Third Summit: ONE MEKONG, ONE SPIRIT

Lancang-Mekong navigation Plans, perception and reality

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Civil Engineer in hydraulics,
Waterway and Navigation Channel Expert
1. Definition of the subject stretch of the Lancang-Mekong project
2. Design vessel
3. Characteristics of the improved channel
4. Three sample cases of channel improvement:
   • Hat Ngao (sand and moveable river bottom)
   • Keng Pha Dai (bedrock and rocky embankments)
   • Keng Kep (huge rock outcrop in middle of River)
5. Conclusions
1. Definition of the subject stretch of the Lancang-Mekong project

Total project length: 300 Km
1. Definition of the subject stretch of the Lancang-Mekong project
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Chinese Survey
1. Definition of the subject stretch of the Lancang-Mekong project

Total length in MRC-mandated area = 58.4 km

- Golden Triangle
- Chiang Saen
- New port of Chiang Saen
- Chiang Khong
- Hat Ngao
- Huay Xay

UHA – Atlas MRC (1988-89)
2. Design vessel

The Chinese Lancang-Mekong project opts for boats and vessels of max 500t.

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<th>PART 1</th>
<th>Inland Waterway Classification Standard for the People’s Republic of China</th>
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<td>Class</td>
<td>Ship’s dimensions</td>
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<td>DWT</td>
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## 2. Design Vessel

### ECMT Classification of 1992

<table>
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<tr>
<th>Type of Inland Waterways</th>
<th>Type of Vessel: General Characteristics</th>
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<td></td>
<td>Dénomination</td>
<td>Longueur</td>
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<td>Designation</td>
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<td>Péniche</td>
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<td>IV</td>
<td>Barge</td>
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<td>Freighter</td>
<td>67.5x10.8x1.6</td>
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<td>Grands Rhénans Large Rhine Vessels</td>
<td>95-110</td>
<td>11.40</td>
</tr>
</tbody>
</table>

- (1) 111.0x10.8x1.6
- (2) 67.5x10.8x1.6
- (3) 111.0x10.8x1.6
- (4) 67.5x10.8x1.6

The MRC International Conference, 2-3 April 2018, Siem Reap, Cambodia
3. Characteristics of the improved channel

**W**
- Navigation channel width

\[ w = \text{channel width} = 42 \text{ meter (MRC)} \]
\[ 40 \text{ a } 50\text{m (Lancang-Mekong)} \]

\[ d = \text{channel depth} = 4.00 \text{ or } 3.50\text{m (MRC)} \]
\[ 2.00 \text{ a } 2.50\text{m (Lancang-Mekong)} \]

\[ H = \text{air clearance under the bridges or HT cables} = 10 \text{ a } 15 \text{ m (MRC design)} \]

All MRC-dimensions in accordance with PIANC
4.1 - Hat Ngao example

- The survey result has been coloured according to the depths. All shades of blue are below chart datum.
- The river bottom is moveable and consist mainly of sand and silt. There is no rock removal needed.
- Additional studies are needed to identify suitable dumping area[s] for the dredged material.
4.1 - Hat Ngao example; Channel design

- Average depth to be dredged = 0.50m
- Average depth to be dredged = 1.50m
- Average depth to be dredged = 2.50m

Total Volume = 91,367.272 m³
4.2 – Keng Pah Dai example
4.2 – Keng Pah Dai example

- All shades of blue are below chart datum and permanently under water.
- The river bottom is bedrock with sand deposits trapped between the rock outcrops.
- There are two channels but the Northern is the deepest.
4.2 – Keng Pah Dai example

All channel design starts with a detailed condition survey and computer graphics

Then comes the channel design ($R_{\text{min}} = 430\text{m}$)

And finally the computation of the surfaces and volumes
4.2 – Keng Pah Dai example

**LB = 28,392.950 m³**

**RB = 16,247.810 m³**

**Total volume = 45,247.810 m³**

Chart Datum = 330.782 m (Kolak)
Length of survey along the channel = 1,064.543 m
Total Surveyed Area = 50.822 Ha
Minimum channel width = 34.01 m

LEFT BANK: 6,330.123 m²
RIGHT BANK: 8,894.181 m²
TOTAL: 15,224.304 m²

**Total area represents:**
- 8.55% of low water surface
- 2.99% of high water surface

SURFACE OF LOW WATER PLANE: 178,037.079 m²
SURFACE OF HIGH WATER PLANE: 508,215.774 m²
4.3 – Keng Kep (DA-10)

Keng Kep is barely 2Km downstream the HP project of Pak Beng. It will not be flooded by any HP project, unless the backwaters from Luang Prabang HP. It has a narrow gap in a sharp bend with a huge rock outcrop in the middle of the River.
4.4 – Recommendations for rock blasting

In case rock blasting is direly needed:

- use the minimum of explosives that are required to fragment and break up the rock outcrop;

- Use compressed air bubble screens to dim the shock wave from propagating further into the River;

- Produce under water sounds to frighten the fish and chasing them from the danger zone;

- Use excavators to collect the debris and/or suitable hydraulic equipment to further fractionate the rocks;

- Transport by barge the rock debris to a well designated location in the current but out of the navigation channel so that the ‘relocation’ of the obstacle does not significantly change water tables up- and downstream.
4.4 – Alternatives

In sandy or silty river bed:

In bedrock and/or rock embankments:
4.5. Channel improvement animation

Substantially widened channel
5. Conclusions (1)

1. It is *technical* feasible to upgrade the navigation channel to accommodate either 500t. vessels (Chinese classification) with limited draft (2.20-2.50m below CD) or (perhaps in a later stage) 1,600 – 2,000t barges (European classification) with 3.00-3.50m draft;

2. Due respect to the environment is vital and essential. No efforts or costs during implementation should be avoided to safeguard the environment;

3. More studies have to be carried out before modifying the channel in rocky areas, since these are *irreversible*. The opted solution will be permanent!

4. Dredging sandy river beds have to be dynamic: “*dredge where the river wants to go*”.
5. Conclusions (2)

5. Channel improvement in rocky areas could be phased in channel depth, but difficulty in curvature and channel position, which should be chosen right from the start to the most economical and environmental friendly position, causing the least disturbances to the morphology of the river;

6. Channel improvements in sandy/silty areas are likely to be maintenance dredged after every flood season. The moveable river bed is not stable and morphology changes occur after each flood;

7. Once the cascade from HPP will be completed, only some 87Km (between Golden Triangle and Keng Pha Dai, being the upstream end of the impounded Pak Beng reservoir.)
THANKS for your ATTENTION