

CVEN30008 Engineering Risk Analysis

Tutorial 2-Qualitative Risk Analysis Solutions

Project 1	Excavate a services trench through the University grounds & install an electrical cable
Context	To be done during University term with minimum disruption to University activities. The University's vital services must be maintained (power, communications & water supply), The work must take up the least space possible, not damage trees, reinstate ground surface immediately after finishing & complete the project as quickly as possible. The services route generally follows an existing road way.
Hazards	Lots of existing underground services to avoid, lots of trees along the route, lots of pedestrian traffic and some vehicle traffic along the route, soft ground to trench in, limited space to stockpile materials, only space for one delivery vehicle at a time
Risk Owner	Contractor's Project Manager
Tutorial : Identify six(6) Risks (what if)	<ol style="list-style-type: none"> 1. Major injury to pedestrian. 2. Minor injury to pedestrian. 3. Backhoe damages an existing non-vital existing service line. 4. Backhoe damages an existing vital service line. 5. Tree roots damaged and tree dies. 6. Cable connected incorrectly causing power blackout over a wide area of the University. 7. Passing vehicle slips into the trench. 8. Worker injured by slipping on mud next to the trench while carrying a conduit. 9. Project time over-runs due to bad weather. 10. Project cost over-runs due to unexpected existing service lines to be protected. 11. Project cost over-runs due to unexpected tree roots to be avoided or protected. 12. The side of the trench collapses and the adjacent roadway sinks.
Tutorial : Propose Control Measures for the six risks	<p>1 & 2: Fence the site to exclude pedestrians and place warning signs. During necessary activities outside the fence, use a flagman to stop pedestrians & keep them away from the activities.</p> <p>3 & 4: Map all service lines before digging and use a hand auger to locate service lines before backhoe starts work each day. Hand excavate around known <u>vital</u> service lines. Remind workers at daily induction to watch carefully for services in the trench during excavation.</p> <p>5: Use a hand auger in advance to locate tree roots in the proposed trench alignment, then change the trench alignment to avoid the roots. If not possible, change to hand excavation around tree roots and use cable connectors to "bend" around or through the roots.</p> <p>6: Bring the University electrician to the site to identify and tag all existing cables in the trench. Isolate the cable being connected to, so only a limited area is blacked out if a problem occurs. Notify in advance the customers using the existing cable to be connected and arrange for the University electrician to disconnect while the cable connection is made. Arrange a separate power supply for vital customers who must remain on line while the cable is connected.</p> <p>7: Fence the site to exclude vehicles and place warning signs. Use trench support timbers if the vehicle has to come close or place a heavy steel plate over the trench temporarily if a vehicle has to drive over the trench.</p> <p>8: Clean mud from the area continually. Prepare a dedicated non-slip walkway with hand rail. Place warning signs to remind workers to take care and include warnings in the daily</p>

	<p>site induction.</p> <p>9: Transfer the commercial risk to the project Owner by including reimbursement in the Contract for weather delays. If not possible, allow contingency amount in the quotation to the Owner. (use weather modelling to predict frequency of bad weather)</p> <p>10: Transfer the commercial risk to the Owner by including extra reimbursement in the Contract if more than "x" number of service lines actually need to be avoided or protected.</p> <p>11: Transfer the commercial risk to the Owner by including extra reimbursement in the Contract if there are more than "x" number of tree roots actually to be avoided or the route has to be diverted a large extra distance.</p> <p>12: Cover the trench to minimise rain affecting the soil, keep trench-support timber nearby. Keep the trench dry (pumped out) at all times.</p>
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Project 2	Organise & operate a University campus charity party
Context	The charity organisation has a high profile and good reputation. Good publicity is required. The venue is on the south lawn in summer time and starts at dusk. The University offers use of toilets and power supply but not security staff. The Campus must be vacated by midnight and left clean by 9-00am next day. It is proposed to use amateur musicians and have a food stall run by volunteers. If there are complaints about the event, it may be banned in future.
Hazards	Drugs & alcohol, a large crowd in a confined area, "gate crashers", bad weather, large quantities of cash money on site, temporary power set-up for lights, stage sound and food stalls.
Risk Owner	Project Manager for the student group running the event.
Tutorial: Identify six (6) Risks (what if)	<ol style="list-style-type: none"> 1. An attendee tries to sell illegal drugs at the event. 2. Some attendees arrive under the influence of drugs or alcohol and create a disturbance or cause damage to University property. 3. Some attendees are injured in the large crowd. 4. The amateur musicians are excessively noisy and neighbours complain to police, the University and to the charity organisation. 5. The amateur band is not liked by the attendees and very little money for charity is collected. 6. Heavy rain occurs early and the event has to be abandoned 7. There is a problem with the food and some attendees become sick. 8. Part way through the event, some trouble-makers arrive and cause violence. 9. A large amount of cash is stolen. 10. The temporary power supply causes a short circuit and blacks out the campus. 11. The temporary power supply is dangerous and an attendee is electrocuted. 12. The attendees refuse to leave at midnight. 13. The attendees leave a lot of rubbish which is too much to clean up by 9:00am next morning.
Tutorial: Propose Control Measures for the six risks	<p>1 & 2: Engage a professional security service for the evening. Notify the police about the event and ask their advice on preparations. Inspect all large bags being carried into the event.</p> <p>3: Plan the area to encourage dispersed groups, ask the security personnel to stop large groups forming as much as possible, have a qualified first aid team at the event, notify the local hospital & ambulance service about the event and ask their advice on preparations. Arrange third party insurance to protect the event organiser, authorised event staff, the University and the charity organisation.</p> <p>4: Make sure the band knows the noise level requirements and ensure that there is a</p>

	<p>responsible leader of the group who will respond to requests.</p> <p>5: Conduct an informal survey of potential attendees to gauge the acceptance of the band before asking the band to play for the event.</p> <p>6: Arrange insurance protection to cover the unavoidable and unrecoverable costs of staging the event.</p> <p>7: Choose a simple food menu with minimum preparation at the event and minimum chance of contamination. Ensure that there is at least one trained food preparation manager amongst the volunteers or pay for a trained food preparation manager.</p> <p>8: Engage a professional security service for the evening. Notify the police about the event and ask their advice on preparations.</p> <p>9: Arrange for a safe place away from the event (but nearby) to store cash and arrange for a dedicated team to continually collect cash at the cash collection points (entrance, food stall etc) to ensure minimum cash is kept at the event site.</p> <p>10 & 11: Engage a qualified electrician to set-up the temporary power system with an earth leakage protection system, fully test it before the event and don't allow any volunteers to change it during the event.</p> <p>12: Advertise clearly that music stops at 11.45pm and the event concludes at midnight. Stop the band and close the food stalls at 11-45pm. Announce that people must leave by midnight. Engage a professional security service for the evening. Notify the police about the event and ask their advice on preparations.</p> <p>13: Make sure that there are plenty of rubbish bins and signs. Ask security to stop people entering with large amounts of food or other items.</p>
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Project 3	Replace the asphalt surfacing on a busy footpath in Lygon street.
Context	<p>The footpath is in front of shops that mostly operate 9 to 5 Monday to Thursday but late on Friday and normal hours Saturday and Sunday. Some cafes & restaurants operate till 11PM most nights. The footpath is used by pedestrians and is designed for disabled persons also. Kerb-side parking is provided adjacent the footpath and the running lane beyond that is shared by cars and push bikes.</p> <p>The work involved is stripping back existing asphalt, excavating 300mm and placing bedding sand then 30mm bluestone pavers to the finished level.</p> <p>Shopkeepers wish to maintain access at all operating times and have minimum disruption in front of their shops.</p>
Hazards	Pedestrians, disabled persons, car-parking adjacent the footpath, shop front glass, delivery of goods to shops, pet animals, limited space for construction access and materials storage.
Risk Owner	Construction Site Manager
Tutorial: Identify six (6) Risks (what if.....)	<ol style="list-style-type: none"> 1. The commercial risk of one or more shops suffering loss of business due to the project. 2. Shop front window glass damaged. 3. Dust causes damage to shop items. 4. Noise level is too great and shop keepers gain a stop work order. 5. A major injury occurs to a pedestrian. 6. A minor injury occurs to a pedestrian. 7. A parking car runs onto the works area and damages work or injures a worker. 8. Insufficient space to store equipment & materials and the project is delayed. 9. Expensive paving materials are stolen out of hours. 10. Construction activities cause a vehicle accident on the adjacent road.
Tutorial: propose Control	1: Engage with shop owners to determine peak time for shopper access and to agree on protection to be provided to windows and premises. Work in a staggered (patch-work) pattern to maintain shop front access as long as possible and only restrict door

Measures for the six risks	<p>access out of hours or by agreement.</p> <p>2: Erect a protection screen in front of windows.</p> <p>3: Keep the works area damp at all times and restrict work on windy days.</p> <p>4: Use quietest equipment available and ensure all equipment has noise attenuators fitted. Take noise measurements regularly and advise shop keepers that noise is at permitted levels.</p> <p>5: Arrange for handover of parking lanes next to the footpath and divert pedestrians onto adjacent parking lane where works are occurring. Ensure that the surface on the diversion is smooth and provide lots of signs to warn and give directions. Place temporary barricades to stop pedestrians straying onto the adjacent road.</p> <p>6: Arrange for handover of parking lanes next to the footpath and divert pedestrians onto adjacent parking lane where works are occurring. Ensure that the surface on the diversion is smooth and provide lots of signs to warn and give directions. Place temporary barricades to stop pedestrians straying onto the adjacent road.</p> <p>In addition, use a flag man to stop pedestrians passing when there is a potential high risk due to the works.</p> <p>7: Notify Police of your plans and seek advice on preferred arrangements. Engage an experienced traffic management Consultant. Place warning signs at each end of the works area to reduce traffic speed. Arrange for occupation of several parking lanes each side of the works to provide a “buffer” between works and cars. Place temporary traffic barriers at “pinch points” with flashing lights on top of the barricades.</p> <p>8: Arrange for occupation of several parking lanes each side of the works to provide temporary storage areas and arrange for a larger and secure off-street storage area as close to the works as possible.</p> <p>9: Bring the minimum amount of materials onto the site sufficient for say 1 days work. Place all costly materials overnight into the secure off-street storage area. Notify local police of your activities and seek advice regarding potential theft.</p> <p>10: Notify Police of your plans and seek advice on preferred arrangements. Engage an experienced traffic management Consultant. Place warning signs at each end of the works area to reduce traffic speed. Arrange for occupation of several parking lanes each side of the works to provide a “buffer” between works and cars. Place temporary traffic barriers at “pinch points” with flashing lights on top of the barricades.</p>
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Project 4	Design & construct a new drainage pipeline through a parkland with conservation values.
Context	<p>The alignment of a 500 mm diameter jointed concrete storm drain has to pass through a large park over a distance of 1 km. Other alignments to avoid the park were investigated but were found to be unviable.</p> <p>The park has acknowledged environmental values with many native trees and shrubs, typical native fauna as well as endangered bird species and some rare insect species that have been recorded in the past but not sighted recently.</p> <p>The trench excavation will be 3 m deep on average in firm to soft clay material and with the water table varying from 30 cm to 3 m below surface.</p> <p>A small natural waterway crosses the drain alignment and this contains protected amphibians. The waterway leads to a local wetlands that is managed by the Catchment Management Authority.</p>
Hazards	Poor ground conditions, limited access, stringent environmental controls, an aggressive local “Friends of the Park” group who are against the drain project, onerous construction contract conditions regarding environmental protection, construction noise, construction pollution, high water table and wet winter conditions.
Risk Owner	Construction Project Manager

Tutorial Identify six (6) Risks (what if)	<ol style="list-style-type: none"> 1. The trench collapses & the project is delayed. 2. The trench collapses and a worker is injured. 3. Community resistance raised and access is blocked causing delay. 4. The excavation inadvertently causes damage to flora and causes delay and penalty cost. 5. Local residents complain about the construction noise level and an EPA enquiry causes delay. 6. "Friends of the Park" claim that a rare insect exists in the Park and work must stop until protection is arranged. 7. Silt from trench excavation near the waterway washes into the waterway and contaminates the wetlands. 8. During adverse weather events, managing the water table in the trench becomes impossible and work stops. 9. A fuel spill from stored fuel in the Park is a breach of Contract conditions causing a long delay for investigation and a cost penalty. 10. Cranes handling heavy concrete pipes get bogged in the Park and damage the surface badly. 11. Trucks hauling surplus trench spoil and bringing in pipe bedding material get bogged in the Park and damage the surface badly.
Tutorial : propose Control Measures for the six risks	<ol style="list-style-type: none"> 1: Do enough exploration drilling in advance to know where soft clay and high water table are and provide trench support equipment. 2: Do enough exploration drilling in advance to know where soft clay and high water table are and provide trench support equipment. Provide routine trench support where ever workers have to enter the trench, Include risk in the daily safety induction agenda with workers. 3: Undertake intense community engagement before starting work and build credibility in environmental protection. Seek community ideas for environmental protection and use them where practicable. 4: Investigate possibility of a revised alignment to provide more clearance to flora. Install barricades around all flora near the trench. Include flora protection in the daily induction agenda for workers. 5: Use quietest equipment available, take regular noise measurements to demonstrate compliance (or problems). Notify residents of upcoming noisy construction activities. 6: Engage a specialist entomologist to investigate the site as soon as the contract is awarded to confirm existence of insects or not. Re-align the trench route if possible to avoid likely habitat. Engage with stakeholders throughout to demonstrate credibility. Transfer commercial risk to Owner in contract conditions as much as possible. 7: Install robust silt fences between the trench and the waterway. Stop excavation near the water way during wet weather. 8: Investigate the historic frequency & intensity of rain storms and schedule excavation in high water table areas during low risk periods. Arrange stand-by pumping equipment for emergency use in high intensity events. Transfer commercial risk of exceptional events to the Owner in contract conditions as much as possible. 9: Do not store fuel in the Park. Arrange off-site storage and delivery to vehicles at a bunded area outside the Park. 10: Assess the likely duration of wet conditions during the contract period and choose temporary ground protection or a more permanent solution if justified. Investigate substitution of light weight pipe material. For exceptional situations, transfer commercial risk to Owner if possible in contract conditions. 11: Minimise the amount of truck movements by using local stockpiles or by using rail mounted equipment and installing a rail delivery system along the pipe route (gantry or side rail) instead of rubber tyred vehicles.