

1. VALUE MANAGEMENT (VM) – Pre-Contract

Features & purposes

- Seeks to achieve value for money by providing all the necessary functions at the lowest total cost consistent with required levels of quality & performance
- Reduce project costs & time w/o sacrificing quality or functionality
- Identification of employer's needs, expectation & project critical success factor
- Ensure every idea generated will undergo a thorough evaluation process, including risk analysis
- Define mission statement, provide important performance indicator
- Prioritize tasks & actions which will support construction process
- Support the choice of the most resource-effective solutions, while maintaining employer's satisfaction

Stages

(a) Inception stage

- Initial question of VM → whether the project is required to deliver the anticipated benefits to the employer
- Employer needs to clearly define his needs & establish a clear plan of action
- Construction cost at this stage is not an issue

(b) Concept stage

- Design team will develop a master plan with various options for consideration
- Convene a VM study involving the employer, operator, consultants & possibly MC
- Identify modification to the master plan & make improvement on original concept

(c) Feasibility stage

- Most valuable to carry out VM study at this stage
- Selection of experts from all fields in order to test the proposed design & principle adopted
- All suggestions should be soundly debated & costed, which help identifying problems of construction methods, materials & design
- Non-financial criteria should also be tabulated for consideration
- Design team should issue a report to employer with recommendations

(d) Design stage

- Establish the most cost-effective design solution
- Carry out value engineering study

(e) Construction stage

- MC was selected, and directly control about 1/4 of total construction cost
- MC may proposed some alternative materials for meeting the minimum specification requirements only in order to save cost

Roles & functions of VM Facilitator → refer to 2001 APC Q1.3(e)

- Manage, coordinate & facilitate the VM workshop activities
- Facilitators should have group management skills, communication & analytical skills, interpretation & questioning skills, lateral thinking skills

VM workshop

(a) 5-phase

- Information / analysis / creativity / judgment / development

(b) Key elements

- Well structured with set goals & objectives
- Multi-disciplinary, professional & specialist input
- Professionally facilitated
- Shared understanding
- Group decision & evaluation to create innovative solution
- Ownership & commitment

(c) Cost, duration & no. of participants

- Approx \$100,000 for a 2-day workshop
- Typical duration of a series of VM workshop (from commencement → pre-workshop → workshop → conclusion) about 6 weeks to 4 months
- Each workshop about 1-5 days
- Longer duration of workshop
 - allow more in-depth study of issues, but discourage senior personnel's attendance
 - ∴ mid-levels officers attend 1st stage workshops & seniors attend later stages
- 15-30 professionals (representatives of employer, specialists consultants & other stakeholders)
 - invite correct level of representatives in order to make contributions

Others - VM
(P.) 1.

(d) Objectives

- Updating standards, criteria & objectives
- Promoting innovations & optimizing resources
- Eliminating unnecessary items & costs & finding solutions that best fit project objectives
- Breaking dead-lock situations
- Time saving, & ensuring ownership & commitment

VM reports → sample refer to ETWB TC no. 35/2002

- Studies of background & findings
- Re-define project rationale & objectives
- Summarize outlines of key functions in terms of key scope, programme & cost
- Describe value improvement options with implications
- Outline & other necessary information of action plan

2. VALUE ENGINEERING (VE) – Post-Contract

Features & purposes

- Reduce project costs & time w/o sacrificing quality or functionality
- Value is defined as the measure of cost, quality & customer choice
- VE is usually carried out after the design is finished, which is a problem solving approach
- Develop & implement the best solutions
- VE will be conducted by a team of several specialists, between 12 to 15 participants
- **QS** being a team member who can provide comments on cost planning & able to apply approx cost to conceptual design (refer to 2001 APC Q1.3(d))
- An essential process that uses functional cost analysis to reduce cost
- To fulfill the required functions & provide appropriate quality at the minimum cost
- To ensure free-thinking from the original design, and to avoid biased opinions

Stages → refer to 2001 APC Q1.3(b)

- Information → analysis → creativity → development → evaluation & recommendation

VE studies(a) Cost

- Detailed cost analysis of MC's rates → to determine if any rates in the tender contain excessive profits, inefficient use of labour, high material wastage, or utilize incorrect plants & equipments
- Cost savings in plumbing & MVAC systems ~ 15%, water circuits & elec installation ~ 10%

(b) Quality

- If the quality is lowered as a result of cutting cost → not VE
- Components changes should uphold the quality & improve value
- Build quality must never be compromised except employer's instruction
- Use of supplier's standard components rather than tailor-made products
- Unnecessarily high quality standard & over-tight tolerance → VE can remove such inhibitors & result in significant cost savings
- Experience shows that simple systems based on latest technology have lower initial cost & more reliable

(c) Time

- Reducing construction time to bring forward revenue could transform the viability of retail (hotel) operation

(d) Productivity

- New products, plants & equipments are introducing in the market all the times
→ the building can be designed with using those new materials & techniques

Advantages → also refer to Features

- Identify the correct balance of cost, time & quality, which involve the whole project team
- The decision making is explicit, accountable and clearly linked to the project objectives
- Encourage the development of creative solutions, potentially eliminating causes of poor value on projects
- Apply value-based design which eliminate unnecessary cost, identify redundancy & over-engineering
- Reviewing the design from a value of money perspective

3. RISK MANAGEMENT (RM)

Features & purposes

- Improve project delivery certainty for employer & consultant team
- Appropriate team's minds & actions on big issues
- Enabled better communication channel with information & decision exchange, and better understanding
- Enable link between contingency allowance in a project & the risks

Type of risks → also refer to ERA notes Annex A

(a) Project risks

- Physical works including site & ground conditions, defective materials & workmanship
 - e.g. discovery of unexplored WWII bombs → depends on contract conditions (old cl. 34)
 - e.g. no one knows the site is in the vicinity of MTR tunnel → seek Arch/Str E's clarification
- Damage & injury to persons & property, e.g. sth collapse → depends on 3rd parties, employer & MC
- Discovery of asbestos which required specialist removal → require AI
- Design / Supervision → lack of communication, defective design, lack of clarification in requirements, design missing, required SA → in GMP, allowance in DD
- Payment → under-valuation, delay in settlement of claims, MC's insolvency, fluctuation of exchange rate
- Dispute → delay in resolving disputes, uncertainty due to lack of records

(b) Employer's risks

- Lump sum contract price → VO will lead to additional costs
- Excusable delay & disruption → site possession, availability of info, neutral events
- External factors → government policy, safety, other statutory approvals, war, civil commotion
 - e.g. the statutory planning board insisted a smaller CFA → lower future revenue
- Market changes which shows the project will be no longer profitable
 - e.g. the demand of hotel is nearly saturated → need to consider other type of building
- MC's delay in completion and late handover
 - LD may not recover employer actual loss
 - this may affect the corporation's share price

(c) MC's risks → refer to notes

Procedures for RM

- (a) **Risks identification** at feasibility stage
 - Keep sufficient notes on file for inclusion & exclusion of risks
 - Agree the "fixed" or "variable" risks & its probabilities
- (b) **Qualitative assessment** → refer to ERA notes section 3.2
- (c) **Identify owners** → who should bear the risks
 - Risks should be borne by the party who is:
 - ✓ Under the party's control & best to evaluate
 - ✓ The party can transfer the risks by insurance & allow for premium
 - ✓ The preponderant economic benefit of running the risks
 - ✓ To place the risk on the party is in the interests of efficiency
 - but should also consider that party's ability to bear the risks
- (d) **Management of risks (ERIC)** → should be continuous, not one-off
 - To **E**liminate the biggest risks
 - by reviewing project aims, re-appraise concept, or cancel the part of the project
 - To **R**educe risks
 - by conducting surveys, re-design, alternative materials, different construction methods, change in procurement plan
 - To **I**nsure / transfer risks, and allocate them differently
 - transfer to consultant team → higher fees
 - transfer to MC/SC by amending the contract conditions → higher tender price
 - transfer to insurer → higher insurance / bonds premium
 - To **C**ontain risks within unallocated contingency, and used in case of extreme necessity
- (e) **Compile a risk register**
 - List & illustrate all identified risks → review monthly → remove past risks → add new risks
- (f) **Quantify the risks** in terms of cost & time → refer to methodology of RM
 - Terms of quantifications including risk, consequence, impact, likelihood, rating & ownership
 - Process: identify (ERIC) → assess → categorize → manage → monitor
- (g) **Calculation of risk allowance** & add to risk register → refer to ERA notes section 3.3
- (h) **Notify the employer** → by notification b4 potential risks occurred

Types of methodology of RM → Quantification of risks(a) Detailed analysis & simulation → GOOD!!!

- No longer restricted to conventional estimate
- Complete judgment of all variables & the likelihood of each value in the range
- Judgment is made in the form of probability distribution, which is defined by the estimator, and reflect the sum of his knowledge about the variables
- The project is assumed to be built many times (i.e. many trials), so that the effect of combined probability could be observed
- Simulation results in a statistical sample of project can identify the unique characteristics, which has a different outcome
- Analysis of the sample allow evaluation on the degree of risks in the estimate
- **Advantages:**
 - ✓ The probability density of cumulative distribution function is a powerful tool for measuring risk exposure
 - ✓ Allow informal input of risk attitude
 - ✓ Require little knowledge of mathematics
 - ✓ Can cope with large number of project variables
 - ✓ Flexible by dealing with correlation between components
- **Disadvantages:**
 - ✓ Relatively complicated, and relies on the use of computer
 - ✓ Each analysis need to be simulated carefully with many times

(b) Sensitivity testing

- Measure & examine certain specified changes & effects in values of input variables
- Use in a sophisticated manner in order to convey an extremely useful picture of the project decision under dynamic real practice
- Taking into account the specific scenario
- **Advantages:**
 - ✓ Quick & easy, little information required, fully recognize the uncertainties in input variables, and any combine effects to the output
- **Disadvantages**
 - ✓ Not give a full picture of risk exposure
 - ✓ Possibly ambiguous, misleading, subjective & mostly depends on estimate

(c) Expected monetary value

- Take the testing of scenarios and further by considering the subjective probability of occurrence of each scenario
- The model is broken into small components
- It's a powerful means for examining separate sources of risks
- Involve assigning discrete outcome & combining the result to form "expected monetary value"
- **Advantages:**
 - ✓ Solve some limitations of sensitivity analyses
 - ✓ Explicitly allow for the probability of change in input values
 - ✓ Produced a risk-adjusted outcome
- **Disadvantages:**
 - ✓ The problem is associated with probability
 - ✓ May not be able to give practical advice for specific project decision
 - ✓ Tends to give the same result for projects with similar size & characteristics, which cannot reflects each project's uniqueness
 - ✓ It's subjective, & depends on the estimate

Strategy of RM

→ refer to Procedures for RM – (d) Management of risks → Eliminate, Reduce, Insure, Contain

Advantages of RM(a) To employer

- Identify risks which are not yet discovered
- Enable risks to be mitigated in good time with less cost
- Identify specific resources & training requirement
- Contributes to the security of project aims
- Increase understanding of risks with less surprise
- Identify best parties to manage specific risks
- Allow for a more realistic assessment of required contingencies

(b) To CA

- Can constantly provide high quality management information
- Expedite the assessment & granting of EOT & L&E
- Effectively monitor the implementation of delay recovery measures
- Reduce disputes

(c) To MC

- Speedy solutions regarding delay, EOT & L&E
- Improve cashflow & reduce dispute

Problems of RM

- Difficult to assemble the straight-forward records required
- The procedure adopted may not suit the real commercial practice and results in problems
- Impossible to eliminate uncertainties completely
 - a degree of uncertainty is required to motivate MC to the efficient use of resources & promote sound technical & commercial judgments
- MC must be protected from uncertainties which is beyond his control

Considerations of adopting RM in HK

- Gov't/employer should accept risks of unforeseen physical conditions
- Gov't should not delete impossibility clause (HKGCC cl. 15)
- Risk of lawful 3rd party interference (utility)
- Risk of change in law
- Risks should be borne by the party who is best to evaluate, can transfer the risks by insurance, and contribute interests to the party
 - but should also consider that party's ability to bear the risks
- Consider the premium of risks transfer
- Structured RM & identification to improve project performance
- Clear risk allocation

RM services provided from pre-contract to completion stage → refer to TRM notes

Due diligence audit → refer to notes

Risks of unforeseen ground conditions (HKGCC cl. 13) & U/G utilities

Common law principle

- MC has to assume all the risks not specifically assumed by the employer
- But MC should only price for those risks which an experienced MC could reasonably expected to foresee at the time of tender

Current problems & risks on existing projects

- **Uncharted utilities**
 - if the location of utility cannot be diverted & causes conflict to the construction which required VO to the building works → **excusable** (∴ variation)

- ✓ EOT (old cl. 23(e), new cl. 25.1(3)(h), HKGCC cl. 50(1)(b)(iv))
- ✓ additional payment (old cl. 11(6), new cl. 27.1(2)(c), HKGCC cl. 63(b))

➤ **Charted utilities**

- utilities shown on drawings but may be different in exact locations
- **OR** U/G utilities could not be foreseen by a reasonable MC at the time of tender
- **non-excusable** (∴ HKGCC cl. 13 → MC accepts the site, no provisions in both old & new SFBC)

- ✓ EOT (new cl. 25.1(3)(u), HKGCC cl. 50(1)(b)(xi))
- ✗ additional payment (HKGCC cl. 13(2))

➤ **Impossible for MC to do enough investigation on site** (especially large civil eng'g sites) **at tendering stage**

- HKGCC cl. 63 (no provisions in both old & new SFBC)
 - **not allow cost reimbursement to MC** for delay by utility undertakers (UU)
 - **MC bears risks if UU fail** to pursue planned locations with due diligence
- old cl. 23(h), new cl. 25.1(3)(q) & HKGCC cl. 50(1)(b)(ix)
 - **allow EOT to MC for delay by UU ONLY** if they fail to perform "in due time" & MC has taken all practicable measures
 - MC has no control over time actually taken by UU to complete U/G works
- Uncharted utilities risks always occurred because:
 - utility lines are everywhere in HK
 - UU rare meet MC's expectation for prompt commitment during tendering stage
 - the actual utilities usually deviated substantially from the record drawings
- **Risks of U/G utility is not insurable**
 - ∴ in the absence of detailed U/G utilities info, it's impossible for MC to price the risks
 - MC can only predict the standard or location of utilities which will be encountered

MC's arguments to escape from liability

- Under **Exemption Clauses Ordinance (Section 3)**
 - ✓ Validity of Exclusion Clause in HKGCC is subject to the reasonableness test under exemption ordinance in the legislation
 - ✓ Exemption clause valid if satisfy the **Reasonableness Test** by considering the follows:
 - a) parties were of equal bargaining power
 - b) risks are on both sides
 - c) contract should be formed with grounds for negotiation
 - d) ample opportunity to re-consider the contract terms
 - e) insurance cover
 - ✓ but there is no legislation which specially prohibited an "unfair" construction contract

➤ Under **Misrepresentation Ordinance**

- ✓ if employer either innocently or negligently misrepresents the actual site or U/G situation, or if the results of investigation drastically different from the reality
- ✓ statutory remedy to MC for misrepresentation
- ✓ Exclusion clause always states:

"...neither the contract sum nor contract period shall be adjusted in the event that the piles actually installed are of greater or lesser length than the anticipated at tender stage..."

"No claim for additional payment or EOT from MC will be ascertained on the grounds that information given in the SI reports or obtained from the excavations on site is incorrect or misleading."

- ✓ The above ambiguities render the exclusion clause to be strictly "Contra Proferentem" against the employer
- ✓ by construing this clause, employer is in breach of contract by fraudulent misrepresentation, because the information given and consideration at tender stage is different from when contract execution.
- ✓ The liability cannot be excluded, unless satisfy the reasonableness test

➤ **Re-rating of BQ items (VO)**

→ How to argue as a VO?

- ✓ change the original scope of works? (must be VO!)
- ✓ An instruction to carry out the utilities diversion? (AI → VO!)
- ✓ Re-programme the permanent works to facilitate the diversions by UU?
(Additional co-ordination & resources → VO!)

→ applicable if the works are carried out in dissimilar nature or conditions
 → substantially increase/decrease in qty (e.g. pile length / earthwork qty) which is not results from VO (new cl. 13.4(c)(ii), HKGCC cl. 59(4)(b))
 → EOT to MC for substantially change in qty (new cl. 25.1(3)(u), HKGCC cl. 50(1)(b)(v))

➤ HKGCC cl. 15 → **proof of legal / physical impossibility**

- ✓ extremely onerous tasks for MC to proof, and it's expensive & difficult
- ✓ MC can't excuse for non-performance of work due to adverse ground conditions
- ✓ in order to success this argument, MC has to establish that the execution of works as designed is physically impossible
- ✓ Meaning of "Impossibilities"
 - i) Not require absolute impossibility
 - ii) From a "practical commercial point of view" or "on an ordinary commercial competitive basis" is OK!
 - iii) Assessment of impossibilities need to consider:
 - ❖ nature of obligation
 - ❖ time & cost for performance
- ✓ Legal impossibility
 - where works cannot be performed, e.g.
 - ❖ w/o infringement of planning law or building regulations
 - ❖ if materials to be used is protected by patent right and no license could be obtained
 - render unlawfully for either party to fulfill its contractual obligation
- ✓ Physical impossibility
 - i) It's impossible to build due to unforeseen ground conditions
 - ii) e.g. too much rebar which prevent concreting
 - iii) e.g. the construction method proved impossible
 - iv) e.g. the wastage rate specified in the contract was so high
- ✓ If no EOT provisions for the legal/physical impossibilities → employer can't deduct LD (principle of "one cannot benefit from its own wrong")

➤ **Breach of Implied Warranty**

- ✓ Inaccurate site information maybe challenged by MC based on implied terms or collateral warranty
- ✓ Strong commercial reasons for implied term in the warranty which:
 - i) MC to know the nature of soil conditions before designing foundations
 - ii) MC to know the soil conditions for planning programme and estimate his requirement of materials
- ✓ If MC is prevented by the above reasons, employer was liable on the implied term of warranty

➤ **Protections to U/G utilities**

- ✓ **Gov't General Spec** stated that MC shall support, protect & record the location of all U/G utilities encountered.
- ✓ then if the utilities are uncharted, who should bear the risks of protection of utilities?
- ✓ If the actual location of U/G utilities is different from that shown on drawings
- ✓ MC can't include the cost of protection of unforeseeable utilities in the original bill rates
- ✓ EOT & additional payment should be granted for delay caused by the protection works of unforeseeable utilities

Key risks of SC in HK → refer to BB's audit manual

Problems if MC assumes risks

- The contingencies costs in the tender may not be realistic
- MC tends not to price the risks & instead seeking claims to mitigate his loss
- The malpractice that MC may cut corners to the cost
 - leads to poor workmanship, disputes, claims & delays
 - defects appeared early in construction
 - costly & wasteful rectification cost & higher running costs
- Employer/consultants will be reluctant to take any initiatives to assist MC
 - MC will then argue the loss about risk allocation → waste time

Reasons for employer to assumes risks

- If the risks occurred, employer/consultant can issue instructions to mitigate with minimum cost & delays
- Employer/consultants should have more knowledge on the ground conditions
 - interference from existing & future utilities is outside MC's control
 - i.e. best person to evaluate
- The project & site belongs to the employer → ∴ employer should be fair to pay for risks
- Tenderers rely upon the accuracy of site & U/G utilities information ∴
 - legal requirement to obtain excavation permit b4 excavation in roads & TTA
 - TTA require the combined approvals of various departments
 - physically impossible to carry out necessary exploratory excavation in tendering period

Advantages if employer assumes risks

- Competition could be improved with price certainty
- Reduce claims & disputes

Disadvantages if employer assumes risks

- Tendering period will be lengthen for MC to price risks
 - but could result in competitive tenders and reduced claims & disputes

Immediate solution for unforeseen U/G risks

- **SA on the basis of quantum meruit** → refer to KCRC Siemens's case
 - ✓ a rightful commercial settlement in the best interest of employer, which maximize the profits & minimize the costs
 - ✓ avoid costly & lengthy disputes on EOT & additional cost claims
 - ✓ avoid knock-on effects on other related / interfacing contracts
 - ✓ ensure MC is bound by the newly targeted completion date by paying a fair price to off-set the risks
 - ✓ outcome: [the original contract sum (i.e. 1st lowest tender sum) + SA sum] may be still lower than [the 2nd lowest tender sum]
 - ✓ ∴ worth for SA → also lower the opportunity cost

Recommendations & practical measures

- Provide possible **information in tender documents** including:
 - ✓ Details, records & tendering **drawings** should be accurate, and prepared based upon as-built records which clearly show all existing, abandoned, new, diverted, upgraded, modified utilities as current at the time of tendering
 - ✓ **Time required by UU** to do their works including sequencing of multiple UU in the same site
 - ✓ Special **procedures for dealing with unexpected utility diversion works**, including arrangement of cost sharing by both MC & employer
 - ✓ **Realistic programme for utility diversion** which is agreed by UU
 - ✓ The **risks** of unforeseen ground condition & U/G utility should be **clearly defined in the contract**, which should be borne by the employer
- **Provide enough time & information** to MC for pricing the risks
 - prevention instead of mitigation at later stage
 - ensure greater price certainty than traditional procurement strategy
- **Allow prov'l qty / items in BQ** to be remeasured in case of the U/G risks occurred
 - e.g. for earthwork & piling trades, adopt remeasurement approach
 - reduce MC's claims for additional payment or re-rate under substantial changes
- Provide **separate items for ELS** or other U/G temp works → reduce MC's pricing risks in other relevant items
- Provide **adequate contract provisions** for controlling interface problems
 - reduce potential conflicts & delay

- The provision of Information should be at the risk of employer, if changes → VO. ∴ also **consider the opportunity costs** if failure by MC
- Designer's assumption should not have any contractual implication
- **Carry out pre-tender investigations** for the ground conditions or U/G utilities, check on-site the exact locations of U/G utilities existing buried structures
- Gov't Project Administration Handbook should be amended to reflect best practice
- **Utilities records should be upgraded** by radio-location or GIS system
- Ensure the availability of dumping area, room for utility diversions & installations, safety issues & maintenance of traffic flow
- For public sector employer/Gov't, consider the public accountability, & ensure the decision making process is transparent & independent

Risks & suggestions in HK contracts

- (a) **EOT (KCRC contract)**
 - condition precedent of NOD → poorly drafted
 - ∴ NOD should be required but not condition precedent
- (b) **Unforeseen ground conditions & U/G utilities**
 - MC assumes all risks including liaising with UU
 - ∴ employer should assume the U/G risks instead
- (c) **Milestone payments**
 - MC will suffer potential cashflow problem with further risks
 - ∴ adopt milestone + monthly payment with payment limit on each key dates
- (d) **Constructive acceleration**
 - Arch is unwilling to assess & grant EOT → the only way for MC to catch-up uncertain delay & prevent LD liability is construction acceleration → claims arise
- (e) **Dispute resolutions**
 - lengthy process with multi-tiers of ADR
- (f) **Quality problems**
 - inappropriate demands of spec, which w/o affecting the integrity of the structure
 - such onerous & unnecessary conditions & requirements causes MC's serious financial problems
 - corruptions / cut corners
 - ∴ encourage MC to propose alternative materials / construction methods with cost savings
 - or consider alternative procurement approach, e.g. D&B, GMP with MC's early involvement of design w/o unnecessary technical advance/materials

(g) **Pay when paid** provisions

- onerous S/C regime especially happened in Green Form or other in-house DS/C
- SC suffered cashflow problems with disputes regarding the ambiguity of "when" clause or "if" clause
- ∴ remove pay when paid clause, use bonds / guarantees to secure release of retention, and expedite the F/A process

4. PROJECT MANAGEMENT (PM)

Objectives of PM → refer to L&B notes & powerpoint

- Cost + time (progress) + quality + safety + site management

PM strategy

- (a) Implementation of project plan
 - Key elements → refer to L&B notes
 - Objectives → refer to L&B notes
- (b) Control & evaluate the PM plan & procedures
- (c) Risk management

QS's services in PM → refer to L&B notes

5. QUALITY MANAGEMENT (QM)

SC auditing manual → audit procedures from SC selection to F/A → refer to BB's audit manual

ISO 9001: 2000 QM system → refer to notes

Consultant firm internal QM system implementation → refer to DLS's notes

Document control during pre-contract period → refer to 2001 APC Q1.2

Quality assurance for BQ production → refer to 2000 APC Q2.2