1. “Magway” is like “railway”.

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1. The Portland Cement Association is active in manufacturing, in raising the quality of construction, in improving portland cement and its uses, and in contributing to a better environment.
2. PCA has well-rounded programs of market development, education, research, technical services, and government affairs on behalf of PCA members-cement companies in the United States and Canada.
3. PCA offices are located in Skokie, Illinois and Washington, D.C. with regional engineering managers located in California, Minnesota, New Jersey, Virginia and several other states.

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1. In addition, admixtures such as fly ash, silica fume, and blast furnace slag are added to enhance the properties of concrete.
2. Also, chemicals may be added to improve placing characteristics, and to retard or accelerate curing.
3. Most concrete is also reinforced with steel reinforcing bars.
The Concrete Industry

- Portland Cement
- Sand & crushed stone
- Steel reinforcing bars
- Ready mixed concrete
- Concrete contractors
- Precast/prestressed concrete

1. The concrete industry is made up of the separate segments shown on this slide.
2. PCA member companies may own in sand and crushed stone and ready mixed concrete subsidiaries.

California Concrete Industry

<table>
<thead>
<tr>
<th>Attribute</th>
<th>Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>Direct employment</td>
<td>227,000</td>
</tr>
<tr>
<td>Cement plants</td>
<td>10</td>
</tr>
<tr>
<td>Ready mixed concrete plants</td>
<td>485</td>
</tr>
<tr>
<td>Other concrete plants</td>
<td>394</td>
</tr>
<tr>
<td>Concrete contractors</td>
<td>3,280</td>
</tr>
</tbody>
</table>

1. Other concrete plants produce precast, precast/prestressed, concrete block, concrete brick, and concrete pavers.
2. Since the Los Angeles area contains about 1/3 the population of California, divide the numbers in the chart by three to obtain the numbers in the LA area.

California Concrete Industry

<table>
<thead>
<tr>
<th>Activity</th>
<th>Amount per Year</th>
</tr>
</thead>
<tbody>
<tr>
<td>Value of concrete construction</td>
<td>$5 Billion</td>
</tr>
<tr>
<td>Concrete industry payroll</td>
<td>$5 Billion</td>
</tr>
</tbody>
</table>

1. Quantities for SCAG IOS considering concrete construction occurs over a 4 year period.
1. This slide shows the recreational improvements that could be built along the Magway.

Objectives for Use of Highway Right of Way

- Provide a Functional System
- Minimize the Cost of New Real Estate
- Promote Rapid Construction
- Build Aesthetic Structures
- Maintain Highway Traffic
1. For spans less than 100’ precast/prestressed concrete beams will be supported on a single pier or straddle pier depending on the site conditions.

2. The beam in turn will support the precast concrete guideway.

1. For spans greater than 100’ precast segmental concrete beams will be supported on a single pier or straddle pier depending on the site conditions.

1. For spans less than 100’ precast/prestressed concrete beams can be supported on an offset pier if required by site conditions.

1. The following slides show transit system construction because similar concepts can be used for Magway construction.
1. Washington D.C. Metro is planning to use the Interstate right of way for expansion of the Metro.
2. Because there is not enough space for a double track at grade, aerial structures are required.
3. The spans could range from 80' to 130'.
4. For side by side dual track, the required width is 31'.
5. Shelf pylons are used where there is not enough space for side by side tracks.

1. This slide shows a precast/prestressed concrete beam being lifted into position on the shelf pylon after being delivered by a truck.

1. This slide shows a precast concrete segment being lifted into position after being delivered by a truck.
2. The segments are hung from the erection truss until the entire beam is complete.
3. After the segments are all in place the beam strong cables are pulled through ducts in the beam and post tensioned.
1. This slide shows a shelf pylon at an intersecting road where the height of the pylon is 78'.
2. The drawing on the right shows the segment layout.
3. After all the segments are in place they are post tensioned with strong cables.

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**Erection of Segmental Pier**

1. The JFK Airtrain runs down the Van Wick Expressway in New York.
2. The aerial structure is 8.7 miles long.
3. Spans are 80-150 feet.
4. The dual track are placed side by side with a total width of 31'.
5. The piers were cast-in-place.
6. The precast segmental beams required 1.5 day per span.
1. The JFK Airtrain aerial structure used segments which were 7' deep x 9' long.
2. A total of 5,195 segments were produced for the project.
3. 12 segments/day were cast in a plant in Virginia and shipped on barge to New Jersey and then transported on trucks to the construction site.
4. The segments on this project were supported on the erection truss until they were post tensioned.

1. This view shows the aerial structure under construction and the space required for the erection crane.
2. Notice that traffic continued to use the roadway.

1. Precast segmental construction was used to build the Selmon Crosstown Expressway Reversible Traffic Lanes.
2. This project used 142' spans and sculptured shapes & feature lighting.

1. The owner’s bid documents should address the structural & aesthetic criteria, work zone limitations, maintenance of traffic, and incentives to meet the schedule.
Examples of Concrete Bridges

1. Lighting adds interest to bridge structures at night.
2. Notice the curved columns and vertical lines on the columns.

Port of Miami Bridge
Miami, Florida

1. Precast/prestressed concrete bulb tees with 150’ maximum span along with precast segmental construction were used to build 45 new bridges for the large interchange.
2. The interchange was constructed in 24 months.
3. Color stain was used to match the surrounding area and to give a uniform appearance.
4. The repeated use of simple shapes and streamlined girders are appealing.
1. The first U.S. cast-in-place balanced cantilever segmental bridge was the monumental Pine Valley Creek Bridge near San Diego, completed in 1974.

2. The I-75/I-595 Interchange in Broward County, Florida incorporates 14 precast balanced cantilever segmental bridges with average spans of 148 ft. Segments were cast at the on-site casting yard simultaneously with earthwork and sub-structure work. The interchange was completed one month ahead of schedule.

3. Precast span-by-span segmental construction was used to build 11 new bridges for this interchange. The total area of the bridges was 253,313 sq ft and the total length of bridges was 1.4 miles.

4. The construction method was selected to minimize traffic disruption and reduce the quantity of on-site materials. One span per week was completed. The construction procedure was as follows:
   - Construct Column and Set Pier Segment
   - Launch Span by Span Overhead Gantry
   - Place Segments (10 Segments Typical)
   - Epoxy Joint and Temporary Post Tension
   - Install closure pour
   - Install final post tensioning
1. The traffic was detoured if the gantry pier support beam is moved over traffic.
2. The traffic was detoured while segments were moved.
3. Traffic was permitted under the span for temporary post tensioning, closure pour, and final post tensioning work.

1. This slide show the Skytrain Project in Vancouver, B.C.
2. Segments are hung from the truss until final post tensioning.

1. Southwestern style art welcomes drivers to Guadalupe County and New Mexico.
2. Four precast 54” deep U beams were used for the superstructure.
3. Spans are 105’-8” and form liners were used to create the art.

1. The 4500’ long bridge was built using precast segmental construction with 316’ spans.
2. Included in the design is local Indian culture symbols.
3. Precast concrete segmental construction was selected because of its durability, low maintenance, speed of construction, and low initial cost.
1. Precast/prestressed concrete was used to simulate the original bridge which was built using cast in place construction.
2. The new bridge was constructed in a total of 9 months.

1. This is the most unusual bridge I have seen. The bridge, completed in 2003 cost 500 million euros and took six years to construct.
2. The large concrete bathtub is 918 meters long, contains 24,000 metric tons of rebar, and 68,000 cubic meters of concrete.

The Maglev aerial structure has demanding requirements. The modular components must be built to accurate fabrication and erection tolerances. Stator packs, part of the functional components, are built in approximately one meter lengths. Normal deflections that are caused by the load of the Maglev vehicles and changes in ambient temperature must be sufficiently small to maintain a comfortable ride for passengers at 310 mph. Vertical deflections under the load of the Maglev vehicle must be limited to 0.25" and the vertical deflection under temperature changes must be limited to 0.187" for girders with a span of 31 m (102').

Long life and long term stability are also necessary for the Maglev guideway. The design service life of the structure is required to be 80 years. Of course, to make Maglev economically feasible, the guideway initial construction cost and annual maintenance cost should be as low as reasonably possible.
1. The most important example of the use of concrete girders is Transrapid’s own experience at the TVE-Test Facility.
2. The test track is 31.5 km long and 2/3 of all the girders are constructed of concrete.

1. The test track was built to the very tight tolerances required by Maglev and became operational on January 1, 1985.
2. Problems with stator attachments experienced in the initial use of the test facility were solved.
3. Although provision for adjustment of 20 mm was built into the beam bearings, no adjustments have been required after 20 years of operation.
4. The concrete girders were built to the required tolerances in a specially constructed fabricating plant.

1. A new plant was constructed to manufacture the concrete beams for the Shanghai Maglev.

1. Up to 12 girders a day were produced by the plant.
1. The piers were built using cast-in-place construction.
2. On the left is shown the formed piers and rebar cages in the background.
3. On the left is the completed pier.

1. This picture shows the 81.8' concrete girders being transported and erected for the 19 mile Shanghai Maglev project.

1. This is another view of the beam erection by gantry cranes.
1. The new vehicle is moved out of the maintenance facility.

Concrete Magway

- Proven Material
- Long Life
- Low Maintenance
- Lowest Life Cycle Cost

1. Concrete is a proven material and is used for 70% of the highway bridges built since 1990.
2. The use of high performance concrete will allow the structure to last 100 years.
3. Concrete structures used in transportation facilities have an excellent record of low maintenance.
4. The initial construction cost and life cycle cost of concrete aerial structures are lower than for any other material.