, quantity of aggregates for embankment).

### **External Risks**

- Landowners unwilling to sell,
- Local communities pose objections,
- Unreasonably high expectations from stakeholders,
- Political factors or support for project changes(the road is passing on 3 communes and one municipality),
- New stakeholders emerge and request changes,
- Threat of lawsuits (GRD),
- Increase in material cost due to market forces(fuel, steel),
- New permits or additional information required(rail way),
- New information required for permits (Narta Lagoon pump station during constructions of box culverts),
- Pressure to deliver project on an accelerated schedule(election period),
- Labor shortage or strike (no payment by the sub-contractors).

### **Environmental Risks**

- Environmental analysis incomplete,
- Design changes require additional Environmental analysis (Lagoon of Narta for disturbing of animals).

### **Organizational Risks**

- Inexperienced staff assigned (local staff ),
- Inexperienced sub-contractors (local staff ),
- Losing critical staff at crucial point of the project (deferent advisers, local administrator and general director change due construction time),
- Insufficient time to plan (the technical office covered 2 projects at the same time),
- Internal “red tape” causes delay getting approvals, decisions(head managing by head office and quarter office),
- Lack of understanding of complex internal funding procedures,
- Priorities change on existing program,
- Lack of specialized staff (borrow pit).

### **Project Management Risks**

- Project purpose and need is not well-defined (the design didn't provide same connections between two sides of the road )

- No control over staff priorities (bed management by head office)
- Sub-contractor delays
- Estimating and/or scheduling errors (mistakes on quantities of piles and embankment),
- Unplanned work that must be accommodated (removing of materials came during installation of piles),
- Underestimated support resources overly optimistic delivery schedule(missing quantities for construction of embankment),
- Underestimated support resources or overly optimistic delivery schedule (aggregates)
- Unanticipated escalation in right of way values or construction cost(mistakes done in tender period for different items in B o Q),
- Delay in earlier project phases jeopardizes ability to meet programmed delivery commitment(new box culverts)
- Local agency support not attained(GRD for land expropriations),
- Unforeseen agreements required(sub-contractors)
- Priorities change on existing program(often),
- Inconsistent cost, time, scope, and quality objectives.

#### **Right of Way Risks**

- Unforeseen railroad involvement (KRIPA),
- Needs for “Permit to Enter” not considered in project schedule development(camp was installed at KRIPA area, for different reasons we are not allowed to work after 17 am),
- Acquisition of parcels controlled by a State may take longer than anticipated,

#### **Construction Risks**

- Inaccurate contract time estimates(wrong calculations on tender period),
- Unidentified utilities(water supply and pipe gas network),
- Street or ramp closures not coordinated with local community,
- Delay in demolition due to sensitive habitat requirements (houses),
- Long lead time for utilities caused by design and manufacture of special components (steel beam).

#### **Engineering Services Risks**

- Bridges constructed at grade and then excavated underneath may require(damn not foreseen in B o Q or secondary bridge),
- Foundation and geotechnical tasks (foundation drilling and material testing) not identified and included in project work plan,
- For projects involving bridge removal, bridge carries traffic during staging.

### Phase 3 - Risk likelihood and Risk impact assessment.

#### 3.1. Risk likelihood assessment.

No.	Design Risks	Prob.	Ranking
1	Unexpected geotechnical or groundwater issues	50%	4
2	Surveys incomplete	55%	4
3	Bridge site data incomplete to DES(is missing method of statement )	23%	3
4	Unforeseen design exceptions required (connections of two areas village and cemetery)	30%	3
5	Incomplete quantity estimates(quantity of piles, quantity of aggregates for embankment)	70%	5
	<b>External Risks</b>		
6	Landowners unwilling to sell	80%	5
7	Local communities pose objections	20%	3
8	Unreasonably high expectations from stakeholders	70%	5
9	Political factors/support for proj. changes (road passing on 3 communes and 1 municip.)	15%	2
10	New stakeholders emerge and request changes	10%	2
11	Threat of lawsuits (GRD)	10%	2
12	Increase in material cost due to market forces (fuel, steel, guardrails)	80%	5
13	New permits or additional information required (rail way , Narta Laguna pump station during constructions of box culverts)	90%	5
14	Pressure to deliver project on an accelerated schedule (election period)	90%	5
15	Labor shortage or strike (no payment by the sub-contractors)	60%	5
	<b>Environmental Risks</b>		
16	Environmental analysis incomplete	20%	3
17	Design changes require additional Environmental analysis (Lagoon of Narta for disturbing of animals)	20%	3
	<b>Organizational Risks</b>		
18	Inexperienced staff assigned (local staff, geotechnical mixing of sandy + gravel material)	65%	5
19	Inexperienced sub-contractors (local staff )	60%	5
20	Losing critical staff at crucial point of the project (different advisers, local administrator and general director change due construction time)	30%	3
21	Insufficient time to plan (the technical office covered two projects at the same time)	25%	3
22	Internal “red tape” causes delay getting approvals, decisions (bad managing by head office and quarter office)	40%	4
23	Lack of understanding of complex internal funding procedures	15%	2
24	Priorities change on existing program (elections period)	90%	5
25	Inconsistent cost, time, scope and quality objectives (borrow pits)	25%	3
	<b>Project Management Risks</b>		

26	Project purpose and need is not well-defined (the design didn't provide same connections between two sides of the road )	10%	2
27	No control over staff priorities (bed management by head office)	30%	3
28	Sub-contractor delays	70%	5
29	Estimating and/or scheduling errors (mistakes on quantities of piles and embankment),	25%	3
30	Unplanned work that must be accommodated (removing of materials accumulated during installation of piles),	10%	2
31	Unanticipated escalation in right of way values / construction cost (dam of Vjosa bridge)	10%	2
32	Delay in earlier project phases affects ability to meet programmed delivery commitment	60%	5
33	Local agency support not attained (GRD for land expropriations)	80%	5
34	Unforeseen agreements required (sub-contractors)	70%	5
35	Priorities change on existing program (often)	90%	5
36	Inconsistent cost, time, scope, and quality objectives,	20%	3
	<b>Right of Way Risks</b>		
37	Unforeseen railroad involvement (railway),	10%	2
38	Needs for "Permit to Enter" not considered in project schedule development (camp was installed at KRIPA area, for different reasons we are not allowed to work after 17 am),	15%	2
39	Acquisition of parcels controlled by State may take longer than anticipated, (GRD)	80%	5
	<b>Construction Risks</b>		
40	Inaccurate contract time estimates (wrong calculations on tender period),	40%	4
41	Unidentified utilities (water supply and pipe gas network)	65%	5
42	Street or ramp closures not coordinated with local community	35%	3
43	Delay in demolition due to sensitive habitat requirements (houses)	40%	4
44	Long lead time for utilities - design and manufacture of special components (steel beam)	25%	3
	<b>Engineering Services Risks</b>		
45	Unforeseen work required for Bridges construction (dam or secondary bridge not foreseen in BOQ)	20%	3
46	Foundation and geotechnical tasks (foundation drilling and material testing) not identified and included in project work plan)	15 %	2
47	For projects involving bridge removal, bridge carries traffic during staging.	5 %	1

### 3.2. Risk impact assessment.

#### Design Risks

Bridge site data incomplete to DES (is missing method of statement).

Evaluation Impact of a Threat on Major Project Objectives						
Impact		Very Low	Low	Mod.	High	Very High
Objective	Time				Delivery Plan milestone delay of more than 1 quarter	
	Cost		< 5% Cost Increase			
	Scope	Scope decrease is barely noticeable				
	Quality				Quality may be made acceptable through mitigations or agreement (i. e Fact Sheet)	

Incomplete quantity estimates (quantity of piles, quantity of aggregates for embankment).

Evaluation Impact of a Threat on Major Project Objectives						
Impact		Very Low	Low	Moderate	High	Very High
Objective	Time				Delivery Plan milestone delay of more than 1 quarter	
	Cost			5-10 % Cost Increase		
	Scope			Changes in project limits or features with 5-10 % Cost Increase		
	Quality	Quality degradation barely noticeable				

### External Risks

Increase in material cost due to market forces (fuel, steel).

Evaluation Impact of a Threat on Major Project Objectives						
Impact		Very Low	Low	Mod.	High	Very High
Objective	Time		Delivery Plan milestone delay within quarter			
	Cost				10-20 % Cost Increase	
	Scope	Scope decrease is barely noticeable				
	Quality	Quality degradation barely noticeable				

Labor shortage or strike (no payment by the sub-contractors).

Evaluation Impact of a Threat on Major Project Objectives						
Impact		Very Low	Low	Mod.	High	Very High
Objective	Time				Delivery Plan milestone delay of more than 1 quarter	
	Cost		< 5% Cost Increase			
	Scope	Scope decrease is barely noticeable				
	Quality		No safety issues, C,O,M deficiencies approved by project team			

### Environmental Risks

Design changes require additional Environmental analysis (Lagoon of Narta for disturbing of animals).

Evaluation Impact of a Threat on Major Project Objectives						
Impact		Very Low	Low	Moderate	High	Very High
Objective	Time			Delivery Plan milestone delay of one quarter		
	Cost		< 5% Cost Increase			
	Scope	Scope decrease is barely noticeable				
	Quality	Quality degradation barely noticeable				

### Organizational Risks

Inexperienced staff assigned (local staff)

Evaluation Impact of a Threat on Major Project Objectives						
Impact		Very Low	Low	Moderate	High	Very High
Objective	Time		Delivery Plan milestone delay within quarter			
	Cost		< 5% Cost Increase			
	Scope		Changes in project limits or features with < 5 % Cost Increase			
	Quality			No safety issues, C,O,M deficiencies required District management approval		

Losing critical staff at crucial point of the project (deferent advisers, local administrator and general director change due construction time).

Evaluation Impact of a Threat on Major Project Objectives						
Impact		Very Low	Low	Mod.	High	Very High
Objective	Time				Delivery Plan milestone delay of more than 1 quarter	
	Cost		< 5% Cost Increase			
	Scope		Changes in project limits or features with < 5 % Cost Increase			
	Quality		No safety issues, C,O,M deficiencies approved by project team			

### Project Management Risks

Local agency support not attained (GRD for land expropriations).

Evaluation Impact of a Threat on Major Project Objectives						
Impact		Very Low	Low	Moderate	High	Very High
Objective	Time					Delivery Plan milestone delay outside fiscal year
	Cost		< 5% Cost Increase			
	Scope	Scope decrease is barely noticeable				
	Quality	Quality degradation barely noticeable				

Priorities change on existing program (often).

Evaluation Impact of a Threat on Major Project Objectives						
Impact		Very Low	Low	Mod.	High	Very High
Objective	Time				Delivery Plan milestone delay of more than 1 quarter	
	Cost		< 5% Cost Increase			
	Scope		Changes in project limits or features with < 5 % Cost Increase			
	Quality		No safety issues ,C,O,M deficiencies approved by project team			



### Right of Way Risks

Needs for “Permit to Enter” not considered in project schedule development (camp was installed at KRIPA area, for different reasons we are not allowed to work after 17 am).

Evaluation Impact of a Threat on Major Project Objectives						
Impact		Very Low	Low	Moderate	High	Very High
Objective	Time			Delivery Plan milestone delay of one quarter		
	Cost		< 5% Cost Increase			
	Scope		Changes in project limits or features with < 5 % Cost Increase			
	Quality	Quality degradation barely noticeable				

### Construction Risks

Unidentified utilities (water supply and pipe gas network),

Evaluation Impact of a Threat on Major Project Objectives						
Impact		Very Low	Low	Mod.	High	Very High
Objective	Time		Delivery Plan milestone delay within quarter			
	Cost		< 5% Cost Increase			
	Scope	Scope decrease is barely noticeable				
	Quality	Quality degradation barely noticeable				

Long lead time for utilities caused by design and manufacture of special components (steel beam).

Evaluation Impact of a Threat on Major Project Objectives						
Impact		Very Low	Low	Mod.	High	Very High
Objective	Time		Delivery Plan milestone delay within quarter			
	Cost		< 5% Cost Increase			
	Scope		Changes in project limits or features with < 5 % Cost Increase			
	Quality	Quality degradation barely noticeable				

### Engineering Services Risks

Unforeseen work required for Bridges construction (dam or secondary bridge not foreseen in BoQ).

Evaluation Impact of a Threat on Major Project Objectives						
Impact		Very Low	Low	Mod.	High	Very High
Objective	Time				Delivery Plan milestone delay of more than 1 quart.	
	Cost		< 5% Cost Increase			
	Scope		Changes in project limits/features < 5 % Cost Increase			
	Quality	Quality degradation barely noticeable				

Foundation and geotechnical tasks (foundation drilling and material testing) not identified and included in project work plan,

Evaluation Impact of a Threat on Major Project Objectives						
Impact		Very Low	Low	Moderate	High	Very High
Objective	Time			Delivery Plan milestone delay of one quarter		
	Cost			5-10 % Cost Increase		
	Scope	Scope decrease is barely noticeable				
	Quality				Quality may be made acceptable through mitigations/agreement (I.e Fact Sheet)	

### 3.3 Likelihood impact matrix development.

#### Objective TIME

No.	Risk description	Prob.	Impact	Score	Risk
8	Local agency support not attained (GRD for land expropriations).	5	5	25	High
2	Incomplete quantity estimates (quantity of piles, quantity of aggregates for embankment).	5	4	20	High
4	Labor shortage or strike (no payment by the sub-contractors).	5	4	20	High
9	Priorities change on existing program (often).	5	4	20	High
1	Bridge site data incomplete to DES (is missing method of statement).	3	4	12	Moderate
7	Losing critical staff at crucial point of the project (deferent advisers, local administrator and general director change	3	4	12	Moderate

	due construction time).				
13	Unforeseen work required for Bridges construction (dam or secondary bridge not foreseen in BOQ)	3	4	12	Moderate
3	Increase in material cost due to market forces (fuel, steel).	5	2	10	Moderate
6	Inexperienced staff assigned (local staff)	5	2	10	Moderate
11	Unidentified utilities (water supply and pipe gas network),	5	2	10	Moderate
5	Design changes require additional Environmental analysis (Lagoon of Narta for disturbing of animals).	3	3	9	Moderate
10	Needs for "Permit to Enter" not considered in project schedule development (camp was installed at KRIPA area, for different reasons we are not allowed to work after 17 am).	2	3	6	Low
12	Long lead time for utilities caused by design and manufacture of special components (steel beam).	3	2	6	Low
14	Foundation and geotechnical tasks (foundation drilling and material testing) not identified and included in project work plan,	2	3	6	Low

### Objective COST

No.	Risk description	Prob.	Impact	Score	Risk
3	Increase in material cost due to market forces (fuel, steel).	5	4	20	High
2	Incomplete quantity estimates (quantity of piles, quantity of aggregates for embankment).	5	3	15	High
4	Labor shortage or strike (no payment by the sub-contractors).	5	2	10	Moderate
6	Inexperienced staff assigned (local staff)	5	2	10	Moderate
8	Local agency support not attained (GRD for land expropriations).	5	2	10	Moderate
9	Priorities change on existing program (often).	5	2	10	Moderate
11	Unidentified utilities (water supply and pipe gas network),	5	2	10	Moderate
1	Bridge site data incomplete to DES (is missing method of statement).	3	2	6	Low
5	Design changes require additional Environmental analysis (Lagoon of Narta for disturbing of animals).	3	2	6	Low
7	Losing critical staff at crucial point of the project (deferent advisers, local administrator and general director change due construction time).	3	2	6	Low
12	Long lead time for utilities caused by design and manufacture of special components (steel beam).	3	2	6	Low
13	Unforeseen work required for Bridges construction (dam or secondary bridge not foreseen in BOQ)	3	2	6	Low
14	Foundation and geotechnical tasks (foundation drilling and material testing) not identified and included in project work plan,	2	3	6	Low
10	Needs for "Permit to Enter" not considered in project schedule development (camp was installed at KRIPA area,	2	2	4	Low

	for different reasons we are not allowed to work after 17 am).				
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### **Objective SCOPE**

No.	Risk description	Prob.	Impact	Score	Risk
6	Inexperienced staff assigned (local staff)	5	2	10	Moderate
9	Priorities change on existing program (often).	5	2	10	Moderate
7	Losing critical staff at crucial point of the project (deferent advisers, local administrator and general director change due construction time).	3	2	6	Low
12	Long lead time for utilities caused by design and manufacture of special components (steel beam).	3	2	6	Low
13	Unforeseen work required for Bridges construction (dam or secondary bridge not foreseen in BOQ)	3	2	6	Low
2	Incomplete quantity estimates (quantity of piles, quantity of aggregates for embankment).	5	1	5	Low
3	Increase in material cost due to market forces (fuel, steel).	5	1	5	Low
4	Labor shortage or strike (no payment by the sub-contractors).	5	1	5	Low
8	Local agency support not attained (GRD for land expropriations).	5	1	5	Low
11	Unidentified utilities (water supply and pipe gas network),	5	1	5	Low
10	Needs for "Permit to Enter" not considered in project schedule development (camp was installed at KRIPA area, for different reasons we are not allowed to work after 17 am).	2	2	4	Low
1	Bridge site data incomplete to DES (is missing method of statement).	3	1	3	Low
5	Design changes require additional Environmental analysis (Lagoon of Narta for disturbing of animals).	3	1	3	Low
14	Foundation and geotechnical tasks (foundation drilling and material testing) not identified and included in project work plan,	2	1	2	Low

### **Objective QUALITY**

No.	Risk description	Prob.	Impact	Score	Risk
6	Inexperienced staff assigned (local staff)	5	3	15	High
1	Bridge site data incomplete to DES (is missing method of statement).	3	4	12	Moderate
4	Labor shortage or strike (no payment by the sub-contractors).	5	2	10	Moderate
9	Priorities change on existing program (often).	5	2	10	Moderate
14	Foundation and geotechnical tasks (foundation drilling and material testing) not identified/included in project work	2	4	8	Moderate

	plan,				
7	Losing critical staff at crucial point of the project (deferent advisers, local administrator and general director change due construction time).	3	2	6	Low
2	Incomplete quantity estimates (quantity of piles, quantity of aggregates for embankment).	5	1	5	Low
3	Increase in material cost due to market forces (fuel, steel).	5	1	5	Low
8	Local agency support not attained (GRD for land expropriations).	5	1	5	Low
11	Unidentified utilities (water supply and pipe gas network),	5	1	5	Low
5	Design changes require additional Environmental analysis (Lagoon of Narta for disturbing of animals).	3	1	3	Low
12	Long lead time for utilities caused by design and manufacture of special components (steel beam).	3	1	3	Low
13	Unforeseen work required for Bridges construction (dam or secondary bridge not foreseen in BOQ)	3	1	3	Low
10	Needs for "Permit to Enter" not considered in project schedule development (camp was installed at KRIPA area, for different reasons we are not allowed to work after 17 am).	2	1	2	Low

Risk ID	Threat or Opport.	Risk Categ.	Risk Description	Primary Objective	Prob. (P)	Impact (I)	Overall Rating	Risk Owner	Strategy	Response Actions	WBS Affected
3	threat	Design risks	Bridge site data incomplete to DES (is missing method of statement).	time, quality	3	4	12 Mod.	Quarter office	Retention	Request for method of statement from the Client	Bill no 4 (Deck Bridge)
5	threat	Design risks	Incomplete quantity estimates (quantity of piles, quantity of aggregates for embankment).	time, cost	5	4	20 High	Quantity surveyor	Reduction	Re measurement contract. Efficient resource planning	Bill no 2,3 and no 5 (Earth Works, Foundation piles and Road Works)
12	threat	External risks	Increase in material cost due to market forces (fuel, steel).	time, cost	5	4	20 High	Quarter office	Retention	Absorb	All WBSs
15	threat	External risks	Labor shortage or strike (no payment by the sub-contractors).	time, cost, quality	5	4	20 High	PM	Reduction	Share risk with sub-contractors	All WBSs
17	threat	Environmental risks	Design changes require additional Environmental analysis (Lagoon of Narta for disturbing of animals).	time	3	3	9 Mod.	PM	Retention	Variation order by Client	Bill no 6 (Road Signs)
18	threat	Organizational risks	Inexperienced staff assigned (local staff)	time, cost, quality	5	2	10 Mod.	Human resources	Retention	Change technical staff	All WBSs

20	threat	Organizational risks	Losing critical staff at crucial point of the project (deferent advisers, local administrator and general director change due construction time).	time	3	4	12	Mod.	Quarter office	Retention	Absorb	All WBSs
24	threat	Organizational risks	Priorities change on existing program (often).	time, scope, quality	5	4	20	High	Quarter office	Retention	Absorb	All WBSs
33	threat	Project management	Local agency support not attained (GRD for land expropriations).	time, cost	5	5	25	High	PM deputy	Transfer	Transfer risk for delays to the Client according contract conditions	Bill no 2 (Earth Works)
41	threat	Construction risks	Unidentified utilities (water supply and pipe gas network),	time, cost	5	2	10	Mod.	PM deputy	Reduction	Variation order by Client	Bill no 2 (Earth Works)
45	threat	Engineering services risks	Unforeseen work required for Bridges construction (dam or secondary bridge not foreseen in BOQ)	time	3	4	12	Mod.	Technical office	Retention	Absorb	Bill no 3 and no 4 (Foundation Piles and Deck Bridge)
46	threat	Engineering services risks	Foundation and geotechnical tasks (foundation drilling and material testing) not identified and included in proj. work plan,	quality	2	4	8	Mod.	Technical office	Retention	Absorb	Bill no 3 and no 5 (Foundation Piles and Road Works)

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