Net-Zero Velodrome

Formal Proposal

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Abstract:

With cycling becoming an increasingly popular sport, what would it take to create a net-zero velodrome in the Oklahoma City area? The benefit of the facility being zero net energy is that the money raised by the facility, both with fundraising and racing events, will go back into the facility instead of toward heating, cooling, and lighting costs. By utilizing day lighting, sun shading, passive solar design, and cross ventilation those expenses can be managed more efficiently.

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# Project Description

## Introduction:

Cycling is one of the fastest growing sports in the United States, and it is already extremely popular overseas. Cycling has five main disciplines that occur during different times throughout the year. Building a site that creates a hub for the five main cycling disciplines (*track racing, road racing, cyclo-cross, mountain biking, and criterium racing*), would be instrumental in increasing not only interest in the sport but also encouraging healthier lifestyles. The only discipline requiring an indoor facility is track racing, which will need a velodrome. The main issue I wish to address is how to design a net zero velodrome in Oklahoma’s hot, humid environment. The building itself needs to be large enough to hold the spectators as well as the event. It also needs to be energy efficient during not only the peak season, when energy consumption is highest, but also during the off-season as well, when the athletes are training and less revenue is being generated. To make the most use of the space, the building and site would need to be integrated. Along with the cycling facility, the incorporation of commercial spaces for retail, dining, and hospitality would allow for more convenience and public exposure on site. As for the site conditions, landscaping and vegetation would need to be addressed to incorporate a cyclo-cross track, mountain bike course as well as a road criterium course.

## Problem Statement:

The main problem I am looking at researching in this proposal is what key sustainability features to use in creating a net zero velodrome in Oklahoma’s climate. There are many systems that can be used to reach net zero, the problem is certain systems work best in certain climates. Also the size of the building will help determine which systems are best as well. I do not want to incorporate costly systems if they are not going to have a considerable contribution on the energy needs of the building.

A velodrome would serve two purposes. First, it needs to be an event center; large enough to accommodate the crowds coming to watch the event. Facilities that hold hundreds to thousands of spectators at a time are normally not sustainable for the simple fact that these spectators create heat that needs to be regulated to maintain a comfortable environment for not only the athletes but also the other spectators as well. The issue with designing a velodrome as strictly an event center is that this facility also needs to be a training facility where the athletes train between events or in the off seasons. During this time the entire building does not necessarily need to be heated or cooled, but the areas the athletes are utilizing need to be comfortable.

Secondly, smaller scale sporting complexes have a difficult time standing alone. For instance, Oklahoma City is home to both the Devon and Chesapeake Boathouses. These boathouses are used as both training facilities and viewing platforms for rowing race events. Some may not even know of the boathouses because of the lack of exposure to the sport of rowing in the area. These buildings are underutilized because there is no integration in the area surrounding the boathouses to bring more people and exposure to that area. To effectively expose new people to a sport or facility there needs to be an attraction factor that brings them to the area. Creating a building that is attractive to not only cyclists but the general public as well is essential in making a velodrome successful in any urban setting. Incorporating commercial spaces would aid in making the area more attractive.

# Background Research

## Conceptual Framework:

Creating a net zero velodrome involves many sustainable systems that have to work together in order to succeed. Being that I am looking at Oklahoma City, Oklahoma as my location, the program, Climate Consultant, suggests I focus on the following main systems:

* Day lighting- to help offset the cost of lighting the space.
* Sun shading- to reduce the need for air conditioning in the summer time.
* Passive solar design- to provide a free heating and cooling system by exposing the south facing façade to direct sunlight during the winter months only allowing the interior of the building to absorb the sunlight while shading the summer sun and not allowing it into the building to keep it cooler inside.
* Cross ventilation- directing the wind thru the building at certain times of the year will help cool the building without using energy.

Climate Consultant also suggested other items that are not systems but are good design strategies when designing in this environment like:

* Ceiling Fans- indoor air movement can make it seem cooler, thus less air conditioning is needed.
* Sun/Wind protected outdoor space- extend internal areas outdoors in cooler weather
* Limit floor plan size- keeping building small will limit amount of energy needed to heat/cool spaces.
* Plants along the west façade to shade structure from evening summer sun

The ultimate goal of the facility is reaching zero net energy so that money raised for the facility, whether thru fundraising or events, can go to the users of the building in the form of events and not the systems of the building like heating and cooling or lighting the building. The lower overhead costs will promote greater utilization of the facility.

## Definitions:

**Velodrome:** “an arena for track cycling. Modern velodromes feature steeply banked oval tracks, consisting of two 180-degree circular bends connected by two straights. The straights transition to the circular turn through a moderate easement curve. Velodromes may be indoors or outdoors.”(“Velodrome”)

**Cyclo cross**: “the sport of racing bicycles over rough terrain that usually requires carrying the bicycle over obstacles.” (“Cyclo Cross”)

**Criterium:** “a bicycle race of a specified number of laps on a closed course over public roads closed to normal traffic." (“Criterium”)

**Mountain Biking:** “an all-terrain bicycle with wide knobby tires, straight handlebars, and typically 18 to 21 gears.” (“Mountain Biking”)

**Day lighting:** Bringing natural sunlight into a building to light that space allowing the building to use less energy and allowing the people to absorb vitamin D throughout the day which aids in one’s health

**Passive solar design:** refers to design techniques that utilize natural heating and cooling from the sun. Through design, you can passively heat a house or building and through shading, you can help keep a house or building cool. This idea helps to reduce the need for fossil fuels to heat or cool a house or building. (“Morrissey Builders”)

**Displacement ventilation**: a method of letting cooler air replace warmer air in a space to promote natural ventilation. This method uses much less energy than traditional forced air. It also reduces circulation of indoor pollutants by bringing in fresh air to circulate. (“Morrissey Builders”)

**Zero-net-energy:** buildings and communities that produce all of their own energy from onsite renewable sources or that purchase energy from those who produce it from renewable resources. (“Morrissey Builders”)

**Sustainability:** of, relating to, or being a method of harvesting or using a resource so that the resource is not depleted or permanently damaged

## Literature Review:

In the following articles I plan on looking at the sustainable features of the last couple Olympic velodromes and how the systems work together in each of the buildings to help create a more sustainable building. I am only interested in the systems I listed above that are suitable for my building sites climate.

* “Sustainability” The 2012 Olympic Velodrome is the flag ship sustainable building.
* “Delivering London 2012: The Velodrome” The impact and sustainable features of the 2012 London Olympic Velodrome.
* “Roof Structure Node Detail Olympic Velodrome” In depth look at the 2012 Olympic Velodrome Roof and its sustainable qualities.
* “Olympia-Veladrome In Sydney” Explains the sustainability and construction of the Sydney Olympic Velodrome along with site configuration.

To me, sustainability not only means creating an efficient building but also creating a building that is used often to keep bringing people there to experience it, which would generate greater revenue for the facility. The next series of articles address how velodromes can become multiuse facilities so people are continuing to use the building for more than just track racing events.

* “Sustainability of Future Projects” Goes over velodromes as a multipurpose event center showing how they can be used for concerts as well as other types of sporting events.
* “The Lao Shan Olympic Velodrome” Explains the use of the 2008 Beijing Olympic Velodrome after the Olympics are over.

The following articles I want to address the history of the velodromes in Europe and how building more in the United States can be beneficial.

“Velodromes: A Precedent Study” goes thru a historical precedent study of what building help influence the design of the 2012 London Olympic Velodrome.

The following articles deal with the cost benefits and strategies shading devices play on a buildings energy efficiently.

* “Energy and Carbon Emission Payback Analysis For Energy-Efficient Retrofitting In Buildings–Overhang Shading Option."

Lastly I want to use the following articles to show what the residents of existing sustainable velodromes view the facilities. Demonstrating that even though it is more expensive to build the building sustainably the public sees the cost benefits the building will have over time.

* "Residents' Perceptions of Environmental And Security Issues At The 2012 London Olympic Games."
* “Residents' Perceptions of Environmental Impacts of The 2008 Beijing Green Olympic Games."

The following buildings will be presented as president studies for existing velodromes with sustainability features. I am going to analyze these buildings and see if they utilize and of the specific systems I listed earlier in my paper and if they do I will see how well they worked together within their own specific climate zones.

* 2012 London Olympic Velodrome
* Berlin Velodrom

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# ****Curriculum Vitae****:

2428 SW 99th St Oklahoma City, ok 73159

**Cell Phone: (405) 802-9223**

**Education :**

2010-Present **University of Oklahoma** Norman, OK

* Masters in Architecture (Graduation date: 2013)
* Member of Cycling Team

2002-2006 **Texas Tech School of Architecture** Lubbock, TX

* Bachelors in Architecture

1996-2000 **Lebanon High School**  Lebanon, MO

* 1999 Fourth in State in Architectural Drafting (VICA)
* 2000 Third in State in Architectural Drafting (VICA)

**Experience :**

Aug 2007-Present **HSE Architects** Oklahoma City, OK

*Architectural Intern/CAD Specialist Contact:* Larry Herzal **(405) 526-1302**

* I set up and update the CAD Standards within the office.
* I maintain and teach all design programs to new employees.
* I designed and maintain spreadsheets used both in our offices and in the OKC City Offices.
* AIA Associate Member

Feb 2007-Aug 2007 **Parkhill, Smith, & Cooper Inc.** Lubbock, TX

*Architectural Intern Contact:* Mike Moss **(806) 473-2200**

* I was on CAD Standards Committee
* I was involved in the “Facility Use Survey” (FUS) Team working on all US Military Bases.
* Provided 3D Models Using Sketch-up

May 2004-June 2006 **Godwin & Associates Architects & Engineers** Springfield, MO

*Architectural Intern Contact:* Wes Godwin **(417) 887-4438**

* Designed Floor plans and Layouts using AutoCAD
* Drawing/Putting together Construction Documents
* Provided 3D Models using Sketch-up

Aug 2002-Dec 2006 **Texas Tech School of Architecture** Lubbock, TX

*Student Assistant (Wood Shop)*  *Contact: Michael Martin* **(806) 789-8834**

* Maintain shop equipment.
* Taught students to use equipment, (helped teach furniture design class)
* Build/maintain furniture for Architecture Building

**Skills :**

Experienced in the following:

|  |  |  |  |
| --- | --- | --- | --- |
| AutoCAD | Mechanical Desktop | 3D Studio Max | Sketch UP |
| Rhino | Wood Working | Metal Working | Welding |
| Model Building | Microsoft Office | Photoshop | Adobe Illustrator |