What is the University of California Pavement Research Center?

- Mission
  - *Dedicated to providing knowledge, the UCPRC uses innovative research and sound engineering principles to improve pavement structures, materials, and technologies.*
- 3 to 5 year contracts with Caltrans since 1995
  - Basic research
  - Development of tools, specifications, tests
  - Support and evaluation of implementation
  - Bringing or developing the best technologies to California and making them work
- www.ucprc.ucdavis.edu

UCPRC
UNIVERSITY of CALIFORNIA Davis • Berkeley | PAVEMENT RESEARCH CENTER

Some Recent UCPRC Work

- Caltrans (90% of our work)
  - Performance related specifications for materials
  - Life Cycle Cost Analysis (LCCA)
  - Pavement structure design methods
  - Environmental Life Cycle Assessment (LCA)
  - Pavement management
  - Recycling (asphalt, concrete, rubber, at-plant, in-place)
  - Construction quality
  - Rapid Rehabilitation construction productivity/traffic
  - Noise, smoothness
- Caltrans and industry
  - Permeable pavements for storm water infiltration

Some Recent Work of UCPRC

- California Air Resources Board
  - Urban heat island life cycle assessment (with LBNL)
- CalRecycle
  - Rubber asphalt mix development and specifications
- Federal Highway Administration
  - Pavement LCA, resilience, sustainability training (consortium)
  - Full-depth reclamation
  - Wide base single truck tires
- Federal Aviation Administration
  - Asphalt recycling
  - Mechanistic-empirical design methods
  - Airfield environmental life cycle assessment
- National Center for Sustainable Transportation
  - Complete streets LCA framework considering equity and environment
  - Prioritization approach for local government climate action plans

Transportation Infrastructure Resilience

- Extreme events (floods, fires, heat events)
  - Response to event
    - Prioritizing routes that should be hardened
  - Restoration of functionality
    - Protecting infrastructure while vulnerable
    - Trade-off of infrastructure damage cost vs economic inactivity cost
- Medium-term changes
  - Planning for future risks
    - Don’t build there, abandonment
    - Don’t build it if can’t afford to maintain it
  - Design and specification changes
    - Consider pace of climate related change (extreme events, sea rise) vs rehabilitation and reconstruction of infrastructure
    - Communication with climate change and infrastructure practitioners: Infrastructure-Climate Network (ICNet) example for northeast

Transportation Infrastructure Reducing Greenhouse Gas Emissions

- Where are the impacts?
  - Materials are 70 to 90% of GHG emissions from roads and bridges
    - Cement and asphalt "glue" that hold the rocks together is 50 to 80% of the materials emissions
  - Construction and maintenance operations are 5 to 15%
  - Materials transportation is the rest
- Biggest reductions can come from:
  - Making pavement last longer
    - Training, construction quality, good design
  - Keeping high traffic lanes smooth
  - Using less cement and asphalt over the long haul
  - Reducing transportation of materials
    - Mining existing hardscape for materials
- How much for pavement?
  - If do all currently known possible, on the order of 1.5 to 3 MMT reduction out of current 430 MMT state total; about 0.4 to 0.7%

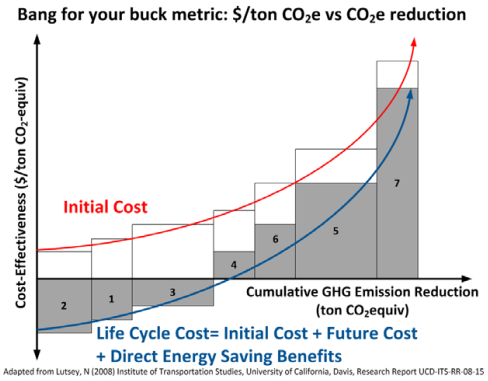
Local Government

City and County Pavement Improvement Center

- Local government owns 80% of the state's public pavement
  - 35% counties; 45% cities
- CCPIC chartered in 2018
  - UCPRC, California State Association of Counties, League of California Cities, CSU (Chico, Long Beach, SLO), UC Berkeley
  - Currently funded by SB1 funds from UC Davis, UC Berkeley, Mineta Transportation Institute
  - www.ucprc.ucdavis.edu/ccpic
- Mission
  - Delivering training and technology transfer
    - Pavement management and engineering certificate program
  - Developing guidance, specifications, and tools
  - Creating and operating a resource center
  - Providing research and development support

Prioritization of Change Strategies for Resilience and Reduction of Environmental Impacts

- Cost and environmental impacts assessment and decision-making, need to consider
  - Full system (what changes due to interactions)
  - Full life cycle (initial change and what happens after)
  - Getting most benefit from available funding
- If not, high risk of negative unintended consequences
- Approach currently being piloted:
  - Caltrans internal operations
  - Local government Climate Action Plans



Ask me at a break how this works

Government and Industry Changes and Challenges Next 30 Years

- Training
  - Thousands of new people making decisions, poor retention of corporate knowledge in government
  - Lack of transportation infrastructure training
    - Especially pavement
  - Planning and management of infrastructure
- Resilience for extreme events and medium-term change
  - How can hardscape play a role in slowing, reducing stormwater flow?
  - Where and how to harden for response and to minimize economic losses
- Future of key materials
  - Reusing existing materials, using less new asphalt and cement
  - Will we have asphalt as we transition away from refining oil?
  - Hardscape for future mobility: electric vehicles, active transportation
  - New UCPRC initiative: synergies of using forest and ag biomass for transportation infrastructure, and potentially biomass energy
    - Current partners: Caltrans, Rice Research Board, USFS Endowment