The purpose of the information in this presentation is to guide ICA programs and provide members with information to make independent business decisions.
Antitrust Guidelines

Antitrust Guidelines for Copper Industry
Trade Association Meetings

The following guidelines with respect to compliance with antitrust laws of the United States, Japan and European Community are intended to govern the conduct of participants in copper industry trade association meetings, both at the meeting itself and in informal discussions before or after the formal meeting.

**Price:** Competitors should not discuss future prices (including terms of sale) of their products. There is no blanket prohibition against the mention of or reference to current or past prices but limits must be observed. Such references or mentions should occur only when necessary in connection with the development of association programs. For example, reference to a particular price level in comparing the cost of a copper product to a competing product is permitted. Whenever possible, such references should be discussed in advance with legal counsel.

**Competitive Information:** Competitors should not discuss the market share of a particular copper producer or copper fabricator’s products. Furthermore, nothing should be said at a meeting which could be interpreted as suggesting prearranged market shares for such products or producer production levels. The overall market share of copper products may be discussed with regard to competition with non-copper products and general market acceptance.

**New Products:** Competitors should not encourage or discourage the introduction of a new product by another competitor or reveal a particular copper company’s plans to change the production rate of an existing product or to introduce a new product. No company should disclose to another company whether it is in a position to make or market a new product. New products may be discussed in a technical manner or from the standpoints of competition with non-copper products and general market acceptance. In addition, proposed methods for and results of field and laboratory testing can be considered.

**The Role of Legal Counsel:** Legal counsel attends association meetings to advise association staff and other meeting attendees regarding the antitrust laws and to see that none of the matters discussed or materials distributed raise even the appearance of antitrust improprieties. During the course of a meeting, if counsel believes that the discussion is turning to a sensitive or inappropriate subject, counsel will express that belief and request that the attendees return the discussion to a less sensitive area.

A paper entitled ‘Copper Industry Trade Associations and Antitrust Laws’ is available upon request.

10/92, 5/93, 10/10

1. Other foreign competition laws apply to International Copper Association, Ltd. (ICA)’s activities worldwide.
FUTURE CHINA TRANSPORT

Huang Fangqing, Director
Content

➢ Development of China’s Transportation System
➢ Current Material Use
➢ Opportunities and Challenges for Copper
➢ Demand Forecast
Development of China’s transportation system

Economic development has been the main driver for transport growth over the past 10 years

- From 2008-2018, per capita GDP in China increased from 1,000 USD to 10,000 USD.
- Economic growth promotes the process of urbanization, which leads to huge investment in transportation infrastructure.
- The growth of personal income leads to a pressing requirement for good logistics.
- The development of industry and commerce puts forward more requirements for high efficiency traffic, and further promotes the development of transportation technology.

Distance of travel and logistics

Source: BC Consulting research in 2019
Development of China’s transportation system
Railway, shipping, aviation and automobiles are major areas

**China GDP (1999-2018)**

- Unit: 100 billion RMB
- GDP > 30 Trillion RMB, sufficient resource to support high-speed railway network
- 2008 to 2019 is a period for a rapid growth of High-speed railway in China
- China is the largest shipbuilding country and also have 7 world largest ports (10 in total worldwide)

**China Per capita GDP (1999-2018)**

- Unit: thousand RMB
- Per capita GDP from 20,000 RMB in 2007 to 65,000 RMB in 2018
- Growth in overseas travel and long-distance business trip
- Wide acceptance of personal cars

Source: NBS, CAAM
Due to the large land area and high population density in China, high-speed rail is a suitable solution for future transportation requirements at a national level. This network will support regional and cross-regional economic development.

- **Development of China’s transportation system**
  - Rail is likely to be the key market

- **High-speed rail as the backbone of the rail transit network for transportation between 50-1000Km**
  - Long-distance traffic demand based on aviation
  - 1-50Km, short-distance transportation
  - Large hub airport and large passenger aircraft
  - Mid & long-distance transportation focus on cost, efficiency, and capacity
  - Short-distance pay more attention on convenience and efficiency
  - High-speed railway across and connect many populated areas (China & Japan)
  - Convenience and diversity, hard to have a simple transportation solution to meet
Development of China’s transportation system

New drivers for ‘future transportation’ – Electrification, Autonomy, Connected, Sharing and Environmental friendliness

Source: BC Consulting research in 2019
Current material use
Copper is widely used in China’s transportation

➢ In 2018, the total copper usage in China’s transportation is 1,755 thousand Tonnes Copper\(^1\)

➢ By segment in transportation\(^5\)
  • Auto & Road\(^2\): 613k Tonnes
  • Train & Railway\(^3\): 428k Tonnes
  • Ship & Ports: 66k Tonnes
  • Aircraft & airport: 6k Tonnes
  • Motorcycle & Bike: 51k Tonnes
  • Off-road\(^4\)\(^5\): 352k Tonnes
  • Others\(^4\) (Parts): 239k Tonnes

Total 1755k Tonnes

\(^1\) 2018 IWCC dataset
\(^2\) Including charging equipment for NEV
\(^3\) Including Metro & sky-train
\(^4\) Including Construction machinery, agriculture machinery, low-speed vehicle, which is not included in followed slides
\(^5\) Source: BC Consulting research in 2019
Current material use
Since 2009 the use of copper has 3 new directions

- Connected & Electrification
- Electrification in train

City train
- City train replace bus

Growth in total transportation is leading to more use of copper

More NEV in auto industry
- Growth in total vehicle sales/production

NEV

Tech. develop leads to change in copper intensity of use

High-speed train
- High-speed train replace aviation
- Road replace water transportation

Change in transportation method leads to change in copper demand

Source: BC Consulting research in 2019
Current material use
Future drivers for copper in transportation

➢ Technology will promote copper use in transportation

**Electrification**
- To reduce CO2 emission, more autos are transforming into electrification, creating additional demand for electrical charging infrastructure

**Connected**
- Diversified and safety requirement ➔ Connected and autonomy

**Environmental friendly**
- 100% recycle, copper is an environmentally friendly material
Opportunities and challenges
Over the last decade, more copper has been used in transport, both in equipment and infrastructure.

### Copper intensity of use in 2009

- **Auto**: 8.4-12.1 kg/vehicle
- **Train**: 353 kg/train
- **Electrical bike**: 0.7-1.0 kg/bike
- **City road**: 2.5 Tonne/Km
- **Railway**: 2 Tonne/Km
- **E-Railway**: 25 Tonne/Km
- **Metro**: 107 Tonne/Km
- **Electri. ratio**: 32%

### Copper intensity of use in 2019

- **Auto**: 9.3-19.5 kg/vehicle
- **Train**: 377 kg/train
- **Electrical bike**: 1.4-1.7 kg/bike
- **City Road**: 3 Tonne/Km
- **Highway**: 5 Tonne/Km
- **Railway**: 12 Tonne/Km
- **E-Railway**: 45 Tonne/Km
- **Metro**: 107 Tonne/Km
- **Electri. ratio**: 69%
- **River port**: 86 Tonne/berth
- **Ocean port**: 138 Tonne/berth

Source: BC Consulting research in 2019
Opportunities and challenges
Changes in future transport impact positively

1. E-railway replaces aviation ➔ More copper
2. E-railway replaces auto ➔ little change
3. E-railway replaces shipping ➔ More copper
4. Aviation replaces shipping ➔ Less copper
5. Auto replaces motorcycle ➔ More copper
6. E-bike replaces motorcycle ➔ More copper

More copper will be used in “future transportation”

Source: BC Consulting research in 2019
Opportunities and challenges
Technology will affect the use of copper

- New tech and new products will be used in transportation, which will have significant impact on copper usage in the next decades.

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Lightweight in Auto ➔ Lightweight in auto harness</td>
<td>Improve energy efficiency in traffic ➔ New material replace current material (REPM motor)</td>
<td>Wireless tech: replace signature harness by wireless or CAN-BUS tech.</td>
</tr>
<tr>
<td>Positive</td>
<td>Clear Tech tendency</td>
<td>Clear in tendency, but waiting for tipping-point (2020-2025)</td>
<td>Unclear in tech. tendency (2025-2030)</td>
</tr>
<tr>
<td></td>
<td>Electrification &amp; Autonomy: NEV &amp; Electric train</td>
<td>Introduction to new tech such as copper rotor motor</td>
<td>New application: Electrification in Aviation &amp; Ship</td>
</tr>
<tr>
<td></td>
<td>More attention on environment protection</td>
<td>Complete supply chain such as Li-ion battery in e-bike</td>
<td>New tech: Heat pump air-conduct with copper HEX in NEV and train</td>
</tr>
</tbody>
</table>

Source: BC Consulting research in 2019
Forecast on future demand
Neutral scenario

Copper demand forecast (neutral case)

<table>
<thead>
<tr>
<th>Products</th>
<th>Drivers</th>
</tr>
</thead>
<tbody>
<tr>
<td>Auto &amp; Road</td>
<td>Auto electrification, NEV will be the mainstream in China</td>
</tr>
<tr>
<td></td>
<td>Charing infrastructure can support the daily usage of NEV</td>
</tr>
<tr>
<td></td>
<td>Improve road standard ➔ more green lighting, road intelligence and control, and information equipment on road</td>
</tr>
<tr>
<td>Train &amp; Railway</td>
<td>Passenger train will be completely electrified, higher ratio of electrification in freight train</td>
</tr>
<tr>
<td></td>
<td>All of new railway is electrified line. Railway mileage will be more than 200,000 Km in 2030</td>
</tr>
<tr>
<td>Ship &amp; Port</td>
<td>Stable in global shipbuilding market, China is still the largest shipbuilder in next 10 years</td>
</tr>
<tr>
<td></td>
<td>Keep stable in number of river and ocean berth, all of berth will install shore-power equipment in 2030</td>
</tr>
<tr>
<td>Aircraft &amp; airport</td>
<td>In 2030, the number of civil airplane is 6000 airplanes and general aviation is 9000 airplanes</td>
</tr>
<tr>
<td></td>
<td>370 airports in China in 2030</td>
</tr>
<tr>
<td>Motorcycle &amp; Bike</td>
<td>Weak in motorcycle market, e-bike replace low-end motorcycle</td>
</tr>
<tr>
<td></td>
<td>E-bike is popular, Li-ion battery replace lead-acid battery</td>
</tr>
</tbody>
</table>

Source: BC Consulting research in 2019, excluding off-road and parts

Unit: thousand tonnes copper

<table>
<thead>
<tr>
<th>Year</th>
<th>Auto &amp; Road</th>
<th>Train &amp; Railway</th>
<th>Motorcycle &amp; Bike</th>
<th>Ship &amp; Port</th>
<th>Aircraft &amp; airport</th>
</tr>
</thead>
<tbody>
<tr>
<td>2018</td>
<td>1165</td>
<td>500</td>
<td>400</td>
<td>650</td>
<td>600</td>
</tr>
<tr>
<td>2025E</td>
<td>2,422</td>
<td>900</td>
<td>800</td>
<td>950</td>
<td>900</td>
</tr>
<tr>
<td>2030E</td>
<td>3,308</td>
<td>1,000</td>
<td>900</td>
<td>1,150</td>
<td>1,050</td>
</tr>
</tbody>
</table>

2018-2030E

© 2015 BC. ALL RIGHTS RESERVED.
Forecast on future demand
Scenario analysis

Current: The growth of copper demand in transportation mainly comes from increases in total volume. More copper applications come into effect through new tech.

Opportunities: Both new tech. & future transportation will lead to increased material demand.

Challenges: Some uncertainty remains for the direction of new technologies.

Opportunities: Tech. promotes the growth of copper demand in transportation, esp. electrification in auto and railway leads to higher copper intensity of use.

Challenges: Competitive materials are also trying to meet the requirement in transportation through tech. development

Source: BC Consulting research in 2019