

Dragos Andrei, Ph.D., P.E., M.ASCE
Virginia Pavement Recycling Conference
November 2012



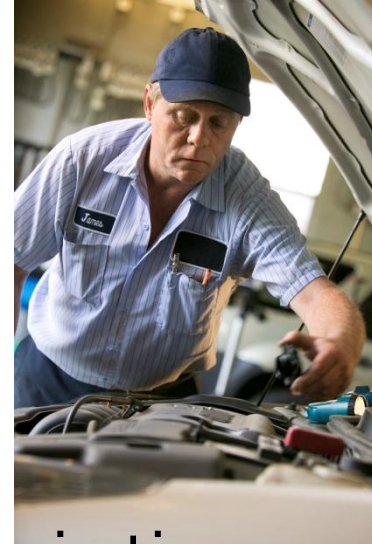
Integrating Recycling Strategies in Pavement Management



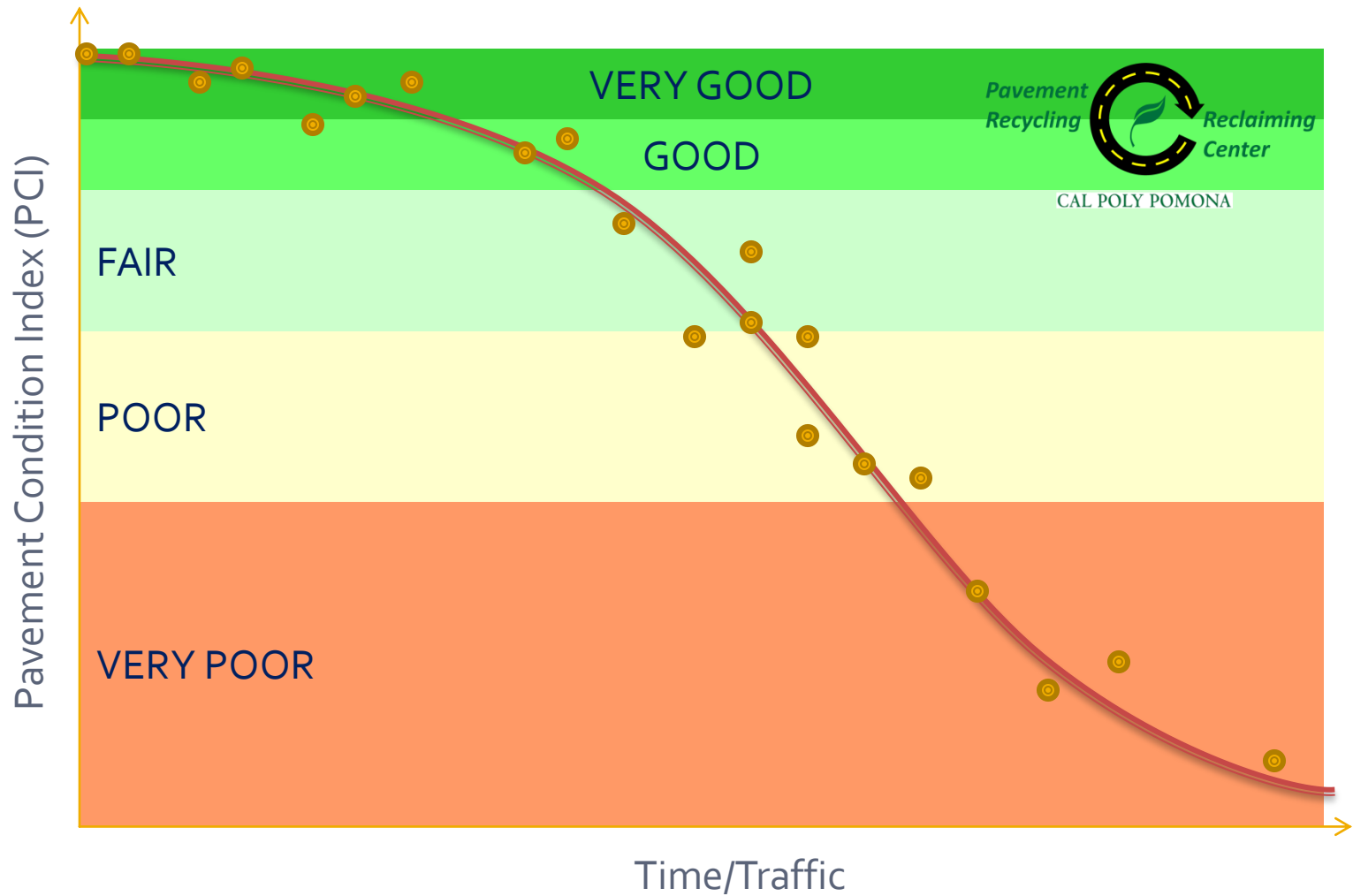
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Pavement Management Under the Hood

- Database of pavement sections
 - Location, geometry, surface, rank, etc.
- Pavement condition over time
 - Construction date or last major rehab
 - Pavement Condition at different moments in time
 - Pavement Condition Index (PCI)
 - International Roughness Index (IRI)
 - Other



Performance Models

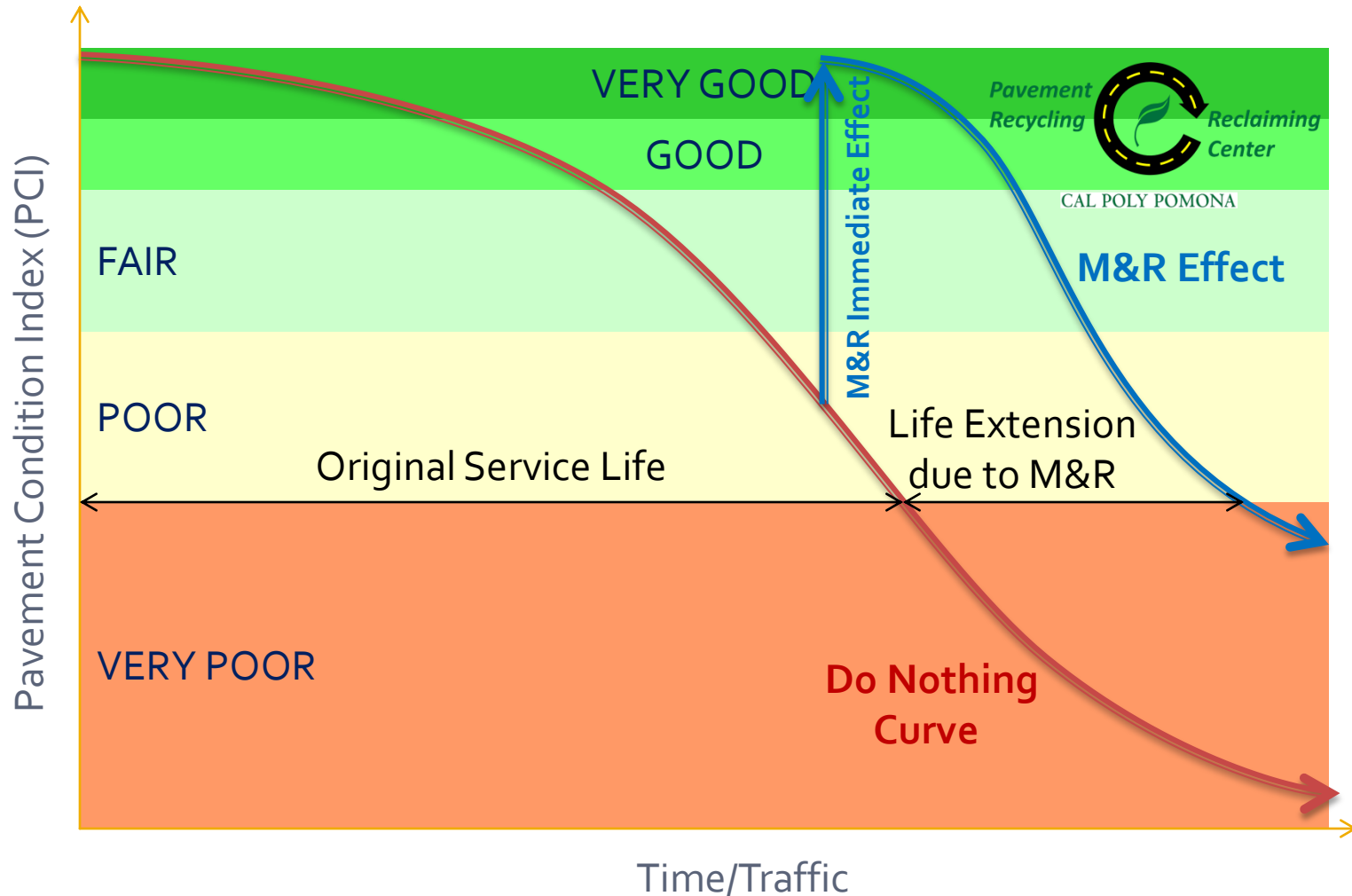


More ...

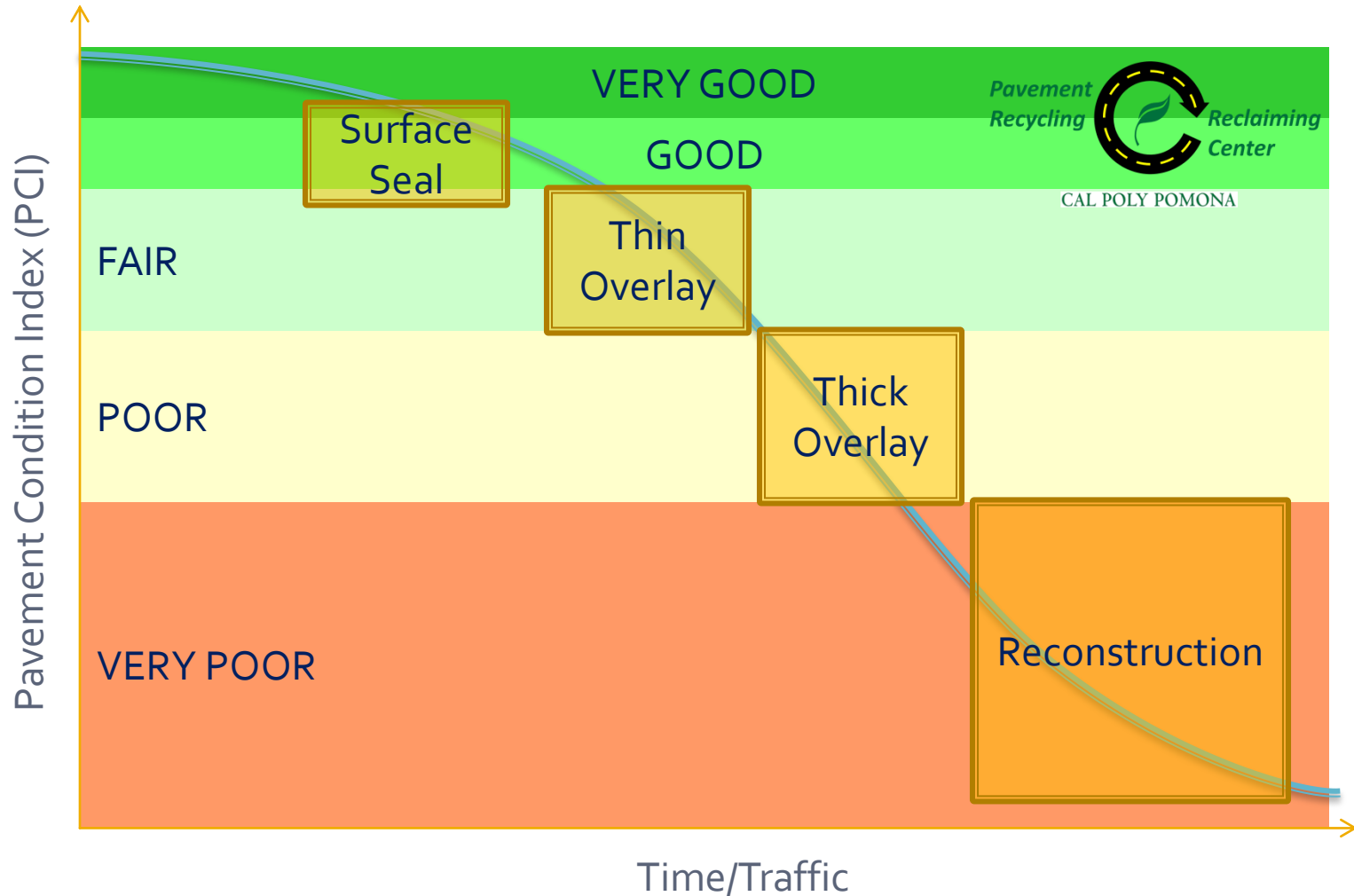


- Annual Budget
- M&R Decision Tress
 - What M&R strategies are available?
 - When should a certain strategy be used?
 - What is the cost of each strategy?
 - What is the EFFECT of each strategy on pavement performance?

M&R Effect on Performance



Traditional M&R Decision Tree



How about recycling strategies?

- We have no experience with it ...
 - Learn from the many agencies that used it with success
 - Significant progress has been made in the last few years both at national and international level
- We tried once and had a bad experience ...
 - Equipment and technologies have evolved, use the “RIGHT” approach:
 - RIGHT STRATEGY
 - RIGHT PAVEMENT
 - RIGHT TIME
 - RIGHT _____?



How about recycling strategies?

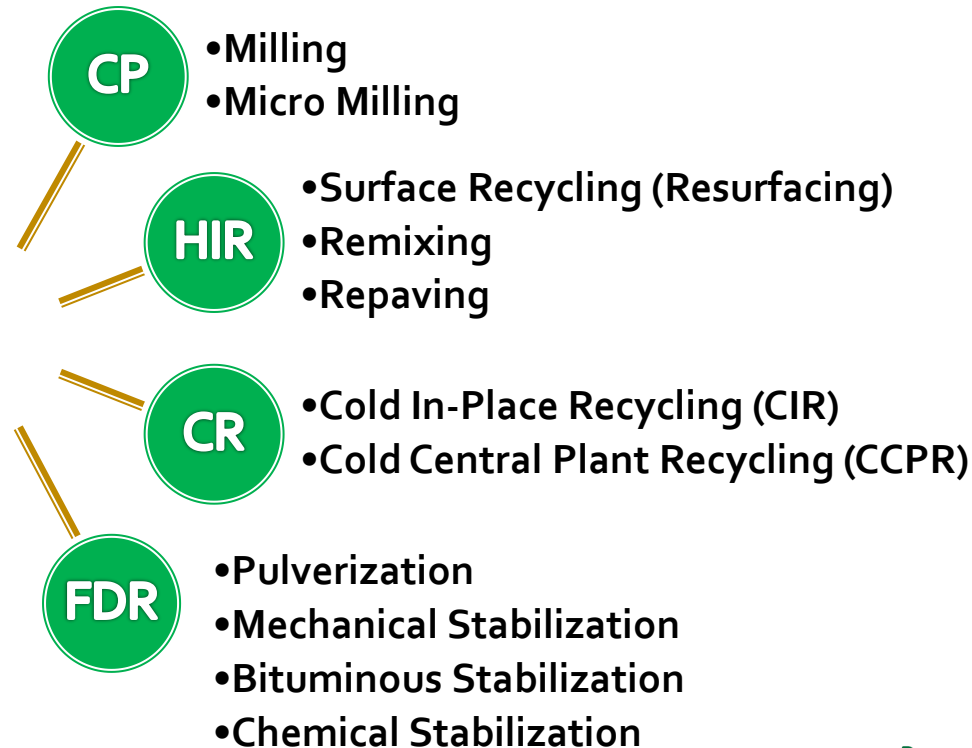
- Does it qualify for federal funding?
 - Yes, federal funds can be used for recycling programs including full depth reclamation (MAP-21 Section 1304)
- Why recycle?
 - Think about future generations
 - Makes economic sense
 - Makes engineering sense



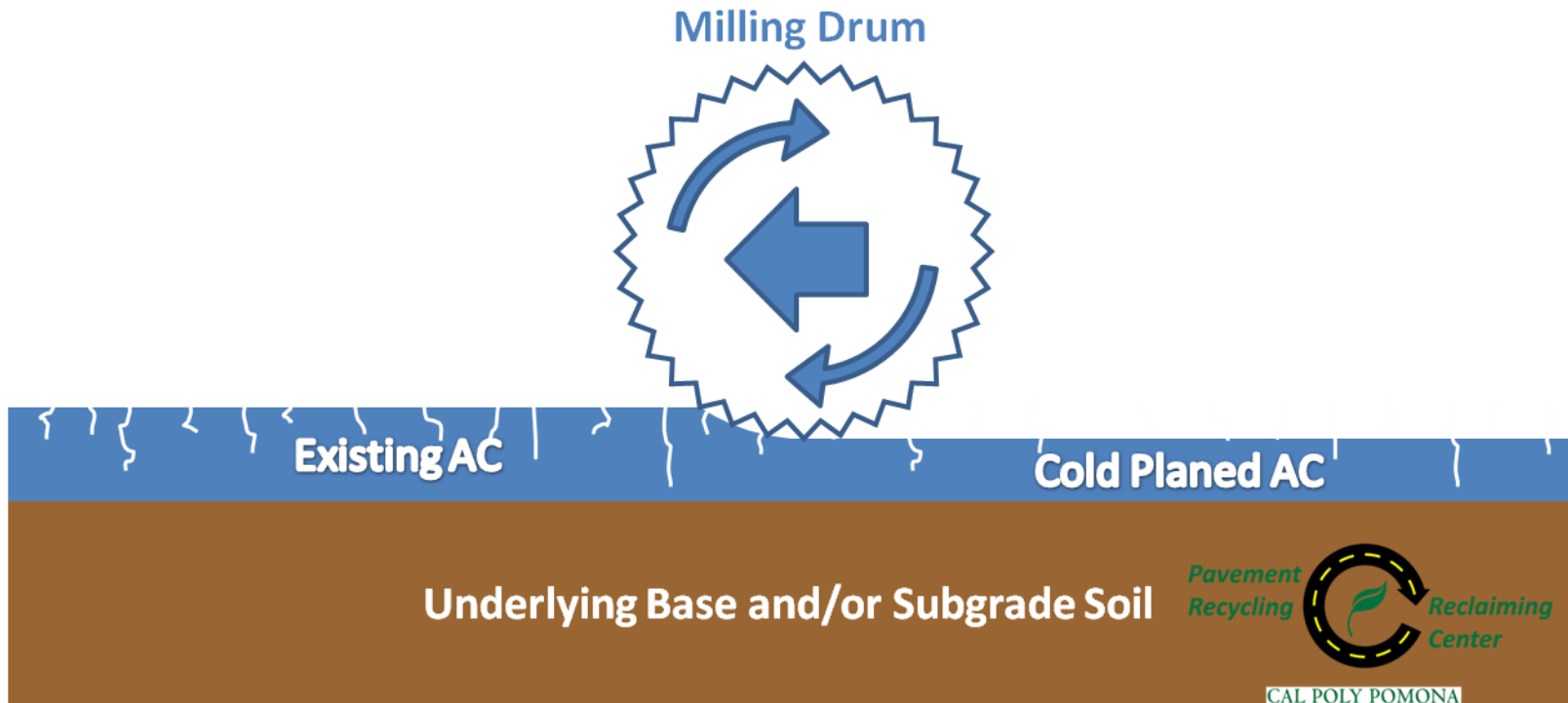
Recycling Strategies



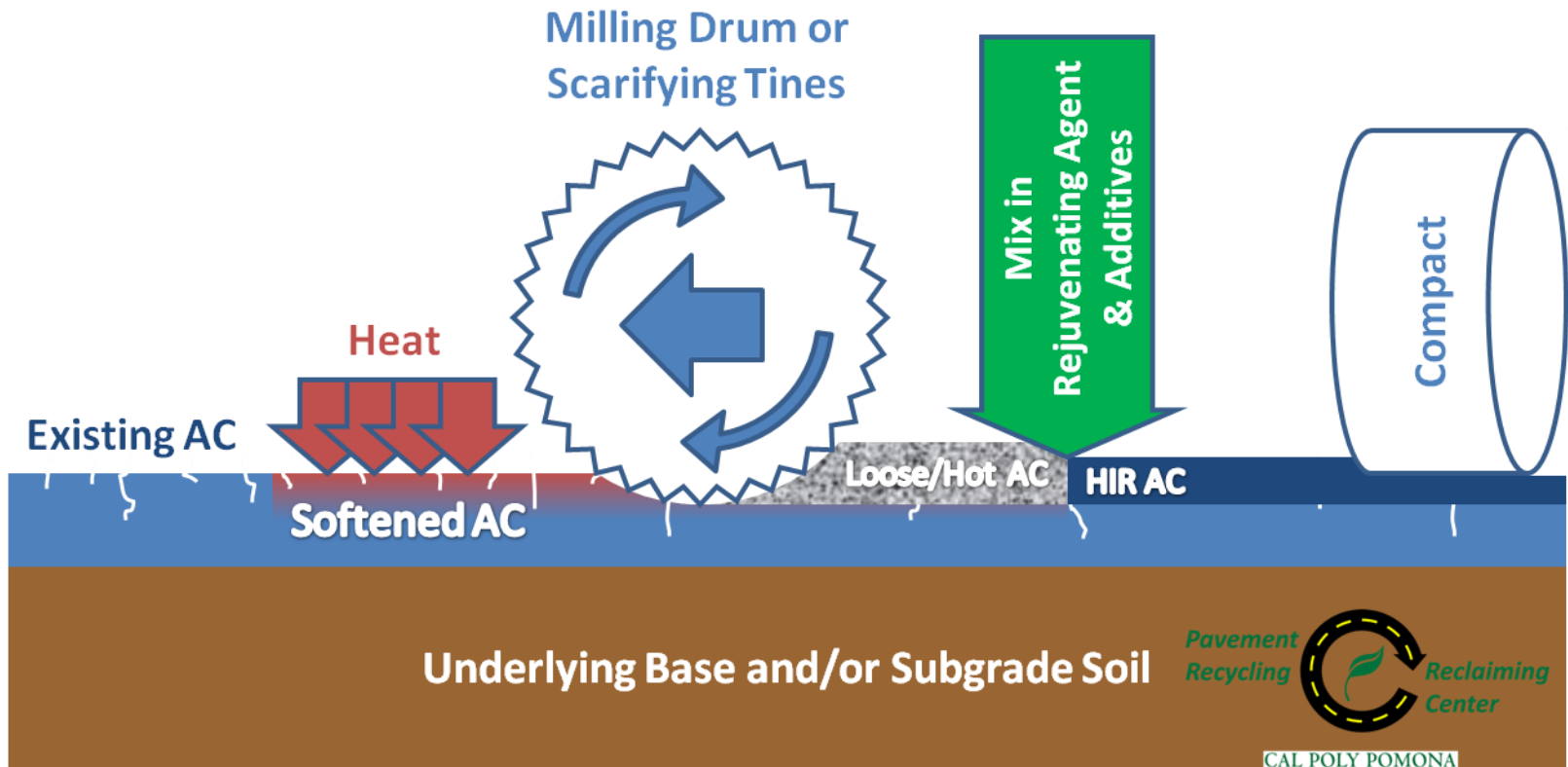
■ Pavement Recycling and Reclaiming Strategies:



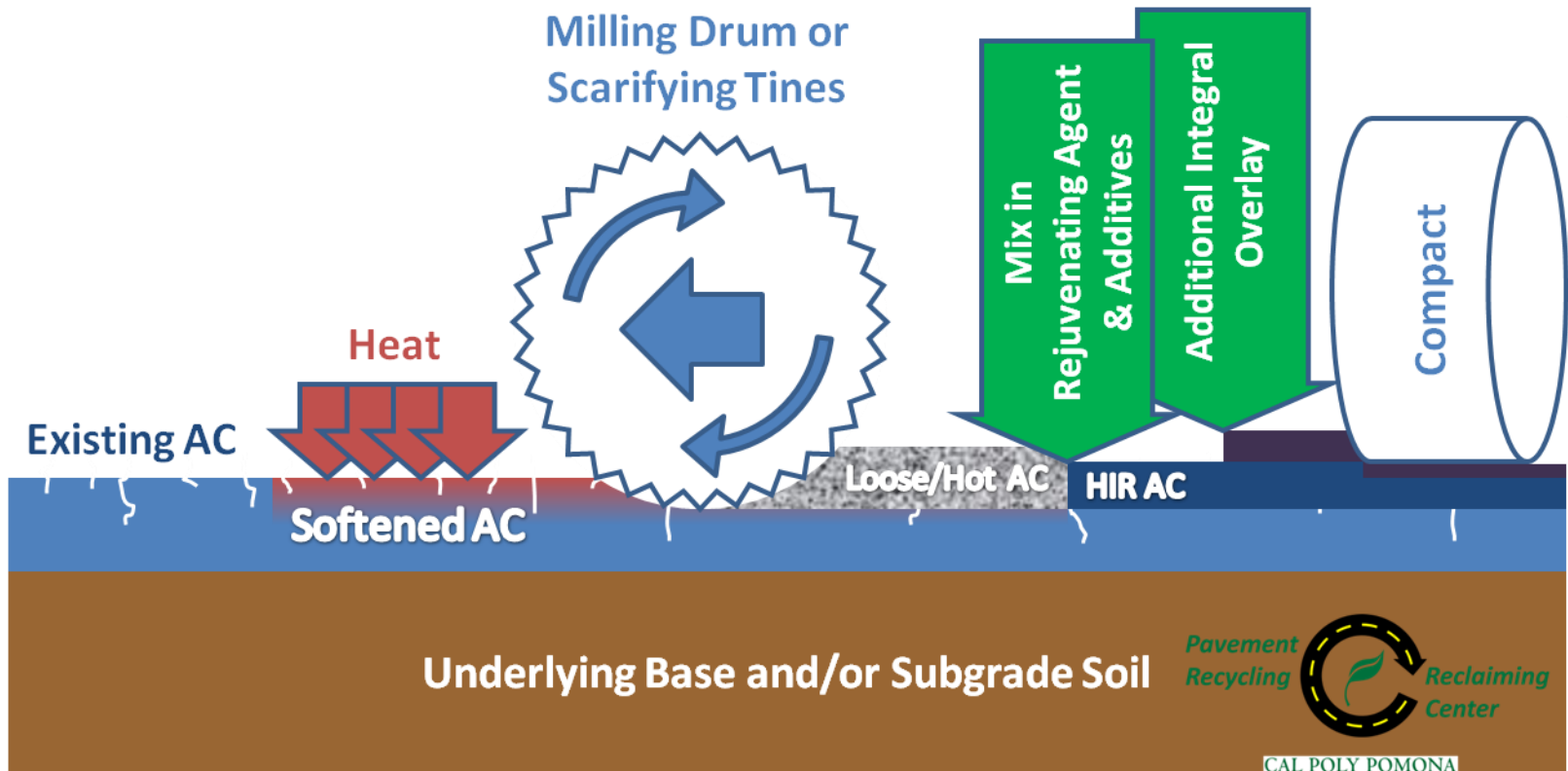
Cold Planing



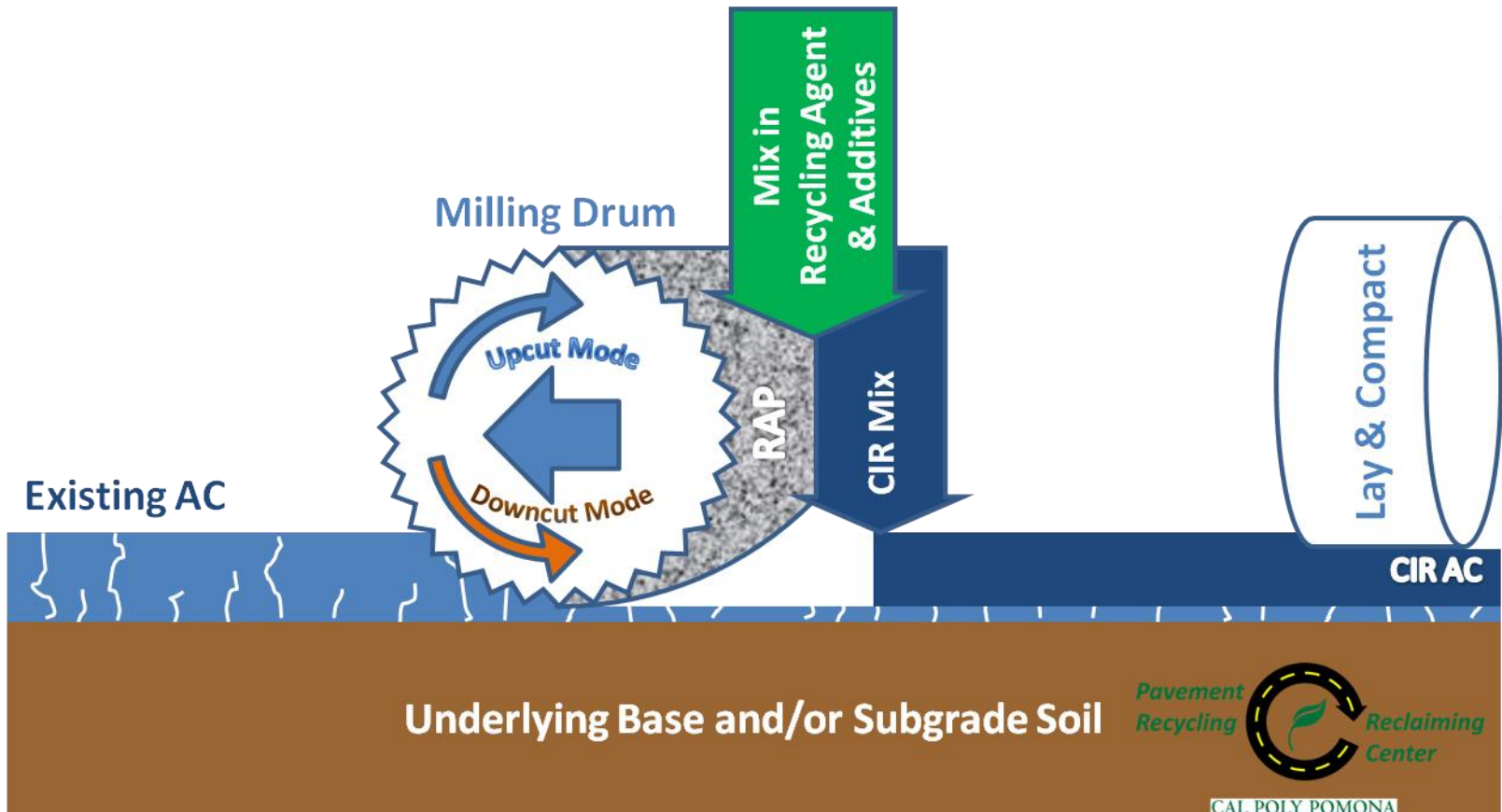
HIR - Remix



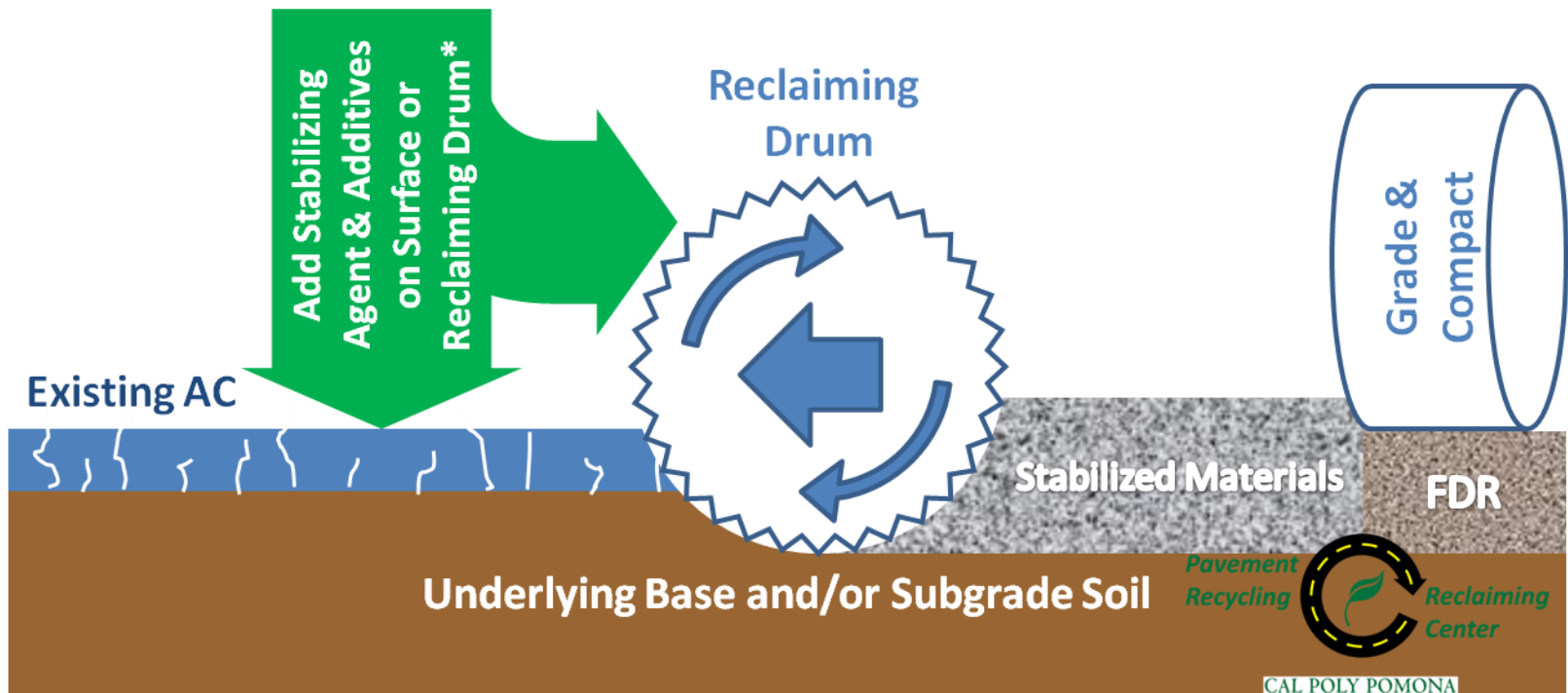
HIR - Repave



Cold In-Place Recycling

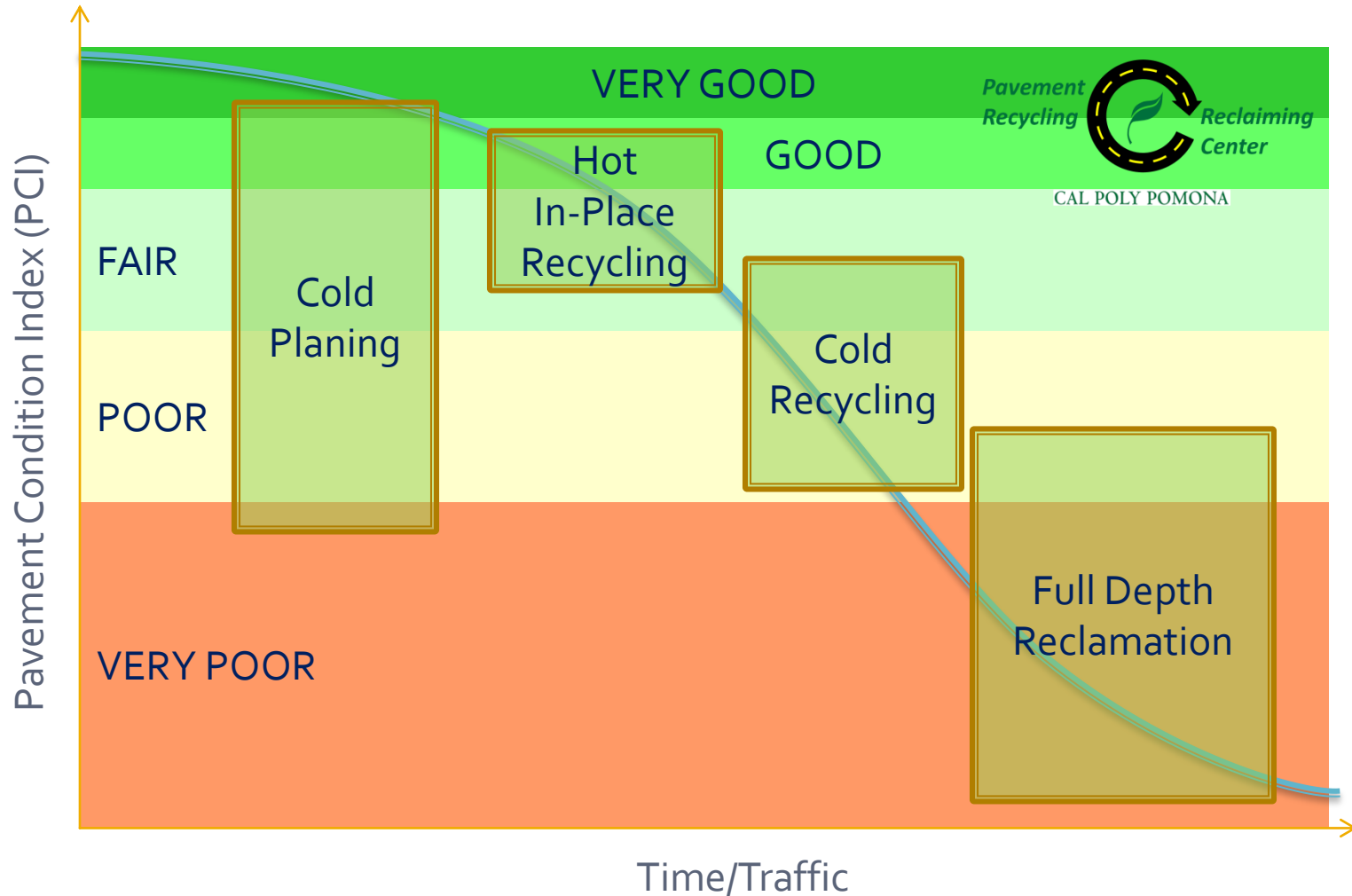


Full-Depth Reclamation



*In some cases the materials are pre-pulverized before the reclaiming drum does the mixing pass.

R&R Decision Tree



M&R Information Needed

- PCI range and other agency-specific decision criteria
- Cost of materials, transport, construction
- Effect: i.e. life extension and anticipated maintenance costs
- Impact: green house gas emissions (GHG), energy consumption, duration of traffic closures, amount of waste, etc.



Quantifying the IMPACT

- Challenges:
 - Material costs vary over time and with project location
 - Different construction equipment/technology will have different “carbon footprint” and will continue to change with time
 - It is impractical to take measurements on each project
- Simplified Approach:
 - Look at the qualitative difference between materials, M&R technologies and the expected life extension



M&R Relative Comparison

M&R Strategy	Typical PCI Range	Relative Cost	Life Extension (Years)	"Green" Rating
Surface Seal	Good	\$-\$\$	3-5	🍁🍁🍁+
HIR	Good to Fair	\$\$\$	5	🍁🍁+
HIR + Seal	Good to Fair	\$\$\$\$	7	🍁🍁
HIR + Thin Overlay	Fair	\$\$\$\$\$	10	🍁+
Thin Overlay	Fair	\$\$\$	7	-
Mill + Thin Overlay	Fair	\$\$\$\$	10	-
CIR + Seal	Fair	\$\$\$	7	🍁🍁🍁
CIR + Thin Overlay	Fair to Poor	\$\$\$\$\$	12	🍁🍁+
CIR + Thick Overlay	Poor	\$\$\$\$\$\$	15	🍁🍁
Thick Overlay	Poor	\$\$\$\$\$	12	-
Mill + Thick Overlay	Poor	\$\$\$\$\$\$	12-15	-



M&R Relative Comparison (Cont'd)

M&R Strategy	Typical PCI Range	Relative Cost	Life Extension (Years)	"Green" Rating
FDR + Seal	Poor	\$\$\$\$\$\$	12-15	🍃🍃
FDR + Thin Overlay	Poor to Very Poor	\$\$\$\$\$\$\$	18	🍃+
FDR + Thick Overlay	Poor to Very Poor	\$\$\$\$\$\$\$\$	20+	🍃
Reconstruction	Very Poor	\$\$\$\$\$\$\$\$\$\$	20+	-

- Notes:

- Subjective relative ratings based on engineering judgment and experience
- Use as a starting point in selecting M&R strategies

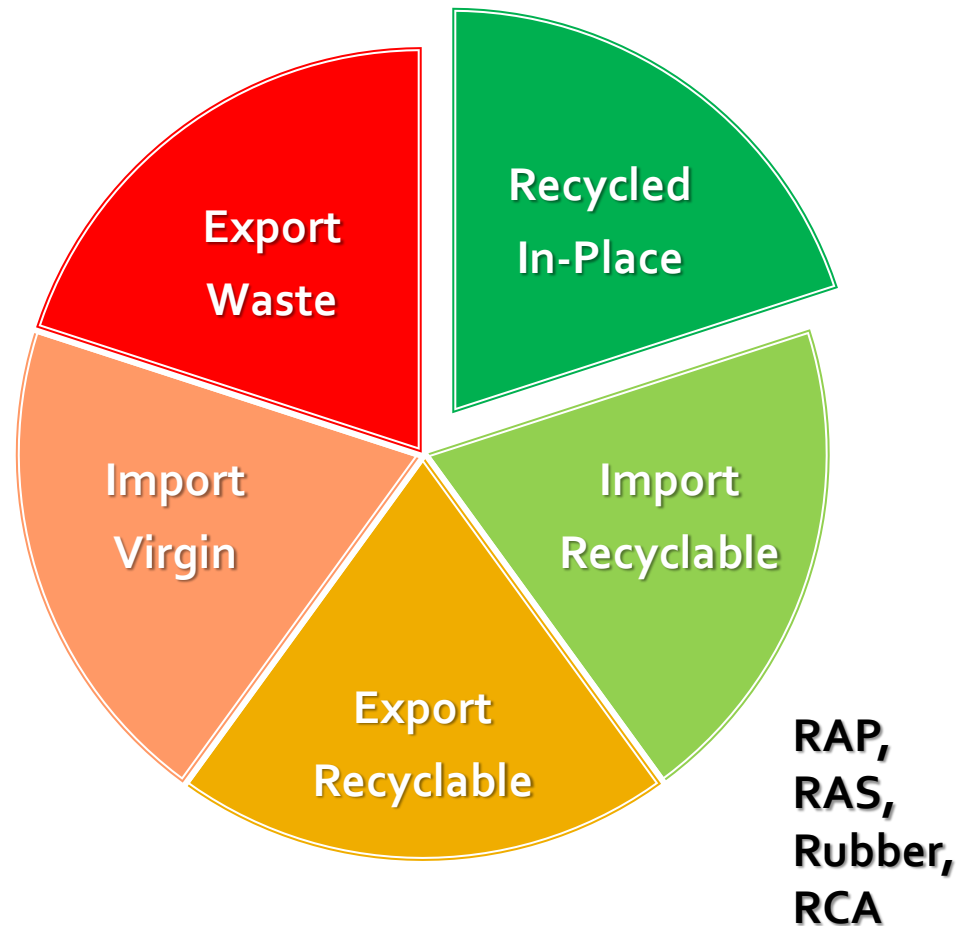
Bottom Line



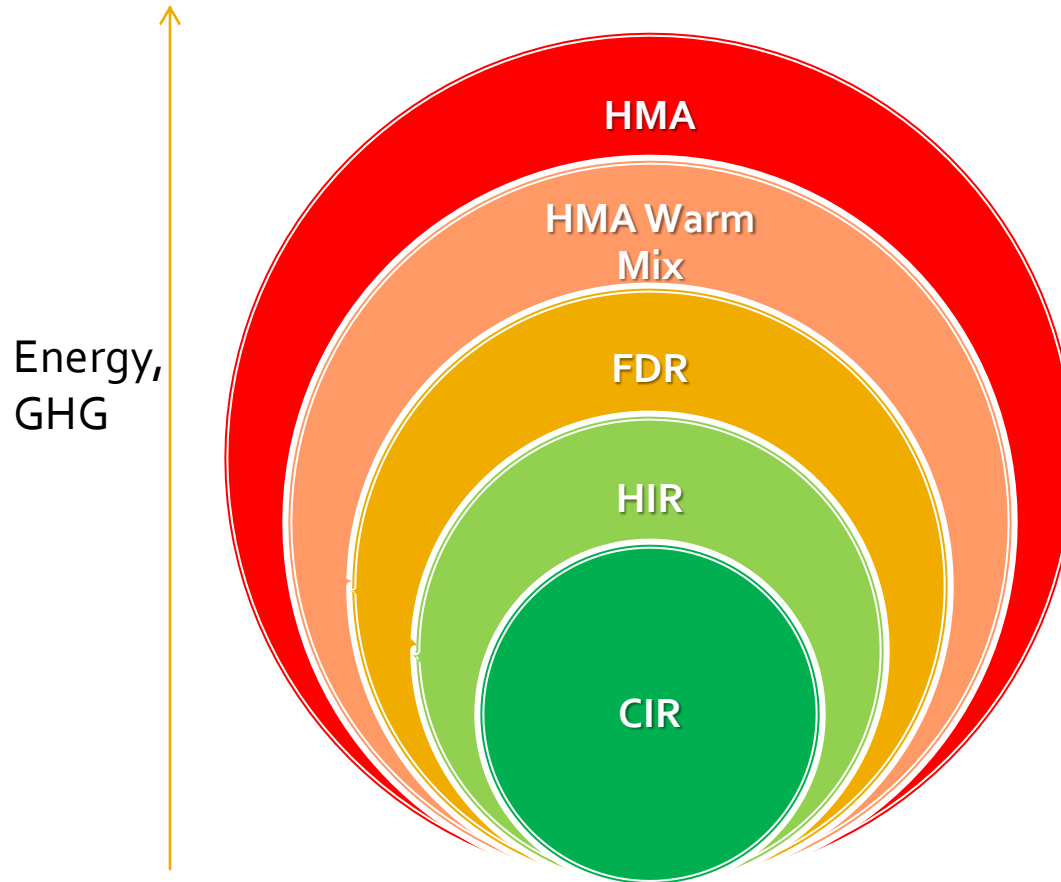
- Include R&R in your pavement management decision trees
- Periodically update your PMS database to fine tune the information specific to each M&R strategy: cost, life extension, “green” benefits
- Require that pavement rehabilitation recommendations include sustainable alternatives such as HIR, CIR, CCPR, FDR, High-RAP, Warm Mix, etc.



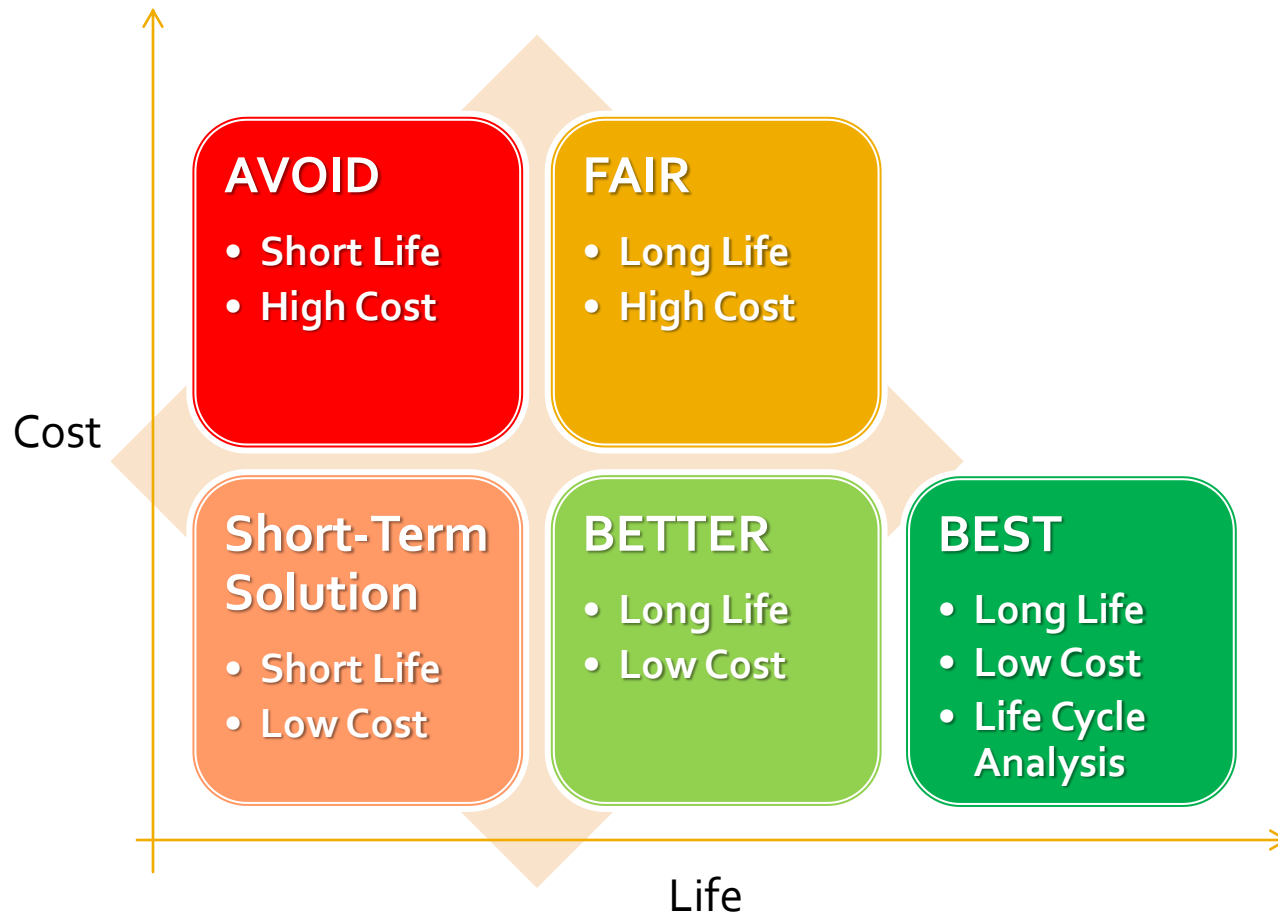
Use "Green" Materials



Use "Green" Technologies



Design for generations !



Thank You

Dragos Andrei, Ph.D., P.E., M.ASCE
Associate Professor, Civil Engineering
Technical Director, Pavement Recycling and Reclaiming Center
CAL POLY POMONA
dandrei@prrcenter.org

www.PRRCenter.org



Is your pavement as green as the world around us?