MTS2A3
Komputer & Simulasi

Kuliah 1: Pemodelan Numerik Bidang Teknik Sipil

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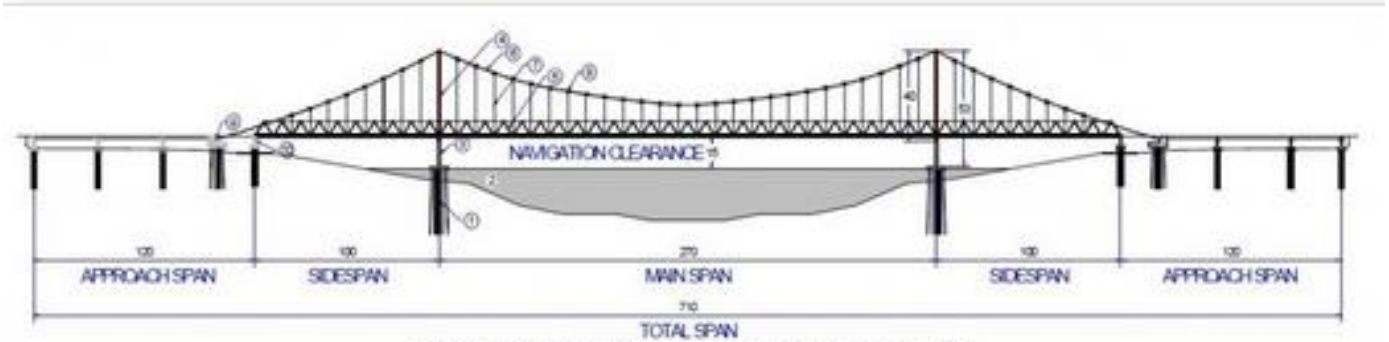
Mengapa model Numerik?

- Penggunaan IT untuk **penguatan pemahaman dasar^2 ilmu Teknik Sipil**
- Kemajuan Teknologi bidang Engineering Education yang menunjang Pendidikan lanjutan Teknik Sipil yang memungkinkan efisiensi waktu dan biaya seperti penggunaan **Program Virtual Laboratory dan Animasi**
- Pemodelan Perancangan Struktur, Pengawasan bahkan pemeliharaan struktur dan **analisis kegagalan struktur** menggunakan software yang tepat mempercepat proses penulisan thesis.

Penguatan Pemahaman dasar^2 Ilmu Teknik Sipil

- Dalam pemodelan kita dituntut untuk mengetahui mekanisme penyebaran beban dalam struktur sehingga dapat memperkirakan penempatan perkuatan ysg diperlukan andaikata terjadi penyimpangan dari perencanaan awal. Tanpa pengetahuan mengenai mekanisme penyebaran beban maka analisis yang dilakukan akan mengakibatkan kegagalan konstruksi :

- Contoh: Kegagalan Jembatan Kutai Kartanegara 26 Nopember 2011



1. FONDASI TIANG PANCANG BAJA
2. PILE CAP
3. PORTAL PYLON BETON
4. PORTAL PYLON BAJA
5. TRUSS JEMBATAN
6. KABEL UTAMA (MAIN CABLE)
7. KABEL PENGGANTUNG (HANGER)
8. ALAT PENGGANTUNG (SADLE AND CLAMPS)
9. BLOK ANGKUR UJUNG KABEL UTAMA
10. ABUTMENT

Penguatan Pemahaman dasar^2 Ilmu Teknik Sipil

- Dalam pemodelan kita dituntut untuk mengetahui deformation behaviour dari material pembentuk struktur mulai dari Tanah sebagai pondasi maupun material yang digunakan (kayu, baja, beton, sintetik, komposit dll). Tanpa pengetahuan mengenai deformation behaviour maka analisis yang dilakukan akan mengakibatkan kegagalan konstruksi :

- Contoh: Kegagalan Nichol Highway di Singapore (13 April 2004)

Why study Modeling

Attribute to
Nicholl highway collapse,
April 2004

Undercover investigator

The collapse last year of the Nicoll Highway cut and cover tunnel in Singapore holds some important lessons for engineers, says Benaim director Richard Davies.

Richard Davies' feet have barely touched home turf since the start of the inquiry into last year's catastrophic collapse of Singapore's Nicoll Highway cut and cover tunnel.

Davies is consultant Benaim's director of geotechnical engineering and something of a specialist in the challenges posed by deep excavation in Singapore's soft marine clay, which he describes as behaving "like toothpaste" when stressed. He has been working in the island state for most of the last 30 years, and has a string of technical papers on its geology to his name.

When a public inquiry into the Nicoll Highway catastrophe was launched, Davies was quickly recruited as an expert witness by Singapore's Land Transport Authority – client for the Mass Transit Railway Circle Line, on which the collapse occurred. He says it echoes an excavation collapse he witnessed in Singapore in 1971. "It's almost like a 30 year cycle," he says.

With the inquiry finally over, he has his first opportunity to sit back and really reflect on some of the lessons for the geotechnical industry.

"Geotechnical engineering is a bit of an art. It requires a huge amount of experience. You need to see what happens when you dig a hole in the ground and turn that from geology into engineering," he says.

What happened at Nicoll Highway was in part down to over-reliance by engineers on computerised soil analysis programs, he believes. These are "far more sophisticated than the people using them", Davies asserts. "What matters is how you put the data in to start with. You need to look at the overall problem." He maintains that use of inappropriate data in modelling soil behaviour skewed temporary works design in the wrong direction – steelwork was found to be under-strength.

Davies points out that the geotechnical market has grown, with "a large number of people involved simply in operating building codes". Engineers increasingly "do things according to a set routine rather than thinking for themselves".

He expresses dismay at the absence of third party design checks for temporary works, and reflects: "The Singapore collapse will lead to much tighter control."

Frustratingly, "it always takes a disaster for things to change", Davies adds.

Davies started his 36 year career as geotechnical engineer with Arup's fledgling department in 1969, where he spent eight years.

There he met many of geotechnics' key people, including Professor Alec Skempton, "one of the early stars of geotechnical engineering", and a mentor to Davies, passing on his enthusiasm as well as the valuable lessons of his own experience.

The two worked together for two years in the late 1970s in Hong Kong, on the island's first Metro station. Davies recalls the challenges of "digging a trench 30m deep in the ground between all those tall buildings".

This experience impressed upon Davies the great importance of working closely with contractors and getting hands-on experience. "It's not a paper exercise," he explains.

Later, as Arup's chief geotechnical engineer from 1977, Davies was involved in investigating the disastrous Po Shan Road collapse, which happened in Hong Kong's Mid Levels. He points out that at that time "people were cutting into the hillside to build tall buildings".

The subsequent investigation led to the establishment of Hong Kong's Geotechnical Control Office to "vet works at the design stage".

Davies set up his own consultancy in 1985, but was persuaded to join Benaim in 2001. Career high points are measured in terms of challenges faced and overcome. He was geotechnical consultant on construction of tunnel to Singapore's Changi Airport in 2000. "It involved cutting off piled foundations of operational buildings above the tunnel." It was probably the most difficult project he has yet undertaken, he says.

Richard Davies will be speaking about the Nicoll Highway collapse and inquiry at NCE's Megatunnels conference, on Wednesday 18 May. Details at: www.megatunnels.com Tel (020) 7505 6944.

Lessons can be learned from the Nicoll Highway collapse, says Richard Davies (right).

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Kasus kasus kegagalan struktur lainnya

Bangunan di Shanghai, Cina 29 Juni 2009

Sport Stadium at Kuala Terengganu, Malaysia 2009

Kasus kasus kegagalan struktur lainnya

Gedung 17 Lantai Bintaro, Jakarta 2 June 2016

Saint Francis Dam Tragedy – United States (1928)

Penggunaan Software untuk Teknik Sipil (Perencanaan, Pelaksanaan, Pengawasan, Pemeliharaan, dan Thesis Master

- Penggunaan software dianjurkan untuk membuat analisis yang cepat dan analis untuk berbagai kondisi
- Harus dibarengi dengan ilmu pengetahuan yang cukup mengenai mekanisme penyebaran beban dan sifat deformasi material
- Perencanaan harus mengacu pada standar Teknis SNI terbaru atau (dalam hal tidak ada SNI) standar yang direkomendasikan

Penggunaan Software

Struktur

- MIDAS Civil
- ANSYS
- ABAQUS
- SAP2000
- ADINA
- CSIBridge
- LUSAS
- RSTAB
- RM

- Geoteknik
- Plaxis
- FBBridge
- GROUP
- PHASE2
- FLAC
- SLOPE/w, SEEP/W, SIGMA/w (dari Geostudio)
- MIDAS GTSNX
- C Tunnel
- GEO 5