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Case Report on Stakeholders Management in a Construction Project in an Urban Environment

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Abstract

The continuing growth of population density in urban areas around the world has placed greater emphasis on the utilization and development of underground space to meet the increasing demands of the city. Due to limited land space available in downtown areas, many cities in the world are also embarking on integration of major construction projects of metro infrastructure, commercial developments and residential estates etc., to meet the growing demand of infrastructure. Construction project in an urban area necessitates the involvement of internal and external stakeholders in the planning phase of the project and requires managing the expectations of the stakeholders throughout the project.

This paper will present a case study to depict the ways for managing the stakeholders affected due to the construction project in an urban environment. Stakeholder management in construction projects which are of national importance is even more challenging and complex than private projects. To make the project successful, it is very important to identify all the stakeholders and engage them in early phases of project. The very task of managing the different priorities and requirements of internal and external stakeholder groups at various stages of project is tedious in itself. This paper will describe the different strategies and present 2 case studies to manage the expectations of various stakeholders during the construction works in a densely populated area.

Keywords: Stakeholders • Management • Construction • Environment

Introduction

The Thomson-East Coast Line (TEL) is an underground Mass Rapid Transit (MRT) system along the North-South corridor and eastwards along east coast of approximately 43 km [1]. It consists of 31 MRT stations and an integrated MRT cum bus depot at Mandai [2]. Contract T222 includes construction of outram park station box and entrances and integration of extensive network of linkways to the existing East West Line (EWL) and North East Line (NEL), two TEL mainline tunnels to Maxwell and Havelock station [3]. The site location of Contract T222, Extent of T222 station and linkways is demarcated [4].

Case Presentation

Due to the location of T222 in Central Business District (CBD) area, numerous stakeholders were involved with each one having different sets of requirements including two Public Transport Operator and general public [5]. Network of underground linkways at basement 1 and Basement 3 levels were constructed under the outram road which is one of the widely used road leading to downtown area and is full of services. It was necessary to meet the expectations and satisfy the requirements of stakeholders including the utility agencies to facilitate the construction of project. Due to the proximity of health science authority, singapore general hospital, existing MRT stations, residential and commercial developments, there were numerous restrictions on working hours, construction sequences, stringent monitoring requirements etc. Stakeholder's expectations were managed by the early engagement of stakeholders in the planning phase (Figure 1) [6].

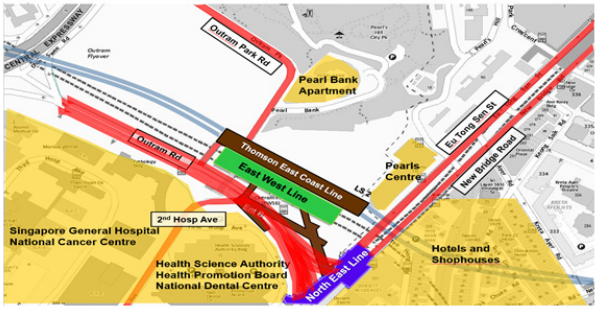

Figure 1. Site plan of the project showing external stakeholders.

Stakeholder engagement

Project Information Center (PIC) was set up next to the construction site which served as a platform to invite the stakeholders and engage them in the site activities. PIC was equipped with the working model which was helpful for stakeholders to understand the scope of the project as well as the impact of the project on to them. A full time Public relation officer and 24 hours project hotline were also provided to attend to any feedback or query from the stakeholders promptly. Regular dialogue sessions were arranged with stakeholders to brief them on site activities and to understand their requirements at the same time. Circulars were also issued to notify stakeholders on the upcoming activities such as road closures, mining under their property, material deliveries which could only occur at night etc that were likely to affect them in one way or another.

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Noise control

Noise control was one of major concerns from all the stakeholders. To minimise the discomfort to stakeholders, noise mitigation plan was developed before starting the construction activities. Noise mitigation plan included the identification of the stakeholders which will be affected by the construction noise, impact of the noise on the different stakeholders as well as mitigation measures to ensure compliance with permissible noise limits. Numerous source controls were implemented on site to reduce the noise from the construction activities including:

• Noisy parts of construction machineries were enclosed with noise panels.

• Silent Piler was used for the installation of sheet piles.

• Scheduling of noisy activities in day time.

• Engage specialist consultant to evaluate noise simulation at site.

• Use of rubber mallet hammer in place of metal hammer for rebar works.

• Acoustic cover for crawler cranes engine covers.

In addition to above, various noise mitigation measures such as noise barriers, noise blankets, noise meters etc. were also installed on site to reduce the noise nuisance to stakeholders.

Noise barrier

Noise barrier is an exterior structure which was used to protect the inhabitants of the nearby structures from the noise pollution arising from construction activities. Noise barriers were installed at numerous locations to reduce the impact of noise from the construction works. Figure 2 shows the line of noise barriers installed in front of health science authority.

At some locations, it was not feasible to provide proper foundation for the noise barriers due to either space constraint or nature of the work. In such circumstances, noise blanket was used to minimise the noise pollution. Figure 3 shows the noise blanket installed during the modification works at public car park (Figures 2 and 3).

Figure 2. Noise barriers installed in front of existing building.

Figure 3. Noise blanket in public car park (left) and noise meter on the roof top (right).

Noise meter

Noise meter were installed on the roof-top of nearby residential areas and Health Science Authority to monitor noise levels in real time throughout the construction period. If the noise level exceeded the permissible limits, the person in charge was notified immediately so that appropriate actions can be taken without any delay.

Environmental management

As T222 was surrounded by numerous stakeholders, it was necessary to ensure that stakeholders in the neighbourhood are not unduly inconvenienced or subjected to nuisances or public health hazards. Environmental management is essential in order to prevent or minimise the propagation of vectors by destroying or removing the potential locations of larval habitats as well as to minimise the air pollution. A report was submitted to the neighbouring stakeholders periodically about the activities towards environmental management to give them assurance that constant effort is done to minimise the impact of construction onto them.

Vector control

Vector control is always one of the key concerns of the stakeholders residing nearby the construction site. To address this concern of the stakeholders, various vector control measures were enforced on site.

• Vector control specialist was engaged to conduct weekly inspection and larviciding.

• Weekly maintenance of overgrown vegetation to prevent potential mosquito breeding ground.

• Misting was done periodically to remove the adult mosquitoes.

• Daily housekeeping to eradicate potential vector breeding ground.

• Pest Control officer was engaged to insect and apply rodent baits to monitor rodent activities.

Dust control

Dust generation is inevitable from a construction site which makes dust control very crucial for human health protection. A variety of dust-control techniques were enforced on site to ensure environmental compliance and minimise the air pollution.

• Usage of water sprinklers at site to settle the dust.

• Washing of public access way periodically to ensure its cleanliness.

• Washing of construction vehicles wheels before exiting the site.

• Removal of construction debris only through approved route and properly covered to prevent dust generation.

• Use of low dust generating techniques for demolition works such as hacking works were replaced with saw cutting works.

• For the connection of new MRT station to existing EWL and NEL, full height hoarding was provided to prevent the flow of dust to existing MRT stations. IN addition, air purifiers were also provided in the existing structures to minimise the dust nuisance.

Internal stakeholders

Internal stakeholders refer to everyone inside the company associated with the project. Each stakeholder has different influence and role within the project. In project T222, more than 20 internal stakeholders were involved and it was necessary to seek their guidance and involve them in project whenever required. To achieve this, it was necessary to develop a proper communication channel to prevent any room of misunderstanding. Meetings were conducted regularly with the internal stakeholders to ensure proper coordination among the teams and to address the issues that relates to them. A full time coordinator was also appointed who will ensure that all internal stakeholders are looped in at every phase of project. For the success of the project, it is important to ensure common understanding among all the stakeholders.

Results and Discussion

Instrumentation and monitoring

Construction in urban environment requires a number of precautions to minimize or prevent damage to adjacent structures. Careful planning and engineering, pre-construction surveys, neighbouring building movement monitoring, vibration monitoring, coordination with neighbouring stakeholders, and overall due diligence all play a vital role in successful completion of a new construction project within an urban setting. Before starting the construction activities, a comprehensive instrument monitoring scheme was installed in the nearby structures to monitor their movement during the construction works. Alert Limit (AL) and Work Suspension Limit (WSL) was given by the qualifies personnel based on the criticality of the structure. For instance, one of the stakeholder informed that they have certain equipment's which are very sensitive to vibrations, hence the limits for AL and WSL were very strict to ensure safe running of the equipment. In the event of breech of AL or WSL, owner of the respective property and project engineer were informed *via* the automatic system so that immediate remedial actions can be taken (Figures 4 and 5).

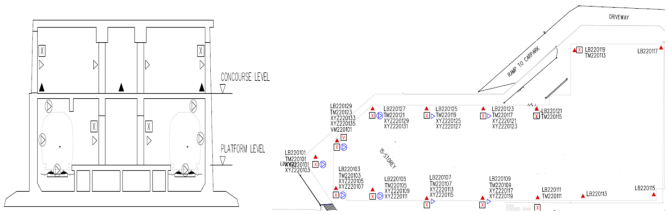

Figure 4. Instruments in EWL station and trackside (left) and in existing 15 storey building (right).

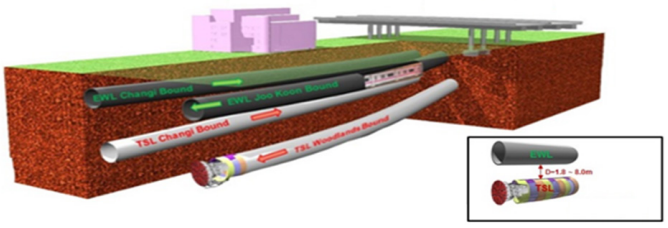

Figure 5. The pipeline wangz hotel.

Real time monitoring was employed in the existing track of East West Line and North East Line so that movement of existing track could be monitored closely at all times. Instruments in the nearby buildings were also monitored periodically and were reviewed by qualified personnel if any movement was observed. Respective stakeholders were informed of the monitoring readings on regular basis.

Precondition and post condition survey

Before starting the actual works, pre-condition survey of the existing properties was conducted with the specialist and owner of the property to establish and document the condition of the existing properties within the influence zone of project. A copy of precondition report was submitted to owner also for their record. This report is vital to determine the origin of the defect, whether it existed before or after the beginning of the project and to avoid any dispute that may arise if there is any damage noticed in the existing property. Precondition report also helps the engineer to assess the current condition of the existing property and provide the necessary remedial/strengthening measures if existing structure is not capable to withstand the impact of new construction.

After the completion of construction works, post condition survey was also conducted to determine if there are significant changes to the property resulting from the construction activity. If the engineer deems that damage to the existing property is caused due to the construction activity, necessary rectification works were carried out to restore the damage.

Stakeholders management during tunneling works

Stakeholder management for the tunnelling was one of the challenging tasks for this particular contract as we had to deal with the two train operators, Singapore Mass Rapid Transit (SMRT) and the Singapore Bus Services Transit (SBST), as the tunnels built were to undercrosss and over cross respectively the live tunnels. This was mainly due to the interchange station as it will be serving as a future interchange station. These stakeholders were very sensitive as there was a potential fear that daily train commuters might be affected if there were any disruption to the train services as a result of the construction. There was a much precise timely coordination needed to be carried during the tunnelling operations. The other stake holders were a few hotels and about 401 shop houses to

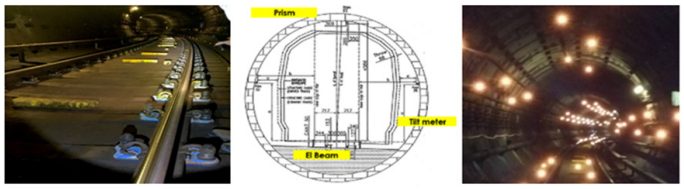

Figure 6. Image showing the emergency operation circular (OPS).

Pre- engagement with stake holders

Due to criticality of the works an extensive pre engagement was done with the stake holders. Many structures were deemed within the influence zone and hence a detailed assessment was needed. For an effective assessment the teams also had to consider the pre-existing conditions of the buildings. Pre-Condition survey was carried out on almost all the structures and based on the report an impact assessment was made. For the buildings under high risk a detailed instrumentation layout was prepared and installed for close monitoring and monthly engagement with the stake holder was carried out to ensure there are no major concerns. The team also developed a decanting plan with detailed analysis as to what actions to be taken during incidents and to ensure the safety of the people. This precautionary measure were well developed in pre engagement stages and briefed to the stakeholders.

As for the under crossing of the live Metro lines, extensive stake holder engagement with the operators was necessary as there was high risk involved in case of emergency. A detailed pre meeting with the operator was arranged along and detailed presentation and briefing was given to the technical team on the tunnelling works. The likely impacts and detailed impact assessment was submitted to them. Prior to tunnelling lot of instruments were installed inside the existing tunnels to monitor the track and tunnel movements. The instruments comprised off Prisms, Electro

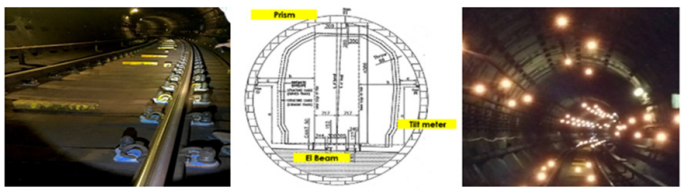

Figure 7. Image showing the emergency operation circular (OPS).

Emergency Operation Circular (OPS) which was agreed between the regulator and detailed down. This had the information pertaining to the key contact person, emergency track access slots, flow chart detailing the steps to be followed in case of any breach of levels and instance when speed restriction needs to be imposed. An in depth analysis of the bearing condition and assessments were carried out for the CTE viaduct, as the piles toe of CTE expressway was within 5 m of the influence of the TBM. This was to ensure there are no structural concerns arising from the tunnelling works.

During tunneling

While the TBM commenced, the stake holders were briefed well ahead on the TBM movements under and an extensive instrumentation cycle was carried out during the tunneling works. Once the TBM had crossed the particular influence area, the stake holders were notified and post condition survey will be done and reports were submitted to the Stakeholders (Figure 8).

Figure 8. Image showing the reports were submitted to the stakeholders.

Communication channel

If there were any feedbacks/complaints from the stakeholders during tunnelling works, special attention was given to attend to it. Feedback was to be accessed by the SPRO together with the project manager and construction team for follow-up action on any fault or inconvenience issues. These communication means were designed to ensure simplicity and accessibility to all.

During the undercrossing of the live tunnels, regular meetings and site checks were conducted to ensure that existing tunnels are safe to use. A separate team was working over night to enter the tunnels after MRT operation hours and assess the condition. A special device was brought from Denmark to spontaneously measure the rail cant, twist and versaine in the existing tunnels, needed to check the rail levels for operation. A dedicated team was always on standby to take any remedial actions if required before starting MRT operation the next day.

The photos below show the track checks carried out with the operators and once done a detailed report would be sent to the operators to cross check and confirm the safe operations of the trains. With all the above well planned coordination and stakeholder management the project was able to complete safely without any major issues (Figure 9).

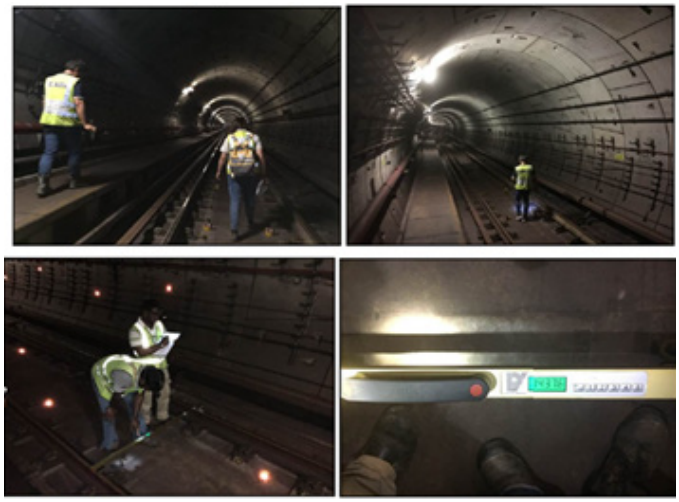

Figure 9. Image showing the communication channel tunnelling works.

Stakeholders management during traffic diversion works

For the construction of link ways underneath the existing road, Outram park road and adjacent public walkways were diverted many times during the course of the construction. One of the major stakeholder affected by these works were road users. Before the diversion of the roads or pedestrian walkways, notices were put up at relevant locations and circulars will be distributed to inform public about the diversions. For the road user, special Variable Message Sign (VMS) panel was installed to keep the road users updated of traffic diversions or lane closures. In addition to this, traffic marshals were provided to guide people of the diverted path. Due to the proximity of Singapore general hospital, dedicated marshals were deployed to guide the way to pedestrians towards hospital.

The construction site was like an island surrounded by busy roads on all sides. To facilitate movement of construction vehicles in and out from the site it was necessary to do the lane closure. To minimise any traffic disruption, such activities were restricted to off peak hours. Also, casting of the concrete was always scheduled during the night to avoid any traffic jam due to the long queue of transit mixers on the road. Weekly inspections were done to ensure the maintenance and cleanliness of public walkways and hoardings along the construction site throughout the project (Figure 10).

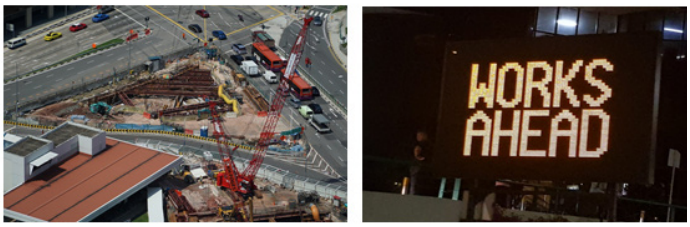

Figure 10. Linkway construction on outram road (left) and VMS panel (right).

Conclusion

Successful stakeholder management is a dynamic process and requires transparency that builds understanding with the stakeholders as the project progresses. It is important that projects must respect the stakeholders' wellbeing rather than treating them as a means to meet corporate needs. Techniques discussed in the paper will be useful in stakeholder management in mega construction projects in downtown areas and in the vicinity of existing sensitive structures which is increasingly becoming unavoidable. It is believed that lessons learnt from this project would give greater confidence for undertaking future underground developments in such challenging environment.

Acknowledgement

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