



Fashioning Technology. Design from Imagination to Practice, ICOHTEC 2007
Copenhagen 14 August – 19 August 2007

The Design of Roads as a Craft

The Role of Research, Experiments and Experiences in Road Construction from 1880-1960

Jørgen Burchardt

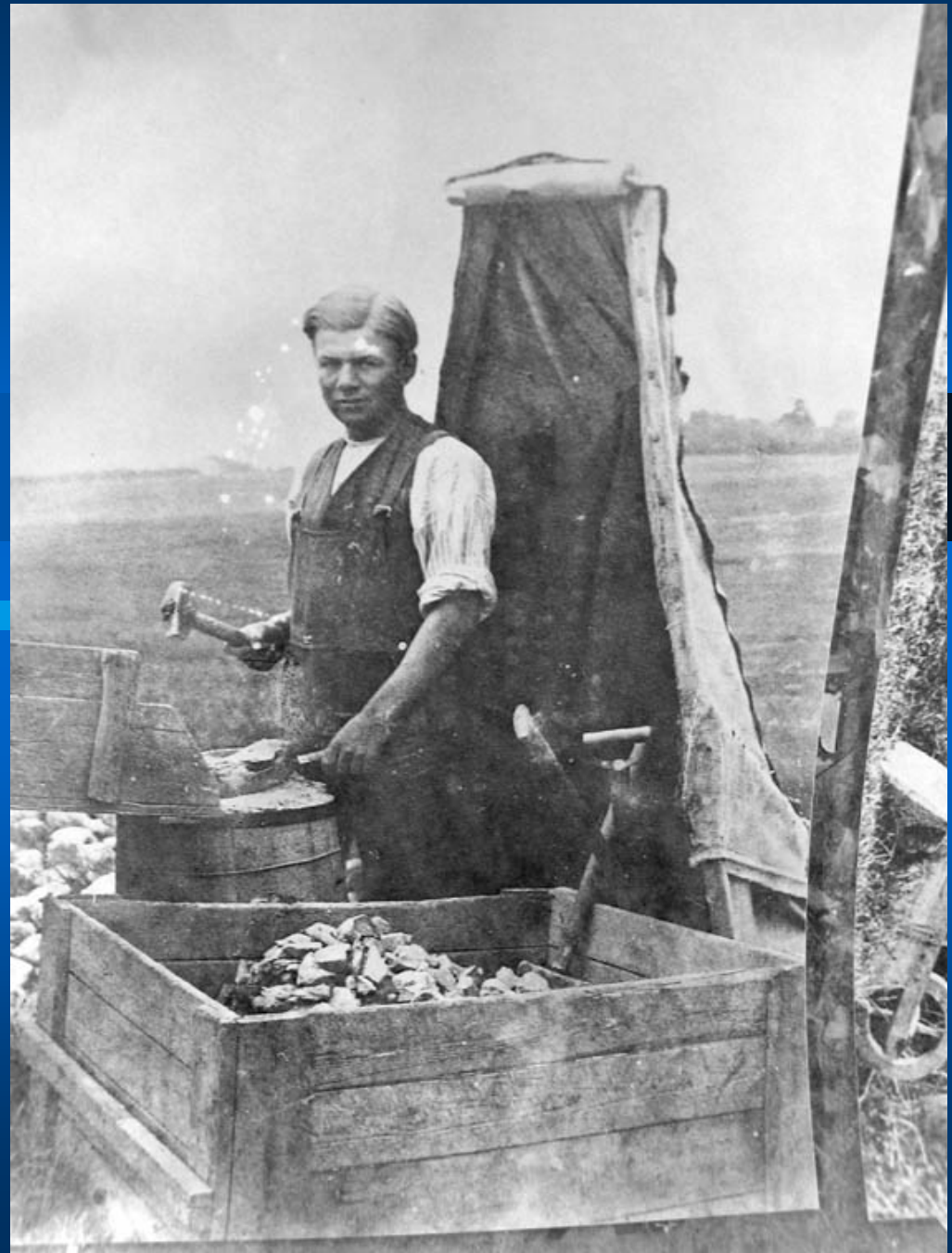
Based on research made for the Danish Road- and Bridge Museum

John McAdam

macadamized roads o.1820



Stone breaker



Horse driven road roller



Road with stone ready for repair



Roadman



Carriage - < 5 tons



Over county road surveyer



Scientific foundation



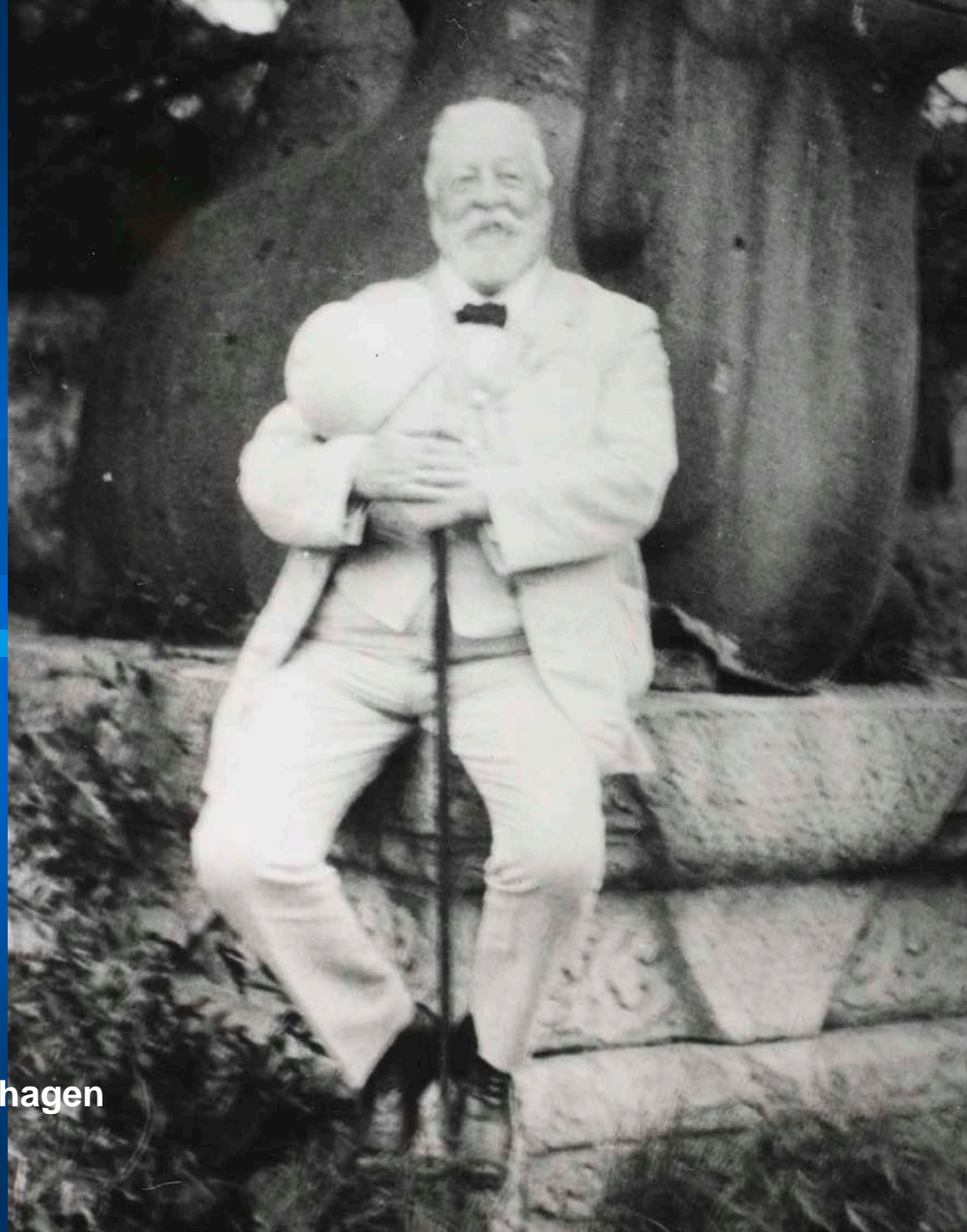
To build bridges



To build roads

Wear and tear
– like drinking

W.R. Winkel
county road surveyor Copenhagen



Paving stones ("kleinpflaster" by Grevenhorst, Germany 1885)



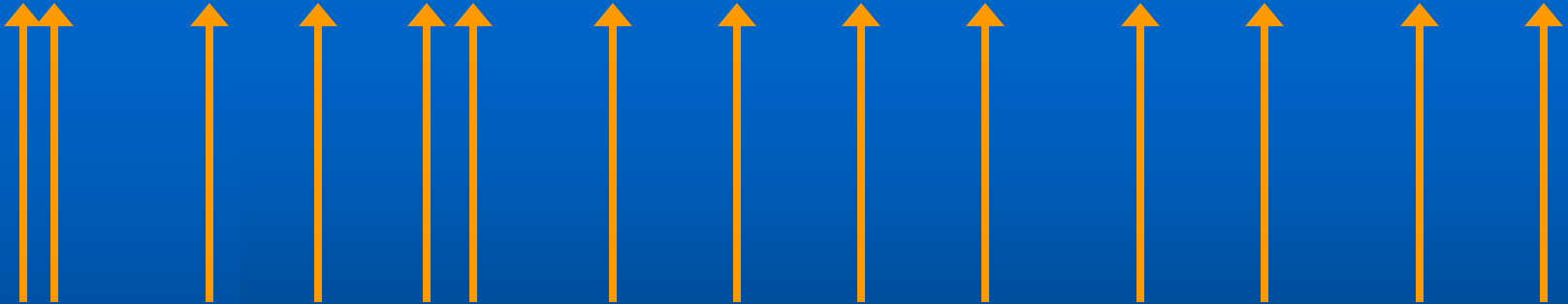
First Danish steam roller 1894



Timetable for new technology c. 1890



1890 1891 1892 1893 1894 1895 1896 1897 1898 1899 1900 1901



How to judge a new technology



Serve its purpose

function, quality, aesthetic



A reasonable economy

cheap, raw materials, workers



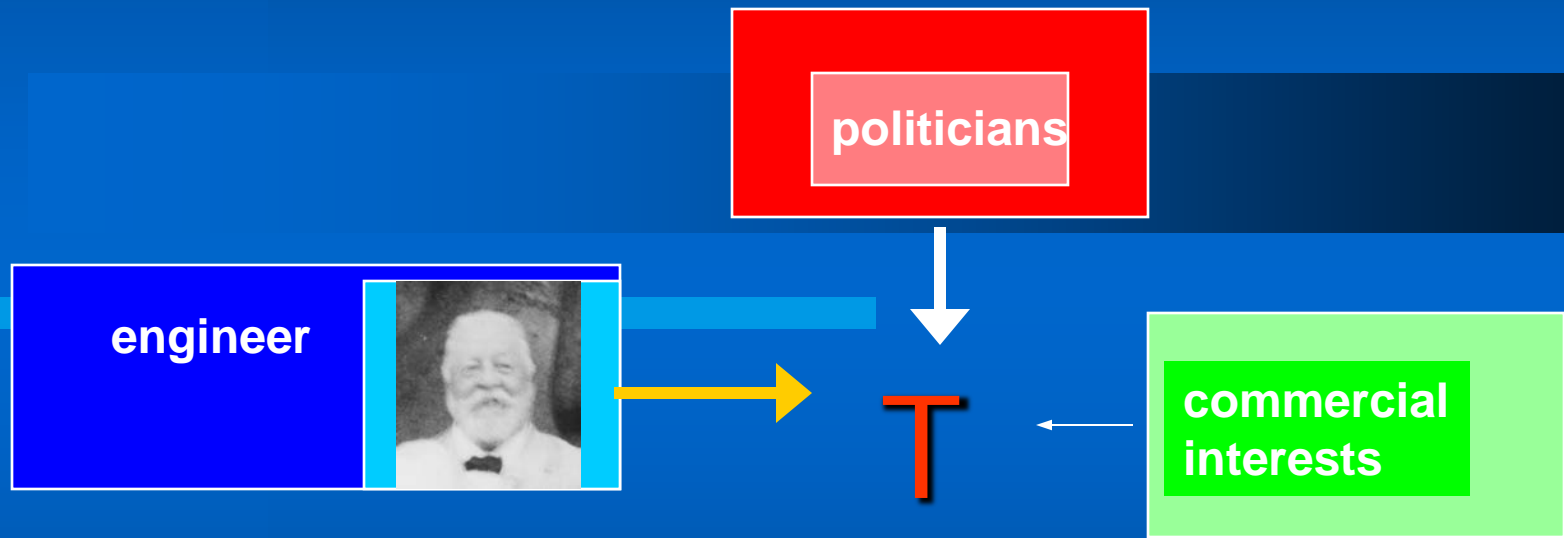
Long term technical succes



Long term economical succes

Chart: decision to new technology

c. 1890



c. 100 % experiences

The car arrive



- and dust became a problem



Cars = new problems

Speed:

A. dust

County road surveyers meets



County road surveyers meetings

1890

1895

1900

1905

1910

1915



1908 PIARC in Paris

(Permanent International Association of Road Congresses)



Solution: tarring



Experiences



Later: solution



Cars = new problems

Speed:

A. dust



Motorpower:

higher weight

1. World War trucks + 10 tons



Problems



Cars = new problems

Speed:

A. dust



Motorpower:

higher weight



Restrictions

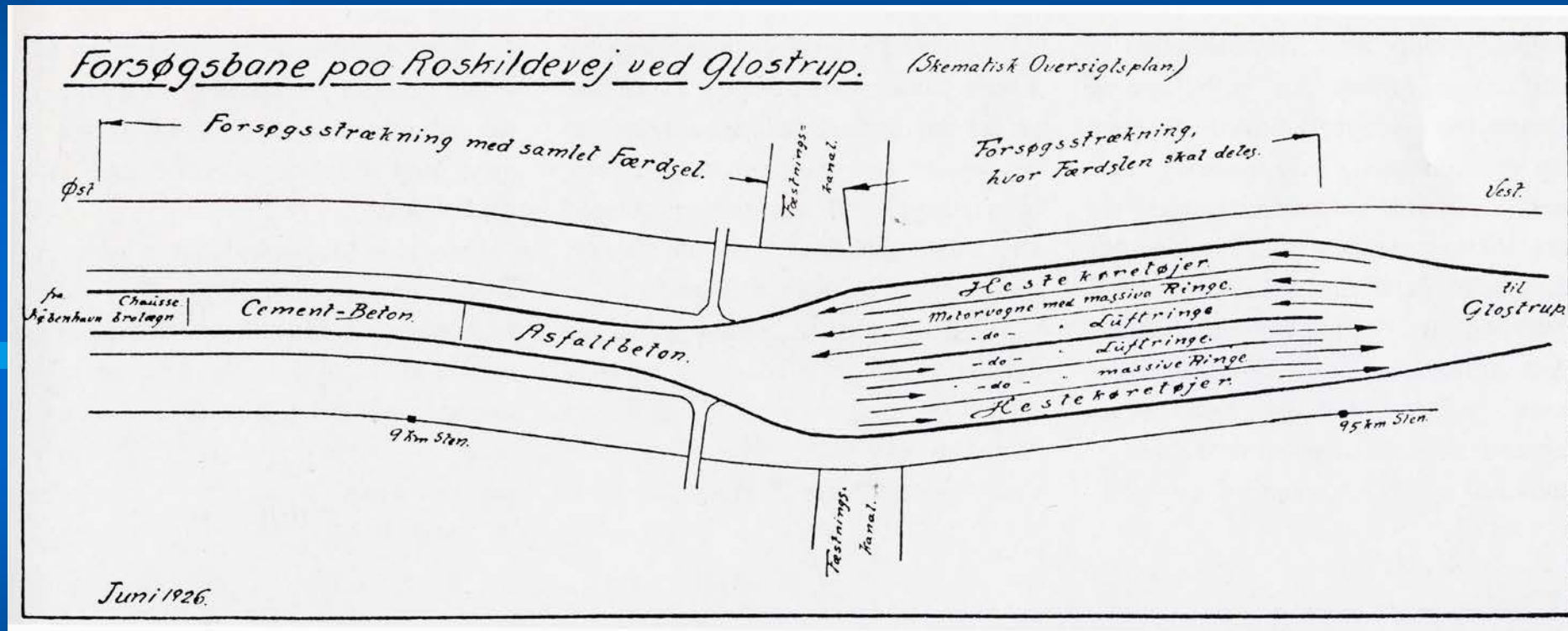
Secondary road car < 450 kg



Experimental road Copenhagen 1924-38



Experimental road Copenhagen 1924-38



English languaged report

THE TECHNICAL ROAD COMMITTEE OF THE
INSTITUTION OF DANISH CIVIL ENGINEERS.

THE EXPERIMENTAL ROAD AT ROSKILDEVEJ
NEAR COPENHAGEN

REPORT No. 1

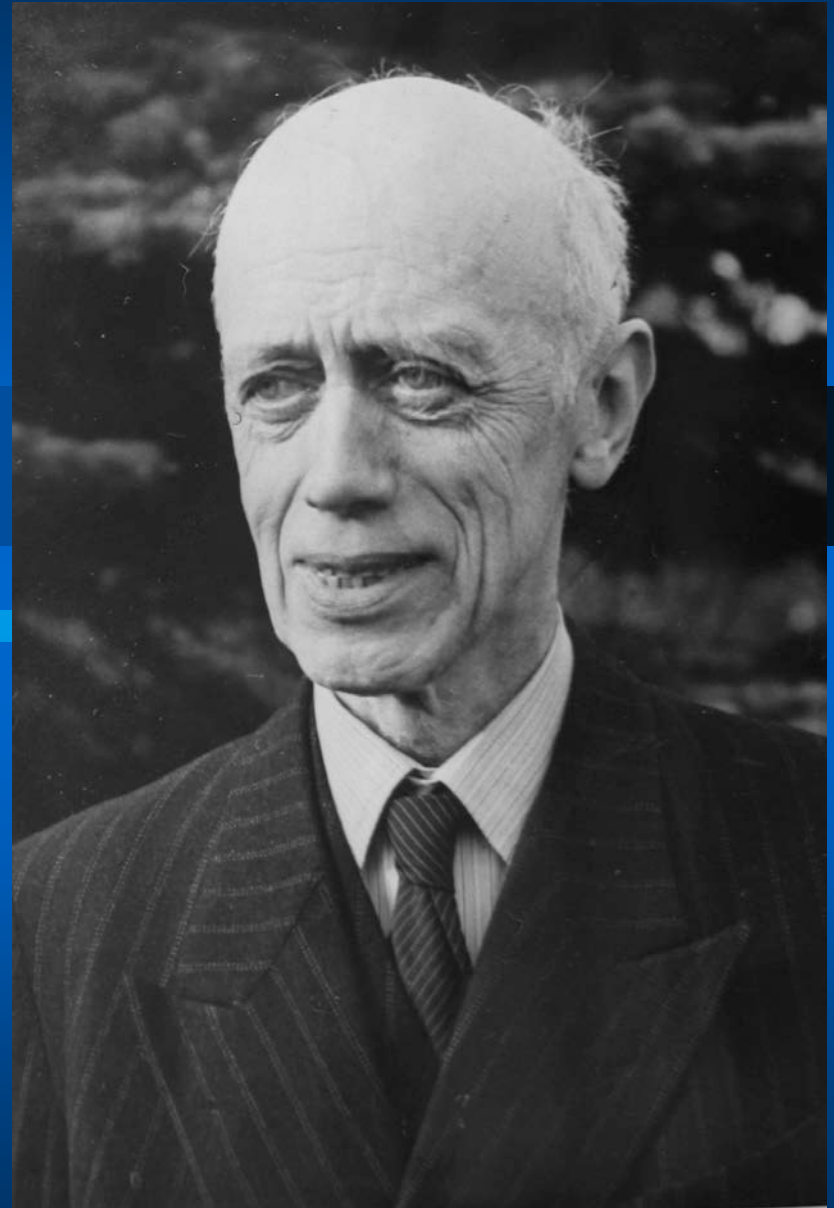
The object of the experiments.
The construction of the experimental road.
Measuring and Counting appliances.

COPENHAGEN
CENTRALTRYKKERIET
1928

The scientist



A.R. Christensen
professor at Polyteknisk
Lærestanstalt (= DTU) 1917-
1949



The Danish Road Journal 1924 -



International experiences

Germany 1934



Cars = new problems

Speed:

A. dust

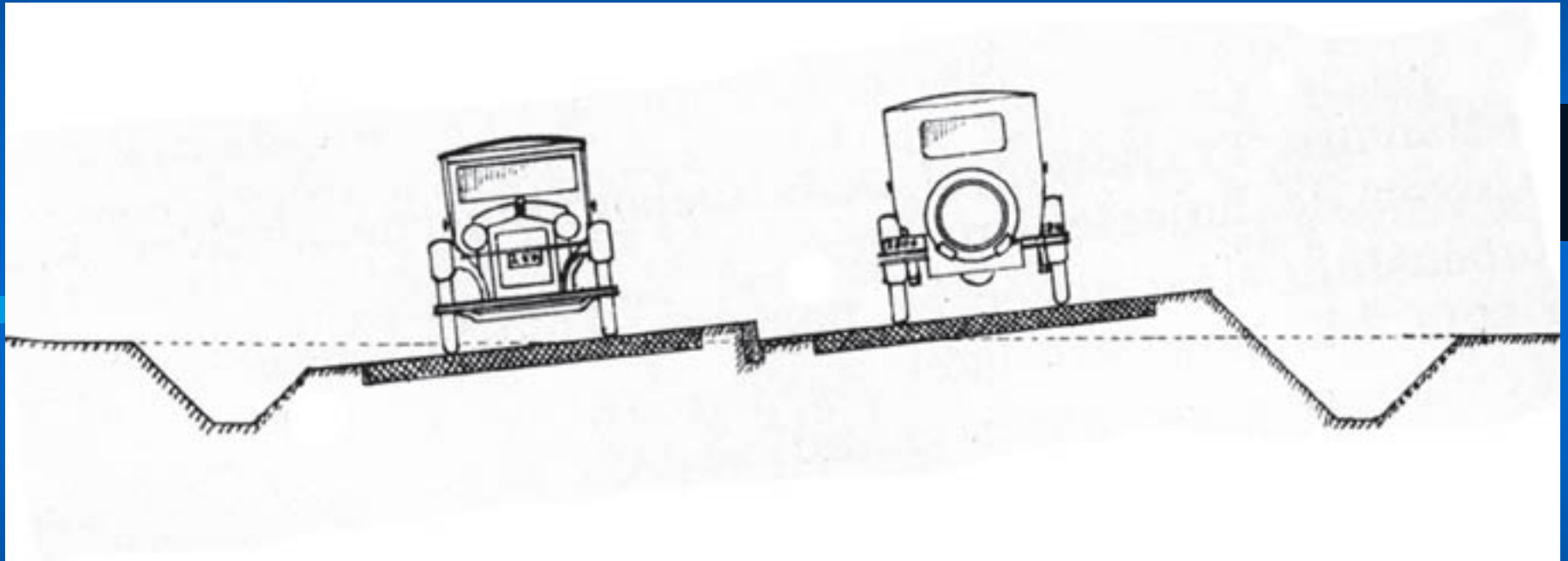


B. danger

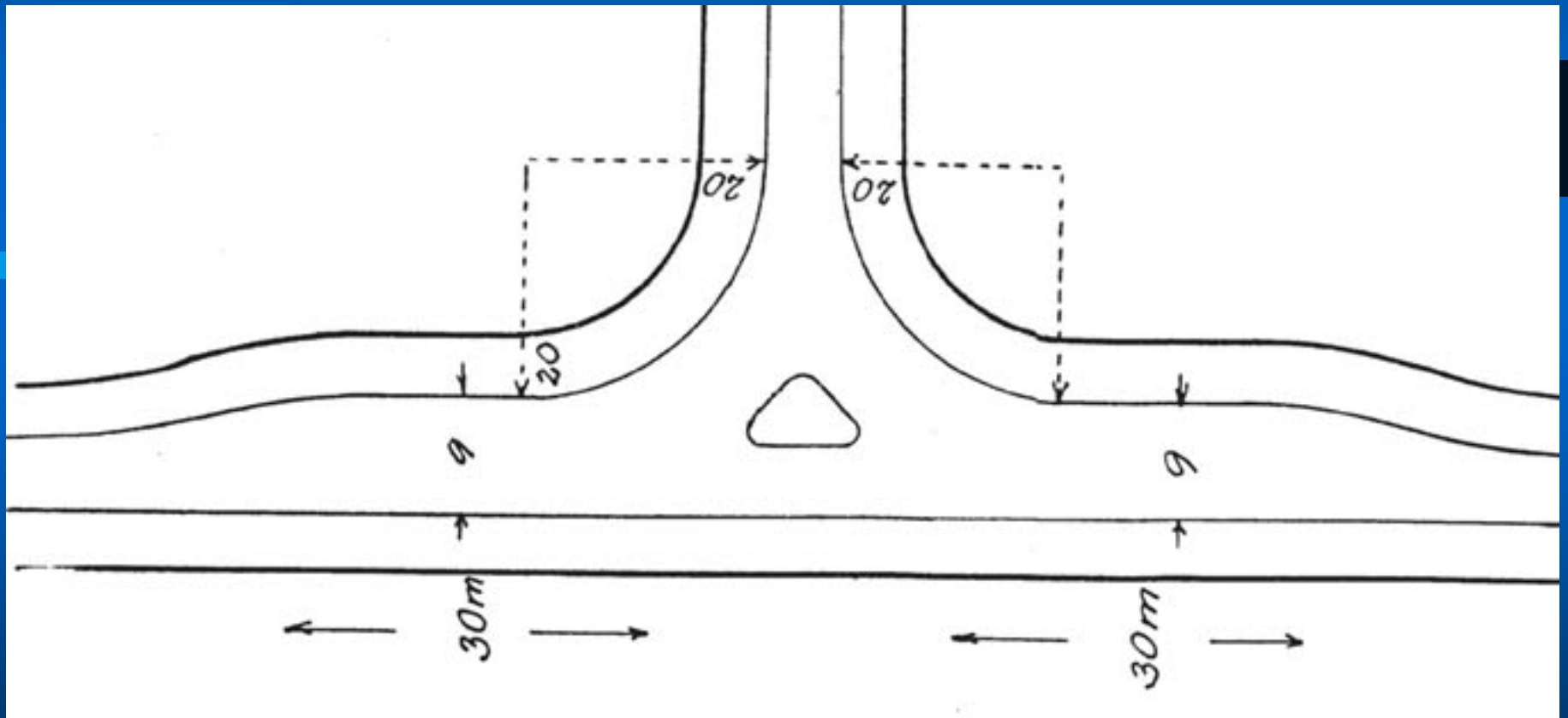
Accidents



New road constructions



New road constructions

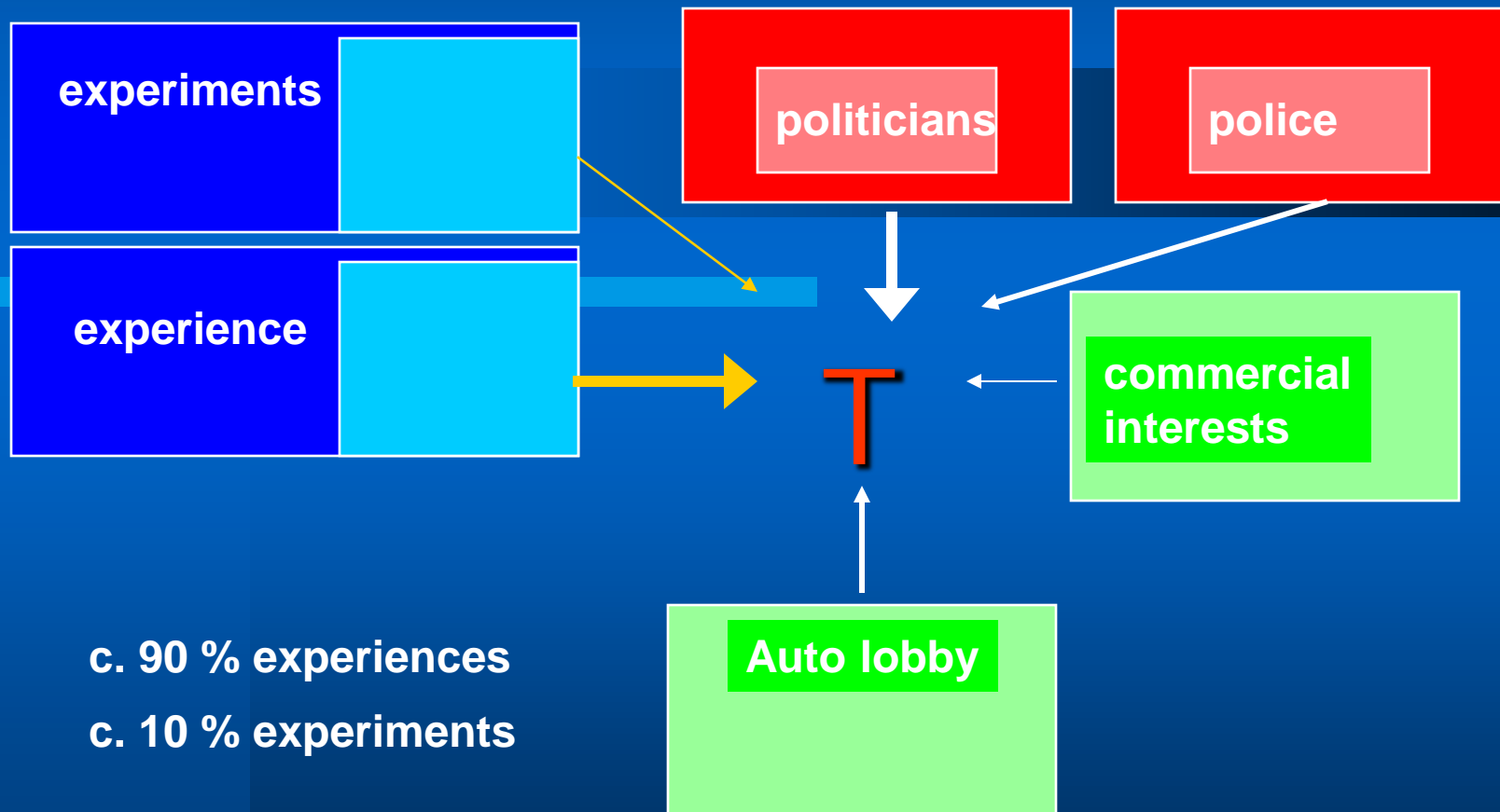


= new players



Chart: decision to new technology

c. 1930



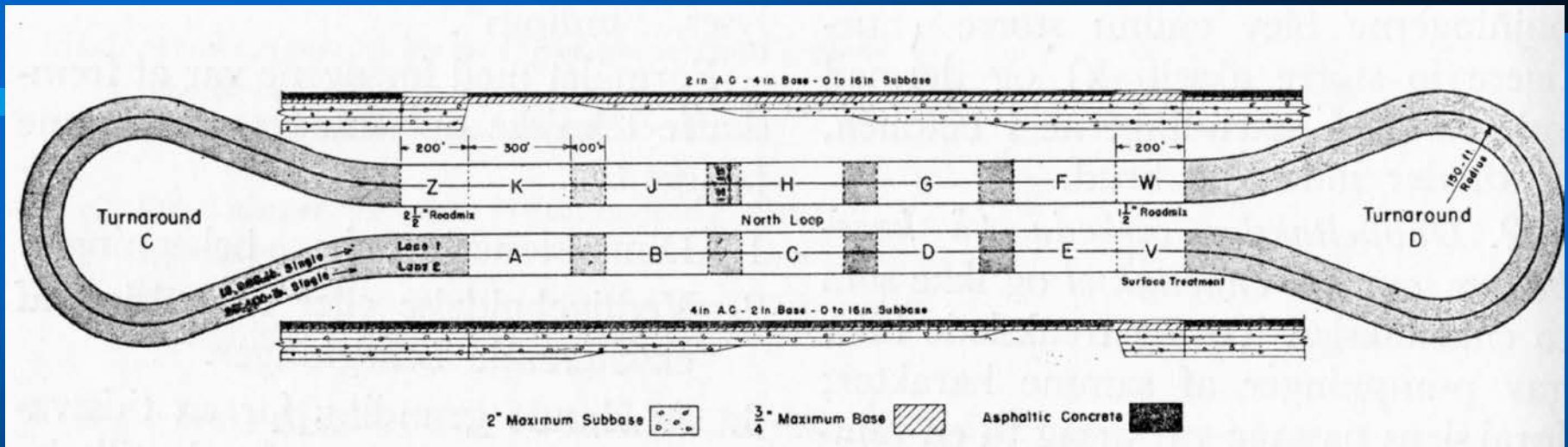
New technology: asphalt



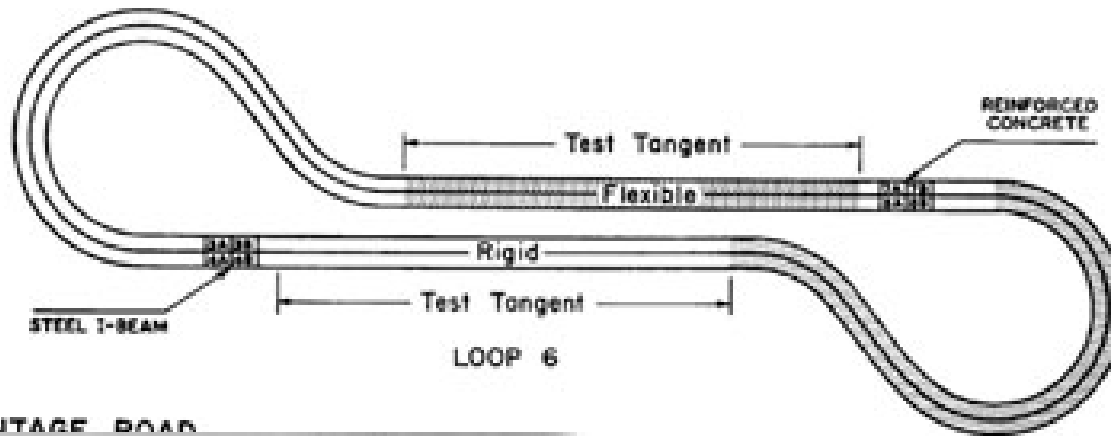
Technology pushed by the 2.th WW



WASHO experiments 1953-1954

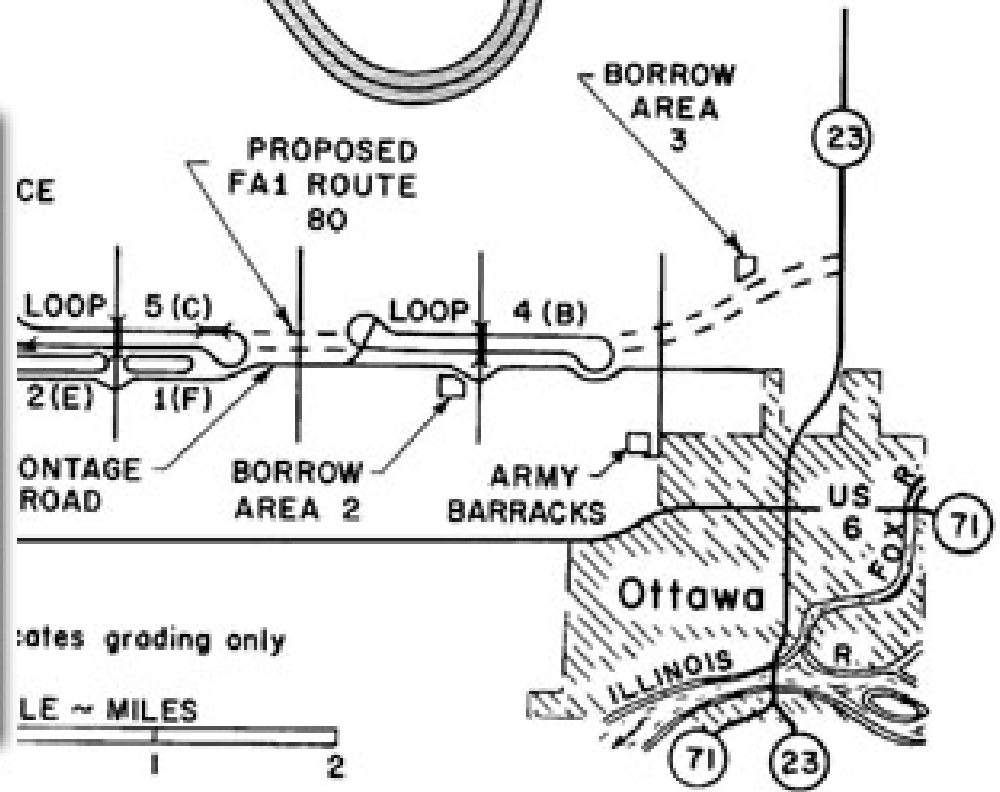


AASHO experiments 1958-1960

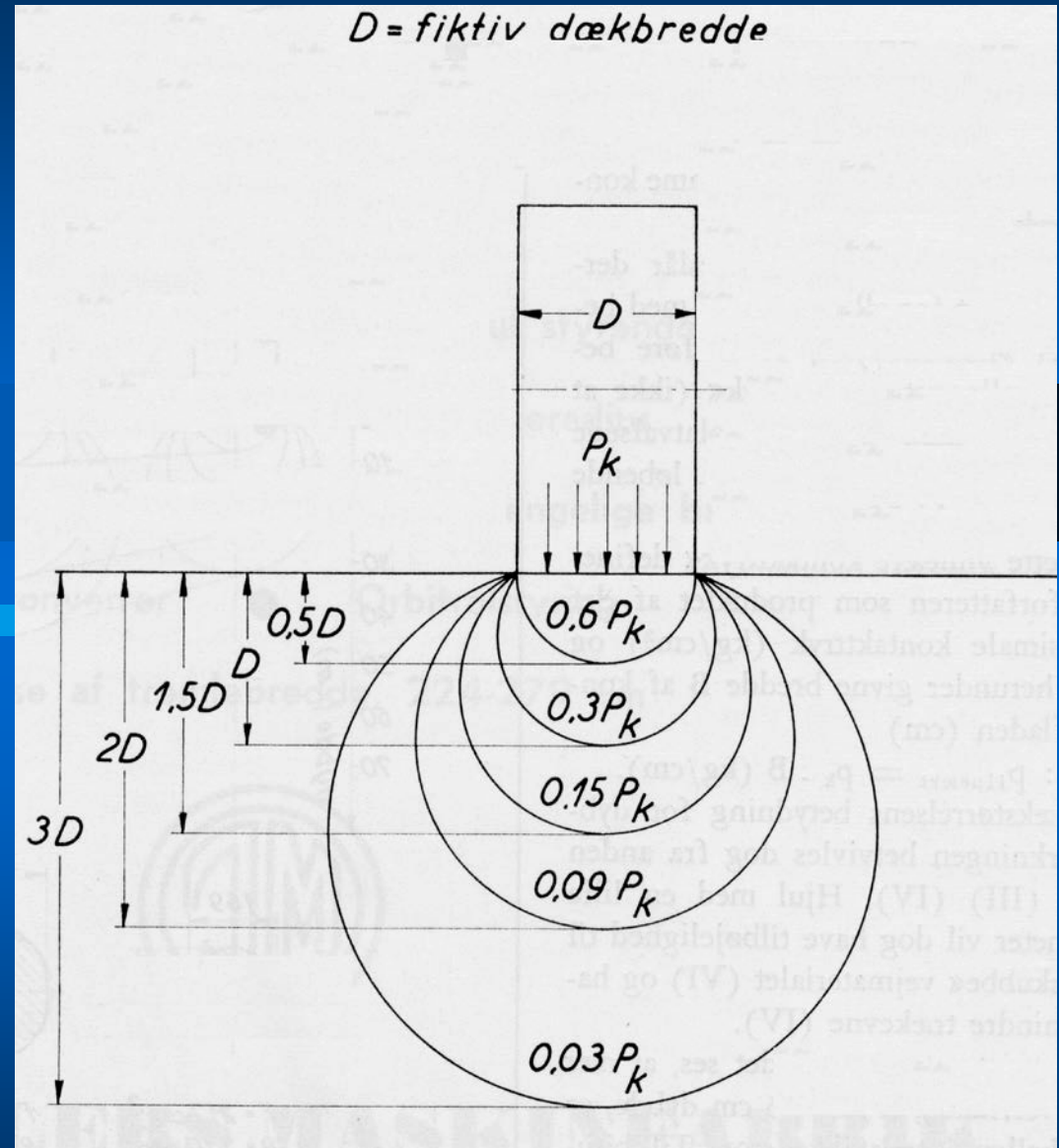


LOAD

FRONTAGE ROAD



Pressure in the deep



Tables

Shell 1963: "Design charts for flexible pavements"

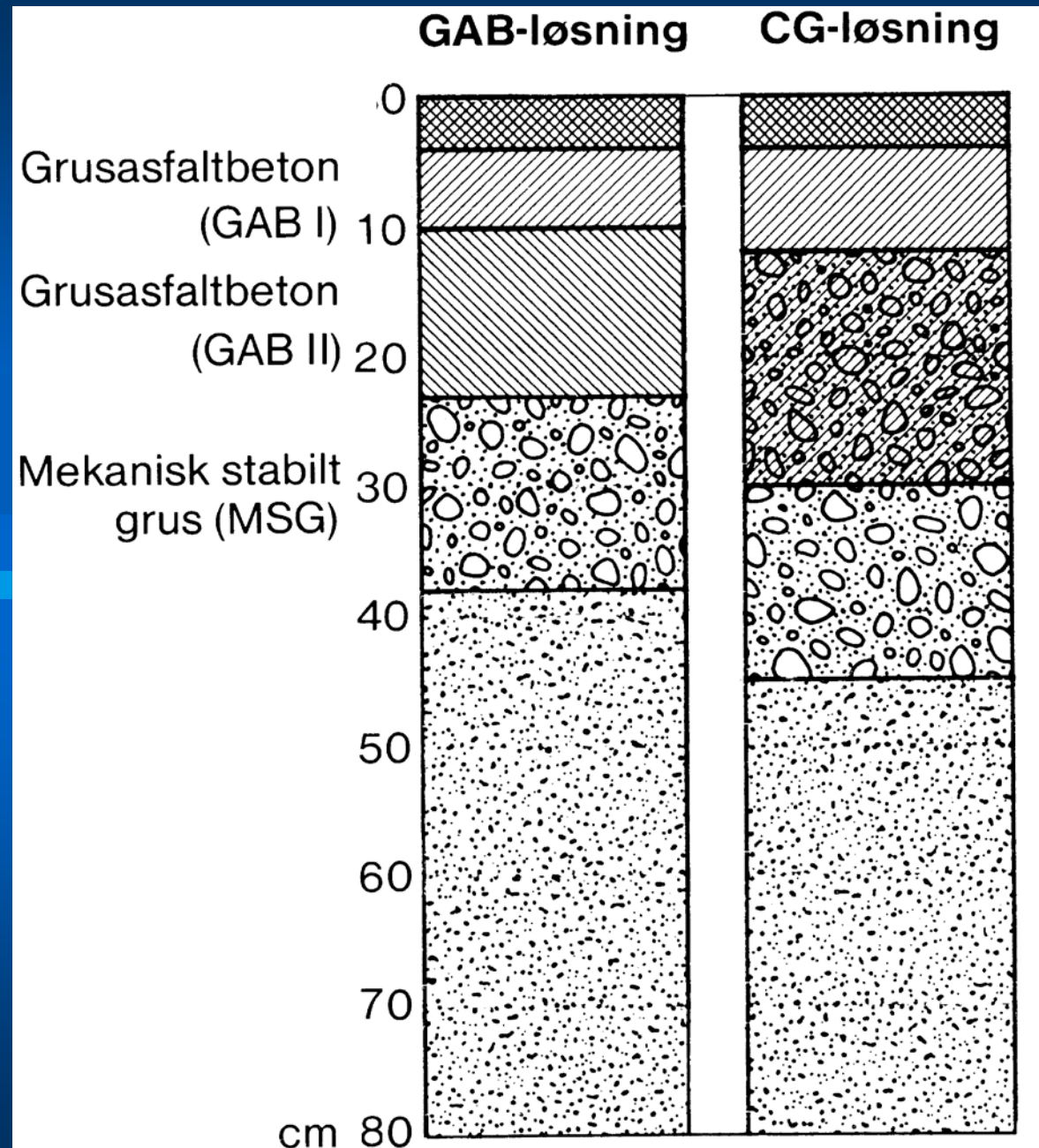


New theories

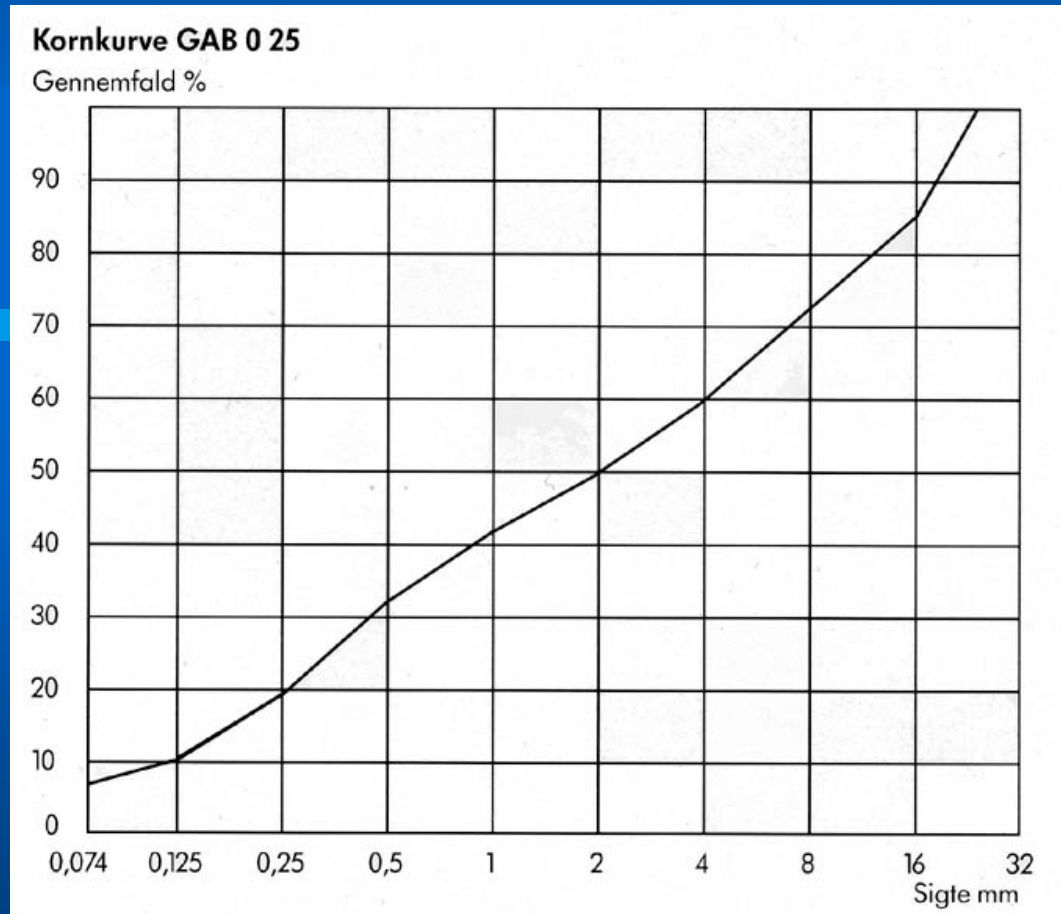
$$AE_{10} = \sum_{i=1}^n \sum_{j=1}^m \frac{k_{at} \cdot k_{wt} \cdot k_f \cdot k_{tp}}{a_j} \left(\frac{P_{ij}}{5t} \right)^\gamma$$

One heavy truck = 70.000 person cars

New road Building technology



Grain size distribution



Weight messenger test machine

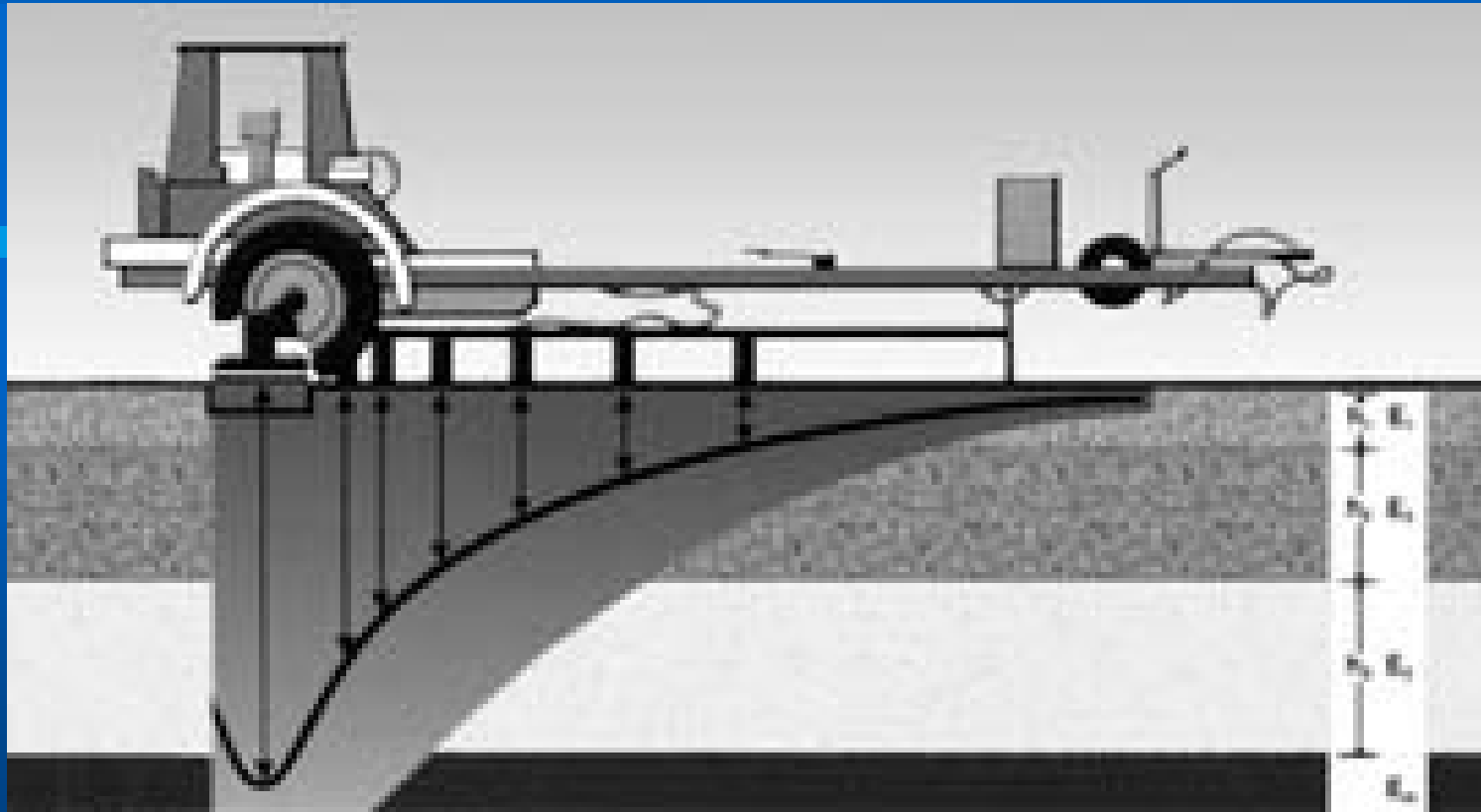
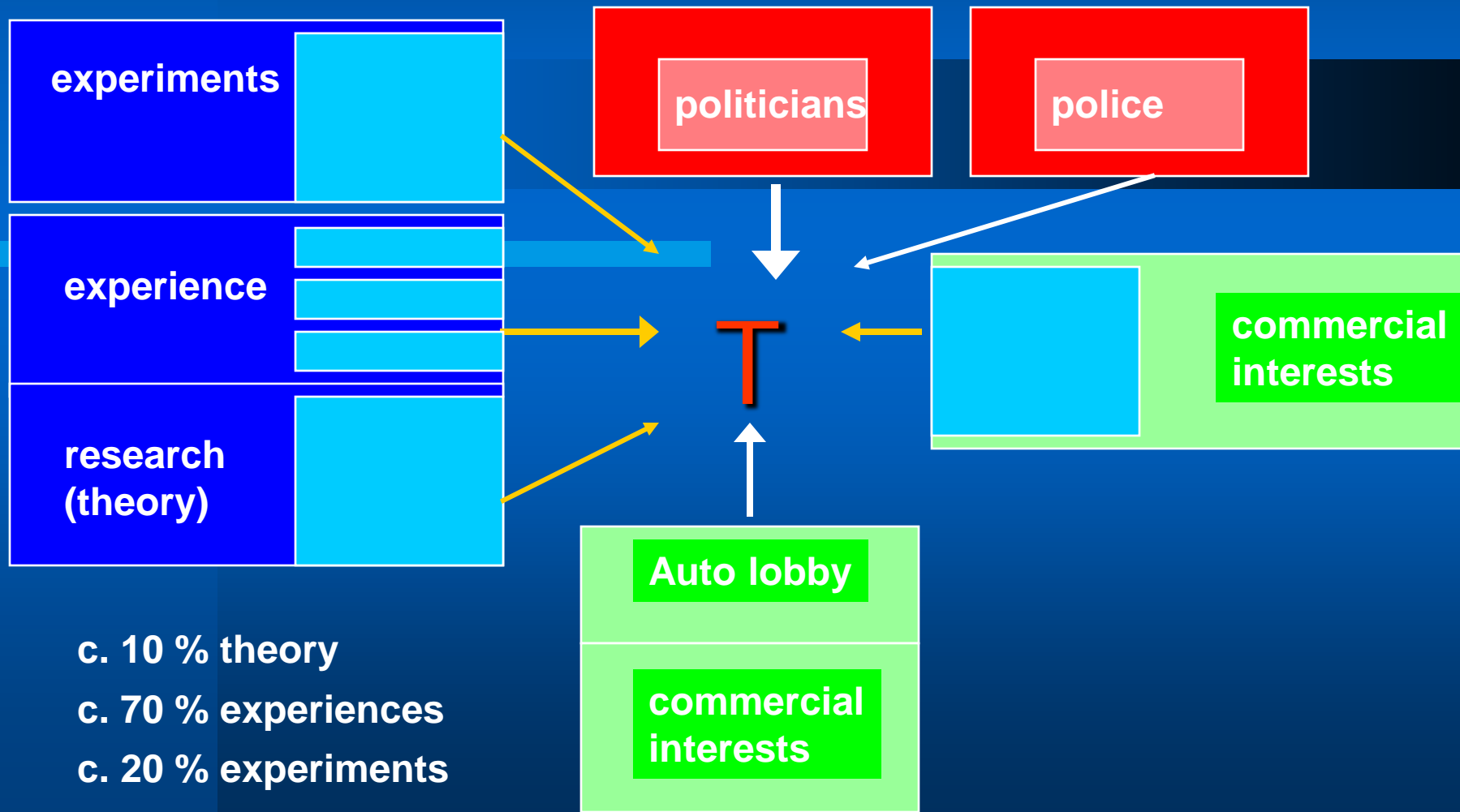


Chart: decision to new technology

c. 1960



Spring 1955

