

Optimal Routes for Madison Marathon and Madison IRONMAN

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Abstract

In this paper, we explore the optimal design of routes for the Madison Marathon and IRONMAN events, focusing on creating an engaging and sustainable experience for participants, spectators, and the local community. We analyze Madison's unique geographical and climatic features, emphasizing how meticulous route planning can enhance the experience. Through comprehensive research, including environmental studies, participant surveys, and expert interviews, we uncover key factors that influence route design, such as weather conditions, safety, and community engagement. We emphasize the importance of leveraging advanced route optimization technologies and

strategically positioning medical support and aid stations to enhance the athlete experience. Additionally, we propose routes that capitalize on Madison's scenic landscapes, aiming to strike the right balance between challenge and accessibility. Our recommendations intend to solidify Madison's status as a premier destination for endurance sports while simultaneously boosting the city's economic and social vitality.

Keywords: Madison Marathon, IRONMAN, route optimization, event planning, community engagement

Introduction

Madison, Wisconsin stands out as a beacon for those passionate about the great outdoors and competitive sports, providing a perfect backdrop for high-profile athletic showdowns such as marathons and IRONMAN competitions. These events do more than test physical limits; they weave the local and broader communities together, while generating notable economic, societal, and cultural benefits. Athletes and fans alike converge on Madison, immersing themselves in the city's vibrant economy and broadcasting its charm as a prime location for sports tourism. Such gatherings amplify local pride and highlight Madison's commitment to fostering a culture of health, wellness, and environmental consciousness.

Annually, the Madison Marathon and Madison IRONMAN emerge as key highlights on the athletic calendar, drawing a diverse array of competitors ranging from passionate amateurs to the crème de la crème of professional sports. These competitions set the

stage against Madison's unique landscape, challenging each participant while simultaneously bolstering the city's economic health and elevating its status as a top-tier destination for sports aficionados.

Given the importance of these events, it's crucial to focus on the meticulous planning of their routes. This involves balancing the routes so that Madison's geographic layout meets the needs and aspirations of participants and spectators alike, all while minimizing environmental impacts and maximizing community benefits.

The aim of this study is twofold. First, it seeks to analyze Madison's landscape, including its natural and urban features, and evaluate the environmental factors that could influence the events. To achieve this, the study will employ methods such as environmental assessments and geographic mapping. Second, it intends to incorporate feedback from athletes, spectators, and planners to identify opportunities for enhancing the event experience. This will be accomplished through structured interviews and surveys designed to gather diverse perspectives and insights. This holistic approach to route optimization is designed to align with competitive standards, safety protocols, environmental stewardship, and community engagement objectives, ensuring that all methods contribute effectively to the study's goals.

Optimizing routes for such significant events has wide-ranging implications. For competitors, a thoughtfully designed course can optimize performance by striking the right balance between challenge and fairness, considering aspects like elevation and

potential climatic conditions. Spectators benefit from routes that improve access and visibility, enhancing their experience. Moreover, careful route planning can reduce the environmental footprint of these events and mitigate disruptions for Madison's residents, ensuring the community remains supportive of these large-scale gatherings.

Efficient route design also plays a crucial role in sports tourism. The appeal of a well-organized event can significantly influence athletes' decisions to participate again. By focusing on route optimization, Madison can solidify its position as a top choice for marathon and IRONMAN events, attracting more participants and further boosting the local economy.

Crafting the perfect courses for the marathon and IRONMAN competitions in Madison involves a complex blend of factors. These include the city's geographical features, the environmental implications of the events, and the firsthand experiences of both those competing and those cheering them on. Our goal is to address this multifaceted challenge by suggesting course designs that cater to this wide array of requirements. In doing so, we aim to secure the ongoing prosperity and eco-friendliness of these crucial community happenings, further establishing Madison as a dynamic hub for outdoor athletic activities and healthful living.

Site Setting: Madison, WI

Madison, the capital city of Wisconsin, offers a distinctive and dynamic backdrop for the organization of significant athletic challenges, including marathons and IRONMAN events. This city, beautifully positioned between the shores of Lake Mendota and Lake Monona, boasts a landscape that's as visually stunning as it is conducive to the rigors of endurance sports. The blend of Madison's natural beauty and urban framework, together with its varied weather patterns and vibrant cultural life, presents a fascinating case for the strategic planning of endurance sports routes.

Geographical Highlights

At the heart of Madison's geographical identity is its isthmus layout, cradled between two major lakes. This distinct feature not only enhances the city's aesthetic appeal but also introduces unique opportunities and challenges in course planning for athletic events. Event coordinators have the creative latitude to design routes that not only make the most of the breathtaking lakeside views, enriching the experience for participants, but also must navigate the logistical hurdles that come with such a setting. These include ensuring spectator accessibility and managing the potential for bottlenecks in the isthmus's more constricted passages.

Moving away from the water's edge, Madison unfolds into an area of undulating hills, offering diverse challenges to competitors. These variations in elevation are a key tool for course designers, allowing them to tailor the difficulty level of the race to achieve a balance between a high-speed course and one that tests the limits of endurance.

Moreover, the city's architectural layout, with its harmonious blend of urban streets and verdant spaces, provides a broad spectrum of options for routing. This ensures that the courses devised can satisfy the dual objectives of competitive integrity for the athletes and engaging viewing points for the audience.

Climatic Conditions

Madison experiences a wide range of weather conditions throughout the year, making climatic considerations pivotal in event scheduling and route selection. The city enjoys warm summers with average temperatures from June to August ranging between 77°F (25°C) and 82°F (28°C), ideal conditions for hosting summer events. However, event planners must be mindful of the potential for higher temperatures and humidity, which could impact athlete performance and safety.

Spring and fall in Madison offer cooler, more temperate weather, with average temperatures ranging from 50°F (10°C) to 70°F (21°C). These seasons are often considered optimal for marathon running, providing a comfortable climate for participants. Nonetheless, the variability of weather during these transition seasons, including the possibility of unexpected heat spells or cold snaps, requires adaptive planning and contingency measures.

Winter in Madison is cold and snowy, presenting challenges for outdoor athletic events. While a winter event might be less common, the stark beauty of the snowy landscape

could offer a unique experience for participants and spectators alike. In such cases, considerations around road safety, hypothermia, and other cold-weather risks become paramount.

Cultural and Social Context

Madison's vibrant community engagement with outdoor sports, combined with its infrastructure, makes it an attractive host for marathon and IRONMAN events. The city's residents have a well-documented passion for outdoor activities, including cycling, running, and water sports, contributing to a supportive and enthusiastic atmosphere for large-scale athletic events.

This strong community engagement is bolstered by Madison's infrastructure, which supports the logistical needs of large events. The city boasts an extensive network of bike paths and running trails, public parks, and community spaces that can serve as vital components of event routes or as venues for related activities. Madison's commitment to maintaining and enhancing these resources reflects its identity as a hub for outdoor sports and its readiness to host major events.

Moreover, Madison's significance as a host for sporting events extends beyond its physical and climatic attributes. The city's cultural embrace of outdoor and athletic endeavors fosters a welcoming environment for athletes and spectators alike. Annual events, local sports clubs, and community groups contribute to a rich tapestry of sports

culture, enhancing Madison's appeal as a destination for marathon and IRONMAN competitions.

In summary, Madison's unique geography, variable climate, and dynamic cultural landscape offer a compelling setting for the optimization of marathon and IRONMAN routes. The city's natural features and urban layout provide a versatile foundation for course design, while its weather patterns and community ethos add layers of complexity and opportunity to the planning process. Together, these elements frame Madison as a prime location for hosting engaging and challenging athletic events.

Key Concepts

Crafting the ideal paths for marathon and IRONMAN competitions demands a comprehensive strategy that weaves together various elements including the impact of weather conditions, the well-being and feedback of participants, the overall perception of the event, and operational aspects like managing injuries and distributing resources efficiently. Situated in the scenic yet diverse landscape of Madison, Wisconsin, the local marathon and IRONMAN challenges offer a unique set of circumstances for event organizers. Leveraging insights from a broad spectrum of research, this document proposes strategies for designing the best possible routes. These strategies are carefully tailored to minimize environmental repercussions, enhance the experience for all involved, and prioritize safety, thereby ensuring these significant events can be conducted successfully and sustainably in Madison.

Environmental Considerations

Environmental conditions have a significant impact on athletic performance, particularly in endurance events like marathons and IRONMAN competitions. Nikolaidis et al. (2019) highlight the adverse effects of increasing temperatures and precipitation on marathon performance, emphasizing the need for route planning that minimizes exposure to unfavorable weather conditions. Ely et al. (2007) further underscore the detrimental effects of warmer weather, advocating for routes that offer shade and cooler microclimates. Wong et al. (2013) note microclimate variations in urban environments, suggesting that routes should avoid enclosed spaces like tunnels where possible, to mitigate the "herd effect" and ensure more stable environmental conditions.

Participant Satisfaction and Event Image

Participant satisfaction is closely tied to the overall image of the event and plays a crucial role in encouraging repeat participation. Koo et al. (2014) establish a direct link between event image and participant satisfaction, highlighting the importance of scenic routes and well-organized events in creating a positive image. Larsen (2021) and Edensor & Larsen (2018) discuss the sociological and geographical aspects of marathon running, suggesting that routes should not only be physically optimal but also culturally enriching, passing through landmarks and areas of local significance to enhance the participant's experience and connection to the event.

Safety and Logistics

The safety and logistical support of participants are paramount. Nguyen et al. (2008) focus on injury patterns and the need for strategic placement of medical resources along the route. This implies planning routes with accessible points for medical stations, particularly in areas where participants are more likely to require assistance. Ren et al. (2020) emphasize the importance of considering natural environmental factors such as terrain and air quality, suggesting routes that avoid high elevation and heavily polluted areas, ensuring a safer and more enjoyable experience for participants.

Technological and Analytical Tools

The use of advanced planning tools, such as the greedy and backtracking algorithm described by Wang et al. (2023), can significantly enhance the efficiency and effectiveness of route planning. These technologies allow for the optimization of routes based on various criteria, including environmental factors, participant safety, and the aesthetic appeal of the course.

Optimizing routes for the Madison Marathon and IRONMAN requires an integrated approach that balances environmental considerations, participant satisfaction, and logistical challenges. By leveraging advanced analytical tools and drawing insights from comprehensive studies, event organizers can design routes that offer a safe, enjoyable,

and memorable experience for participants. Incorporating scenic elements and cultural landmarks, while ensuring the efficient placement of medical and logistical support, will not only enhance the immediate experience of the participants but also contribute to the long-term success and sustainability of these events in Madison.

Literature Review

Event Management and Marketing Theories

The principles of event management and marketing provide a critical lens through which to view the organization of significant athletic competitions, such as marathons and IRONMAN events. At the heart of these principles lies the creation of an unforgettable experience for those who participate, one that goes beyond mere satisfaction to actively involve and positively affect the surrounding community. The work of Koo and colleagues in 2014 highlights the necessity for careful consideration in several key areas, including effective branding, promotional strategies, and the overall design of the event, to achieve a high degree of satisfaction among both participants and spectators. Furthermore, the importance of engaging with the community is strongly emphasized, shedding light on the invaluable role that local support plays not only in the immediate success of the event but also in contributing to the economic and social wellbeing of the host city.

Geographic and Environmental Considerations

Geographical and environmental theories emphasize the significance of the physical and climatic conditions in which outdoor sports events are held. These theories highlight the importance of terrain analysis, climate impact assessment, and sustainable event planning to minimize the environmental footprint while maximizing participant performance and safety. The interaction between athletes and their environment is critical, suggesting that optimal route selection and event timing can significantly influence the outcome and enjoyment of the event for all stakeholders involved.

Environmental Conditions and Performance

The relationship between environmental conditions and athletic performance has been extensively studied, with findings indicating a clear impact of weather variables on marathon outcomes. Nikolaidis et al. (2019) provided comprehensive evidence of how varying temperatures, wind conditions, and precipitation levels affect marathon running performance over an extensive period. Similarly, Ely et al. (2007) demonstrated the adverse effects of higher wet-bulb globe temperatures on marathon runners' speed, particularly for slower runners. These studies offer valuable insights for planning events in Madison, suggesting that race organizers should carefully consider the timing of the event and potential weather conditions to optimize participant performance and safety.

Participant Satisfaction and Behavioral Intentions

The study conducted by Koo and colleagues in 2014 delved into how the perception of an event by its participants directly impacts their satisfaction and their inclination to partake in future events. Their findings revealed a notable positive link between how participants view the event and their levels of contentment, which subsequently affects their decisions on whether to participate again. Highlighting the significance of maintaining a favorable impression of the event and ensuring a rewarding experience for participants, this research points to the critical role these factors play in building loyalty and encouraging repeated engagement. This aspect is particularly vital for the ongoing success of events such as the Madison Marathon and IRONMAN competitions, where fostering a strong participant base is key.

Route Planning and Natural Environmental Factors

The study by Ren et al. (2020) highlights the influence of natural environmental factors on the planning and distribution of marathon events. The preference for routes in areas with favorable topography, climate, and air quality show the necessity of selecting event routes that align with these criteria. For Madison, this means leveraging the city's scenic landscapes, lakes, and relatively flat terrains to design routes that are not only environmentally viable but also appealing to participants.

Medical and Safety Considerations

Nguyen et al. (2008) shed light on the patterns of injuries and the utilization of medical services during marathons, emphasizing the need for strategic placement of medical stations and the allocation of resources. Their findings guide the optimal placement of aid stations along the marathon route in Madison, ensuring participant safety and quick response to medical emergencies.

Microclimate Variations

Wong et al. (2013) investigated the effects of microclimate variations within semi-enclosed and open sections of a marathon route, revealing the impact of different environmental settings on temperature and humidity levels. This study suggests that race organizers in Madison should consider the microclimate effects of urban and natural landscapes when planning the route, potentially employing technology like iButton sensors for real-time monitoring and adjustments.

Methods

To gather comprehensive data on Madison's geographical features, climate conditions, and participant feedback, a mixed-method approach will be utilized. This will include the use of Geographic Information System (GIS) for detailed mapping of the terrain and urban infrastructure, weather data analysis to understand historical and seasonal climate patterns, and qualitative feedback from past event participants, spectators, and

planners through surveys and interviews. This holistic data collection strategy will inform the planning and optimization of marathon and IRONMAN routes in Madison.

Qualitative Analysis

Qualitative analysis allows for a deep exploration of participants' experiences, emotions, and perceptions. It enables us to capture the complexity of how individuals interact with, perceive, and are impacted by these endurance events. This approach is invaluable for understanding the subtleties that quantitative data alone cannot reveal, such as personal motivations, the psychological impact of the race environment, and the emotional journey of athletes and spectators.

Qualitative analysis is also ideal for identifying recurring themes, patterns, and insights across different interviews. These thematic insights can offer a grounded understanding of common challenges, preferences, and factors contributing to the enjoyment and success of endurance events, directly informing improvements and strategies for future event planning.

Endurance events like Ironman and marathons are as much about personal journeys and transformations as they are about physical challenges. Qualitative research honors these personal stories, providing a platform for voices to be heard and shared. These narratives can be powerful tools for fostering a sense of community among athletes and spectators.

All of our interviews will start with basic demographic questions such as race attended, role within the race (participant, spectator, or planner), year of race attended, and age of interviewee.

By using semantic grouping, bag of words modeling, and phrase mapping, we can easily identify common themes across different interviews. We plan to send these interview questions in the form of a survey to running clubs on campus for participants and spectators, and intend to interview race planners as well.

Questions for Participants

Example Questions:

- How often have you competed in either of the races? Which course did you prefer? Why?
- In your opinion, what factors lead to faster times?
- In terms of race atmosphere, how did the local community and spectators contribute to your experience?
- What parts of the race did you find most enjoyable? What parts were the least enjoyable?

These questions are designed to probe deeply into the experiences of participants in Ironman and marathon races, focusing on the impact of event organization, geography, weather, and community involvement on athletes' performance and overall race enjoyment. By questioning competitors about the frequency of participation and course preferences, we're looking to understand the subjective appeal of different races and how specific geographical features influence athlete satisfaction.

Questions about the adequacy and placement of aid stations, medical support, and volunteers, along with inquiries into the role of weather, directly address the logistics of race planning and the uncontrollable environmental factors that can affect performance.

By examining factors that participants believe lead to faster times, their strategies for nutrition, hydration, pain, and fatigue management, we're delving into the preparation and resilience aspects of endurance racing. This provides insight into the physical and psychological preparations that contribute to success in such demanding events.

Inquiring about the race's atmosphere and the local community's role, alongside identifying the most and least favored aspects of the event, gives a comprehensive perspective on what it's like to participate. This exploration goes beyond the race's physical demands to encompass the emotional and communal elements that enrich the event's allure. Such discussions underline the significance of encouragement from spectators and the involvement of the local community in elevating the appeal of the race.

Questions for Spectators

Example Questions:

- In what ways were you able to engage with the event (e.g., cheering zones, spectator spots, interaction with participants)?
- Were the facilities and resources available for spectators adequate? (e.g., viewing areas, information booths, restrooms, food and drink options)?
- If you have attended other Marathon/Ironman events or similar endurance sports events, how does this one compare in terms of spectator experience?
- Do you have any suggestions for additional activities or facilities that could

enhance the spectator experience?

The focus on spectator experiences at endurance events forms a vital component of our study, aiming to understand not only the athletes' perspectives but also the interactions and contributions of spectators to the event's overall ambiance. Queries regarding their general experiences, ways they engage with the event, the ease of accessing support zones, and the sufficiency of available amenities probe the logistical and organizational aspects of event management from the viewpoint of a spectator. It's crucial to grasp how these events cultivate a community spirit and bolster support among participants and onlookers alike.

Further inquiries about how simple it is to obtain information and navigate through the event's various stages shed light on the significance of effective communication and logistical planning in enriching the spectator experience. Drawing comparisons with other similar events can help identify the range of experiences spectators have, offering insights into which elements or practices make an event more captivating and enjoyable.

Invitations for suggestions on new activities or facilities highlight the evolving nature of event organization and the necessity for ongoing improvements to meet the spectators' evolving needs and preferences. This approach ensures that events remain engaging, inclusive, and enjoyable for all attendees, reinforcing the importance of continuous dialogue and adaptation in event planning.

Questions for Planners

Example Questions:

- What are the key steps in planning an Ironman event from concept to completion?
- What do you look for when deciding the layout of the run, bike, and swim? What factors are most important?
- What are the biggest challenges in organizing an Ironman event? How do you address them?
- How do you create a memorable experience for participants?
- How do you create a memorable experience for spectators?

These questions are integral to our research as they dive into the intricate planning and execution processes behind Ironman events, shedding light on both the logistical complexities and the creative strategies employed to craft memorable experiences for participants and spectators alike. By exploring the key steps from the conceptualization of an event to its completion, we aim to understand the foundational elements that contribute to the organization of a successful endurance race. This includes selecting a city, which involves careful consideration of geography, infrastructure, and local support—factors that directly impact both the athlete's performance and the spectator's experience.

The process of deciding the layout for the swim, bike, and run segments delves into the strategic planning necessary to balance the event's physical challenges with safety and enjoyment. The biggest challenges faced during organization, and the measures put in place to support athletes of varying levels, addresses the logistical and operational hurdles that can affect the event's quality and accessibility.

Creating memorable experiences for participants and spectators touches on the emotional and experiential aspects that make endurance events like Ironman unique.

This encompasses everything from the atmosphere and community engagement to personal achievements and entertainment, highlighting the multifaceted nature of event success beyond the physical layout and execution.

Summary of Key Points

The comprehensive analysis of optimizing routes for the Madison Marathon and IRONMAN events reveals critical insights drawn from a blend of environmental studies, participant feedback, and theoretical frameworks in event management and marketing. This synthesis provides a strategic roadmap for enhancing these events in Madison, focusing on environmental sustainability, participant satisfaction, and community engagement. Key points from the study include:

Environmental and Climatic Considerations: Studies by Nikolaidis et al. (2019) and Ely et al. (2007) underscore the significant impact of environmental conditions, particularly temperature and humidity, on athlete performance. Applying these insights, route planning in Madison must account for local weather patterns, aiming for cooler, more stable conditions to optimize performance and safety.

Participant Experience: Research by Koo et al. (2014) emphasizes the correlation between event image, satisfaction, and behavioral intentions. Designing routes that showcase Madison's scenic landscapes and cultural landmarks can enhance the event's appeal, encouraging repeat participation and attracting a broader participant base.

Route Optimization Technologies: The utilization of advanced algorithms for route planning, as illustrated by Wang et al. (2023), allows for the integration of diverse data points, including geography, climate, and participant preferences. This approach ensures that routes are not only physically challenging but also environmentally and socially responsible.

Safety and Medical Considerations: The insights derived from Nguyen et al. (2008) reveal the critical role that readily available medical support plays throughout the race. Strategically positioned aid stations, guided by insights from historical data on injuries and recommendations from previous participants, are pivotal for promptly addressing health emergencies and safeguarding the wellbeing of the racers.

Microclimate Awareness: Research conducted by Wong et al. (2013) sheds light on the significant impact that variations in microclimates can have across different segments of the race route. By taking into account the unique features of Madison's cityscape and natural surroundings, planners can effectively reduce the negative impact of these microclimatic variations, thereby enhancing the race experience in terms of comfort and enjoyment for the athletes.

Community Engagement: Fostering a deeper connection with Madison's community and valuing their input in the event's planning stages can substantially enrich the experience for everyone involved—athletes, spectators, and local residents alike. Cultivating a sense of belonging and pride within the community not only garners sustained support for the events but also strengthens the communal spirit.

Economic and Social Benefits: The meticulous organization of marathon and IRONMAN events yields considerable benefits for the city of Madison, boosting the local economy and enriching the community's social fabric. Such well-executed events further solidify Madison's status as a sought-after destination for fans of outdoor sports.

Methodological Approach: Adopting a comprehensive approach that combines Geographic Information System (GIS) mapping, analysis of weather conditions, and the gathering of qualitative insights from past participants and spectators lays a solid groundwork for the meticulous planning of race routes. This multifaceted strategy ensures a thorough consideration of all essential elements, from the geographical layout to the personal narratives that shape the event, in the route optimization process.

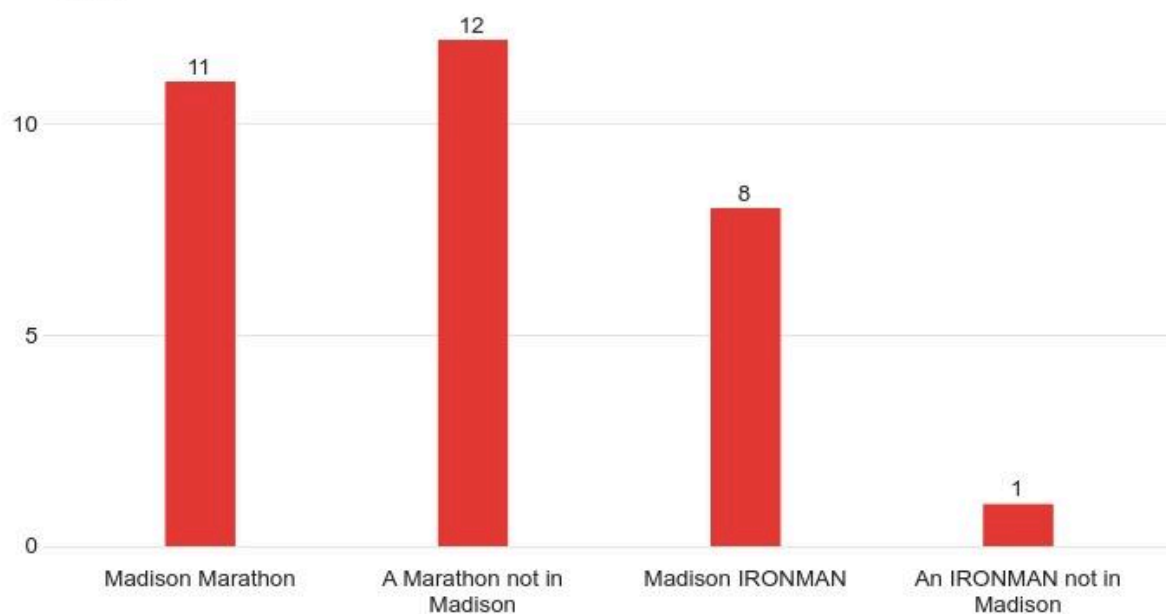
By synthesizing these crucial elements, a robust strategy for route optimization for Madison's marathon and IRONMAN events is established. This approach thoughtfully balances the rigors of the course with considerations for the environment, safety measures, and the overall race experience. Event organizers are thus equipped to guarantee the enduring success and sustainability of these prestigious events, elevating Madison's profile on the international stage of outdoor sports.

Survey Results

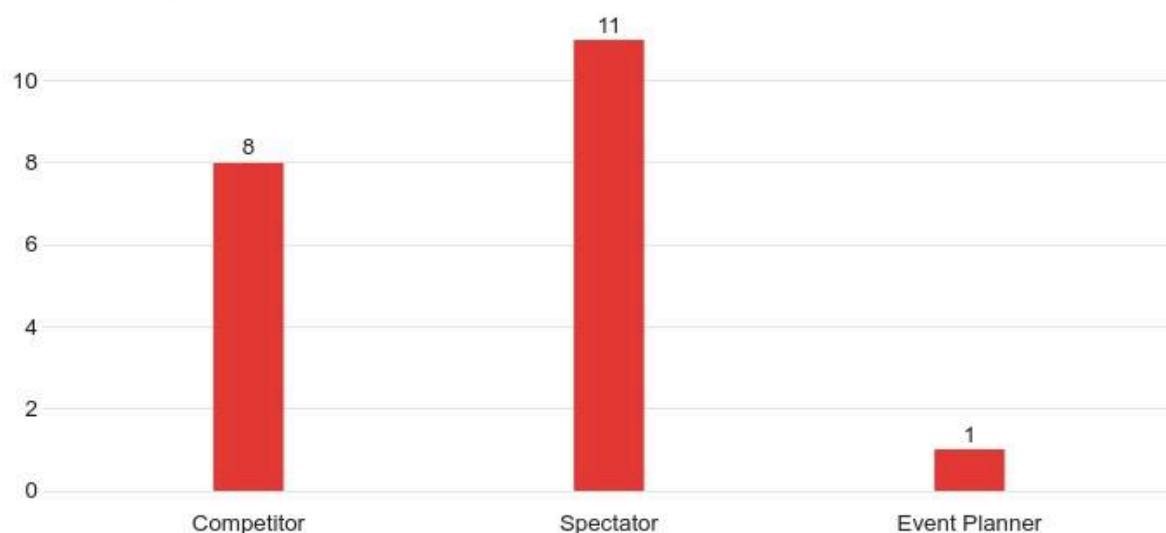
The survey that was conducted contained the following results related to events participated: nine counts were for the Madison Marathon, seven were for marathons not in Madison, five were for the Madison Ironman, and one was for Ironmans outside of Madison. Of those who took the survey, five were competitors and nine were spectators.

The survey asked what years respondents either attended or participated in races ranging from 2020 to 2023 with an 'other' category as well. There was one respondent who participated in 2020, three respondents in 2021, four respondents in 2022, nine respondents in 2023, and three respondents marked the other category.

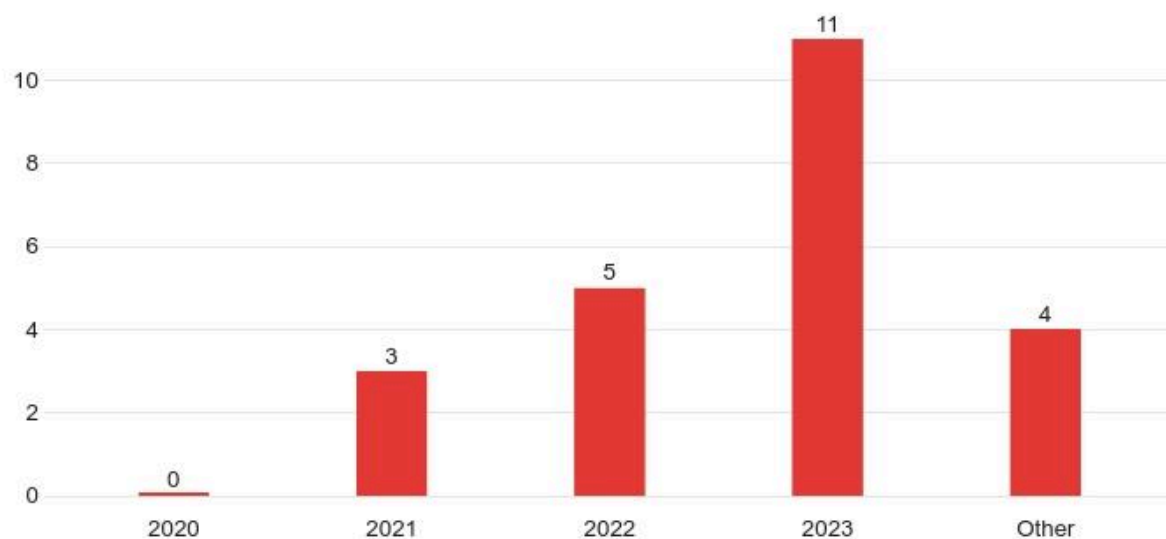
Q1 - Have you attended, or participated in, any of the following endurance events? (Check all that apply)



Q2 - What is your role within the race you checked in the previous question? (Each answer has its own separate questions)



Q4 - What year(s) did you attend or participate in the race you checked in the first question? (Check all that apply) - Selected Choice



Competitors

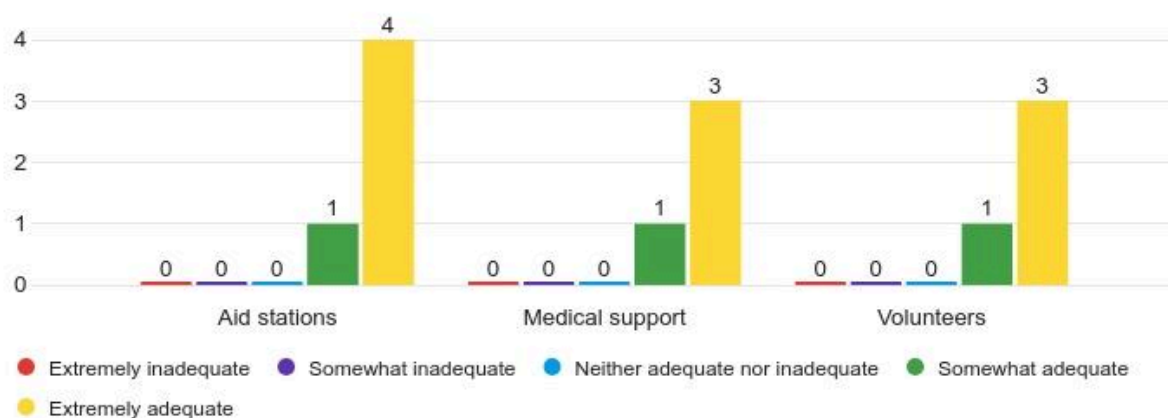
The survey then prompts questions based on how the second question was answered, either as a competitor or as a spectator. Of the five competitors, four of them have done

one or two events, and one has done more than five events. The next question asks which course (if they have done more than one) respondents prefer. Two responses were made to this: Grandma's Marathon in Duluth and the Madison Half Marathon. Respondents were asked how they felt the adequacy and placement of aid stations, medical support, and volunteers were. The majority chose extremely adequate whereas only one responded as being somewhat adequate for all three options.

Q6 - How often have you competed in either of the races?



Q8 - How would you evaluate the adequacy and placement of aid stations, medical...



A question of whether or not weather played a role in respondents' performance. Four of the five responded positively that it did with two specifying that conditions were perfect for running. The temperature was cool and there were not any strong winds. On top of that, availability of food and race support helped achieve stronger performances as well. Respondents were asked how they approached nutrition and hydration during training and competitions. One respondent said, "I try to eat less processed foods and do not restrict the amount I am eating". A number of respondents mentioned drinking lots of water as well as using energy gels with simple carbohydrates for quick acting energy. A lot of the respondents stated how they simply "push through" the pain when feeling fatigue during the race, with some saying they will stop and walk if needed.

Q9 - Do you think weather played a role in your performance? - Selected Choice



Q9_3_TEXT - If yes, why? - Text

If yes, why? - Text

It was dry, not too hot, with a light breeze, perfect conditions to run hard

It was a really great temperature but also quite windy in places

Q11 - How do you approach nutrition and hydration during training and competitions?

How do you approach nutrition and hydration during training and competitions?

Lots of water and lots of food

In training, I carry water for runs >8 miles and nutrition for runs >11 miles. On race day, I take fluids at almost every aid station and nutrition every ~6 miles.

I brought a few GUs with me— I did not bring water with me during the marathon

Generally, I try to eat less processed foods and do not restrict the amount I am eating. I also follow a vegetarian diet. Before a run, I have espresso and something light and sugary to eat, like a banana or smoothie. After a run, I have a protein-rich meal, like a homemade black bean burger. During long runs, I drink water throughout and have energy gummies or Gu's, or just something sugary like fruit snacks.

I like gus! they were provided in the Madison marathon this year which was great

The next question asked how the local community and spectators contributed to their experience. Each of the five respondents answered positively, saying spectators helped energize them throughout the race. The finish line was emphasized as having a great race atmosphere. One respondent answered, “For some stretches the crowd was thin but the views were beautiful - every few miles there would be a larger group (100-300) of people cheering, which felt like [a] little energy boost.”

Q13 - In terms of race atmosphere, how did the local community and spectators contribute to your experience?

In terms of race atmosphere, how did the local community and spectators contribute to your experience?

Heightened it by a positive atmosphere and lots of adrenaline

For some stretches the crowd was thin but the views were beautiful - every few miles there would be a larger group (100-300) of people cheering, which felt like an little energy boost.

Very high energy and fun

The race atmosphere is very energizing, especially at the finish line! I love when there is music along the way.

amazing!! such great turnout

The next two questions asked respondents what their most enjoyable and least enjoyable parts of the course were. There was overwhelming support for running close to and around nature. Three of the five respondents mentioned they enjoyed running around Lake Monona with another respondent answering they enjoyed running close to Lake Superior. The fifth respondent enjoyed running on bike paths. As for components competitors did not like, hills and busy roads topped the list.

Q14 - What parts of the course did you find most enjoyable?

What parts of the course did you find most enjoyable?

Running on the path right along the lake

Running close to Lake Superior

Running the bike trail back to the capital and around the lake

Downtown, any stretch on a bike path

going around the lake loop and seeing people out

Q15 - What parts of the course did you find least enjoyable?

What parts of the course did you find least enjoyable?

Running down the roads towards the finish before the capital

The hill at mile 22 heading toward downtown

Not running closely around Menona and the nice neighborhoods but running along the Main Street at times, also when running along main roads on open pavement

Busier streets in Monona

the weird extra turn they added on butler when running up E Mifflin

Spectators

The nine respondents who indicated that they were spectators for an endurance event were asked to describe their overall experience. There were lots of positive responses with respondents saying it was lots of fun and they really enjoyed watching. One respondent stated that it was important to do some advanced planning due to lots of road closures. When asked about ways in which spectators were able to engage, six responded with cheering zones and spectator zones and five responded with participant interaction.

Q16 - Can you describe your overall experience as a spectator at an endurance race you have attended?

Can you describe your overall experience as a spectator at an endurance race you have attended?

It was super fun to watch all of the runners and support my friend as she ran hers. There was a great energy and everyone was cheering with fun signs!

It was good, sometimes hard to find parking, but once out of the car it was walkable

I enjoyed watching people sweat it out!

I love spectating for marathons! I've done it a lot (and run quite a few halves, but I assume that's not what you're asking about). Sometimes it can be tough to get to different points along the race course quickly enough to be able to offer support for the runner(s) you're there to see because of road closures, or lack of road access, so you need to do some advanced planning to figure out how and when you can see the runner prior to race day. You asked yes/ no on access difficulty below - it really depends on the course! Sometimes yes, sometimes no. I'm not really sure how to answer many of the below questions because they assume you've only participated in one of these races.

Good times!

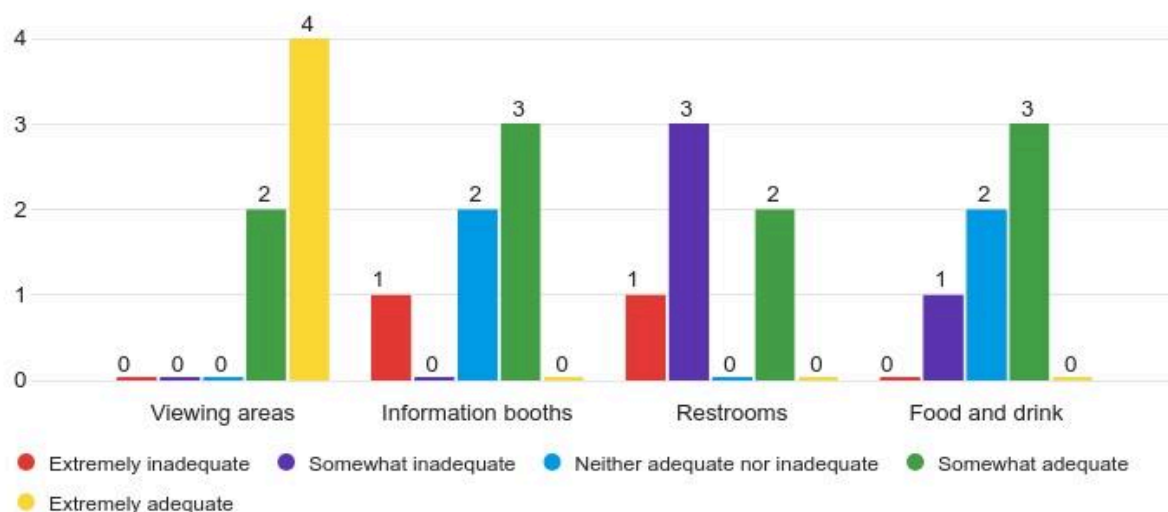
Positive, because I was able to easily walk to the location.

As a volunteer I got a closer level of interaction with the competitors as I was actively helping them with their belongings during the race. It honestly was inspiring to witness people push their bodies to the limit on a personal level.

A number of facilities and resources were asked about including viewing areas, information booths, restrooms, and food and drink. Respondents were asked to rank the adequacy of these. Viewing areas were highly ranked with five respondents answering

extremely adequate and two responding with somewhat adequate. Respondents thought access to food and drink for spectators was neither adequate nor inadequate. Information booths were scored similarly across the board. Restrooms for spectators were all over the place. One respondent marked extremely adequate, two respondents marked somewhat adequate, three marked somewhat inadequate, and one marked extremely inadequate. Respondents were also asked how easily available information was. Six respondents marked somewhat easy, one responded neither easy nor difficult, and another marked somewhat difficult.

Q19 - Were the facilities and resources available for spectators adequate?



Respondents were asked how difficult it was to travel between the swim, bike, and run portions of the Ironman. Answers involved varying degrees of difficulty. One respondent said it was difficult to travel anywhere from the swim. Another respondent said they did not watch the swim and needed a car for everything else. A question about suggesting any additional activities or facilities that could enhance the spectator experience was

asked. One respondent thought adding signs to the volunteer tent would be beneficial. There is a lot of commotion going on and it's hard to see where to go. Another respondent thought more restrooms for spectators would be nice as well as keeping roads open as close to the race course as possible for easy accessibility.

Q23 - Do you have any suggestions for additional activities or facilities that could enhance the spectator experience?

Do you have any suggestions for additional activities or facilities that could enhance the spectator experience?

N/A

I actually avoid spectator points most of the time because it's too hard to get to the front to cheer for your runner in a way that they can actually see/ hear you. Mostly trying to keep roads open as close to the race course as possible for spectators, and bathrooms are great too! Also, and I'm sure Madison already does this, ensuring that post-race food and drinks intended for runners isn't easily accessible for spectators (it's the worst when you finish closer to the end and are exhausted but all the food and water is gone because spectators felt entitled to it).

As a volunteer if I hadn't been with a group I probably would've struggled to find the volunteer tent on my own in the mix of all the commotion. The signage on the volunteer tent could have been more visible.

Interviews

Kathy Mock

Organizing large-scale athletic events such as the NICA races presents a series of complex, interlinked challenges that require meticulous planning and management.

According to Kathy Mock, a head organizer for the Wisconsin NICA League, the success of these events hinges on several critical factors, from volunteer management to venue selection and course design.

Volunteer Coordination and Management:

Volunteers are the backbone of NICA races. According to Kathy, "The event can't run without volunteers." Each race requires a structured hierarchy of volunteer roles including chiefs of course, course marshals, a volunteer coordinator, registration managers, and rules officials. Each chief oversees teams of three to five volunteers, ensuring that each aspect of the race is managed effectively. In addition to these roles, a team of 8-10 EMT workers is always on standby, and sweepers follow the last rider of each wave to ensure safety and provide assistance if needed. Volunteers are essential not only for operational support but also for enhancing the race atmosphere. They are rewarded with free food, which is a gesture of appreciation for their indispensable contributions.

Logistical Requirements:

Parking is a major logistical component, with races requiring as much as 7 acres of space to accommodate vehicles. This necessity shows the scale and attendance of these events. Engaging with property owners is crucial, as Kathy notes, to ensure that the event's requirements align with the property's mission. This engagement helps in mitigating any potential conflicts regarding the use of the space.

Course Design and Specifications:

The race course itself must meet specific criteria to ensure it is challenging yet safe for competitors. It includes a beginning hill that must be $\frac{1}{4}$ mile long and 40 yards wide, an adequately long opening stretch, and a 200-yard straight finish line to minimize the risk of high-speed crashes. Additionally, the course design limits single track segments to one minute at a time before opening to double track, allowing safer passing

opportunities for riders. Kathy's son, Daxton, plays a crucial role in testing these courses; if he completes the course in significantly more or less than 18 minutes, adjustments are made to optimize the challenge and timing.

Travel and Venue Selection:

Minimizing travel time is a priority to reduce the burden on participants, ideally keeping venues within about an hour's drive. This consideration significantly influences venue selection. Venues are often reused to leverage existing knowledge and infrastructure, which simplifies planning and reduces the unpredictability associated with new locations.

Competitor Grouping and Management:

To accommodate various levels of experience, competitors are grouped into A, B, and C categories, with A being the most advanced. Races are started in waves, each containing 10 groups with 2-3 minute breaks between them, allowing for a controlled and organized start. This grouping and wave system was refined through trial and error, ensuring a smooth flow of the race and reducing bottlenecks.

Enhancing Participant Experience:

Creating a memorable experience for participants and spectators is paramount. NICA races feature pre-rides, themed races with costumes, team awards, and an obstacle course. Additional attractions include camping options, with breakfast provided for those who camp. Vendors are strategically placed around the venue, offering free samples and engaging the community. Spectator areas are equipped with cowbells and maps to

enhance their experience and involvement, providing them with optimal spots for viewing and cheering.

Shaun and Martha Bollig

Ironman races, known for their grueling intensity and vast scale, offer a unique perspective on endurance sports, both from the eyes of the competitor and the spectator. Shaun Bollig, a seasoned Ironman participant, and his wife Martha, who has been a steadfast spectator at these events, provide a comprehensive view of the logistical, physical, and emotional aspects of the races.

Daily Routine and Spectator Experience:

An Ironman day starts as early as 9 a.m. and extends well past dark, as described by Martha. Spectators like her play a crucial role, akin to a sherpa, managing logistics from carrying equipment to driving across various segments of the race. This often involves navigating through traffic and competing with other spectators for the best viewing spots. Martha's experience highlights the challenging yet vital role of spectators in supporting the competitors.

Venue and Atmosphere:

The atmosphere at Ironman races is consistently described as uplifting and motivational. Both Shaun and Martha emphasize the community of healthy, inspirational

individuals and the festive environment that surrounds the events. Favorite elements like thematic t-shirts, such as “140.6 is a special kind of stupid,” add a humorous and relatable touch for participants and supporters alike.

Safety and Support:

While the support from the public in Madison is notable, with well-set-up aid stations, food tents, and medical tents, concerns about security and overcrowding persist.

Martha points out the need for more restrooms and better crowd management, particularly given the vast numbers of spectators and the complex logistics involved in accessing multiple race segments.

Competitor's Perspective:

Shaun, having completed seven Ironman races, shares that mental toughness and proper nutrition are key to enduring these races. Starting the race day with a high-calorie meal like a McDouble and donuts, and maintaining hydration and energy with peanut butter and jelly sandwiches during the race, are part of his strategy. His detailed description of the race segments—from the challenging swim that often involves physical contact to the relief of coasting down hills during the bike segment and the grueling marathon that tests his limits—paints a vivid picture of the Ironman experience.

Spectator Dynamics and Impact:

Spectators are more than just passive observers; their presence and encouragement significantly boost the competitors' spirits, especially in tough segments like the three challenging hills outside of Verona. Shaun and Martha both highlight the substantial positive impact of having friends, family, and even strangers cheer and provide moral support during the race.

Technology and Engagement:

The use of phone apps for tracking participants helps spectators like Martha manage their time and location to maximize their engagement and support. This technological aid is crucial for coordinating during such a lengthy and spread-out event, ensuring that spectators can be present at key points to motivate the athletes.

Reflections on Ironman Participation:

Shaun's reflections on why he continues to participate in Ironman races reveal a broader motivational context—improving personal health, setting a positive example for children, and fulfilling personal goals. Despite the physical demands and risks, such as an episode of cardiac arrest Shaun experienced, the desire to overcome personal limits and achieve significant accomplishments drives him and many others to persist in these demanding races.

Optimal Madison Marathon and IRONMAN Run Route



Based on our interviews and survey answers, we created an optimal running route for the Madison Marathon and IRONMAN. The run starts at the Capitol then goes down state street. From the bottom of state street, competitors will run along Lakeshore path, around the hospital, down around Lake Wingra, then through the Arboretum. The second half of the run is the notorious Lake Loop with a finishing straight away down East Mifflin.

Questions 14 and 15 of the survey were crucial to our decision making when creating an optimal route. Competitors expressed they enjoy being around nature, running on bike paths, and avoiding busy streets. By running along Lakeshore path, Lake Wingra, the

Lake Loop, and through the Arboretum, competitors will avoid busy streets while enjoying the nature views. These paths also have a relatively low elevation as seen in the graphic, another important factor expressed by competitors.

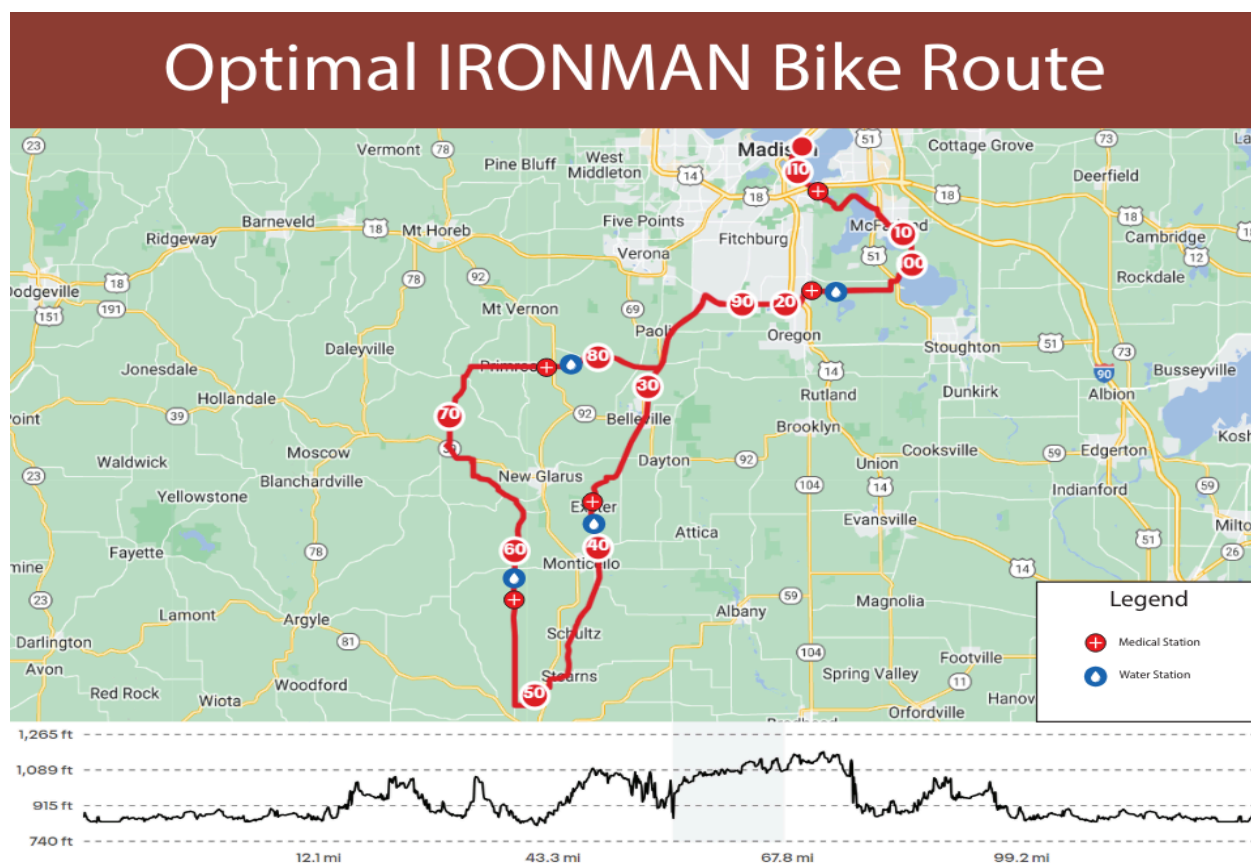
Question 8 of the survey asked competitors about the adequacy of aid stations and medical support placement. Most responses show the placement of these stations were extremely adequate, with some responses indicating they were only somewhat adequate. This led us to the decision of including more of these stations than most endurance events. Every 1.5 miles there is an aid station, and every 2 miles is medical support.

There was one response in terms of spectator viewing experience that stuck out to us. This respondent said “I actually avoid spectator points most of the time because it’s too hard to get to the front to cheer for your runner in a way that they can actually see/hear you.” Because of this response we decided to avoid designated viewing areas. This route was designed to allow spectators to watch and cheer on their runner from virtually anywhere on the course without having to worry about not having a clear view.

It’s not included in our graphic, but our route would include more information booths, food and drink, and restrooms. The standard rule for restrooms is 1 portable restroom per 100 participants. Since the survey results indicated that restrooms were inadequate, we’d include 1 portable restroom per every 50 participants. These restrooms would be placed throughout the course to allow both competitors and spectators to have more accessibility to these amenities. To make food and drink more adequate for competitors

and spectators alike, we'll have more of these stations available with some only for spectators and some only for competitors. Through personal experience and talking to marathon competitors, spectators tend to help themselves to food stations that are meant for the athletes, thus the reason for having them separated. Since information booths were also somewhat inadequate, we intend to have more of these booths placed around the start of the race.

Optimal Madison IRONMAN Bike Route



Incorporating the optimal bike trail as described, which integrates the Capital City Trail, Lower Yahara River Trail, and moves towards McFarland via the Badger State Trail, directly aligns with the themes and goals detailed in the literature review and methodology of the Madison Marathon and IRONMAN optimization study. This proposed route exemplifies a strategic approach to route planning by leveraging Madison's picturesque and diverse landscapes, as well as minimizing interaction with heavily trafficked roads and maximizing the use of scenic, quieter paths.

Geographical and Environmental Optimization

The route takes full advantage of Madison's geography, which is characterized by its connection to scenic trails and proximity to lakes and natural beauty. Utilizing these trails aligns with the environmental considerations emphasized in the paper, which prioritize minimizing the ecological impact of the events and enhancing participants' experience through natural vistas. The chosen trails offer flat to moderate elevations, which are ideal for both competitive cycling and ensuring participant safety.

Participant Satisfaction and Community Engagement

The selected bike trail supports the goal of maximizing participant satisfaction by providing a visually engaging and physically rewarding route. This aspect was highlighted as crucial in the paper, where participant enjoyment directly correlates with the event's overall success and the likelihood of participants returning. Furthermore, by steering the route away from busy highways and onto community-friendly trails, the plan

significantly reduces the disruption to local traffic and increases the accessibility for local spectators, enhancing community engagement.

Safety and Accessibility

By using established trails and avoiding major highways, the route ensures a safer experience for participants, which addresses one of the primary concerns outlined in the paper regarding route safety and logistics. This choice not only reduces potential conflicts with vehicular traffic but also allows for better positioning of aid and medical stations, which can be more strategically distributed along these trails.

Long-Term Benefits and Event Legacy

This route planning approach not only meets the immediate needs of the IRONMAN event but also aligns with broader community and environmental goals, fostering a sustainable relationship between the event and the host city. This synergy is essential for ensuring the long-term success and viability of hosting such events in Madison, as discussed in the literature review, where the alignment of event objectives with local community and environmental priorities is paramount.

By integrating these trails into the Madison IRONMAN route, the plan embodies the principles of thoughtful and sustainable event management. It enhances Madison's reputation as a prime destination for endurance sports, aligning with the city's vision of promoting health, wellness, and environmental consciousness among its residents and

visitors. This route not only optimizes the physical aspects of the race but also enriches the cultural and communal experience, fulfilling the multifaceted goals set forth in the comprehensive study of the Madison Marathon and IRONMAN events.

Conclusion

In wrapping up this project, our focus was to carefully design and enhance the routes for Madison's Marathon and IRONMAN competitions, ensuring they are engaging and sustainable for everyone involved—from participants to the local spectators and the broader community. By integrating detailed environmental analysis, feedback from participants, and insights from experienced professionals, we've pinpointed crucial elements that impact the effectiveness of these events, such as weather patterns, safety protocols, and community interaction.

Our strategic use of sophisticated routing technologies and the careful placement of essential support stations have allowed us to develop courses that showcase Madison's beautiful landscapes, perfectly balancing the challenges athletes face with the accessibility for spectators. The goal has been to not only elevate Madison as a top destination for endurance events but also to enhance its economic and social fabric.

The implementation of these optimized routes takes into account Madison's unique geographic and environmental characteristics. This consideration ensures that the city's

athletic events resonate with its commitment to promoting a healthy lifestyle and ecological awareness. By focusing on these core objectives, Madison is poised to maintain its vibrant atmosphere for competitive sports and continue fostering a strong sense of community and sustainability. This careful planning sets a benchmark for other cities, demonstrating the profound impact of integrating community-focused and environmentally conscious practices in organizing major athletic events.

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