

**2013 FALL TECHNICAL MEETING  
WESTERN STATES SECTIONS OF THE COMBUSTION INSTITUTE**  
Hosted by Colorado State University, Fort Collins  
October 7-8, 2013



## **Technical Program**



**2013 Fall Technical Meeting  
Western States Section of the Combustion Institute  
October 7-8, 2013**



**Colorado State University**  
COLLEGE OF ENGINEERING

The Western State Section of the Combustion Institute would like to thank our generous sponsors for the 2013 Fall Technical Meeting:



Colorado State University  
DEPARTMENT OF MECHANICAL ENGINEERING



ENERGY  
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10:25	<p><b>13F-04</b> KINETICS STUDIES OF RADICAL-RADICAL REACTIONS (I): THE NO<sub>2</sub> + N<sub>2</sub>H<sub>3</sub> SYSTEM  <i>Hongyan Sun<sup>1</sup>, Ghanshyam L. Vaghjiani<sup>1</sup>, Steven D. Chambreau<sup>1</sup>, Adam Schenk<sup>1</sup>, Chung K. Law<sup>2</sup></i>  <sup>1</sup>Edwards Air Force Base <sup>2</sup>Princeton University</p>	<p><b>13F-08</b> <i>IN-SITU</i> MEASUREMENTS OF SOOT PRODUCTION IN THE BERKELEY-DARFUR STOVE USING LASER EXTINCTION  <i>Kathleen M. Lask<sup>1</sup>, Paul R. Medwell<sup>2</sup>, Cristian H. Birzer<sup>2</sup>, Ashok J. Gadgil<sup>1,3</sup></i>  <sup>1</sup>University of California, Berkeley <sup>2</sup>The University of Adelaide <sup>3</sup>Lawrence Berkeley National Laboratory</p>
10:45	<b>BREAK</b>	
	<p><b>Session 2A: Reaction Kinetics</b>  <b>Room A: Durrell Center</b>  <b>Session Chair: Hongyan Sun</b></p>	<p><b>Session 2B: Coal and Biomass</b>  <b>Room B: Durrell Center</b>  <b>Session Chair: Janet Ellzey</b></p>
11:05	<p><b>13F-09</b> INVESTIGATION OF TWO-STAGE FUEL INJECTION ON COMBUSTION INTENSITY AND SOOT FORMATION UNDER DIESEL ENGINE CONDITIONS  <i>Khanh D. Cung<sup>1</sup>, Anqi Zhang<sup>1</sup>, Jeffrey Naber<sup>1</sup>, Seong-Young Lee<sup>1</sup>, Chol-Bum Kweo<sup>2</sup>, Alessandro Montanaro<sup>3</sup>, Luigi Alloca<sup>3</sup></i>  <sup>1</sup>Michigan Technological University <sup>2</sup>US ARL <sup>3</sup>CNR</p>	<p><b>13F-13</b> THE EFFECT OF PRIMARY AND SECONDARY AIR FLOW RATES ON MEASURED GAS COMPOSITION IN A TOP-LIT UP-DRAFT SEMI-GASIFIER COOKSTOVE  <i>Jessica Tryner, Darryl Beemer, Morgan DeFoort, Anthony J. Marchese</i>  Colorado State University</p>
11:25	<p><b>13F-10</b> EXPERIMENTAL AND MODELING ANALYSIS OF 1-BUTENE PYROLYSIS: CHARACTERIZATION OF MOLECULAR WEIGHT GROWTH KINETICS  <i>Kun Wang, Stephanie M. Villano, Anthony M. Dean</i>  Colorado School of Mines</p>	<p><b>13F-14</b> A COMPUTATIONAL STUDY ON THE EFFECT OF OXYGEN PARTIAL PRESSURE ON COAL JET FLAME STAND-OFF USING HIGH-FIDELITY THERMOCHEMICAL MODELS  <i>Babak Goshayeshi, James C. Sutherland</i>  University of Utah</p>
11:45	<p><b>13F-11</b> RATE RULES, BRANCHING RATIOS, AND PRESSURE DEPENDENCE OF THE HO<sub>2</sub>+OLEFIN ADDITION CHANNELS  <i>Stephanie M. Villano<sup>1</sup>, Hans-Heinrich Carstensen<sup>2</sup>, Anthony M Dean<sup>1</sup></i>  <sup>1</sup>Colorado School of Mines <sup>2</sup>Ghent University</p>	<p><b>13F-15</b> FLOW FIELD SIMULATION IN A HYPERTHERMAL TUBULAR REACTOR SYSTEM BY CFD AND DSMC METHODS  <i>Qi Guan, Kimberly N. Urness, G. Barney Ellison, John W. Daily</i>  University of Colorado</p>
12:05	<p><b>13F-12</b> PREDICTION OF THE EFFECTS OF DROPLET SIZE AND O<sub>2</sub> ADDITION TO THE FUEL SIDE OF STRAINED OPPOSED-FLOW DIFFUSION FLAMES  <i>Chenguang Wang, Anthony M. Dean, Huayang Zhu, Robert J. Kee</i>  Colorado School of Mines</p>	<p><b>13F-16</b> INFLUENCE OF CHIMNEYS ON COMBUSTION CHARACTERISTICS OF BUOYANTLY DRIVEN BIOMASS STOVES  <i>J. Prapas, M.E. Baumgardner, A.J. Marchese, B. Willson, M. DeFoort</i>  Colorado State University</p>
12:25	<b>LUNCH-On your own</b>	



	<b>Session 4A: Fire</b> <b>Room A: Durrell Center</b> <b>Session Chair: Judi Steciak</b>	<b>Session 4B: Turbulent Flames</b> <b>Room B: Durrell Center</b> <b>Session Chair: Jerald Cole</b>
<b>4:30</b>	<b>13F-25</b> AN EXPERIMENTAL INVESTIGATION OF THE PILOTED IGNITION OF CYLINDRICAL PMMA UNDER AXIAL FLOW <i>Shmuel Link<sup>1</sup>, Carlos Fernandez-Pello<sup>1</sup>, David Urban<sup>2</sup>, Gary Ruff<sup>2</sup></i> <sup>1</sup> University of California, Berkeley <sup>2</sup> NASA Glenn Research Center	<b>13F-28</b> EFFECT OF GEOMETRIC SCALE ON HEAT RECIRCULATION AND SYNGAS PRODUCTION IN A NON-CATALYTIC COUNTER-FLOW REFORMER <i>E.L. Belmont<sup>1</sup>, P. Radyjowski<sup>2</sup>, J.L. Ellzey<sup>1</sup></i> <sup>1</sup> University of Texas at Austin <sup>2</sup> The University of Edinburgh
<b>4:50</b>	<b>13F-26</b> FLAME SPREAD OVER PMMA FILMS IN NORMAL AND MICROGRAVITY ENVIRONMENTS <i>Wynn Tran<sup>1</sup>, Subrata Bhattacharjee<sup>1</sup>, Sandra Olson<sup>2</sup>, Gaurav Patel<sup>1</sup>, Nelson Romero<sup>1</sup></i> <sup>1</sup> San Diego State University <sup>2</sup> NASA Glenn Research Center	<b>13F-29</b> WHAT ZELDOVICH DID NOT TELL US ABOUT SPONTANEOUS REACTION WAVE PROPAGATION <i>D.R. Kassoy</i> <i>University of Colorado and Kassoy Innovative Science Solutions LLC</i>
<b>5:10</b>	<b>13F-27</b> PHYSICAL SCALE MODELING OF WIND EFFECTS ON SMOKE TRANSPORT IN NATURALLY VENTILATED ATRIA <i>Daniel Murphy<sup>1</sup>, David Rich<sup>2</sup>, Henrik Hindborg<sup>3</sup>, Laurence Bernard<sup>4</sup></i> <sup>1</sup> University of California, Berkeley <sup>2</sup> Reax Engineering Inc. <sup>3</sup> Technical University of Denmark <sup>4</sup> Gexcon AS	<b>13F-30</b> EFFECTS OF SEDIMENT AND SALINITY ON METHANE HYDRATE COMBUSTION <i>S. Karnani<sup>1</sup>, J. Botimer<sup>1</sup>, S. Gutman<sup>1</sup>, Q. Bervas<sup>2</sup>, C. Fillon<sup>2</sup>, P. Taborek<sup>1</sup>, D. Dunn-Rankin<sup>1</sup></i> <sup>1</sup> University of California, Irvine <sup>2</sup> Institut Supérieure de l' Aérotechnique et de l'Espace
<b>6:00</b>	<b>RECEPTION – FORT COLLINS BREWERY</b>	

Tuesday, 8 October 2013



7:15  
7:45  
8:15

**Registration**  
**Welcome: Anthony Marchese**  
**Invited Presentation: Session Chair: Anthony Marchese**  
**Title: “Combustion: A critical link between energy, development, and human health”**  
**Speaker: Morgan DeFoort, Colorado State University**

9:15	<b>BREAK</b>	
	<b>Session 5A: IC Engines</b> <b>Room A: Durrell Center</b> <b>Session Chair: Xinfeng Gao</b>	<b>Session 5B: Laminar Flames</b> <b>Room B: Durrell Center</b> <b>Session Chair: Jason Porter</b>
9:25	<b>13F-31</b> A PHENOMENOLOGICAL RELATIONSHIP BETWEEN OCTANE NUMBER AND CETANE NUMBER AND THE IMPACT OF ALCOHOLS IN TRANSPORTATION FUELS <i>Marc E. Baumgardner<sup>1</sup>, David Llanos<sup>2</sup>, Anthony J. Marchese<sup>1</sup></i> <sup>1</sup> Colorado State University <sup>2</sup> Loyola Marymount University	<b>13F-35</b> THE INFLUENCE OF CARBON MONOXIDE ON THE STRUCTURE AND EXTINCTION OF NONPREMIXED METHANE FLAMES <i>Georg Katzlinger<sup>1</sup>, Vaishali Amin<sup>1</sup>, Kalyanasundaram Seshadri<sup>1</sup>, Ernst Pucher<sup>2</sup></i> <sup>1</sup> University of California, San Diego <sup>2</sup> Vienna University of Technology
9:45	<b>13F-32</b> PREDICTION OF NO <sub>x</sub> EMISSIONS FROM PREMIXED NATURAL GAS AND HYDROGEN ENRICHED FLAMES STABILIZED WITH A LOW-SWIRL BURNER <i>Andrés Colorado, Vince McDonell</i> <i>University of California, Irvine</i>	<b>13F-36</b> A NEW RADIATION MODEL FOR TABULATED CHEMISTRY BASED ON STEADY STATE FLAMELETS. <i>N. Burali<sup>1</sup>, Y. Xuan<sup>1</sup>, G. Blanquart<sup>2</sup></i> <sup>1</sup> Graduate Aerospace Laboratories <sup>2</sup> California Institute of Technology
10:05	<b>13F-33</b> PRODUCER GAS AND NATURAL GAS PERFORMANCE IN A CFR ENGINE <i>D. Wise<sup>1</sup>, R. Seiser<sup>1</sup>, D. Olsen<sup>2</sup>, R. Cattolica<sup>1</sup></i> <sup>1</sup> University of California, San Diego <sup>2</sup> Colorado State University	<b>13F-37</b> APPROXIMATE SOLUTIONS OF THE TRANSFORMATION OF VORTICES THROUGH A PREMIXED FLAME USING GENERALIZED EXPANSIONS <i>Brock Bobbitt, Guillaume Blanquart</i> <i>California Institute of Technology</i>
10:25	<b>13F-34</b> MODELING IN-CYLINDER HEAT TRANSFER FOR A SINGLE CYLINDER HCCI ENGINE <i>Andrew T. Thompson, Marc E. Baumgardner, Anthony J. Marchese</i> <i>Colorado State University</i>	<b>13F-38</b> ANALYZING WATER-LADEN NON-PREMIXED COUNTERFLOW FLAMES USING THE MIXTURE FRACTION/EXCESS-ENTHALPY APPROACH <i>Vinicius M. Sauer, Rosa E. Padilla, Derek Dunn-Rankin</i> <i>University of California, Irvine</i>
10:45	<b>BREAK</b>	
	<b>Session 6A: IC Engines</b> <b>Room A: Durrell Center</b> <b>Session Chair: Derek Dunn-Rankin</b>	<b>Session 6B: Heterogeneous</b> <b>Room B: Durrell Center</b> <b>Session Chair: Anthony Dean</b>

11:05	<p><b>13F-39</b> CHARACTERIZATION OF GASEOUS AND PARTICULATE EMISSIONS FROM THE COMBUSTION OF CELLULOSIC BIOMASS BASED OXYGENATED COMPONENTS IN A COMPRESSION IGNITION ENGINE  <i>Timothy L. Vaughn<sup>1</sup>, Brie Hawley<sup>1</sup>, Jessica Tryner<sup>1</sup>, A. Lakshminarayanan<sup>1</sup>, Daniel Olsen<sup>1</sup>, Matthew Ratcliff<sup>2</sup>, Robert L. McCormick<sup>2</sup>, Anthony J. Marchese<sup>1</sup></i>  <sup>1</sup>Colorado State University <sup>2</sup>National Renewable Energy Laboratory</p>	<p><b>13F-43</b> PRELIMINARY MODELING OF COUNTER-FLOW REACTIVE VOLATILIZATION FOR HIGH EQUIVALENCE RATIO PARTIAL OXIDATION OF LOW VOLATILITY FUELS  <i>W.F. Northrop, A. Ghosh</i>  University of Minnesota</p>
11:25	<p><b>13F-40</b> PERFORMANCE AND EMISSION EVALUATION OF STRAIGHT VEGETABLE OILS IN A TIER - II DIESEL ENGINE  <i>A. Lakshminarayanan, D. Olsen</i>  Colorado State University</p>	<p><b>13F-44</b> SIMULATING AND MODELING A SOLID PROPELLANT ROCKET PLUME USING AN ALUMINUM POWDER FED OXYACETYLENE TORCH  <i>A. Haug<sup>1</sup>, B.C. Hogan<sup>1</sup>, A.B. Donaldson<sup>1</sup>, C.G. Parigger<sup>2</sup>, D.M. Surmick<sup>2</sup></i>  <sup>1</sup>New Mexico State University <sup>2</sup>University of Tennessee</p>
11:45	<p><b>13F-41</b> COMBUSTION CHAMBER DESIGN CONSIDERATIONS FOR A COMPRESSION IGNITION ENGINE TO SPARK IGNITED NATURAL GAS ENGINE CONVERSION  <i>Robert Elgin, III<sup>1</sup>, Chris Turner<sup>2</sup>, Christopher L. Hagen<sup>1</sup></i>  <sup>1</sup>Oregon State University <sup>2</sup>Czero Incorporated</p>	<p><b>13F-45</b> A SOPHISTICATED MODEL TO PREDICT ASH INHIBITION DURING COMBUSTION OF PULVERIZED CHAR PARTICLES  <i>Christopher R. Shaddix, Yanqing Niu</i>  Sandia National Laboratories</p>
12:05	<p><b>13F-42</b> COMPUTATIONAL MODELING OF A NATURAL GAS/DIESEL DUAL FUEL ENGINE USING CONVERGE™  <i>A. Hockett<sup>1</sup>, J. Barta<sup>2</sup>, G. Hampson<sup>2</sup>, B. Suhre<sup>2</sup>, A.J. Marchese<sup>1</sup></i>  <sup>1</sup>Colorado State University <sup>2</sup>Woodward Inc.</p>	
1:00	<b>ADJOURN</b> <b>OPTIONAL: TOUR OF CSU ENGINES AND ENERGY CONVERSION LABORATORY AND NEW BELGIUM BREWING COMPANY</b>	

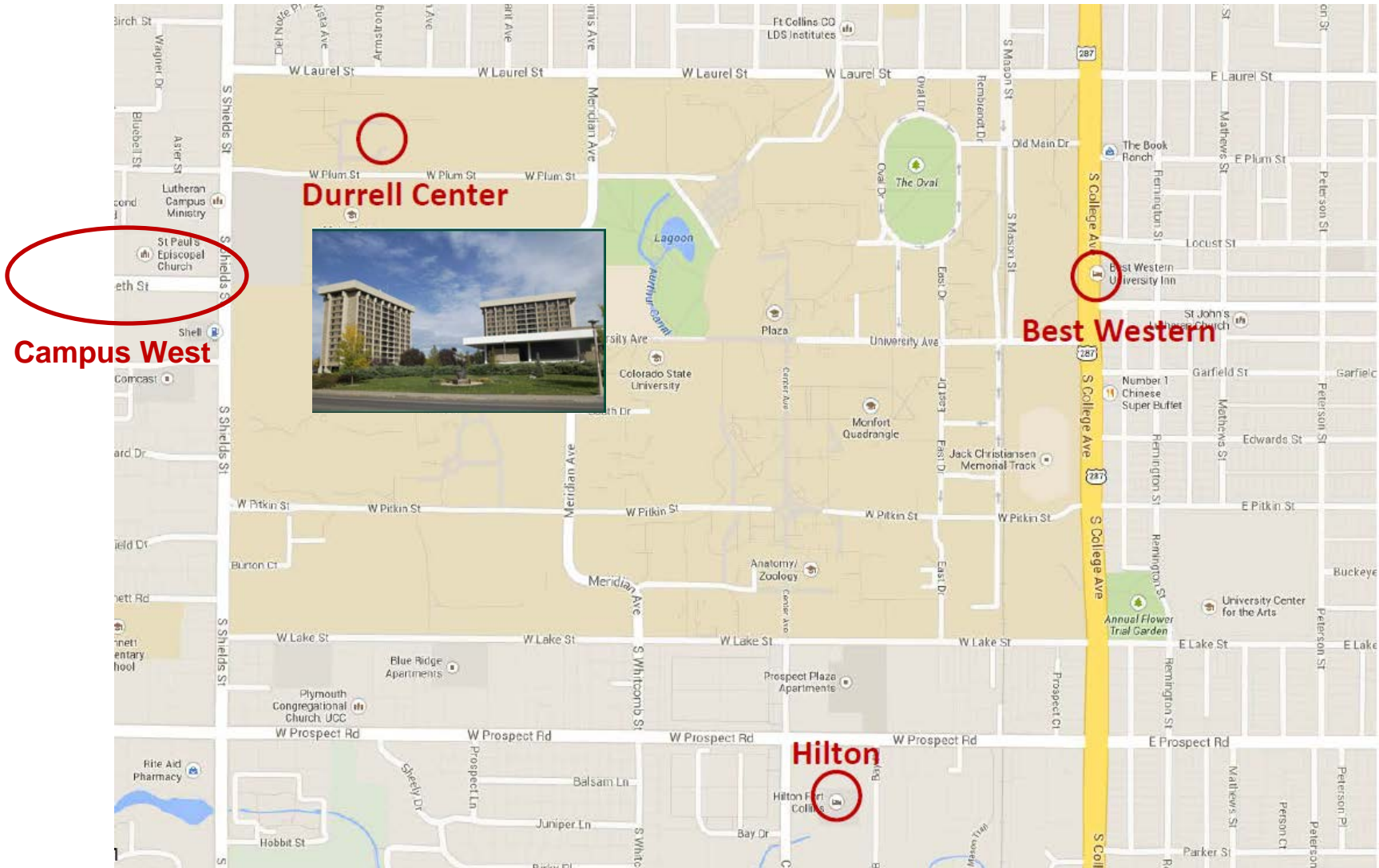


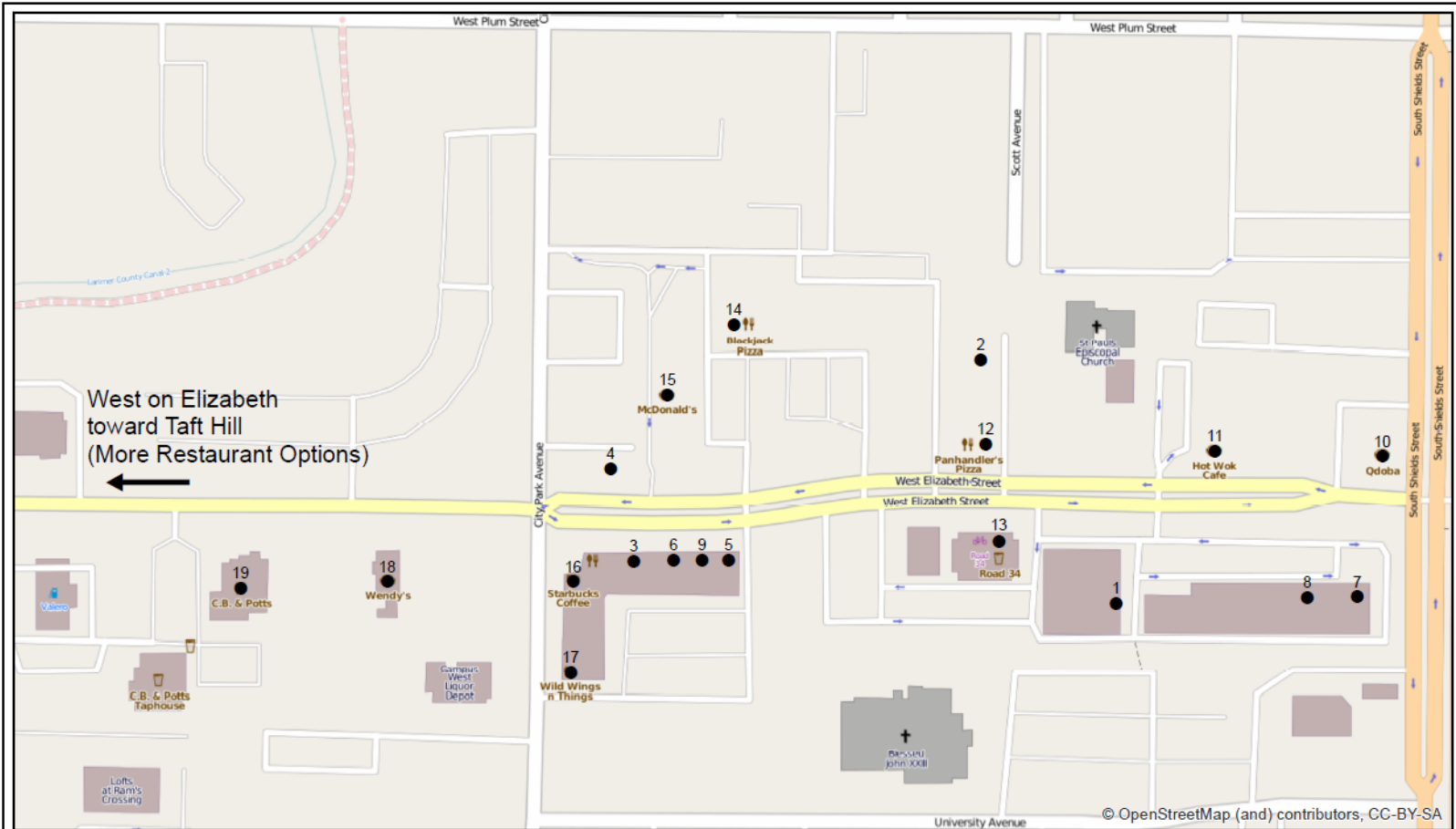
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## Durrell Center, Colorado State University, Fort Collins, CO





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- 2. Nimo's Sushi
- 3. Fuzzy's Taco Shop
- 4. Yum Yum's Mediterranean
- 5. Five Guys Burgers and Fries
- 6. Jimmy John's Sandwiches
- 7. Subway
- 8. Rocky Mountain Bagel Works
- 9. Thai Kitchen
- 10. Q-Doba
- 11. Hot Wok Cafe (Asian)
- 12. Pan Handler's Pizza
- 13. Road 34 Bike Bar
- 14. Black Jack Pizza
- 15. McDonald's
- 16. Starbucks Coffee Shop
- 17. Wild Wings 'n' Things
- 18. Wendy's
- 19. C.B. & Pott's (American)

