



***R2A CASE STUDIES***  
***PROCUREMENT OF E CLASS TRAMS***

## BACKGROUND

In December 2008, the Victorian Government released its \$38b Victorian Transport Plan. As part of that plan and the Government's \$4.2b investment in rolling stock, there was a commitment to purchase 50 new low floor trams for the Melbourne tram system.

This was primarily to address Melbourne's rapidly growing needs. The new trams are high capacity, (capable of carrying at least 200 passengers), energy efficient, environmentally friendly and fully compliant to the Disability Discrimination Act (DDA) standards.

R2A was engaged as the independent risk advisors to the Victorian government for this project. Public Transport Victoria (PTV) adopted a criticality driven project due diligence procurement process.

R2A is an independent consultancy of due diligence engineers specialising not only in due diligence and defensible risk management, but also consulting, education and general troubleshooting.

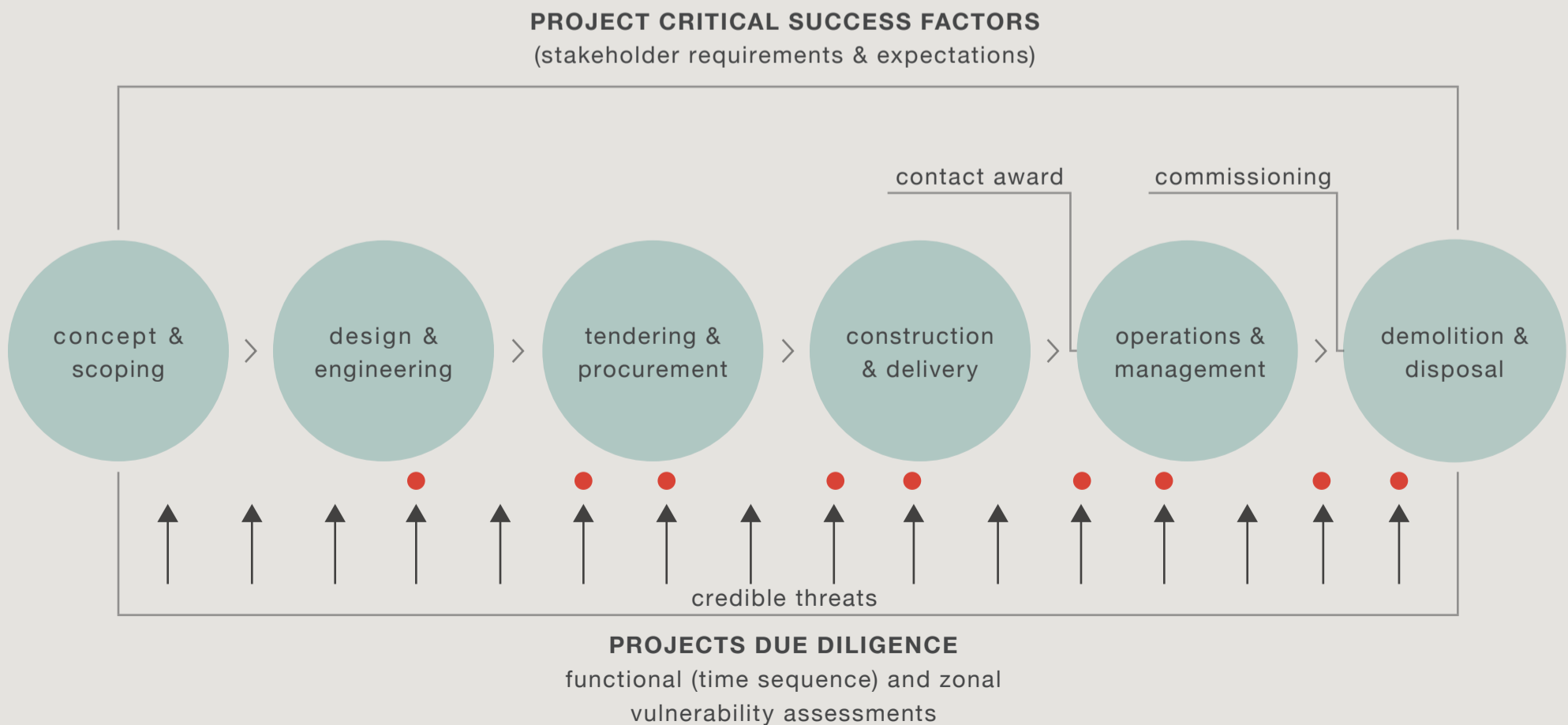


# PROJECT DUE DILIGENCE

Project due diligence provides a transparent argument as to why the critical success factors for the project will be achieved. It ensures there are no foreseeable project show stoppers within a project’s scope and that all reasonable practicable precautions are in place for any issues of concern that remain.

This top-down approach of identifying all project end state critical success factors allows clients’, partners’ and other stakeholders’ expectations to align.

Project due diligence ensures projects succeed in both performance and delivery by encouraging the project team to look back from the desired project end-state (achievement of the critical success factors of the end users) to focus on critical threats that will affect project outcomes.



## THE PROCESS

R2A conducted a high-level vulnerability assessment to ensure that all credible critical threats, which could potentially impact project critical success factors, had been identified and that all reasonable practicable precautions were implemented using a precautionary and risk register.

This provided a completeness check of issues for the entire project to ensure the context of all future risk work.



## CRITICAL SUCCESS FACTORS

The critical success factors were defined as an element that was essential to the success of the project from the viewpoint of the Department of Transport (at the time, now PTV) both in terms of project performance outcomes (once delivered) and project delivery.

### The project performance critical success factors were defined as:

- P1. Enhanced service capability and flexibility (reliable, available, passenger, capacity, passenger access)
- P2. Maintainable asset over design life at target cost
- P3. Operationally safe
- P4. Compliance with all Government Policies (DDA)
- P5. Project Reputation.

### The project delivery critical success factors were defined as:

- D1. First tram operational on time
- D2. First five trams operational on time
- D3. First five trams proven to be maintainable and reliable on time
- D4. The sixth tram operational on time
- D5. Reliable fleet maintained during roll-out
- D6. Contractor safety (OHS) during delivery
- D7. Project delivered within budget.



## ***CREDIBLE THREATS***

Credible threats were then identified using a project life-cycle approach considering:

- Procurement
- Contract
- Design
- Manufacturing and assembly
- Transportation
- Commissioning and testing
- Operations and Maintenance



# **CREDIBLE CRITICAL VULNERABILITIES**

Credible critical vulnerabilities occur when credible threats can potentially impact a critical success factor, therefore deeming the project inviable until addressed. Credible critical threats are outlined below.

## **Procurement Threats**

- Vehicle specification issues
- Evaluation issues
- Re-franchising transition issues
- Contract model selection issues.

## **Design Threats**

- Failure to ensure good practice design
- Delay in the delivery of the approved design
- Incompatibility with existing & enhanced infrastructure

## **Manufacture and Assembly Threats**

- Failure to ensure good practice manufacturing techniques

## **Commissioning and Testing Threats**

- Franchisee non-acceptance
- Regulatory non-acceptance
- Industrial non-acceptance
- DoT non-acceptance



## ***THE PRECAUTIONARY AND RISK REGISTER***

The results of the credible critical vulnerability assessment then fed into the project precautionary and risk register to make sure that all practical precautions were taken to ensure the critical success factors are met. A sample table for the credible threats identified as critical is shown on the following pages.

\*Refer to the Critical Success Factors section on page 4 or the full vulnerability table in the appendix.





THREAT	CRITICAL SUCCESS FACTORS*	PROPOSED CONTROLS / TREATMENT PLANS (PRECAUTIONS)
<b>PROCUREMENT</b>		
Vehicle Specification Issues	P1 P2 P3 P4 P5 D1 D2 D3 D4 D5 D7	<ol style="list-style-type: none"> <li>1 Tram wheelchair lift trials conducted</li> <li>2 Review of tram axle load and vehicle kinematic envelop</li> <li>3 Franchisee submitted functional / operational requirements</li> <li>4 RTBU consultation re: new vehicles</li> <li>5 Franchisee consultation, review, feedback and acceptance</li> <li>6 Facilitated discussions with industrial parties</li> <li>7 Social Transit Unit and PTAC consultation and acceptance</li> <li>8 Consultation with PTSV</li> <li>9 Consultation with Myki and AVL project teams</li> <li>10 Functional specification developed internally</li> <li>11 Internal critique / peer review</li> <li>12 Review of potential supplier proposals</li> <li>13 Technical consultation with short listed suppliers</li> </ol>
Evaluation Issues	D1 D2 D3	<ol style="list-style-type: none"> <li>1 Experienced evaluation team</li> <li>2 Robust agreed evaluation methodology and criteria</li> <li>3 Procurement conduct plan and compliance</li> <li>4 Probity auditor</li> <li>5 Agreed approvals process (Governance process)</li> <li>6 Strategic Procurement Plan</li> <li>7 Two stage procurement process (EOI and Tender)</li> <li>8 Legal and commercial advisors</li> <li>9 Franchisee technical consultation</li> <li>10 Suppliers experience in the market</li> <li>11 EOI / RFT documentation peer reviewed</li> <li>12 Project Gateway Review process</li> </ol>
Contract Model Selection Issues	P2 D5 D7	<ol style="list-style-type: none"> <li>1 Franchise consultation</li> <li>2 Project team experience in rolling stock supply, maintenance and procurement</li> <li>3 Legal and commercial advisors</li> <li>4 Consultation with Treasury (Commercial)</li> <li>5 Market feedback regarding commercial arrangements in EOI</li> <li>6 Risk review of procurement model</li> </ol>
Re-franchising Transition Issues (2009)	D1 D2 D3	<ol style="list-style-type: none"> <li>1 Project not to proceed to request for tender until consultation with franchisee has occurred</li> <li>2 Documentation prepared to final draft status</li> <li>3 Franchisee representatives to join project team</li> </ol>
<b>DESIGN</b>		
Failure to Ensure Good Practice Design	P1 P2 P3 P4 P5 D1 D2 D3 D4 D5 D7	<ol style="list-style-type: none"> <li>1 Reputable contractor</li> <li>2 Clear functional specification</li> <li>3 Design based on existing product and components</li> <li>4 Comprehensive agreed design review process (DoT, Franchisee and Supplier)</li> <li>5 Good communication links during design process</li> <li>6 Appropriate project personnel for design process</li> <li>7 Independent assessor to review design disputes</li> <li>8 Mock up tram tested with stakeholders</li> </ol>
Delay in the Delivery of the Approved Design	D1 D2	<ol style="list-style-type: none"> <li>1 Reputable contractor</li> <li>2 Clear functional specification</li> <li>3 Design based on existing product and components</li> <li>4 Comprehensive agreed design review process (DoT, Franchisee and Supplier)</li> <li>5 Supplier progress payments for design completion</li> <li>6 Good communication links during design process</li> <li>7 Appropriate project personnel for design process</li> </ol>
Incompatibility with Existing & Enhanced Infrastructure	P1 P2 P3 P4 P5 D1 D2 D3 D4 D5 D7	<ol style="list-style-type: none"> <li>1 Reputable contractor</li> <li>2 Clear functional and interface specification</li> <li>3 Design based on existing product and components</li> <li>4 Comprehensive agreed design review process (DoT, Franchisee and Supplier)</li> <li>5 Good communication links during design process</li> <li>6 Appropriate project personnel for design process</li> <li>7 Independent assessor to review design disputes</li> <li>8 Franchisee representative to join project team ASAP</li> <li>9 Ensure infrastructure enhancements compatible with new vehicles</li> </ol>

\*Refer to the Critical Success Factors section on page 4

THREAT	CRITICAL SUCCESS FACTORS	PROPOSED CONTROLS / TREATMENT PLANS (PRECAUTIONS)
<b>MANUFACTURE &amp; ASSEMBLY</b>		
Failure to Ensure Good Practice Manufacturing Technique	P1 P2 P3 P4 P5 D1 D2 D3 D4 D7	<ol style="list-style-type: none"> <li>1 Reputable contractor, sub-contractors and suppliers with DoT rights to refusal</li> <li>2 Contractor to have demonstrated technology transfer experience</li> <li>3 Clear functional and interface specification</li> <li>4 Design based on existing product and components</li> <li>5 Comprehensive agreed design review process (DoT, Franchisee &amp; Suppliers)</li> <li>6 Third party QA advisor</li> <li>7 Audits by project team</li> <li>8 Mock up tram</li> <li>9 Contractor to submit full manufacturing and QA plans</li> <li>10 Initial robust test period for first 5 trams</li> </ol>
<b>COMMISSIONING &amp; TEST</b>		
Franchisee Non-Acceptance	D1 D2 D3	<ol style="list-style-type: none"> <li>1 Franchisee representative part of the project team</li> <li>2 Functional specification agreed by Franchisee prior to RFT</li> <li>3 Increased fleet size and operation advantageous to Franchisee</li> </ol>
Regulatory Non-Acceptance	D1 D2	<ol style="list-style-type: none"> <li>1 Safety Regulator consultation regarding vehicle concept, procurement model and procurement guidelines</li> <li>2 Franchisee consultation with Safety Regulator prior to approval application</li> <li>3 Risk based procurement model including reputable supplier, clear functional specification</li> <li>4 Design based on existing product and components</li> <li>5 Comprehensive agreed design review process (DoT, Franchisee and Supplier)</li> <li>6 Good communication links during design process</li> <li>7 Appropriate project personnel for design process</li> <li>8 Independent assessor to review design disputes</li> <li>9 Mock up tram tested with stakeholders</li> <li>10 RAMS processes to be contained in contact</li> </ol>
Industrial Non-Acceptance	D1 D2 D3	<ol style="list-style-type: none"> <li>1 Early industrial consultation with all relevant unions</li> <li>2 RTBU requirements resulting from early consultation process included in specification</li> <li>3 Mock up tram tested for acceptance/sign-off with stakeholders</li> <li>4 Extensive initial trial of first 5 trams</li> <li>5 Drivers on project team via YT (at appropriate time)</li> <li>6 Stakeholder Communication and Management Plan</li> <li>7 Mock-up Tram Evaluation Plan</li> <li>8 Training Maintenance &amp; Operations Manuals available</li> <li>9 Maintenance secondee provided to Bombardier</li> <li>10 Independent cab ergonomic assessment</li> <li>11 YT cab review and feedback to RTBU from project team</li> <li>12 RTBU visited site on 26/4/13. No issues were raised.</li> <li>13 Monthly meetings with RTBU</li> </ol>
DoT Non-Acceptance	P5 D3	<ol style="list-style-type: none"> <li>1 Appropriate contract targets</li> <li>2 Design control</li> <li>3 Manufacturing controls</li> <li>4 Comprehensive testing program</li> <li>5 Franchisee encouraged to maximise vehicle km</li> <li>6 Contractor to provide good technical and maintenance support</li> <li>7 Good information on vehicle performance collected</li> </ol>



## **CONCLUSION**

The purchase of large rolling stock fleets in Melbourne in recent years has seen PTV adopt such a criticality driven project due diligence (rather than a project risk management) procurement process, which has proved very successful. It involves keeping everyone's eyes focused on the prize and ensuring no one loses sight of the overall objectives of the project.

Specifically, the approach does not use the risk based approach of the risk management standard as this is logically unable to positively demonstrate due diligence for the critical, rare potential project show stoppers, the issues of greatest concern and difficulty for senior decision makers.

R2A's process ensures the organisation has confidence in the project risk management process and will ensure that the project is right the first time resulting in a successful outcome.



## WHERE TO NEXT

If you would like to know more about how to manage due diligence in your business you can:

**Contact R2A** to organise a briefing for your executive management team.

Book an **In-House Course** or **Private Briefing**.

Buy a copy of the 10th edition R2A text: **Engineering Due Diligence**.

Receive **R2A's email newsletter**.

Attend the two-day **Engineering Due Diligence Workshop** presented by Richard Robinson over the last 10 years.

Attend the one-day **Defensible Risk Management Techniques course** presented by Richard Robinson on behalf of Engineering Education Australia.

Enrol in the postgraduate unit **'Introduction to Risk and Due Diligence'** Postgraduate Unit at Swinburne University, also presented by R2A.

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## APPENDIX

The completed vulnerability table is shown on the following page. Note that this is a criticality assessment not a risk assessment, where:

- xxx Potential project show stopper. Project not viable until addressed.
- xx Moderate potential vulnerability that needs to be specifically addressed by tenderers.
- x Minor potential vulnerability. To be addressed by successful contactor project manager.
- No detectable change.

	PROJECT PERFORMANCE CRITICAL SUCCESS FACTORS				
	Enhanced service capability/flexibility. All project aspects vehicles, power & depots.*	Maintainable asset over design life at target cost.	Operationally safe	Compliance with all Government Policies (DDA)	Project reputation
<b>CREDIBLE THREATS</b>					
<b>PROCUREMENT</b>					
Vehicle Specification Issues	XXX	XXX	XXX	XXX	XXX
Depot Specification Issues	XX	X	X	-	XX
Evaluation Issues	XX	XX	XX	XX	XX
Contract Model Selection Issues	XX	XXX	-	-	XX
Re-franchising transition 2009	-	-	-	-	X
<b>CONTRACT</b>					
Scope Changes	-	-	-	-	X
Other Simultaneous Projects	X	-	X	-	-
Termination of Current Franchisee	-	-	-	-	-
Probity Issues	-	-	-	-	XX
Industrial Action (Local)	-	-	-	-	X
Industrial Action (Overseas)	-	-	-	-	X
Adverse Media Coverage	-	-	-	-	X
Change of Government	-	-	-	-	X
Loss of Key Project Personnel/Skills	-	-	-	-	-
Contractor/Key Sub Supplier Insolvency	-	-	-	-	X
<b>DESIGN</b>					
Failure to Ensure Good Practice Design	XXX	XXX	XXX	XXX	XXX
Delay in Delivery of Approved Design	-	-	-	-	-
Incompatibility With Existing Infrastructure	XXX	XXX	XXX	XXX	XXX
Mock Up Tram Issues	XXX	XXX	XXX	XXX	XXX
<b>MANUFACTURE &amp; ASSEMBLY</b>					
Failure to Ensure Good Practice Manufacturing techniques	XXX	XXX	XXX	XXX	XXX
Lack of Availability of Raw Materials	-	-	-	-	-
Lack of Availability of Key Components	-	-	-	-	-
Lack of Skilled Manufacturing or Assembly Workforce	X	X	-	-	-
Technology Transfer	-	-	-	-	X
Local Content (VIPP) Issues	-	-	-	-	XX
<b>TRANSPORTATION</b>					
Transportation Issues	-	-	-	-	-
<b>COMMISSIONING &amp; TESTING</b>					
Limited Track Testing Prior to Arrival to Melbourne	-	-	-	-	-
Franchisee Non-acceptance	-	-	-	-	XX
Regulatory Non-acceptance	-	-	-	-	XX
Industrial Non-acceptance	-	-	-	-	XX
DoT Non-acceptance Reliability Targets	-	-	-	-	XXX
Infrastructure/Vehicle Staging Issues	-	-	-	-	X
<b>OPERATION &amp; MAINTENANCE</b>					
Scope Changes	XXX	XX	-	-	X
Other Simultaneous Projects	X	X	-	-	X
Termination of Current Franchisee	X	-	-	-	XX
Probity Issues	X	-	-	-	XX
Industrial Action (Local)	-	-	-	-	X

\*Enhanced service capability/flexibility include reliability, availability, passenger capacity & passenger access.

	PROJECT DELIVERY CRITICAL SUCCESS FACTORS - PART A			
	First tram operational on time	First 5 trams operational on time	First 5 Trams proven to be maintainable and reliable on time.	Sixth tram operational on time
<b>CREDIBLE THREATS</b>				
<b>PROCUREMENT</b>				
Vehicle Specification Issues	XXX	XXX	XXX	XXX
Depot Specification Issues	-	-	-	-
Evaluation Issues	XXX	XXX	XXX	X
Contract Model Selection Issues	XX	XX	XX	XX
Re-franchising transition 2009	XXX	XXX	XXX	X
<b>CONTRACT</b>				
Scope Changes	XX	X	-	-
Other Simultaneous Projects	-	-	-	-
Termination of Current Franchisee	X	X	X	-
Probity Issues	X	X	X	X
Industrial Action (Local)	XX	X	X	X
Industrial Action (Overseas)	XX	X	X	X
Adverse Media Coverage	-	-	-	-
Change of Government	-	-	-	-
Loss of Key Project Personnel/Skills	XX	XX	X	X
Contractor/Key Sub Supplier Insolvency	XX	XX	-	-
<b>DESIGN</b>				
Failure to Ensure Good Practice Design	XX	XXX	XXX	XXX
Delay in Delivery of Approved Design	XXX	XXX	XX	XX
Incompatibility With Existing Infrastructure	XX	XXX	XXX	XXX
Mock Up Tram Issues	XX	XXX	XXX	XXX
<b>MANUFACTURE &amp; ASSEMBLY</b>				
Failure to Ensure Good Practice Manufacturing techniques	XX	XXX	XXX	XXX
Lack of Availability of Raw Materials	XX	XX	XX	X
Lack of Availability of Key Components	XX	XX	XX	X
Lack of Skilled Manufacturing or Assembly Workforce	X	X	X	X
Technology Transfer	XX	XX	XX	XX
Local Content (VIPP) Issues	XX	XX	XX	-
<b>TRANSPORTATION</b>				
Transportation Issues	X	X	X	X
<b>COMMISSIONING &amp; TESTING</b>				
Limited Track Testing Prior to Arrival to Melbourne	X	X	X	X
Franchisee Non-acceptance	XXX	XXX	XXX	X
Regulatory Non-acceptance	XXX	XXX	XXX	X
Industrial Non-acceptance	XXX	XXX	XXX	X
DoT Non-acceptance Reliability Targets	XX	XX	XXX	N/A
Infrastructure/Vehicle Staging Issues	-	-	-	-
<b>OPERATION &amp; MAINTENANCE</b>				
Scope Changes	-	-	XXX	XX
Other Simultaneous Projects	-	-	-	-
Termination of Current Franchisee	-	-	-	-
Probity Issues	-	-	-	-
Industrial Action (Local)	X	X	X	-

	PROJECT DELIVERY CRITICAL SUCCESS FACTORS - PART B			
	Reliable fleet maintained during roll-out	Network level of service maintained during roll-out	Contractor safety (OHS) during delivery	Project delivered within budget
<b>CREDIBLE THREATS</b>				
<b>PROCUREMENT</b>				
Vehicle Specification Issues	XXX	XX	X	XXX
Depot Specification Issues	XX	XX	X	XX
Evaluation Issues	XX	X	X	XX
Contract Model Selection Issues	XXX	X	X	XXX
Re-franchising transition 2009	-	-	-	-
<b>CONTRACT</b>				
Scope Changes	-	-	-	X
Other Simultaneous Projects	-	-	-	X
Termination of Current Franchisee	-	-	-	X
Probity Issues	-	-	-	X
Industrial Action (Local)	X	X	X	X
Industrial Action (Overseas)	X	X	X	X
Adverse Media Coverage	-	-	-	-
Change of Government	-	-	-	-
Loss of Key Project Personnel/Skills	-	-	-	X
Contractor/Key Sub Supplier Insolvency	-	-	-	X
<b>DESIGN</b>				
Failure to Ensure Good Practice Design	XXX	XX	X	XXX
Delay in Delivery of Approved Design	-	-	-	XX
Incompatibility With Existing Infrastructure	XXX	XX	X	XXX
Mock Up Tram Issues	XXX	XX	X	XXX
<b>MANUFACTURE &amp; ASSEMBLY</b>				
Failure to Ensure Good Practice Manufacturing techniques	XX	XX	X	XXX
Lack of Availability of Raw Materials	-	-	-	X
Lack of Availability of Key Components	-	-	-	X
Lack of Skilled Manufacturing or Assembly Workforce	-	-	X	X
Technology Transfer	-	-	-	-
Local Content (VIPP) Issues	-	-	-	X
<b>TRANSPORTATION</b>				
Transportation Issues	-	-	-	-
<b>COMMISSIONING &amp; TESTING</b>				
Limited Track Testing Prior to Arrival to Melbourne	-	-	-	-
Franchisee Non-acceptance	-	-	-	XX
Regulatory Non-acceptance	-	-	-	XX
Industrial Non-acceptance	-	-	-	XX
DoT Non-acceptance Reliability Targets	XX	-	-	-
Infrastructure/Vehicle Staging Issues	XX	XX	-	X
<b>OPERATION &amp; MAINTENANCE</b>				
Scope Changes	XXX	X	-	XX
Other Simultaneous Projects	-	-	-	-
Termination of Current Franchisee	-	-	-	-
Probity Issues	-	-	-	X
Industrial Action (Local)	-	-	-	X





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