

An Empirical and Visual Tale of a Cross-Country Bicycle Adventure

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Introduction

Riding a bike feels good. Riding a bike is energizing and liberating. Riding a bike is a great way to see, hear, smell and more generally experience virtually any place – big cities, small towns, bike trails, country roads, national parks, wilderness areas, you name it.



This transcontinental ride wasn't my first rodeo. My riding partner for the first ~2,700 of the ~3,700 mile trip, Hank Berg, was my best friend, high school and college classmate and one of my past partners for several other self-contained bike adventures. Our much younger legs had helped us ride through the Rockies from Steamboat Springs to Cortez, Colorado, down the Pacific coastline from Seattle,

Washington to Crescent City, California and through Rockies (US and Canadian) from Kalispell, Montana to Jasper, Alberta. Depending on the particular trip, we were joined by either one or two good buddies or girlfriends who would later become our wives. Every trip was a similar, but different adventure. Every trip produced lasting, vivid memories of what we experienced day after day and mile after mile on more and less travelled that welcomed us along the way.

On the heels of our last trip over the 30 years ago (the Montana to Alberta ride), we agreed that a cross country ride was an eventuality and shelved the idea in favor career, family and vacations that didn't consume a summer. Of course, there were various instances over the last 30 years when we imagined how refreshing a leave of absence from the real world might feel. Once the beer wore off and our wives finished reminding us that we'd lost our minds for thinking that we could escape 'life' for that long and believing we could complete a ride of that length, we would settle for a less physically and time demanding cycling adventure, such as fully supported events like Bike Virginia and Bicycle Tour of Colorado. A few years ago, we decided that our biological timeclocks were screaming *you idiots would be well advised to do the ride in celebration of turning 60. Tick tock, tick tock.* Unfortunately, despite our best intentions, a trip in conjunction with the big 6-0 was not in the cards, so we punted to the following summer and started riding on June 13th, a couple days after the 2017 ICEAA Conference ended.

This paper chronicles the ride and describes post-ride analysis of a time-series data compiled daily during the trip. The narrative and pictures that characterize the journey are designed to not only educate but also inspire readers to get on a bike and experience the 'power' of bike riding, including but not limited to the smile it will undoubtedly generate. The analysis, which likewise represents a journey, is intended to be an educational example of how to use techniques such as influence diagrams and constrained optimization to understand and model how a wide array of parameters may have impacted average riding speed.

The Route, 'Roads' and Gear

The Route

Despite what you might expect, a trip of this type can be accomplished with minimal planning and training. This is in large measure due to the work of Adventure Cycling Association (aka ACA; see <https://www.adventurecycling.org/>), a non-profit organization whose mission is to "inspire and empower people to travel by bicycle." ACA sells maps for a vast network of U.S. bike routes that its researchers have evaluated and ridden. As has been the case for our previous rides, it's ACA's catalog of maps that provides the route options from which to choose.

In the case of transcontinental routes, there are three options for which ACA has produced maps: the Northern Tier Route between Washington and Maine, the Southern Tier Route between California and Florida, and the Transamerica Route between Oregon and Virginia. We opted for the Northern Tier route since we believed it would translate to cooler weather and it offered the challenge and beauty of climbing through the Cascades (in Washington), Rockies (in Montana), Adirondacks (in New York), Green (in Vermont) and White (in New Hampshire) Mountains. Consistent with the conventional wisdom that riders headed east receive 'better' treatment than riders headed west, we opted to start our ride on the

pacific coast with complete knowledge that riding eastward in no way meant that we would routinely benefit from tailwinds. In fact, it was in the plains of Montana and North Dakota where we quickly faced the reality that the wind could be our best friend one day and our worst enemy the next.

The map below extracted from the ACA website is an overview of the Northern Tier Bicycle Route. Hank and I each purchased the full set of maps (i.e., eleven maps, each of which decomposed the ride into ~380 mile sections and then ~20 mile sections). Each of the ~20 mile section map provide written turn-by-turn directions as well as identify landmarks, convenience and grocery stores, motels, campgrounds, bike stores and police stations. Additionally, the map sections that cover the aforementioned mountain ranges provide elevation profiles that do an excellent job of making riders wish they'd gone a different way! Finally, I should note that ACA does its best to develop routes that leverage county and other low traffic density roads as well as roads with rideable shoulders to the maximum extent possible. Not surprisingly, this translates directly into a lot of riding in remote areas where the towns are very small, i.e., populations in the 100 to 1500 range.

As indicated in the route overview above, our trip touched fifteen states in the order that follows: Washington, Idaho, Montana, North Dakota, Minnesota, Wisconsin, Iowa, Illinois, Indiana, Ohio, Pennsylvania, New York, Vermont, New Hampshire, and Maine. We had the option of crossing the US/Canada border in Montana for a short stint of riding in Alberta, but decided to pass since we done so during a past ride.



Additionally, based on intelligence we received before and during the ride about a ~300 mile stretch of the route in Montana/North Dakota plains, we had good reason to avoid that veritable landmine. For example, the stretch passes through Saco, Montana, is renowned for having mosquitoes the size of birds. Prior to departing for the trip, my general practitioner inquired whether our route passed through that part of Montana, told a very funny story about his encounter with the Saco mosquitoes and implored me to do anything/everything possible to avoid getting munched.

The bugs, forecast of hot weather for the seemingly never ending and monotonous plains that lay ahead of us, paired with the availability of a train that would get us through the bad stuff while affording us a rest day made our decision to “go Amtrak” through that portion of the journey extremely easy ... and wise. For completeness sake, I should mention that the net riding distance reduction attributed to the train was ~200 miles; net because we reduced the Northern Tier Route distance by ~300 miles at the cost of ~100 miles of unplanned riding to get us back on route from where we jumped off the train in Minot, North Dakota. In case you were wondering, ACA’s very complete and informative maps conveniently made no mention of the famed Saco Flats mosquitoes!

Although a later section of the paper addresses my impressions of different parts of the route, I want to share ACA's general route description, which paints an image-provoking picture of the diverse landscapes we experienced across the country.

"The route lets you warm up for about 100 miles before any prolonged climbing begins. There are four major passes in the first 300 miles, and Sherman Pass is the highest at 5,575 feet. The terrain then becomes rolling, the route following river valleys until you reach Glacier National Park. Logan Pass, on Going-to-the-Sun Road, is the last major climb in the Rocky Mountains. There's a series of roller-coaster hills heading into Canada. Once you get about 20 miles east of the Rockies, you're truly in Big Sky country with moderately flat plains. The plains roll out through Montana and occasionally become hilly in western North Dakota, and then the route flattens out in eastern North Dakota and Minnesota. In Wisconsin and Iowa the terrain is continuously rolling. Ask any Iowan if Iowa is flat, they will respond with a "No," especially in the northeastern part of the state. From the Mississippi River at Muscatine, Iowa to Palmyra, New York, the route is virtually flat. Illinois has some gently rolling prairie and is treeless except in towns. The trees increase in Indiana. East of Cleveland, Ohio, the route climbs to a low ridge for a few miles and then descends back to the lake shore until Buffalo, New York. From Buffalo to Palmyra, the route experiences only slight elevation changes at the locks along the Erie Canal. The mountains in New York, Vermont, and New Hampshire extend north and south, and the route travels east-west so the remainder of the route has a lot a variety — flat sections along river valleys and several challenging climbs. The Kancamagus Pass at 2,855 feet is the highest point on the eastern end of the Northern Tier Route.

This route is best ridden in late spring to mid-fall. Due to heavy snow falls, State Route 20/North Cascades Highway in North Cascades National Park is usually closed mid-November to mid-April though the park remains open with limited access. Going-to-the-Sun Road in Glacier National Park is usually closed until early to mid-June and has limited hours for cyclists which is noted on the map."

ACA's summary of services available to cross-country cyclists on the Northern Tier route is likewise image and thought provoking.

"Services are generally good along this route. There is a 73-mile stretch of limited services between Cardston, Alberta, and Cut Bank, Montana. There are also some sporadic spots lacking services in central Montana, but nothing is farther apart than a day's ride. The people of the towns across the plains of Montana and North Dakota are super generous and genuine. Camping in town parks is not uncommon. Only a few bike shops exist between Whitefish, Montana, and Bismarck, North Dakota. In the Midwest, townsfolk are friendly. Campgrounds are reasonably plentiful, but there are a few gaps, and advanced planning is needed if you are camping. Some campgrounds will charge a cyclist traveling by himself less if they have hiker/biker sites, but often they will charge the price of a regular tent or RV site, and that can easily be \$10-\$40/night (higher in the east). The maps list churches that have opened their doors to cyclists, but they aren't all that closely spaced. If you're friendly and ask around, you can often get yourself invited to camp in a yard. Our routes sometimes go through national forests (more so in the west) and you are allowed to camp anywhere on

national forest land as long as you "pack it in, pack it out." Many city parks are free to camp in. You may also wish to sign up with Warmshowers, a reciprocal hospitality site for bicycle travelers, for other overnight options."

The 'Roads'

The Northern Tier Route, which I would characterize as 95 percent rural, took us on a combination of mostly county roads, some state roads and, in Minnesota and New York, a few multi-use bike paths. The riding surfaces varied to some extent, but the rural nature of the ride meant we spent many, many miles and hours on a surface called "tar and chip" (aka chipseal), a hallmark of rural roads carrying less traffic and in contrast to the asphalt or cement pavement that us city slickers are accustomed to. Shown in the picture here, tar and chip is a rough surface that causes noticeable increases in vibration (wears on the hands and butt) and rolling resistance, as well as more roadway noise (wears on the ears when those occasional cars pass at high speeds typical of being in the middle of nowhere).



Chipseal

The time we spent on more biker-friendly (i.e., smooth) paved surfaces presented a unique challenge of its own. First, they were also more car-friendly, which necessarily meant more traffic. Second, they were more speed-friendly, which added an element of high-speed danger. Third, they typically featured the very car safety-friendly and extremely biker-unfriendly rumble strips typically located in the middle of the road (i.e., the lane divider on a two-lane road) and outer edge of the road (i.e., the divider between the road and shoulder).

One of two things can happen when your wheels roll over a rumble strip – you can rattle your teeth out of your head and/or lose your balance. The solution to these problems (stay off the strips) is self-evident, but the reality of the situation is stark - moving from the trafficked lane to the shoulder means you have to cross the rumble strip and hope for the best. Naturally, there were instances where a shoulder magically and with no notice transitioned from pavement to 100 percent strip, an unwelcome surprise that forced us back into the trafficked lane.

On a closing and positive note, the rumble strips did provide a very loud and useful warning signal for when fast moving traffic headed the same direction as we were crossed the strip to pass us via the oncoming lane. Always good to know that truckers hauling grain, oil, timber, etc. are looking out for their good buddies on bikes.

Yikes, I almost forgot to mention one other important aspect of roads before shifting my attention to multi-use trails! As the pictures below indicate, there were lots of opportunities along our route to experience road construction, typically repaving work, up close and personal. Depending on the circumstances of a particular work zone (road surface condition, length of the work zone, traffic density, etc.), the riding could be a little or very challenging. There were a few instances when the work zone was closed to vehicle traffic, which was detoured to an alternative route. When I'm on a loaded bike and encounter a "Road Closed – Detour" sign in the middle of nowhere, my first and second thoughts are

“shit” and “no way, no how”. Suffice it to say, I managed to avoid taking any detours around work zones that didn’t present an unsurmountable challenge.



Finally, the subject of multi-use trails, which came in a variety of surfaces -- paved, gravel and dirt. In general, regardless of the surface, these trails represented a low key alternative to the roads in the way of far less cyclists, walkers, runners, dogs, etc. than you’d find on trails in and about urban areas. In fact, based on how few people were on the Central Lakes Trail and Wobegon Trail in Minnesota, it’s clear that the signage catering to snowmobilers is a good indication those trails gets their heaviest use in the winter.

Speaking of signage, there was lots to be had along the roads and even the trails that is worth a quick review. Please enjoy and avoid those turtles!



The Gear

As was true for the other three rides noted earlier, we opted for a self-contained tour, which simply means Hank and I carried everything we needed, including but not limited to tent, sleeping bag/pad, stove/fuel, pot/pan/cooking utensils, clothes, bike tools, spare tire/tubes/spokes and maps. In addition to this stuff which represents fixed payload, we carried other items (i.e., food, water, Gatorade and alcohol) whose weight was variable and dependent on store and campground locations. For example, the maps highlighted a couple stretches along the route that had no services for 60-70 miles, thereby necessitating that we start those particular days with more water and food than we would typically carry at the start of a riding day. In a similar vein, if we knew that a campground for a given night was at say mile 50 of that day's ride and the last place to buy food before the campground was at mile 40, then we needed to ride the last 10 miles with more weight than we'd been carrying the rest of the day. Since weight 'kills', we were extremely conscious of hauling unnecessary payload and, at two different points

in the ride (mile 524 in Sandpoint, Idaho, and mile 1409 in Fargo, North Dakota) decided to mail back gear that we didn't need, including clothes, a camera, a Bluetooth speaker, spare batteries, maps for route sections already ridden, etc. I started the ride with roughly 45 pounds of fixed payload and, depending on daily circumstances, variable payload ranged anywhere from one to five pounds. The two weight reduction events served to lighten my fixed load by roughly 10 pounds. So the fully loaded weight of my bike, approximately 75 lbs., breaks down as follows:

- *Specialized Sequoia Elite* Bike -- ~25 lbs.
- Front and rear racks (four total) and panniers, or bike packs (four total) -- ~ 5 lbs.
- Fixed payload -- ~45 lbs. reduced to 38 in Sandpoint, ID and then 35 in Fargo, North Dakota.



The Weather

The short story is the weather during our more than two months on the road was unbelievably good. There were only two days we couldn't (or more accurate, didn't want) ride due to rain. There were probably another handful of days in which we got some heavy rain and thunderstorms during the ride that either cut our day a little short or required us to lay low while the weather improved.

As we were riding down a road in Wisconsin (a state we were in for less than 10 miles) that had absolutely no spots to take safe cover, we saw a huge storm moving in. After riding for several miles thinking there's got to be something soon, we came upon a house that appeared lived-in (though absent of cars or people) and decided the tree in the front yard was going to be as good as it gets. Had the conditions not been so damn scary, I would have loved to get a picture of the two of us standing under the huge tree and Hank's tent fly attempting to stay dry in the face of heavy and cold rain, high winds, and scary thunder/lightening that seemed dangerously close. We left that location after an hour-long storm really cold and pretty wet thinking we'd been lucky to avoid the lightening and whatever dog(s) prompted the Beware of Dog sign that we hadn't initially noticed.



There is one other of instance or rain that is firmly etched in my mind, that being the rain and sleet we experienced during our climb to and descent from Washington Pass (elevation 5,477 feet) in the Cascades Mountains (Washington), which still had a fair amount of snow on the sides of the road that produced an air conditioning effect that in combination with the rain and 39 degree temp was exactly what we didn't need. I can say without a doubt that the 18 mile descent from this pass was the coldest

riding conditions I've faced in 40 years of cycling. Don't confuse the apparent smile in the selfie with me being happy; I was not happy and that smile-like look was actually a smile from much earlier in the day that slowly froze in place during the climb.

The other weather that can adversely impact riding conditions is heat and wind. Similar to what we experienced rain-wise, I'd say by and large we lucked out here as well. The plains of Montana and North Dakota were the major culprits when it came to heat and wind, but the good news is that we're talking days not weeks and, in fact, some of the wind was actually a welcome partner because it was at our backs!

Bike and Health Problems

Let me start by saying that as is the case for beauty, a "problem" is in the eye of the beholder. When it comes to bikes, I view a problem as something that requires a spare part that neither Hank nor I were carrying or a repair/replacement/adjustment that was beyond our admittedly limited bike mechanic capabilities. Again, I'd say we were damn lucky not because we didn't each have a problem or two, but instead because the timing of our problems aligned with us being near towns with bike shops that had qualified mechanics who not only didn't try to sell us something we didn't need, but also went out of their way to help. So, each of us managed to stretch our chains (we weren't carrying spares, but will next time) to the point that required replacement. As a result of one of my rear wheel spokes pulling through and damaging the rim, I needed to get the rim replaced and wheel rebuilt. We were carrying extra spokes which came in handy at a different point, but an extra rim is simply not practical payload. Hank, thanks to a growing saddle sore problem early in the ride, needed to get a new seat, which again is something you wouldn't carry as a spare (he is pictured below trashing his original seat which he decided to retain while he was breaking in the new one.). I, as a result of my handlebars being too low relative to my seat causing me to put too much weight on my hands, needed a part I didn't have to raise my handlebars. Finally, Hank, as a result of losing a screw from one of his cycling shoes, needed a new screw to continue riding.

Two of the aforementioned problems lead to a couple Midwesterners demonstrating some of that hospitality for which they're known. My rim problem would not have been solved quickly were it not for the mechanic in Great Northern Bicycle Company (Fargo, North Dakota) driving home to get me a rim that he'd planned to use for his bike in lieu of ordering a new one for me that would have taken a day or two to arrive. Can you imagine any person in any business you deal with doing



Hank deposits his seat near Hanks Butte Rd.

the same? Hank's shoe screw problem, which is in fact the only problem that had immediate serious consequences (i.e., he couldn't ride), was solved by a guy who saw us stopped on the side of the road near his IN home and decided that his "good deed for the day" (his words when he humbly accepted our thanks) would be driving Hank to the hardware store in the closest town, 15 miles down the road. For the record, and to my earlier point about bike store quality along our route, they drove to a hardware store because I called the only bike store in town and the owner laughed when I mentioned bike shoes.

Moving on to health problems, there's a lot of things that could start bothering old guys like us during a ride of this length. Likewise, there is always the potential for accidents when you're on a bike. Suffice it to say that I've had a number in my days, some worse than others. Anyway, we were really lucky to have only had two health-related problems that bear mentioning. First, as alluded to earlier, Hank had a pretty serious bout with saddle soreness, which neither he nor I photographed. Second, I had a run in with an invasive plant in a Washington campground that when touched deposits an oil that exposed to sun does some seriously funky stuff to your skin (i.e., extremely painful blisters that caused some swelling). The fact that this ailment presented itself the day before we'd plan to take a rest day was fortuitous cause I would have had a serious problem gripping the handlebars at the same time as keeping sun off my hand, which exacerbated the problem. The rest day helped, but I ended up being uncomfortable for the next 3-to-4 days of riding as the problem worsened.



The Experience

Regardless of the sights, weather, terrain, road surface, traffic, quality of previous night's sleep, etc., there wasn't an hour or mile of the trip that I didn't enjoy and I extremely fortunate to experience. The freedom of being on the road without a daily schedule of pre-designated rest stops and motels or campgrounds necessarily meant we could "smell the roses" whenever and wherever we wanted. In fact, this became our modus operandi on day one! Rather than riding east from Anacortes, Washington, the coastal town that's the designated starting point for the Northern Tier ride, we hopped on a ferry and headed northwest to Orcas Island (one of the San Juan Islands) because: a) we could; b) we'd never been; and c) we were so close (and hour ferry ride) and didn't know if/when we'd be in the vicinity again. Our decision to Go Amtrak was another good example of us exploiting our freedom and the list goes on and on.



One version of the experience is conveyed in a blog that was largely Hank's words (until we parted ways around mile 2,700) and my pictures ... <https://rickandhanksbikeblog.wordpress.com/about/>. This represents a real-time, chronological description of some of the highlights of life on the road told by a

lifetime private school educator devoted to experiential education, with a heavy emphasis on outdoor education before and during his current role as the Head of Highland School in Warrenton, VA. The stories and words were designed to be suitable to his private school community of educators, students and, last but certainly not least, parents paying those fat (my words, not Hank's) tuition bills.

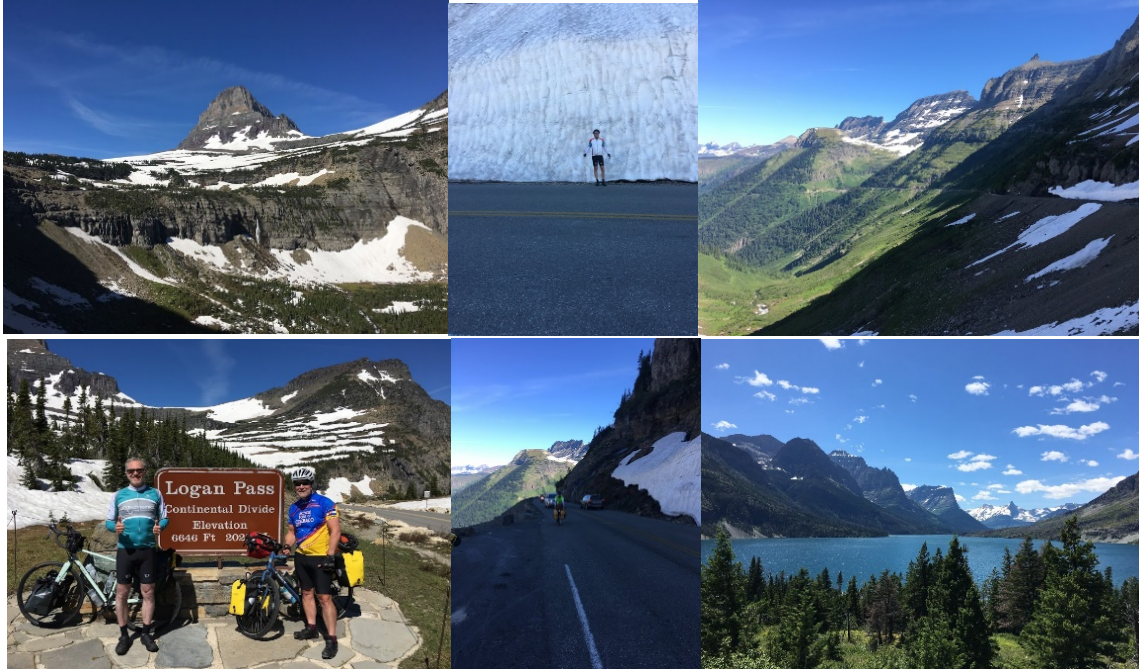
The version of our experience included in this paper is likewise intended to be informative, though might be best characterized as education without borders as told by Rick. This version is organized to provide some insight into first the riding and next the non-riding portions of the day and will touch on topics such as the roads, landscapes, sights, towns, people, etc.

Riding

It's not difficult for me to say that my favorite parts of the ride were the days in or near the five mountain ranges along the route – the Cascades (in Washington), Rockies (in Montana), Adirondacks (in New York), Greens (in Vermont) and Whites (in New Hampshire). First, I'm simply partial to mountain regions and all the great things that tend make them what they are – rivers, lakes, waterfalls, wildlife, etc. Second, as was the case for some of the mountain ranges, they are located in national parks and other protected areas that accentuate the riding experience because the roads are more cyclist-friendly, i.e., well maintained, lower speed limits and, in some instances, less traffic density). Third, I love the challenge of big climbs and the necessity to alternate sitting and standing during the climb, which gives your butt a nice break from the saddle which at any point in a ride this long will become a “royal pain in the ass.”

In fact, I need look no further than Hank, who was riding a relatively new bike and started to have problems with his seat in Washington that lead to him replacing it in ID courtesy of good bike store (Greasy Fingers Bikes N Repairs) in a very cool lake town, Sandpoint, which by the way also had an excellent micro-brewery. The right bike store/mechanic plus a brewery is the cross-country cyclist's equivalent of winning the lottery. Ca-Ching. Come to think of it, I was also a beneficiary of this bike store because the mechanic, while helping me troubleshoot and correct periodic bouts of numbness in my left hand, noticed that one of my rear wheel spokes was broken and replaced the spoke in advance of this turning into a serious problem down the road in the middle of nowhere.

Anyway, one final important point relative to being partial to mountain riding – you can't beat the views on the way up, particularly if the road graces you with scenic overlooks. What a tremendous payoff for a two-to-three hour climb! The pictures below from Going to the Sun Road in Glacier National Park, Montana should help to illustrate this final point regarding the joy of mountain riding.



The mountains of Washington and Montana gave way to the stark contrast of the plains of Montana and North Dakota. This riding was quite flat, very hot and susceptible to winds, sometimes at our backs and other times in our faces or on ears. It's safe to say that the combination of flat roads, high temperatures and head/cross winds was at times more challenging than doing long, steep climbs. Regardless, the vastness of the country, big skies included, was truly awe-inspiring. Speaking of roads, I should note that the two-lane roads in these parts (two lane roads were our home for 99% of the journey across the U.S.) were travelled by 16-wheel grain trucks that produced an interesting challenge when they were oncoming traffic at the same time we were dealing with a headwind. Specifically, the oncoming truck created a momentary gust that was impossible to avoid and a little scary. In fact, there was an instance in North Dakota where the gust got under the front edge of my helmet and shifted it to the extent that the front edge was pointing straight up. Not a good look and definitely not a good feeling.



In contrast to the mountains that delivered great challenges, scenery and fun, the vast fields of corn, soybean and various other crops of the heartland states (Iowa, Illinois and Indiana) along our route produced some very flat, repetitive riding on roads laid out in one mile square grids that all started to look the same after a while. Similarly, a significant stretch of the riding in Minnesota that represented our approach to Iowa and much of the Iowa riding was along the mighty Mississippi River was flat. Despite the "groundhog day" aspect of traversing the heartland states, particularly Illinois and Indiana, I



enjoyed every mile of every cookie-cutter county road that got me up close and personal with farm landscapes that are a far cry from the Washington DC suburbs where I've spent over 80 percent of my life. On a final heartland-related note, I had lost sight of the ACA's caution about Iowa -- *"Ask any Iowan if Iowa is flat, they will respond with a "No," especially in the northeastern part of the state."*-- until we reached northeastern Iowa and I simply couldn't believe all the climbing we were doing in a state that I'd venture to guess most of believe is flat, north to south and east to west.

After leaving the town of Monroeville, Indiana, where we experienced some serious Midwestern hospitality (more on that later), and making our way into Ohio, it didn't take long for our route to reach Lake Erie, which became a scenic and at times windy companion in Ohio, Pennsylvania and New York. The Erie Canal Pathway, a mostly crushed gravel, multi-use trail that parallels the Erie Canal proved a low-stress, ~100 mile break from the roads and great opportunity to see a bunch of small New York towns scattered along the canal, including the current hometown (Brockport) of long-time Technomics and Naval Center for Cost Analysis (NCCA) colleague, Jeff Cherwonik. Though my time along Lake Ontario was relatively short, the opportunity to have a second of the Great Lakes in sight for a portion of the ride was a welcome scenic addition that proved to energize me. I left this portion of the ride feeling very fortunate to have experienced several significant bodies of water and looking forward to the scenery and challenges that awaited me in route to the Atlantic coast.



As I've made pretty clear, my favorite parts of the route were the mountains, so I was excited to have reached the portion of the trip that would feature climbing through the Adirondacks, Greens and Whites of New York, Vermont and New Hampshire, respectively. The challenge of riding these mountains seemed a fitting end (or near end) to a ride that had started a couple months earlier with some serious climbing early on in the Cascades and Rockies. My first time riding in the Adirondacks, which featured some extremely scenic lakes, and the Vermont and New Hampshire mountains proved a real treat. My final climb of the trip to the outrageous view from the top of Cadillac Mountain in Acadia National Park, Maine and the corresponding descent into Bar Harbor, Maine on the Atlantic Ocean coast was the perfect ending to an excellent adventure!



Non-riding

The riding and the route were but one small part of this experience. When Hank and I weren't riding, we were eating, drinking, taking a break, sleeping, exploring towns, winning/influencing new friends and generally having a rip roaring good time. The small towns and characters in those small towns and are far too numerous to mention here, but (no pun intended) this is where the real rubber met the road. Same, but to a lesser degree, can be said about the campgrounds and characters in those campgrounds.

Regardless of whether we expected to spend the night in a room or a tent, our first stop in each and every town where we ended our riding day was a bar. Our rationale for this approach was extremely logical and sound: a) we deserved adult beverages at the end of a tough day in the saddle; b) we would experience the 'best' local color and learn the most about the surrounding area; and c) we always had the option of having dinner there too (truth be told, the bar was the ONLY place to get prepared food in many of the towns we visited). Furthermore, in order to maximize the probability of "b" becoming a reality, we would belly up to the bar rather than sit at a table. Despite Hank's initial reticence to my meet a local, be a local (i.e., sit at the bar) strategy, he came around when I proved to him that a guy in

bike attire can walk into a small town bar and not only avoid getting his ass kicked but also have some 'interesting' conversations and get some useful advice.

Some examples of "b" are definitely in order:

- Interesting conversation with a farmer and the trusted farm machinery guy who had previously sold him equipment totaling more than \$2M. Learned about the rapidly approaching evolution to fully autonomous machinery.
- Amusing conversation with a guy who revealed, after I offered to buy him a shot, that the bar prohibits him from drinking anything but beer and he'd been down on his luck and was due in court the next week to learn if "something he said to a woman" was going to land him in jail. The not-so-amusing aspect of the conversation was the fact that I revealed to this guy that we planned to camp just outside town prior to learning he was a candidate for the joint.
- Scary conversation with a guy who trucked grain for a living on a stretch of the Montana rode we'd just ridden. Scary because he told me in no uncertain terms that he felt cyclists often ride irresponsibly and that he has started responding to them by using some on-the-road scare tactics.
- Touching conversation with two older farmers about their longstanding friendship and the fact that one is in poor health and the other is taking care of him.
- Crazy conversation with a retired farmer/current crackpot (based on faces other regulars were making) who in very emphatic terms indicated that he's 68 and never been to a doctor in his life because his daily training regimen (my words not his) is five raw eggs, no water, no aspirin and, drum roll please, 15 beers.
- Weird conversation with a guy who looked like Charlie Manson and was offering us cycling nutrition advice, which could have been useful if we'd actually had access to nutritious food in any of the small towns that we frequented, since bar food was the only prepared food available in many small towns and decent vegetables/fruit were hard to come by in what was considered grocery stores, which quite often were convenience stores.

Depending on where we landed at the end of a day, the choices of motels and campgrounds left MUCH to be desired. The campground choices were particularly troubling to Hank, who as an outdoor educator and enthusiast, has become accustomed to wilderness camping in locations that may or may not be designated campgrounds and are a far cry from the types of campgrounds (some state, but mostly private) that dotted our route and were always 'littered' with RV-based visitors who were looking for a different type of experience than us (i.e., an indoor tent where one can cook, drink, watch TV, build a camp fire on the front porch, sleep in a bed, etc. versus a real tent in an idyllic setting where one can drink, ponder the meaning of life and pass out in a sleep bag as a result of the day's hard ride). Unfortunately, idyllic camp sites were few and far between on the Northern Tier route. Fortunately, we made the best of whatever we had on given camping night.



In most of our nightly stopping points, motel alternatives were at best mediocre and at worst fleabags visited on a routine basis by local heat, aka Enforcement Control officers, responsible for identifying and holding motels accountable for code violations. We were made aware of this profession upon meeting an officer in Napoleon, Ohio on his way to pay a visit to the manager of the hotel where we had just spent the night. I believe that this was the place with the darkened lobby and complimentary breakfast that featured of two empty coffee pots and a quarter loaf of white bread, a 'spread' that prompted us to walk half a mile to McDonald's. I fear that I can't do these motels justice without sharing a few pictures, including one that features the rear of a motel we were in that resembles a prison.



The fleabag factor plus the close proximity to Hank's snoring eventually led me to prefer camping over motels. Despite use of some industrial strength ear plugs, I had a difficult time cancelling Hank's noise in the tight quarters of a motel room. From my perspective, one of the key advantages of camping was the ability to separate myself from Hank by sleeping in my own tent and, most importantly, locating my tent as far as practical from him. I always felt like I was getting more and better sleep in my own tent. That said, the process of setting up and breaking down camp was effort that arguably increased our daily fatigue level.

We were extremely fortunate to have spent four nights at different locations, two private-owned and two town-owned, that cater to cyclists only. The first was Alice's Attic in Morrill, MN, which provided the option of sleeping under a roof in the attic of an old barn or in a tent in Alice's yard. There was no charge for the lodging, a shower in Alice's farmhouse and, no questions asked, Alice gave her the keys to her pickup for beer and pizza run. The second was the Adventure Cyclist Bunkhouse in Dalbo, MN, another sweet spot located in a converted 100+ year old barn on a farm owned by an Army retiree, Don Olson, who was a great guy interested in hearing our stories and giving road advice. In addition to having four rooms with platform beds and an attic that accommodates a lot of campers in sleeping bags, there was a kitchen that was stocked with a bunch of food that was either free or extremely cheap, a warm shower and some serious air conditioning. This place was an oasis. Like Alice, Don willingly offered the keys to his car for a trip to a nearby convenience store for some beer. Imagine someone in your town offering their car keys to a complete stranger? Not surprisingly, Don has won several ACA awards for accommodating something on the order of 50-75 Northern Tier cyclists per year.



The third spot was the Village Hall in Iroquois, Illinois's City Park. We ended up in the three room hall – one room was the City Manager's office, another room was a garage that housed the city tractor and various other equipment and the third room was a bathroom with shower and clean towels – because the manager (Joe Vaughn) saw us riding around the two block town and flagged us down to tell us about the hall, unlock the place, unfold two cots and recommend the one restaurant/bar in town. In keeping with my approach to snore avoidance, Hank slept in the air conditioned office and I crashed in the garage next to the John Deere. The fourth spot was the Community Park in Monroeville, IN, where the City Manager (Warren Fluttrow) bent over backwards to make our indoor stay perfect. Once again, we had cots, a hot shower and a roof over our heads. Like Don Olson, Warren has won several ACA awards for accommodating Northern Tier riders. Besides the great spot to crash, Warren rounded out our

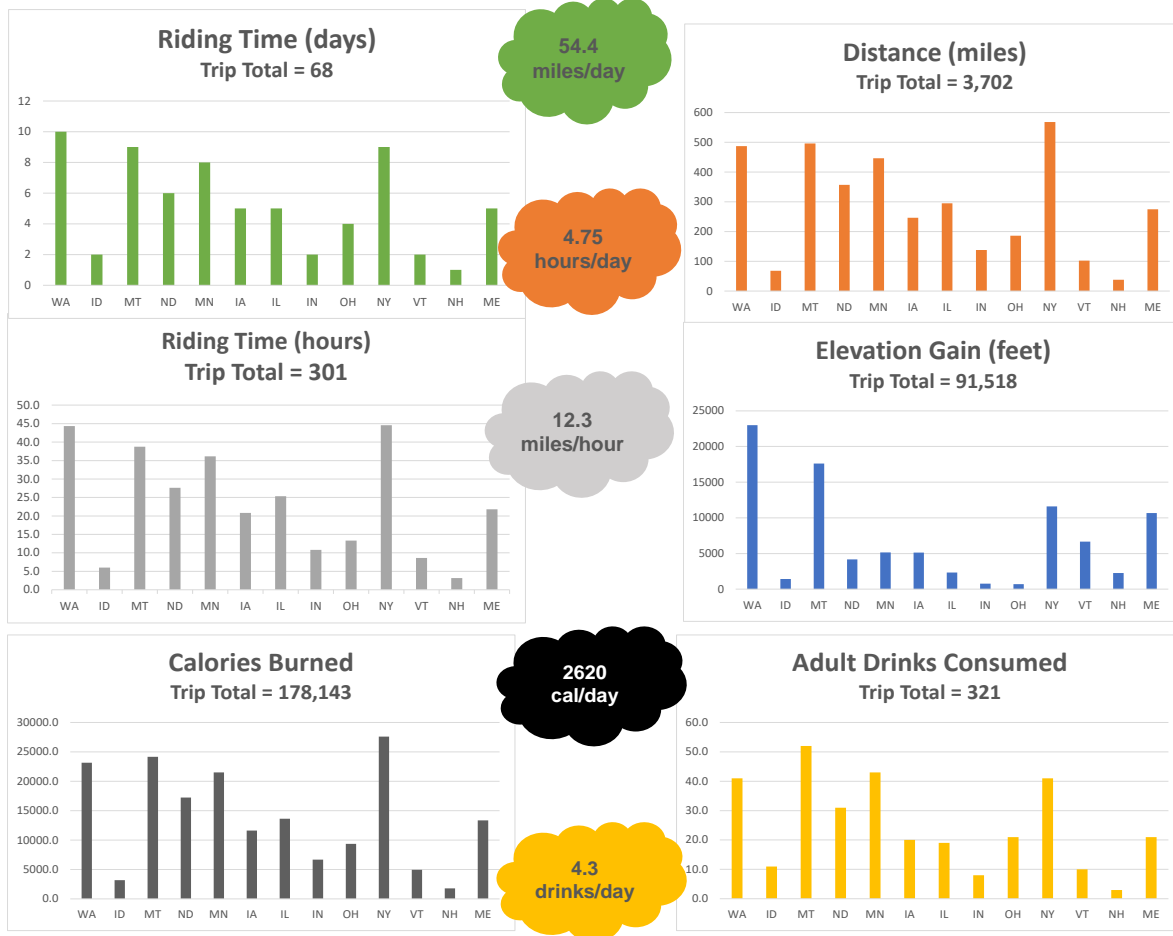
Monroeville experience by inviting us to speak to the Historical Preservation Society, the really nice group of people pictured below, about our trip.



The Data in Summary

As an analyst, I viewed this two-month adventure as an ideal opportunity to collect daily data for use in measuring our progress/performance. This time series data constitutes the database we employed to perform constrained optimization via a tailored version of MS Excel Solver that Technomics developed and has been using for years to develop parametric estimating relationships for our clients. The graphs that follow present summary data by state (note that neither Wisconsin nor Pennsylvania are included because the mileage/time in those states was insignificant, an hour or two) for a number of the key data fields included in our database.

As depicted in the graphs, the trip covered 3,702 miles, required 68 days of riding at an average of nearly 5 hours per day and resulted in an average daily distance of over 54 miles per day at an average of over 12 miles per hour (though not shown in any graph, we took six rest days). Four states (Washington, Montana, MN and New York) account for over 50 percent of the total distance and time ridden, total elevation climbed, calories burned and cocktails consumed.



Although it's a professional cycling race, the Tour de France (TDF) held every July is an interesting point of reference that proved inspirational when we happened to be situated in a motel that had a TV and the right cable service. The 2017 TDF covered 2,200 miles in 21 days (or what the tour "stages") and the winning rider, Chris Froome, completed the race in just under 86.5 hours, averaging over 25 miles per hour. Although he and the other TDF riders benefit from bikes that weigh less than 18 lbs. and have no fixed payload, this average speed (i.e., more than twice my average) is amazing given the amount of very serious climbing in the Alps and Pyrenees that's required to complete the race. There are other things that benefit TDF riders. For instance, unlike Hank and I who camped half of the nights during our trip, TDF riders not only have a bed every night, but also the services of a masseuse, who in professional cycling parlance is known as a soigneur. Furthermore, they are the beneficiary of nutritious meals prepared by their cycling teams' chefs, this being in contrast to the meal crap shoot that was our reality due to being in an endless series of small towns where the only prepared food in town was what you could get at the local bar or, if we were lucky, bars. Speaking of bars, as indicated in the graph above, we figured that a tough day in the saddle warranted post ride libations and, depending on the circumstances, took the liberty of having an occasional drink or two at lunch! The data analysis presented later in the paper may shed an interesting light on the value (or lack thereof) of alcohol to our riding performance. Regardless, you can be sure that TDF riders don't have the option to consume alcohol during or after their daily stage. I knew there was a good reason to not aspire to being a professional cyclist!

The Analysis

Objective

The objective of the analysis was to understand the system behavior associated with the ride. Within the cost community, cost estimating relationships (CERs) are developed via analysis in order to predict the future cost of a system based on various parameters. In our case, the analysis was performed to simply understand the magnitude and quantification of various influences on the ride. To do this, we hypothesized and tested variables that would impact daily average speed.

Approach

The approach used for performing the analysis consisted of the steps below.

- (1) Develop a representation of the system using influence diagramming techniques
 - a. Determine an objective measure within the system (i.e., Average Speed)
 - b. Identify variables and hypothesize their expected influences on each other
- (2) Collect and organize relevant historical data for each variable
- (3) Formulate a quantifiable model (i.e., equation structure) to test
- (4) Determine the influence of each variable using optimization (i.e., Excel Solver)
- (5) Assess and compare the results for type and degree of influence to our hypothesis
- (6) As necessary, revisit/re-think the hypothesis and gather more data and context (i.e., possible explanations) from the participant

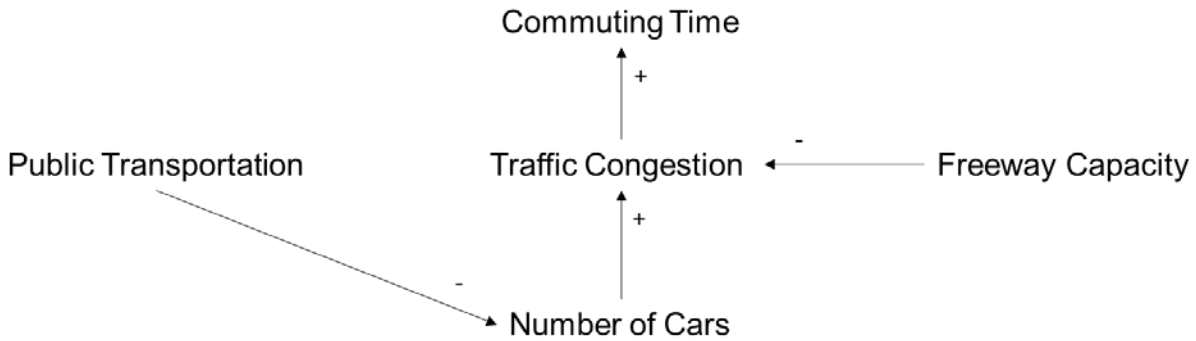
Influence Diagramming (Description)

Influence diagrams provide an efficient way of identifying and showing the relationships among variables participating within a system. This process is extremely useful in that it allows for easier collaboration, clearer understanding, better documentation of ideas, and typically results in an improved system description.

Influence diagramming originated as technique used to develop System Dynamics (SD) models. SD is a methodology and mathematical modeling technique to frame, understand, and discuss complex issues and problems. SD was originally developed in the 1950s by Professor Jay Forrester of the MIT to help corporate managers improve their understanding of industrial processes. The best known SD model is “The Limits to Growth” model developed in 1972.

The figure below shows an example influence diagram where an influence from one variable to another is identified with an arrow. In some cases a double arrow is needed if the two variables influence each other. The relationship of the influence is identified with a (+) or (-) sign. A (+) sign indicates a direct relationship (i.e., an increase leads to an increase or a decrease leads to a decrease). A (-) sign indicates an inverse relationship (i.e., an increase leads to a decrease or a decrease leads to an increase).

The example below describes impacts on commuting time as a result of traffic congestion where traffic congestion is influenced by the number of cars and freeway capacity. It also shows how public transportation might be used to reduce the number of cars using the freeway.

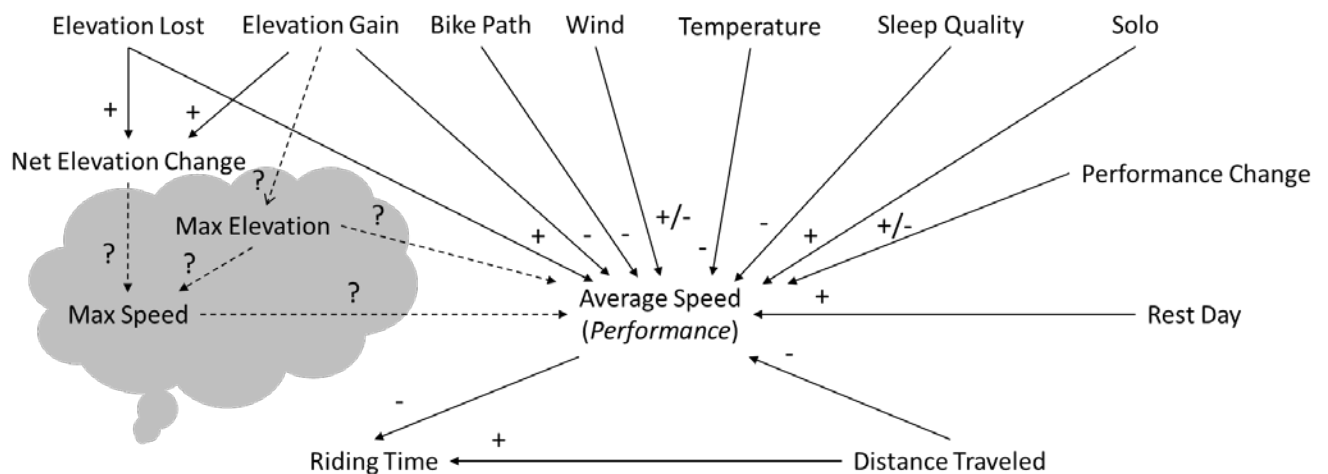


Influence Diagram (Initial Hypothesis)

For our ride analysis, we used the influence diagramming process and developed an initial hypothesis shown in the figure below. As seen in this influence diagram, we identified many variables that should have some impact on daily average speed. Primary impacting variables hypothesized included distance traveled, elevation gain, elevation loss, bike path versus road, wind (i.e., tailwind, headwind or crosswind), and temperature (i.e., very hot or very cold).

Other variables hypothesized to potentially have an impact included sleep quality (i.e., motel or camping), solo (vice riding with a partner during the first part of the trip), performance change (i.e., we assumed a tiring effect during the trip) and rest day (i.e., there were five rest days during the trip and we assumed better performance the following day).

The clouded area of the diagram shows our thought process for those variables which never materialized during the analysis. For example, having a higher max speed during a day was thought to potentially result in a higher average speed. However, this was not observed in the analysis and there is logic (for a full days ride) as to why this might not be the case.



Model Objective

Based on the results of our influence diagramming sessions and resulting initial hypothesis, we developed a number of model objectives. Specifically, the model objectives relate to impacts on daily average speed shown below.

- (1) Distance traveled in a day
- (2) Elevation gain and Loss
- (3) Temperature change (i.e., hotter or colder than average temperature)
- (4) Tailwind, headwind or crosswind
- (5) Bike path versus road
- (6) Sleep quality (i.e., motel or camping)
- (7) Having a rest day
- (8) Riding solo versus with a partner
- (9) Performance change during the trip (with partner and solo)

Data Collection and Organization

The influence diagramming process usually results in some variables where their data is limited or unavailable. This is due to the fact that the objective of the influence diagramming process is not (should not) be constrained to only existing data but instead be focused on understanding the system to the best degree possible. For our analysis, 68 data points (i.e., riding days) were included in the analysis.

The source of most of the data we analyzed was a daily riding log that included variables such as distance traveled, average speed, sleep location (i.e., motel or camping), rest days, and riding solo days. Subsequent to the ride, additional important data was collected from ACA maps and websites, including elevation gain, elevation loss, temperature, wind speed, wind direction and travel direction.

The most difficult part of the data collection process was obtaining wind speed and direction data for each day's ride. After obtaining daily wind data, it needed to be related to the travel direction for that day in order to determine tailwind, headwind and/or crosswind characteristics.

Model Design

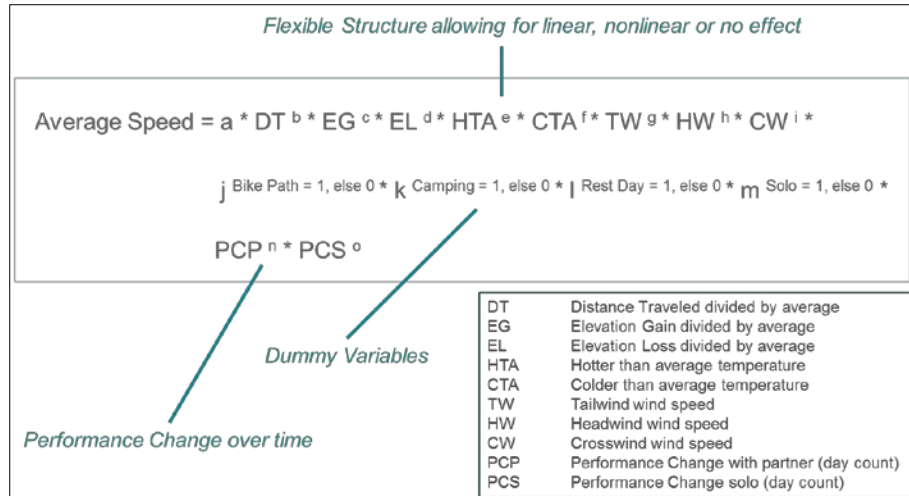
Based on the model objectives developed and described previously, an objective equation (i.e., estimating equation) was developed in order to analyze and test each variable's influence on average speed. The resulting estimating equation, shown in the next figure below, consists of a combination of three types of structures.

The first part of the structure includes variables where the daily input is divided by the ride adventure average. The result is then raised to an exponent. If the coefficient is 0 then there is no effect (i.e., the result is 1).

The second part includes the typical dummy variable approach where the coefficient being solved is raised to exponent of either 1 or 0 depending on the situation (i.e., 1 if camping or 0 if motel).

The third part of the equation attempts to model performance change over time for riding with a partner and riding solo. In this case the input parameter is a day count which is raised to an exponent.

The value of using optimization is the ability to combine estimating structures when needed to better represent the system being modeled.



Analytical Tools

In order to perform the analysis, Excel Solver was used. Excel Solver uses optimization to search for and find the best solution that minimizes a user-defined error term (i.e., objective function), average speed in our analysis. Excel Solver allows for any equation structure hypothesized to be modeled. It also allows for all combinations of defined error terms to be easily tested. Testing different error terms (i.e., objective functions) is useful in order to better understand the quality of the results.

Years ago, Technomics developed a front-end user environment for Excel Solver to allow for more efficient set-up and execution of the analysis. The output of the tool also provides improved understanding of the results. The Technomics Enhanced Excel Solver Tool (TEST) provides the following benefits:

- (1) Allows for multiple run settings, a capability required to find the best solution when dealing with more complex problems
- (2) Informs the user of the quality of the solutions and any need for additional search time/optimization runs
- (3) Uses custom designed visual and statistical output to better understand what is working or not working and why
- (4) Allows for more efficient inclusion or exclusion of specific variables (using a single equation) during the analysis process
- (5) The above benefit allows for additional analyses that can be performed in a more efficient manner to arrive at a better solution

Analytical Results and Findings

Our analytical results and findings are shown in the figure below, which includes a list of all coefficients tested and presents their solved value as well as their degree of influence on average speed in relation to their actual data range for the ride.

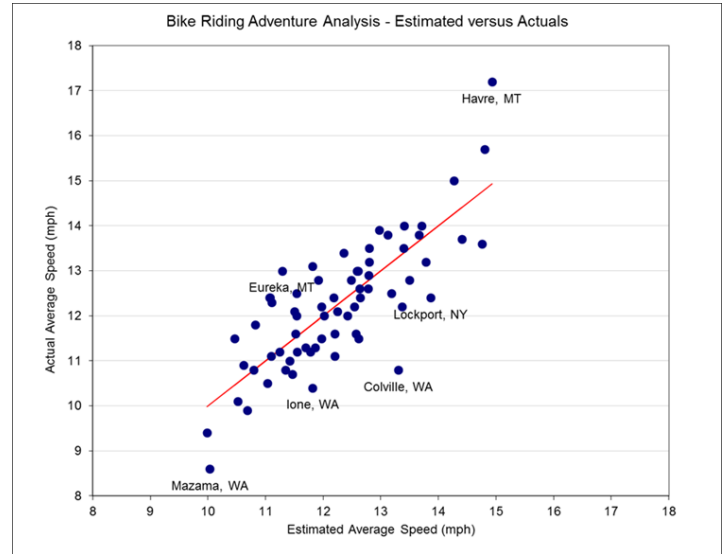
<u>Variable Name</u>	<u>Variable abbr.</u>	<u>Coefficient</u>	<u>Value</u>	<u>Parameter Range</u>			<u>Data Range Influence on Speed</u>	<u>Outcome</u>
				<u>Min</u>	<u>Avg</u>	<u>Max</u>		
Constant (i.e., average speed)	-	a	11	9	12	17	-	
Distance Traveled	DT	b	0.09	15	55	79	17%	<i>Not Expected</i>
Elevation Gain	EG	c	-0.11	36	1,364	6,411	-43%	Expected
Elevation Lost	EL	d	0.09	49	1,348	5,213	50%	Expected
Hotter than average	HTA	e	0.01	0	-	18, 98-80	3%	<i>Not Expected</i>
Colder than average	CTA	f	0.01	0	-	23, 80-57	3%	<i>Not Expected</i>
Tailwind Speed	TW	g	0.04	0	-	11	11%	Expected
Headwind Speed	HW	h	-0.04	0	-	11	-8%	Expected
Crosswind Speed	CW	i	-0.01	0	-	10	-3%	Expected
Bike Path	-	j	0.90	0	-	1	-10%	Expected
Camping	-	k	0.96	0	-	1	-4%	<i>Not Expected</i>
Rest Day	-	l	1.06	0	-	1	6%	Expected
Solo	-	m	1.20	0	-	1	20%	Expected
Performance Change with partner	PCP	n	0.04	1	-	50	19%	<i>Not Expected</i>
Performance Change solo	PCS	o	-0.02	1	-	17	-5%	Expected

Many of the variables we tested have a similar influence to what was expected based on the initial hypothesis. For example, elevation gain decreased average speed and elevation loss increased average speed. In fact, as expected, these two variables had the most influence on average speed. Next, wind speed and direction (i.e., tailwind, headwind and crosswind) results were also consistent with what was expected. Other expected results include (1) bike paths (paved and unpaved) causing a 10% decrease in average speed (2) rest days resulting in a 6% increase in average speed (3) riding solo resulting in an increase of 20% and (4) performance change riding solo showing a decrease of 5% by the end of the trip.

Although many of the variables tested produced a similar influence to what was expected in our initial hypothesis, some did not and are highlighted in red in the figure above. In asking ourselves “do the results make sense?” we revisited our initial hypothesis, gathered additional insights and ideas from Rick and developed the following possible explanations for the unexpected results.

- (1) Distance Traveled – We assumed riding a longer distance in a day would be tiring and result in a decreased average speed for longer rides. We discovered that Rick would ride ahead and stop and rest on longer rides (many times) to wait for his partner. This periodic rest pattern resulted in him having more energy than riding continually on shorter ride days. On shorter ride days he would stay with his partner longer and spend more time riding at his partner’s pace. If we were modeling the training experience of a competitive cyclist then maybe we should see the influence we hypothesized.
- (2) Hotter or colder than average temperature – We assumed extreme temperatures would have a decreasing effect on average speed. Only a very few days were really hot or cold and they were during the portion of the trip when Hank and Rick were together. Possibly on those days Rick (and more so Hank) pushed harder to complete the day’s ride due to the temperature? With more extreme temperature data points and a competitive training experience we might see what we hypothesized
- (3) Sleep Quality (i.e., camping or motel) – We assumed camping the night before might result in better sleep and a faster due to the perceived impact Hank’s snoring in the motel room. Maybe so to some degree but camping required finding the location, setting up, taking down and possibly an overall reduced level of rest due to the quantity of sleep vice quality.

- (4) Performance Change – We assumed every additional day of riding would result produce increasing fatigue and a resulting decrease in average speed over time. Hank was not in the best of shape at the beginning of the trip and actually improved in performance over time. During the last 983 miles of the trip when riding solo, Rick did show some degree of a decrease in performance. But he was also in a more focused “enjoyment mode” during these last days wanting to savor the ride.



The figure here shows a plot of the estimated versus actuals. This view was used throughout the analysis process to identify outliers, gather more information and re-think our initial hypothesis as needed.

Analysis Summary

The benefits of using influence diagramming cannot be underestimated. This technique allowed us to take an unfamiliar problem and begin to understand it better from a systems view. This process eventually allowed us to formulate an actual quantitative model to test. Using the influence diagramming process also allowed us to work more efficiently in sharing ideas, documenting our thoughts and expanding our knowledge of the system via discovery of related influences.

Given the formulated model was rather complex compared to many other CER types, using excel solver was extremely beneficial. It allowed us to efficiently analyze the many variables within the model, better understand the meaning of the results, and re-think/refine our analytical approach and model during the analysis process.

Furthermore, having Rick (the subject of the data collection) available to ask questions and help re-think our initial hypothesis was a great benefit. Typically, access to an engineer or expert intimately familiar with particular data because s/he were deeply involved in the associated program is not an option. In the end, this structured analytical approach helped us better understand and solve a problem with which we had no prior experience.

Parting Comments and Images

I sincerely hope that this paper has educated and inspired both outdoor and analytical adventurers. The ride was definitely a great physical and mental test for Hank and me. While some days were more physically challenging and others were a greater mental test, every day on the bike was a great opportunity to see the countryside and experience countless small towns in a way that's different and better than passing through in a car. The conversations in bars, outside convenience stores, and on the

sidewalk with locals who seemed genuinely interested in our ride was a refreshing contrast to what seems to be a trend of increasing self-absorption in the U.S. As an analyst, it was great to be in a position to collect actuals for the ride and employ influence diagrams, a powerful technique underused by cost analysts, and constrained optimization techniques to understand and model how a wide array of parameters may have impacted my average riding speed. I highly encourage readers to consider the value of influence diagrams to your analytical work.

I leave you with some smiling faces from the trip and a few related comments. First, my favorite picture of local color might just be the three young ladies behind the Dairy Queen counter in Melrose, Minnesota who helped me celebrate my first Blizzard ever! Second, I opened this paper with "Riding a bike feels good. Riding a bike is energizing and liberating." It is fitting that I close with Riding a bike makes you smile.



I sincerely thank and congratulate you for your diligence if you've made it to this point. You have just completed your own cross-country endurance test!

