Sustainability

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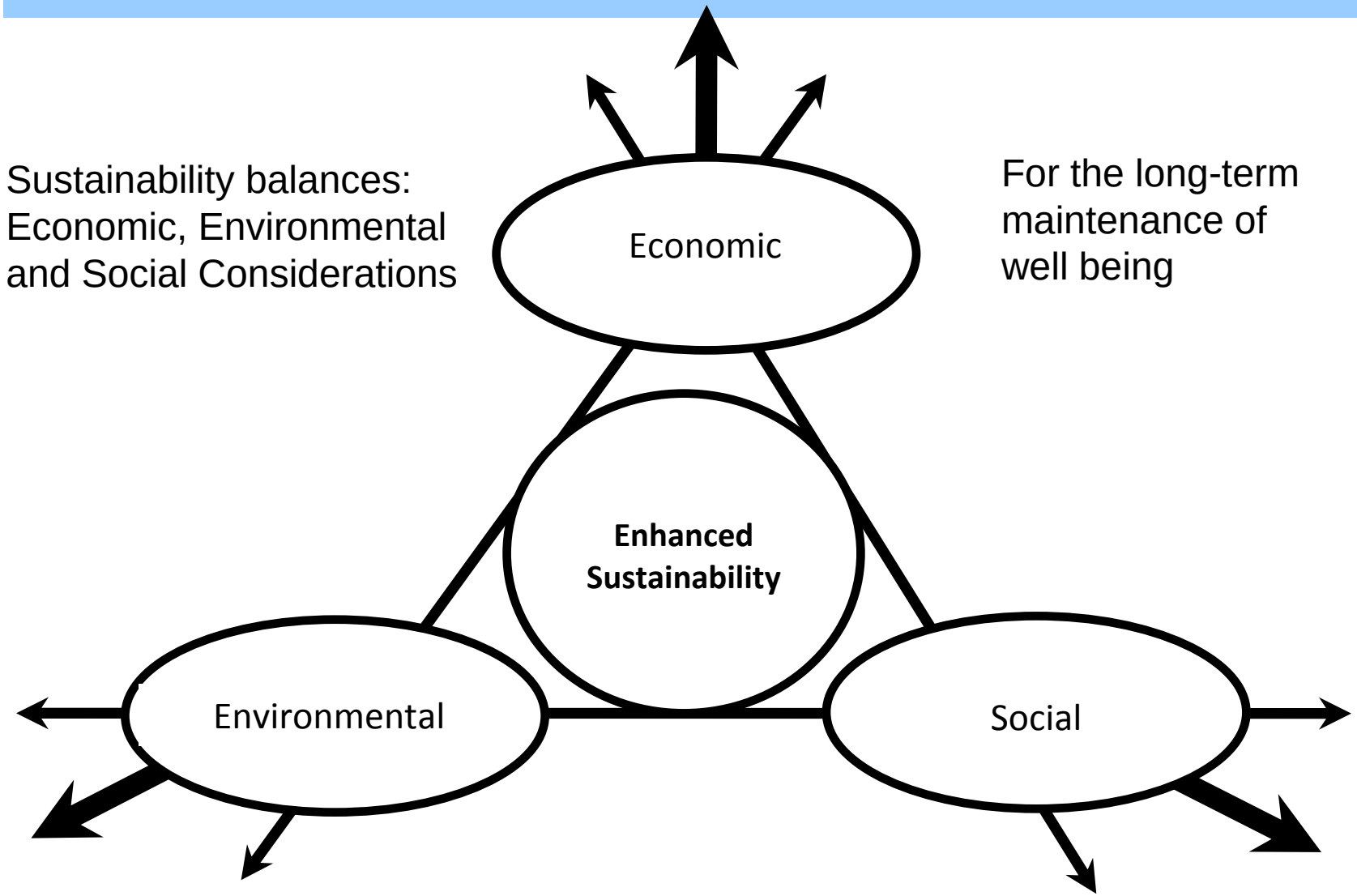
What is Sustainability?

Sustainability balances:
Economic, Environmental
and Social Considerations



For the long-term
maintenance of
well being

How Do We Achieve Sustainability?

- Life Cycle Considerations
  - Repairing and replacing infrastructure is costly and resource intensive
- Less is More
  - All things equal, less material means
    - Less environmental impact
    - Less social disruption, and
    - Less money

What is Portland Doing?

- **Greener Paving**
  - **Warm Mix Asphalt**
- **Storm Water Mgmt**
  - **Pervious Pavement**
  - **Swales**
- **Reuse and Recycling**
  - **Sunderland Yard**
  - **Recycled Aggregates**
- **Life Cycle Costs**
  - **Concrete Intersections**
  - **CIPP**
- **Signals & Lighting**
  - **Traffic Signal Upgrades**
  - **LED Street Lighting**

Warm Mix Asphalt (WMA)

- **Problem:** Traditional Hot Mix Asphalt (HMA) is energy intensive and releases greenhouse gases
- **Solution:** WMA requires less energy and reduces greenhouse gas emissions

HMA

WMA

Warm Mix Asphalt

- **Benefits:**
  - Reduction in greenhouse gas emissions associated with fuel savings. Using WMA for all City jobs would reduce greenhouse gas emissions by 800 metric tons per year
  - Increased workability and better working conditions for the paving crews
  - Extended paving season
  - WMA does not prematurely age the binder

Storm Water Management

- **Problem:**
  - The City's combined sewer system is near capacity. Storm events sometimes result in combined sewer overflows and basement backups.
  - Untreated storm water can carry contaminants to ground and surface water.

- **Goal:**
  - Better manage storm water by removing or delaying it from entering the combined sewer.
  - Remove contaminants from storm water before it can pollute ground and surface water

Storm Water Management

Solutions:

- Pervious pavements
  - Pavers
  - Concrete
  - Asphalt
- Storm water detention and infiltration facilities

Pervious Pavers

Generally used in parking lanes, alleys, and medians

Spaces in between pavers allow water to reach the soil

Pervious Concrete and Asphalt

Pervious concrete and porous asphalt contain little or no fine aggregate. The result is a stiff pebbly mixture with interconnected voids throughout.

Pervious Pavement

- **Benefits:**
  - Reduce total impervious area
  - Water is filtered by gravel and soil before it reaches ground and surface water
  - Can reduce or eliminate need for storm system

Pervious Pavements

- **Limitations**
  - Should primarily be used on local streets or in parking areas
  - Need relatively well-draining soils
  - Need relatively flat grades (less than 5%)
  - Need routine maintenance to prevent plugging
  - For pervious pavers we have had an aesthetic issue with weeds growing between pavers.

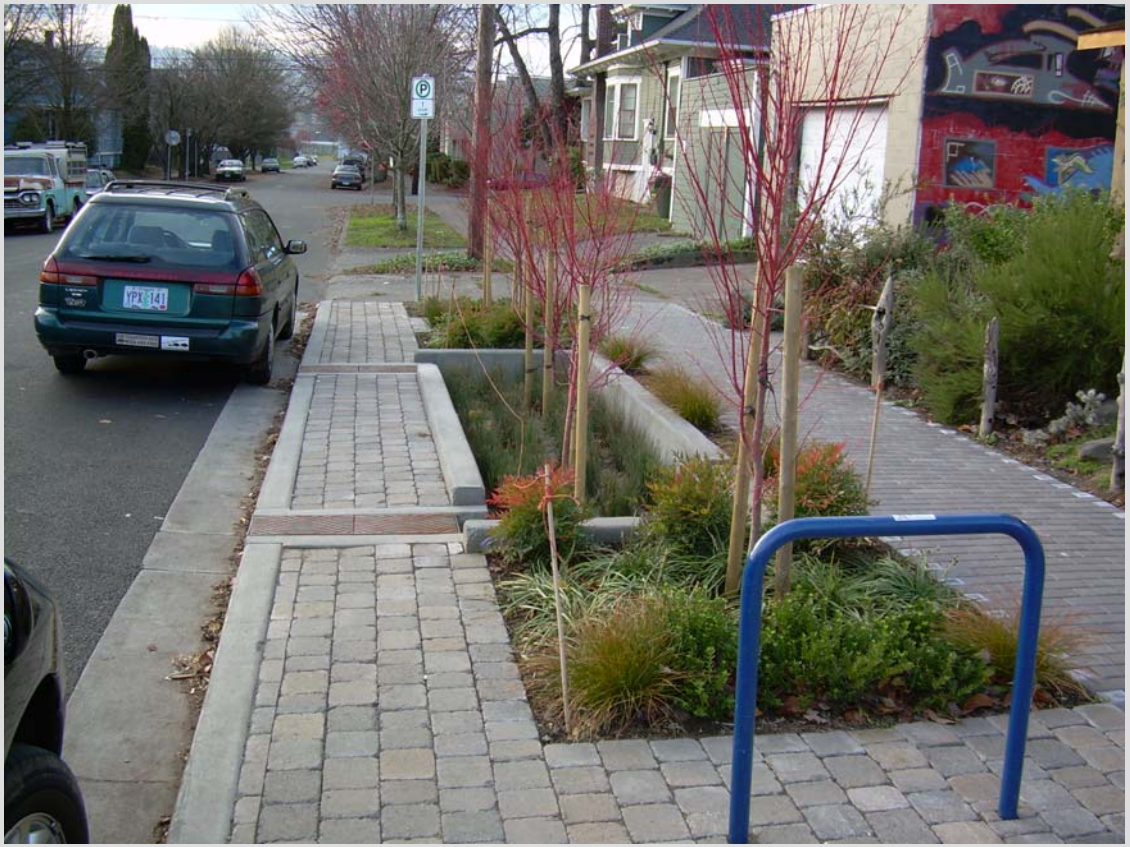
Storm Water Detention Facilities

Swales and planters capture water from the roadway. The water either infiltrates into the soil or is detained before draining into the sewer.

Storm Water Detention Facilities

Curb extensions can be built in areas with limited right of way, and can be combined with ADA ramps to improve pedestrian crossings.

Storm Water Detention Facilities



Planters are useful on narrow roads or in areas where parking must be preserved.

Storm Water Detention Facilities

Rain gardens are a good option where there is plenty of space or an awkward intersection.

Storm Water Detention Facilities

- **Benefits**
  - Treat and detain treat storm water before it reaches ground and surface water sources.
  - Reduce combined sewer overflows and basement backups by removing or delaying storm water from entering the combined sewer system.
  - Reduce amount of water conveyed to waterways
  - Help extend the life of the combined sewer system by decreasing demand during storm events.
  - Can be cheaper and less destructive to pavement than installing storm sewer lines.

Storm Water Detention Facilities

- **Limitations**
  - Works best with well-draining soil
  - Can impact street parking and bike lanes
  - Challenging to build where terrain is steep or completely flat
  - Not always enough available space within narrow Right-of-Ways (ROW)

Reduce, Reuse and Recycle

- **Problems:**
  - Construction debris often ends up in landfills.
  - Sending construction debris to landfills is expensive and not environmentally friendly.
- **Goal:**
  - Reduce the amount of debris that ends up in landfills and reduce the need to purchase new aggregates.
- **Solution:**
  - Sunderland Yard recycling center

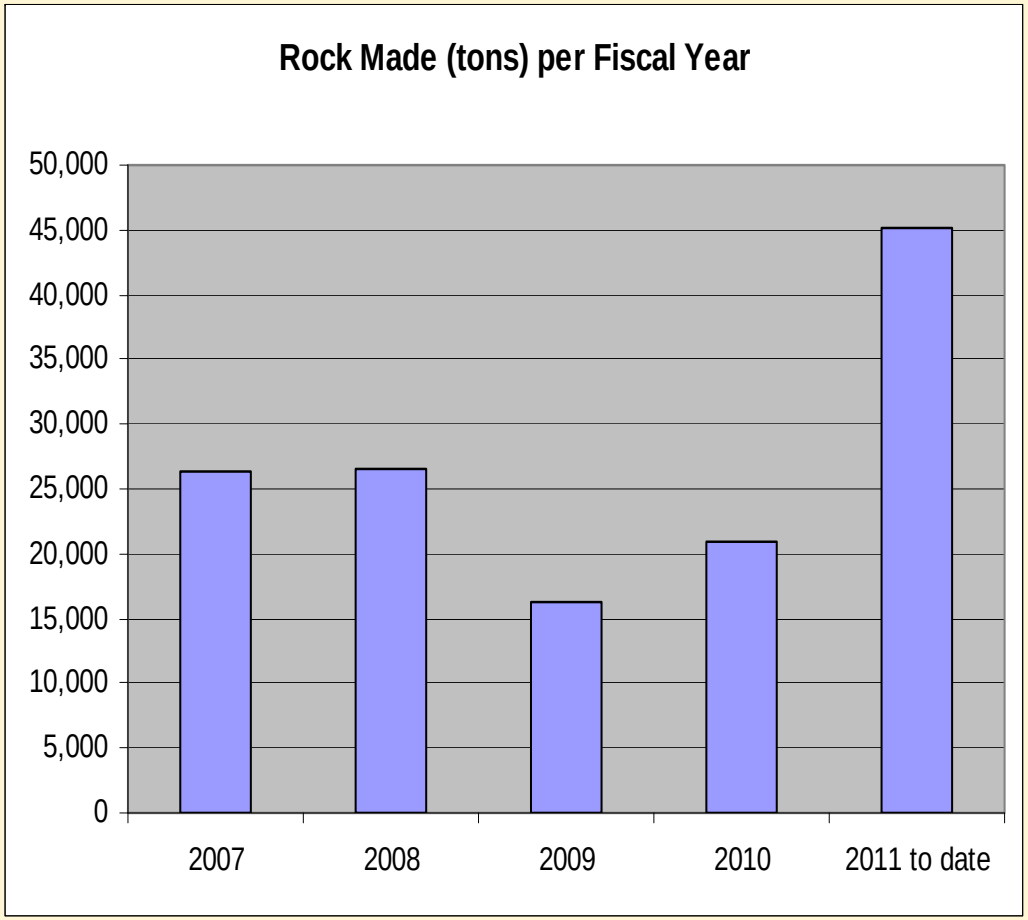
Sunderland Yard

Aerial view of Sunderland Yard

Sunderland Yard

The crusher makes recycled aggregates from concrete and asphalt debris from City projects and private contractors.

Sunderland Yard



- Program Goals
  - Reduce tipping fees for disposal
  - Decrease the need to purchase virgin aggregates
  - Offset operating costs through sales of compost and aggregates

Sunderland Yard

Sunderland Yard composts leaves collected by City crews. Last year 14,000 cubic yards of leaves were composted!

The compost is utilized by City crews and sold to the public to help offset operating costs.

Sunderland Yard

- **Benefits**
  - Environmental benefits
    - Keeps concrete and asphalt debris out of landfills
    - Reduces the need for gravel and rock mining
    - Reduces pollution associated with trucking in material from quarries.

Sunderland Yard

- **Benefits cont'd**
  - Economic benefits
    - Saves money on "tipping" fees
    - Reduces fuel costs from trucking
    - Compost and crushed rock are sold to the public to offset costs.

Recycled Asphalt Shingles (RAS)

Asphalt binder is made from a by-product of the oil refining process. The high price of oil has made using recycled shingles for road repaving economically viable.

Approximately 11 million tons of shingles are landfilled each year.

Common rooftop shingles contain approximately 20% asphalt binder.

The asphalt binder used in shingles is often higher quality than that commonly used in pavement.

Life Cycle Considerations

- **Problem:**
  - Replacing failing infrastructure is an economic and environmental burden.
- **Solution:**
  - Spend more up front on a solution that will last.
  - Find ways to repair rather than replace existing infrastructure.

Concrete Paving & Intersections

SW Naito Pkwy and Salmon St

Concrete is more durable and withstands rutting, washboarding, and shoving often seen at asphalt intersections.

Intersections are the most vulnerable portion of the road network.

High vehicle traffic and turning movements by heavy vehicles degrade the pavement more quickly.

Concrete Intersections

- **Benefits**
  - Last longer
  - Fewer repairs and maintenance
  - Less maintenance means fewer impacts to businesses and traffic

Concrete Intersections

- **<u>Limitations</u>**
  - Higher up front cost
  - Must be scored properly to prevent cracking

CIPP

(Cured in Place Pipe)

CIPP is a resin-soaked felt liner that is inserted inside an existing sewer pipe.

Steam, hot water or UV light is used to cure the resin into a seamless, jointless, corrosion-resistant replacement pipe.

CIPP can be installed from a manhole or small excavation, so minimal or no trench digging is required.

CIPP

- **Benefits**
  - The City of Portland saved $3 million last year by using CIPP instead of traditional trench excavation.
  - Reduces the amount of greenhouse gas produced by 90%, mostly by eliminating the need to haul material to and from job sites.
  - Increases worker safety
  - Reduces traffic disruption
  - Increases the lifespan of roads by eliminating trenching

CIPP

- **<u>Limitations</u>**
  - Special care and materials must be used in pipes with bends.
  - Liners usually need to be fabricated individually for each project due to variations in pipe sizes and project length.
  - Can take longer to install and cure than traditional replacement methods.
  - Chemical agents can be released during the curing process.

Street Lighting

- **Problem:**
  - Street lighting requires large amounts of electricity
  - Portland's signal and street lighting electricity bill was $6 million last year.
- **Goal:**
  - Reduce electricity use while maintaining or increasing public safety.
- **Solution:**
  - LED lighting

LED Street Lighting

LED (left) and Traditional HPS (right)

LED Luminaire

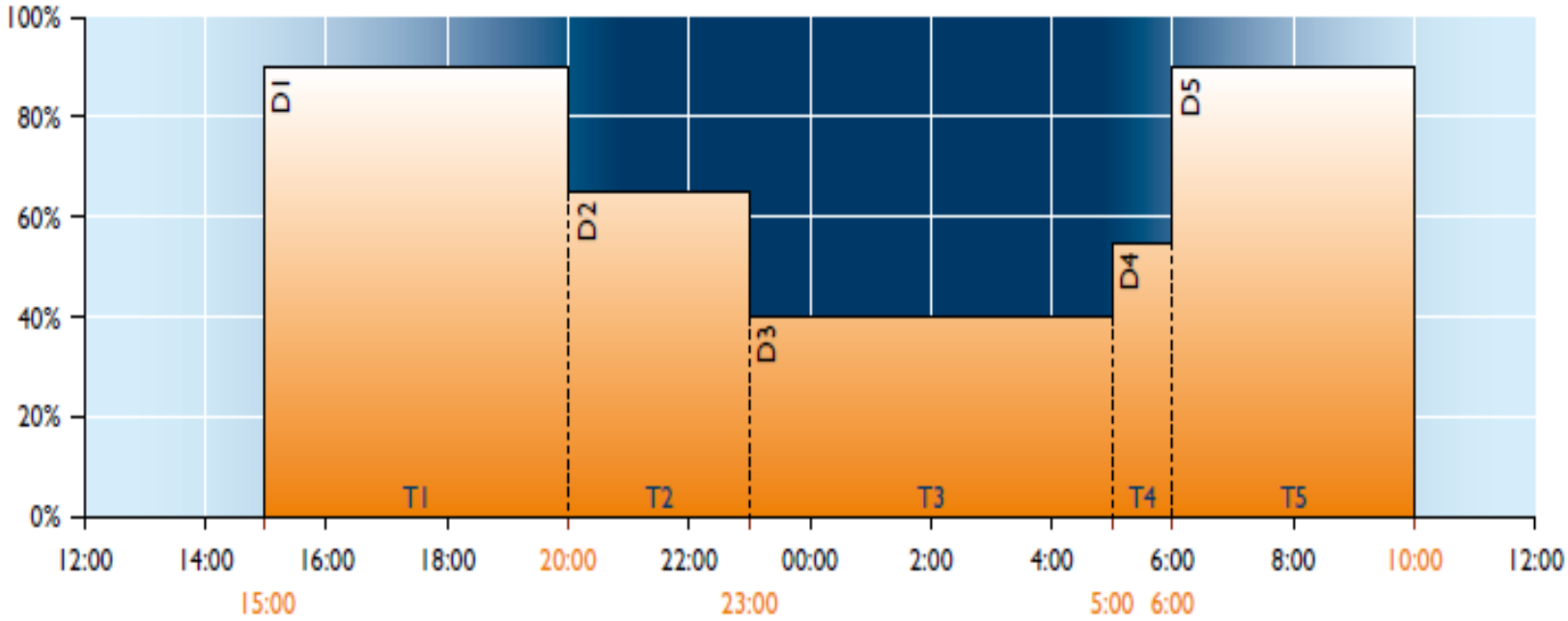
Light Emitting Diodes (LEDs) have been traditionally used in computer and television screens.

New technological breakthroughs make LED lighting an affordable street lighting alternative.

LED Street Lighting

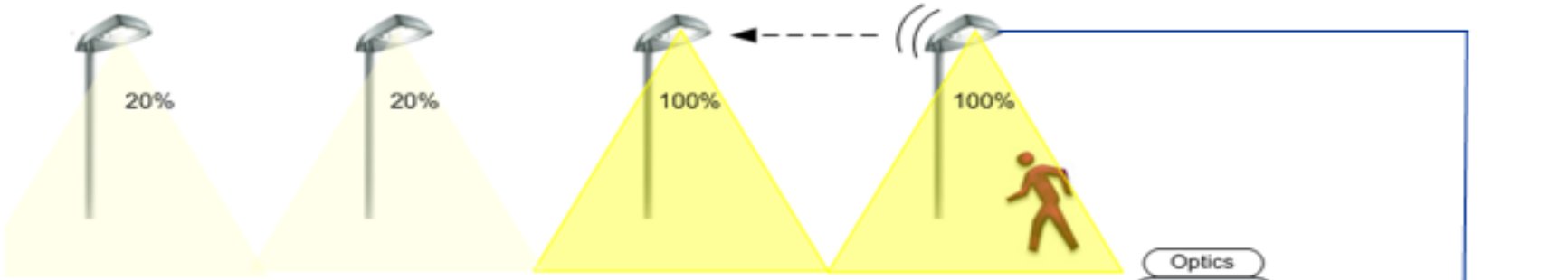
Dimmable Lighting

Fixture Based Systems: LED lights are programmed to dim during low-use hours.

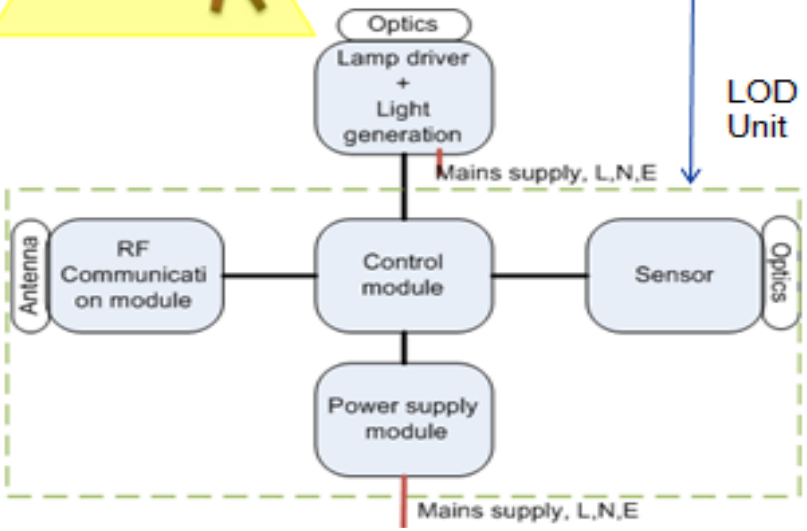


LED Street Lighting

Lighting On Demand: Street lights remain dimmed until a motion detector senses movement by a pedestrian. The nearest light is brightened and sends a wireless signal to nearby street lights, illuminating the street as the person walks.



- Local wireless control (zones)
- Sensing meaningful movement for optimized energy usage
- Enhance surveillance and emergency response



LED Street Lighting

- **Benefits**
  - Reduces electricity usage by 25% savings over traditional street lighting.
  - Dimmable Fixtures available
  - Lighting On Demand Systems.
  - LED technology is constantly improving.

LED Street Lighting

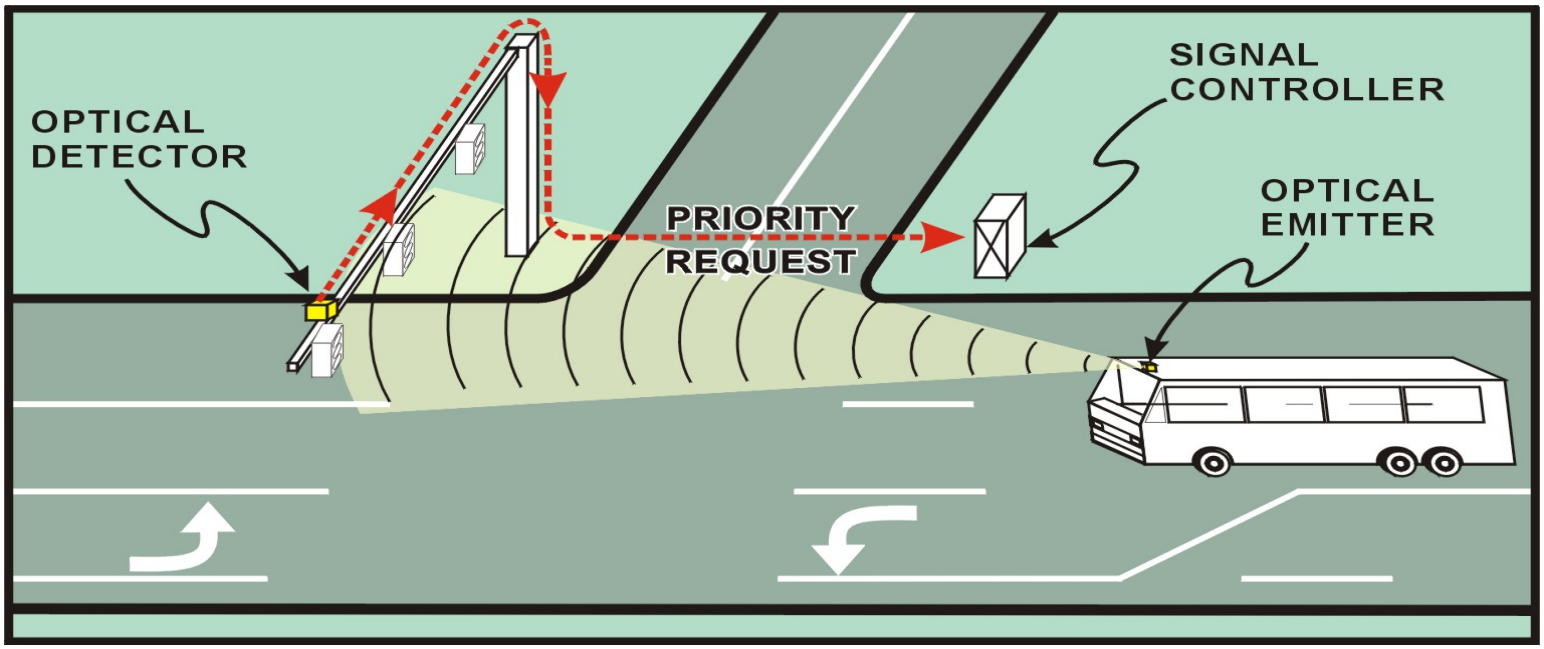
- **<u>Limitations</u>**
  - LEDs are susceptible to contamination from volatile organic compounds. Contamination makes LEDs dimmer and changes the hue.
  - Must use lighting-class LEDs
  - Need proper optical, electronic and thermal design or you throw away many of the advantages that LED lighting provides.
  - More expensive, but prices are declining. Additional cost is recouped in 7-10 years through energy savings.

Traffic Signals

- **Problem:**
  - Traffic signals must be adapted for other modes of transportation.
  - Areas leading to intersections are subject to faster pavement degradation than other parts of the roadway.
- **Goal:**
  - Provide safe and efficient crossings for all modes of transportation, while improving pavement life span at intersections.
- **Solution:**
  - Multimodal traffic signals detect and provide safe crossing for pedestrians and bikes. Bus priority can extend the life of the pavement.

Bus Priority

According to AASHTO ESAL calculations, a fully-loaded bus causes as much pavement damage as 7800 cars.



“Smart” buses have an optical emitter that sends a signal to a detector on a traffic signal. The traffic signal extends the green or shortens the red time, minimizing the amount of time a bus has to wait at the intersection. This reduces delay times and extends pavement life.

Multimodal Traffic Signals

Streets in Portland are shared by cars and bicyclists.

Bike signals can improve safety and reduce delay for both bicycles and motorists.

Passive detectors at crosswalks detect the presence of pedestrians and extend green time for slower walkers.

Traffic Signals

- **Benefits**
  - Signal priority for buses enables faster transit travel times and improved on-time performance.
  - Prioritizing buses reduces braking before intersections and stress on the pavement.
  - Multimodal traffic signals increase safety and comfort for bicycles and pedestrians, and can decrease delay time for motorists.
  - Signal coordination can reduce idling time and reduce greenhouse gas emissions.

Traffic Signals

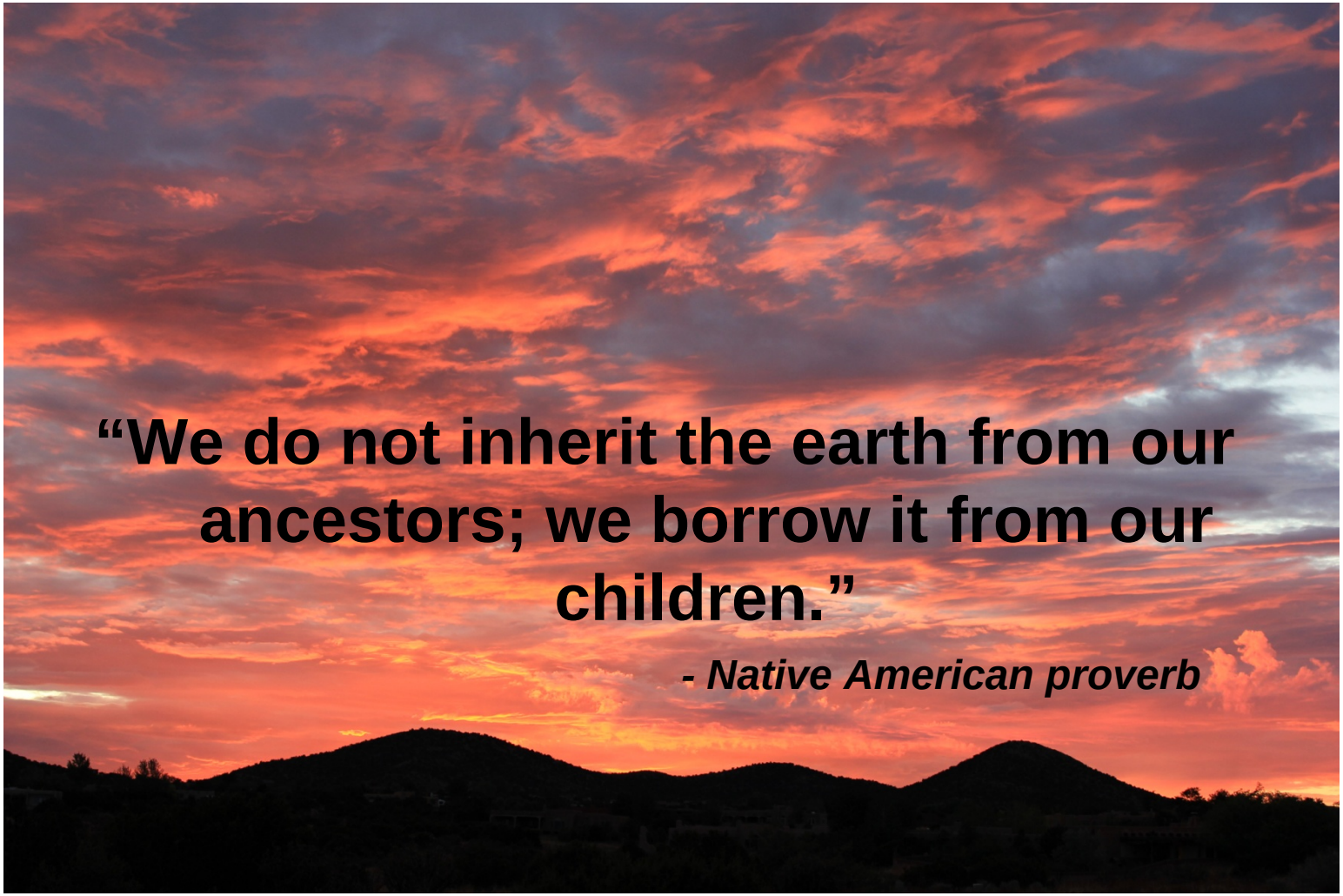
- **Limitations**
  - Not all traffic signals have optical detectors.
  - Bus priority can delay motorists.

Summary

Sustainability balances:

- Economic, Environmental and Social Considerations

Questions?


“We do not inherit the earth from our ancestors; we borrow it from our children.”
- Native American proverb