

Tunnelling Afternoon 2/2014

Prague 28.5.2014

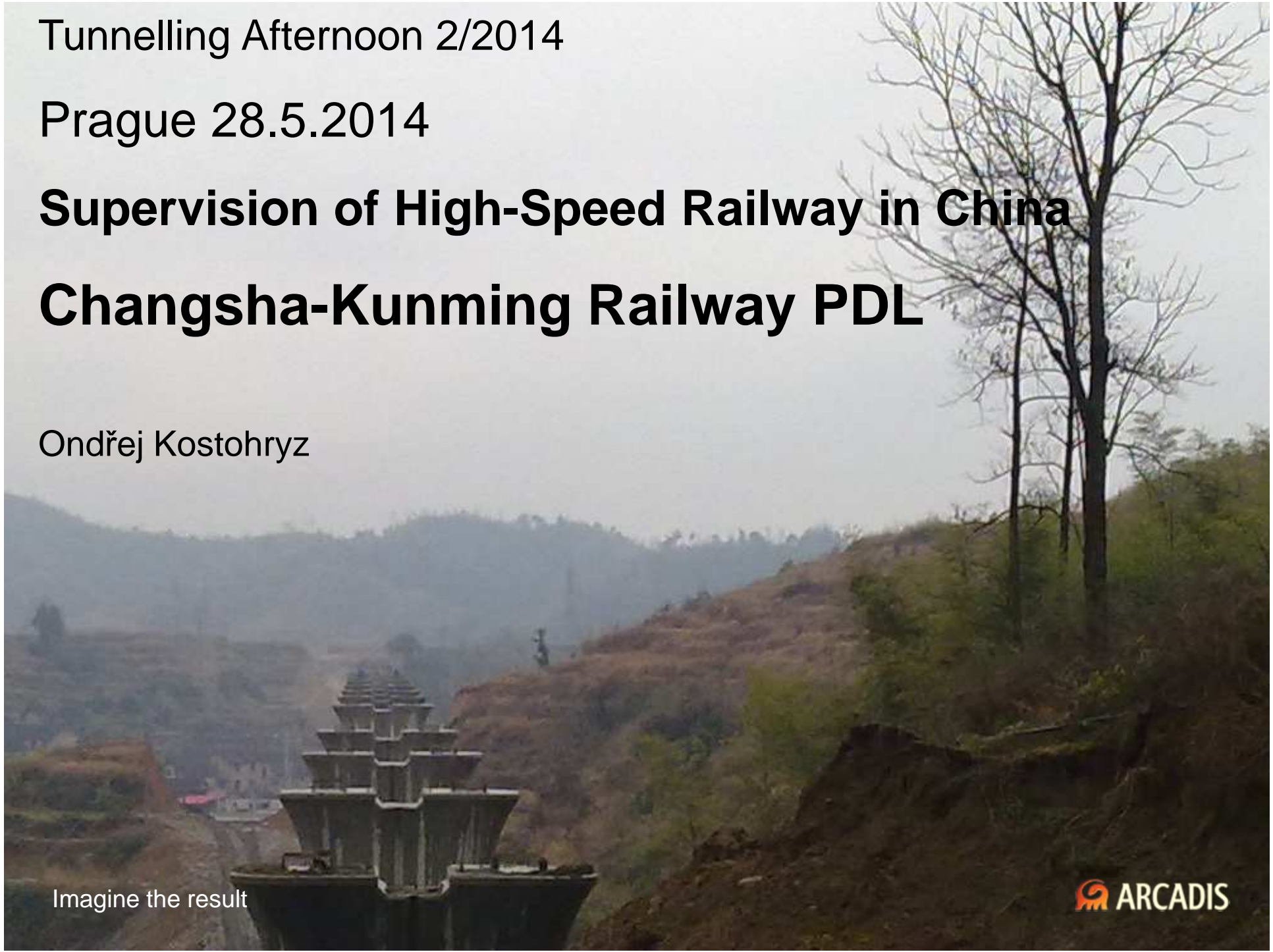
**Supervision of High-Speed Railway in China**

**Changsha-Kunming Railway PDL**

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Imagine the result

 ARCADIS



# High-speed Rail in China

- **World's longest high-speed rail (HSR) network with about 9,676 km (speed of 200 km/h or higher), including 3,515 km of rail lines with top speeds of 300 km/h**
- **Chinese designed CRH380A holds the world record for the fastest production train at 486.1 km/h**
- **Total investment in new rail lines grew from \$14 billion in 2004 to \$22.7 and \$26.2 billion in 2006 and 2007. Total investments in new rail lines including HSR reached \$49.4 billion in 2008 and \$88 billion in 2009. In all, the state plans to spend \$300 billion to build a 25,000 km HSR network by 2020**
- **2011: slowing down**
  - **the removal of Chinese Railways Minister Liu Zhijun in February pending investigation for corruption (1 billion CNY)**
  - **a fatal high-speed railway accident near Wenzhou in July (40 people were killed, at least 192 were injured)**

# Financing

<i>Line</i>	<i>Length</i> (km)	<i>Designed Speed</i> (km/h)	<i>Total const. cost</i> (¥ billion)	<i>Unit cost</i> (¥ million/km)
Qinshen PDL	404	250	15.7	38.9
Hening PDL	166	250	25	150.6
Jiaoji PDL	364	250	11	30.21
Shitai PDL	190	250	17.075	89.87
Hewu PDL	351	250	16.8	47.86
Yongtaiwen PFL	268	250	16.28	60.75
Wenfu PFL	298	250	18	60.4
Fuxia PFL	275	250	15.259	55.49
Chengguan PDL	65	250	13.3	204.62
Changjiu ICL	131	250	5.832	44.52
Changji ICL	111	250	9.6	86.49
Hainan ER ICL	308	250	20.2	65.58
Jingjin ICL	115	350	21.5	186.96
Wuguang PDL	968	350	116.6	120
Zhengxi PDL	455	350	35.31	77.6
Huning HSR	301	350	50	166.11
Huhang PDL	150	350	29.29	195.27
Jinghu HSR	1318	350	220.9	167.6

Imagine the result

# PDL Network in China

**Name:** Shanghai-Kunming Railway PDL

**Length:** 2066 km

**Maximum speed:** 350 km/hour

**Start Date:** 28.12.2008

**End Date:** 30.6.2013



Imagine the result

# Changsha-Kunming Railway PDL

**Project:** Newly-Built Changsha-Kunming Railway Passenger Dedicated Line (Hunan Section) Construction Supervision Section of CKJL-3

**Client:** Ministry of Railways (MOR)

**Project Owner:** Shanghai-Kunming Railway Passenger Dedicated Line Hunan Co., Ltd

**Construction Companies:** Chinese First Highway Engineering Company and Chinese Railway Construction Company Bureau 12

**Quality and Safety Consultant:** Consortium of The Fourth Survey and Design Institute of China Railway Engineering Consulting & Supervision Co., Ltd (FSDI) + Obermeyer Planen + Beraten GmbH (OPB)

# Changsha-Kunming Railway PDL

**Name:** Newly-built Changsha-Kunming Railway PDL Hunan Section

**Location:** Cities of Changsha, Xiangtan, Loudi, and Huaihua

**Length of main line:** 416 km, along with 5 cities, 18 districts or counties

**Stations:** 9 stations

**Bridges:** 274 bridges 161,444 m

**Tunnels:** 127 tunnels 194,844 m

**Subgrade:** 322 sections of subgrade 58,687 m

**Rail:** 872.71 km for rail installment

**Turnout:** 162 groups of turnout

**Cables:** 1,690 km of fiber and power cables for long-way communication,  
1738.4km power cables for high and low voltage

**Houses and buildings:** 76,062 m<sup>2</sup>

**Connecting line:** 12.18 km of Loudi-Shaoyang connecting line

**Investment Amount:** around 34.5 billion static investment

# Time schedule

**Start date:** September 1st, 2010

**Completion date:** August 30th, 2014

**Total duration:** 48 months

- **construction period:** 42 months (construction preparation of 3 months)
- **joint commissioning:** 4 months
- **mixing plants running test:** 2 months



# Xinhua Project

**Total length:** 92.8 km

**Stations:** 2 stations (Shaoyang North and Xinhua South)

**Bridges:** 42 bridges (23,591 m)

**Tunnels:** 26.5 tunnels (56,232 m)

**Subgrade:** 105 pieces of subgrades (12,686 m)

**Girder yards:** 3 girder yards (670 girders)

**Sleeper yards:** 1 sleeper yard (Xinhua sleeper yard)

**Earthworks:** 4 earthworks

**Construction access road:** 190.9 km

**Concrete mixing plants:** 16 concrete mixing plants





# Excavation Methods

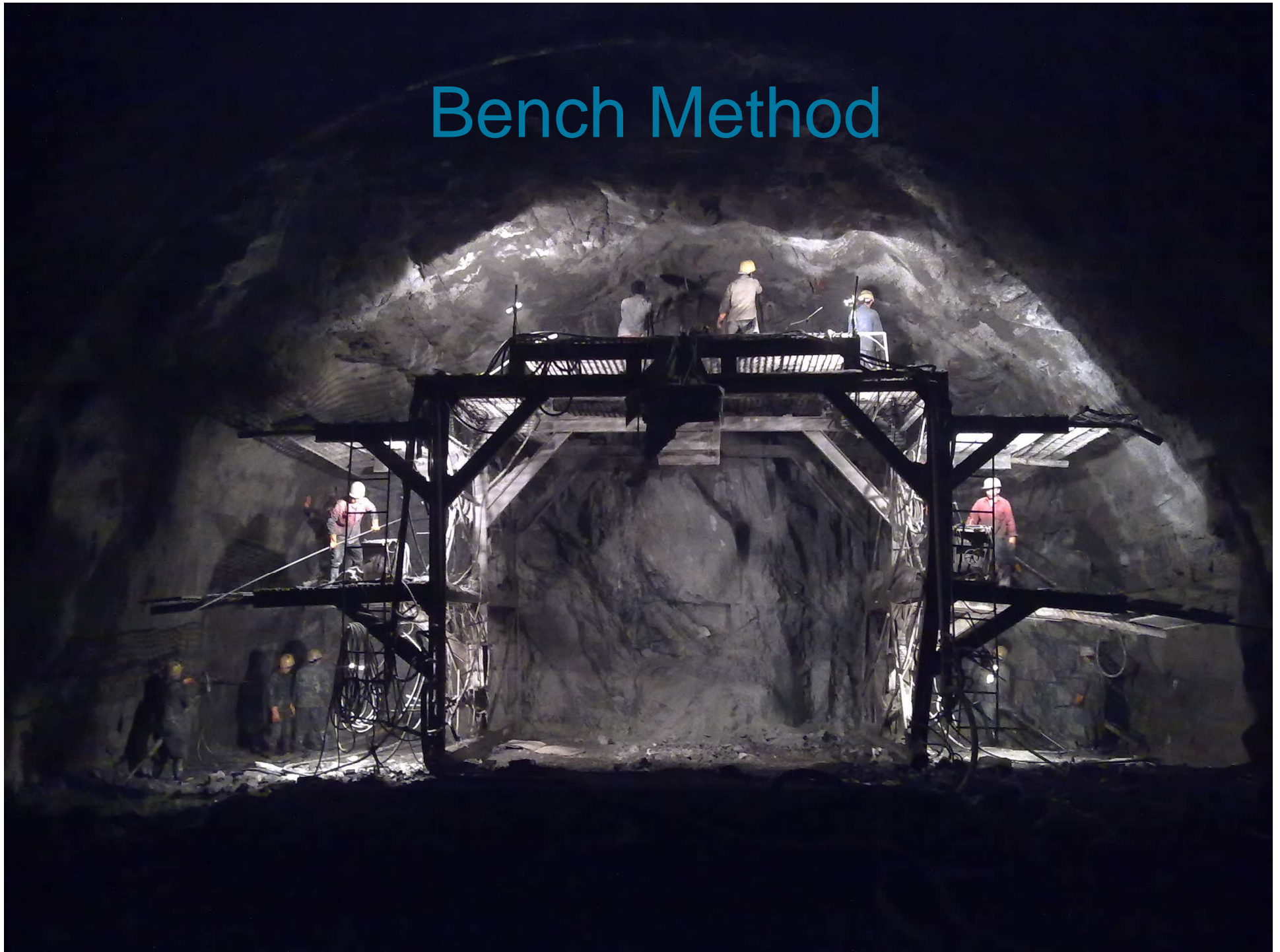
Excavation methods	Rock class	Overburden	Invert	Final lining
Full-face method	Rock Class II			
Benching method	Rock Class III		≤90m	≤120m
Bench method with core	Rock Class IV		≤50m	≤90m
Double bench (three level) method	Rock Class V	deep buried	≤40m	≤70m
Double bench method with big footing	Rock Class V		≤40m	≤70m
Dual side wall drifting method (vertical)	Rock Class V	shallow buried	≤40m	≤70m
Bench method with temporary invert	Rock Class V	deep buried	≤40m	≤70m

Imagine the result

# Full Face Method



# Bench Method



# 7 Steps Method

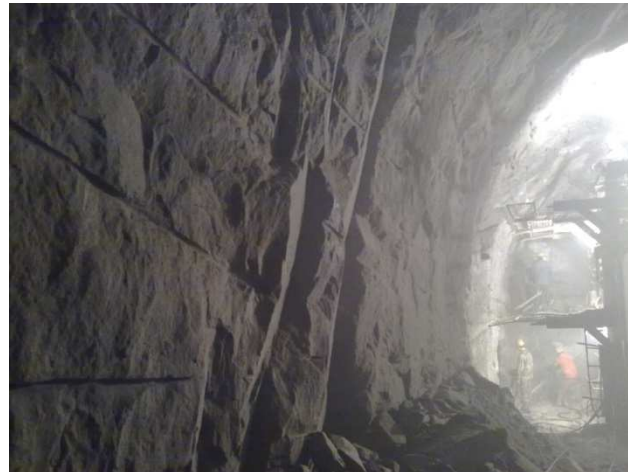


# Primary Support 初期支护



- no shotcrete
- shotcrete as painting
- no rockbolts
- no wire mesh

Imagine the result



# Primary Support 初期支护



- poor connection of I-beams
- cracks, deformation out of tolerance
- collapse of primary support

Imagine the result





# Main Problems in Tunnels

- no log books on the sites
- no shotcrete or dry shotcrete (restricted)
- late installation of primary support
- no rockbolts (or fake heads)
- safety distances not followed
- waterstops not connected and/or out of construction joints
- no or poor concrete compacting
- no or fake monitoring results
- missing PPE

2 collapses of primary lining per month.

# Slope Protection 边坡防护



- insufficient shotcrete
- no wire mesh overlapping
- no rockbolts

Imagine the result





# Main Problems on Slopes



- no log books on the sites
- no shotcrete or dry shotcrete (restricted)
- late installation of slope support
- no rockbolts (or fake heads)
- plastic mesh (instead wired mesh)
- unsafe machinery operating
- missing PPE

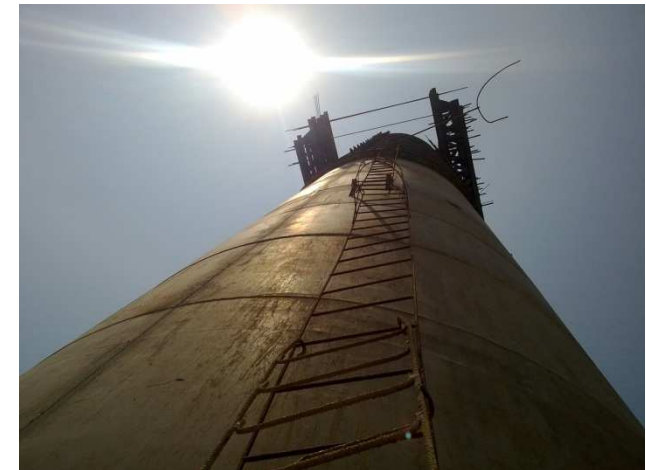
It is cheaper to do minimum or nothing and fix places, where problems occur.

# Work at Height 高空作业



- climbing the casting
- unqualified ladders
- no railings
- no platforms
- safety belts not used

Imagine the result





# Work at Height 高空作业



Imagine the result

# Work at Height 高空作业



Imagine the result



# Main Problems on Bridges

- no log books on the sites
- no staircase towers nor scaffolds on the piers
- no safety railings nor platforms
- low safety during work at height!

Every worker is able to climb the casting, hang on one hand and stand on railing.

# Pile Foundation 桩基施工



- restricted
- family business
- depth up to 20 m



Imagine the result



## Main Problems with Chinese partner

- fighting for leading the supervision
- limited access to cars
- limited access to design drawings
- limited access to information from the sites
- deals with client against foreign supervision team
- covering contractor's „imperfections“ for cigarettes, food and accommodation

Joint-venture not always means connection.

# Life in China



# Hunan Province



- population > 70 mil.
- area 210,000 km<sup>2</sup>
- humid subtropical climate
- Mao Zedong's home province

Imagine the result



# Changsha



- capital of Hunan Province
- population > 7 mil.
- subway in construction

Imagine the result



# Xinhua



- fitness
- massage
- bars
- discotheques
- karaoke
- swimming pool

Imagine the result



# Civil Construction



- no historical buildings because of Cultural Revolution (1966 – 1976)
- construction boom
- no space

Imagine the result





# Local Cuisine

点		菜	
酸辣土豆丝	12元	芹菜炒肉	25元
家常豆腐	12元	青椒炒回锅肉	25元
红烧茄子	15元	酸辣肥肠	18元
芹菜炒牛肉	25元	酸辣鸡杂	18元
白椒炒干鱼	25元	洋葱牛肉丝	20元
酸辣醋汤鱼	25元	三合汤	25元
青椒炒猪肝	25元	白椒炒干泥鳅	25元
小炒牛蹄花	25元	红烧牛肉	30元
爆炒牛百叶	28元	红烧全鱼	30元
开胃鱼头	38元	宝塔黄鳝	38元
豆腐炒肉	15元		

- chilli pepper
- rice
- no butter
- no cheese
- no bread
- sweet sausages

Imagine the result



# Local People



- friendly
- curious
- family supporting
- money showing
- emulative
- playful

Imagine the result





# Typical Chinese Man

- slim, 1.7 m short, black short hair
- drinking a lot, smoking a lot
- a bit lazy
- sleeping at every possible place and time
- drinking tea, not coffee or milk
- eating fast and on time
- sleeping after lunch
- loving his family and friends
- wretchless on public
- cutting his nails on the floor in the train
- beeping while driving
- never heard about environment protection
- never loses his face, that is why he lies to you

# School



- language
- leisure time
- friendship
- fame

Imagine the result







# What to expect in China

- friendly people
- tough businessmen
- cheaters
- beautiful girls
- happy children

Which all live behind language barrier.

You can feel difference every second.



Imagine the result